Differentials and Disparities in the Costs of major hospital procedures in South Africa: A structural analysis from the perspective of the supply side

By

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Acknowledgements

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Abstract

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The aim of this study was to examine the extent to which providers' practices affect the cost of hospital procedures incurred by patients. The specific objective was to explore the magnitude of variations and statistically establish the significance of relationships between admission/specialist costs incurred by patients for four major procedures and the hospital group, geographical location, employer group and demographic related risk profiles. A related objective was to predict the admission and specialist costs by using multiple linear regressions. The perspective of the study was a multivariate one of the variation in the hospital costs of certain hospital procedures. Statistical techniques such as ANOVA and linear regression were used to assess mean differentials and predict costs. Hospital claims data were used to obtain information on the cost of the hospital procedure. This information was analysed from a comparative framework.

The study contributes to a better understanding of the way in which managed care companies could channel beneficiaries of medical schemes to efficient providers. In this context, medical schemes in South Africa have realised the need to reduce costs. Very little is known about ways in which variations in costs correlate with some hospital practices in place. Hospital costs form a large percentage of medical scheme costs. In keeping with efficiency, managed care companies are contracted by medical schemes to reduce these costs. The case study was concerned with Fifth Quadrant Actuaries and Consultants, a privately owned firm that consults with a particular managed healthcare company. The data referred to the records collected in 2005. The descriptive measurement of interest included age, gender, health status, geographical region, hospital and medical speciality, and the cost associated with the four procedures studied.

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CHAPTER 1 INTRODUCTION

The study provides an assessment of the variation in costs of major hospital procedures. Throughout this study the notion of variation refers to the existence of significant differences in statistical terms. This chapter presents the background, the dynamics of the South African private healthcare system, the significance, definitions of concepts, the research problem, objectives, problem statements, the delimitation of the study and ethical considerations.

1.1 Background of the study

In the current economic environment and with medical inflation being higher than headline inflation, medical schemes in South Africa have increasingly realised the need to reduce costs. Legislation around medical schemes has drastically changed over the past six years with the introduction of the Medical Schemes Act of 1998 in 2000. Medical Schemes now have to provide prescribed minimum benefits (PMB) to their members and the Registrar of Medical Schemes monitors the financial situation of medical schemes more closely.

While concerns among medical schemes have been growing around the rise in aggregate costs, very little is known about the way in which variations in costs correlate with some hospital practices in place. Hospital costs form a large percentage of medical scheme costs. Medical schemes contract managed healthcare providers to risk manage the high cost items, such as hospital and chronic medication expenditure. In keeping with efficiency, the

managed care companies are contracted by medical schemes to manage hospital expenditure in order to reduce costs for the medical schemes.

There are many factors that could influence the cost of a hospital admission. Examples of these factors would be the location where the hospital admission occurs, the type of treatment and the specialist performing the treatment (Friedman *et al.*, 2006). In South Africa, little research has been done to assess the variation in costs of major hospital procedures along these lines, and ways in which they predict admission and specialist costs respectively. The proposed study finds its importance in the fact that not much research was conducted in South Africa on differentials in these costs. By gaining more insight into the dynamics underlying these costs, managed care companies and medical schemes can better structure their hospital benefits.

1.2 The dynamics of the South African private healthcare system

According to Fourie (1999), South Africa has "inherited" a two-tier healthcare system. Only 22% of the population is covered by medical schemes (or private healthcare) and the rest of the population is covered by the public sector, yet private healthcare "consumes" over 50% of the national healthcare expenditure (Health Systems Trust, 1998).

During the 1980s the private healthcare industry was regulated, but costs were soaring. There was a call for the industry to be de-regulated and legislation was passed in 1989 by the then apartheid government in an effort

to slow down the escalation of healthcare costs (Doherty and McLeod, 2003). The amendments to the Medical Schemes Act allowed medical schemes to "risk rate" its members, i.e. charging higher contributions for higher risk members. Costs continued to rise into the early years of the new regime with medical inflation outstripping headline inflation, even in an environment of stable membership within medical schemes. Medical schemes started "dumping" their patients from subscribed private facilities into public sector hospitals once they exceeded their limited benefits (Doherty and McLeod, 2003). This practice resulted in an increased burden on the public sector.

In the "World Health Report 2000" by the World Health Organization, South Africa was given a low rating for poor value for money offered in the private healthcare sector. The situation was quite similar in other developing countries. The report recommended "a stronger role" for governments to intervene in their private healthcare markets. In response to this report, the South African government introduced the Medical Schemes Act (Act No. 131 of 1998). The Act and its regulations were implemented form January 2000. The Act made it compulsory for schemes to accept all eligible members (open enrolment) and it restricted medical schemes to charge contributions based solely on income and number of dependents. This is known as "community rating" (Doherty and McLeod, 2003).

Since the introduction of the Medical Schemes Act, many regulations, such as the prescribed minimum benefits (PMB's) package and the single exit price (SEP) for medicines, have been legislated as part of the government's

intervention within private healthcare in South Africa. Many other initiatives, like the risk equalisation fund (REF) are planned to be implemented in the future.

Since the introduction of the managed care in 1995 and the intervention by government through the Medical Schemes Act (Act No. 131 of 1998), hospital costs seem not to have reduced as expected. Due to the lack of competition in the private healthcare sector in South Africa in the form of the number of hospital groups (Inggs, 2006), hospital costs are continuing to soar and the challenge still exists to find appropriate methods to help control hospital costs going into the future.

1.3 Significance of the study

The research helps to establish ways in which structural factors such as hospital groups, location, age and gender influence the variation in the costs of hospital procedures. On the basis of findings, recommendations are made on ways in which manage care companies and medical schemes can structure hospital benefits that will be both cost effective to the scheme and provide the best healthcare for their members. It will also help medical schemes to channel their beneficiaries to efficient healthcare providers.

1.4 Definition of key concepts

In this section, the key notions are defined with the intent to explicit their relevance to the present study.

Admission

The event where a beneficiary of the medical scheme is admitted to a hospital for a particular period of time and during which time a particular procedure is performed by a specialist.

Admission cost

The cost charged to the patient via the medical scheme in lieu of a complete hospitalisation event. This cost includes the hospital costs, the specialist cost and all associated costs whilst the patient was in hospital.

Beneficiary

A person registered with one of the medical schemes under investigation.

Chronic condition

A specific long-term medical condition, for example hypertension, diabetes, etc.

Fifth Quadrant Actuaries and Consultants

A privately owned actuarial consulting company contracted to a particular managed care company to advise on healthcare matters.

Healthcare providers

Either a hospital or hospital group or a specialist providing a service to medical scheme beneficiaries.

Hospital cost

The cost charged by the hospital to the patient via the medical scheme in lieu of facility and theatre fees, as well as consumables used.

Hospital group

A privately owned group of hospitals.

Hospital Procedure

A surgical procedure performed in a hospital, for example a caesarean section or a vasectomy. In this study four hospital procedures will be analysed, namely:

1. The cataract procedure is the surgical removal of a cataract. A cataract is the clouding of the lens of the eye. An ophthalmologist performs this procedure.
2. The hip replacement procedure is the surgical procedure in which the diseased parts of the hip joint are removed and replaced with new, artificial parts. An orthopaedic surgeon performs such a procedure.

3. A caesarean section, performed by a gynaecologist is the surgical alternative to natural childbirth, where the baby is removed from the womb *via* an opening that is cut into the abdomen.
4. A cardiac angiogram (or angiogram) involves inserting a catheter into an artery or vein near the elbow or the groin and then guiding it into one of the blood vessels or chambers of the heart. A cardiologist performs this procedure.

Managed care healthcare providers/company

Organisations that clinically manage healthcare costs of medical schemes by implementing managed care techniques.

Managed care techniques

For example pre-authorisation of hospital admission, case management of particular diseases and hospital admission, utilisation review and retrospective analysis.

Medical scheme

A non-profit organisation owned by its members and supervised by the statutory body, namely The Council of Medical Schemes. A medical scheme provides its members with "appropriate healthcare services, through benefit design, ensuring affordability and financial sustainability".

Patient

A beneficiary of a medical scheme admitted to hospital for a procedure.

Patient health status

The characteristics of a patient in respect of risk factors like age, gender and chronic condition when a particular hospital procedure is performed.

Restricted medical scheme

A medical scheme restricted to a particular employer group or organisation with a common bond.

Specialist

A qualified physician who has acquired the necessary skills and specific expertise to perform a particular procedure in a hospital. There are various types of specialists who are classified according to their particular expertise on a region of the human body.

Specialist cost

The cost charged by a specialist for a particular procedure performed in a hospital.

1.5 Research problem

The general research question:

To what extent, do costs vary according to the hospital procedure?

With reference to the four procedures examined, the research problem is centred around the following specific questions:

How does a hospital group influence the cost of a medical procedure?

How does spatial location influence the cost of a medical procedure?

How does a scheme/employer group influence the cost of a medical procedure?

Is there any relationship between the admission cost and the specialist cost for a particular hospital procedure?

Is there any relationship between the scheme and the hospital group (certain schemes only use certain hospital groups)?

Is there any relationship between the patient's health status and the admission cost for specific procedures?

Is there any relationship between the patient's age and his/her admission cost of a certain procedure?

1.6 Objectives of the study

The main objective of this study is to establish the varying patterns in the admission costs, as well as in the specialist costs for the four major medical procedures.

In the data analysis the following specific differences or variations in costs are explored:

- Variations in the admission and specialist costs across the four different private hospital groups in South Africa.

- Differences exist in the costs of particular hospital procedures when analysed using factors like age, gender, chronic condition and occupation.

- Variations in the hospital costs of the four hospital procedures across the different provinces. In research done in California in the USA, it was found that there are variations in hospital costs in the different geographical regions (Lee, 2002).

- There is a variation in the specialist costs in the different geographical areas.

- The statistical significance of admission and specialist costs against the factors that influence the prediction of such costs.

1.7 Working Hypothesis

In order to fulfill the purposes of this study, the following hypotheses are formulated:

Hypothesis 1:

There is a relationship between the mean costs for hospital procedures and geographical regions.

Hypothesis 2:

A positive relationship exists between admission costs and specialist costs.

Hypothesis 3:

The mean costs for admissions and specialists are not significantly different across employer groups (schemes).

Hypothesis 4:

There is no variation in the mean admission and specialist costs across hospital groups.

Hypothesis 5:

There is a relationship between age and the admission and specialist costs for the cataract and caesarean section procedures.

Hypothesis 6:

The mean costs for admissions and specialists are not significantly different across gender for hip replacement procedure.

1.8 Delimitation of the study

The study is confined to all beneficiaries of the four restricted medical schemes, who have been admitted for one of the four hospital procedures at four hospital groups. The four restricted medical schemes range from employer groups within the retail sector to the police services. The schemes used in the study are as follows:

Scheme 1 – A restricted scheme for the employees of a financial services group;

Scheme 2 – A restricted scheme for the employees of a parastatal organisation;

Scheme 3 – A scheme restricted to employees of a manufacturing company;

Scheme 4 – A scheme restricted to employees of a retail company.

The hospital procedures being assessed in this study are the following:

- The cataract procedure is the surgical removal of a cataract. A cataract is the clouding of the lens of the eye. An ophthalmologist performs this procedure.

- The hip replacement procedure is a surgical procedure in which the diseased parts of the hip or joint are removed and replaced with new, artificial parts. An orthopedic surgeon performs such a procedure.

- A caesarean section, performed by a gynaecologist, is the surgical alternative to natural childbirth, where the baby is removed from the womb *via* an opening that is cut into the abdomen.

- A cardiac angiogram (or angiogram) involves inserting a catheter into an artery or vein near the elbow or the groin and then guiding it into one of the blood vessels or chambers of the heart. A cardiologist performs this procedure.

The selection was guided by the limited time frame of the study. This is to caution that the findings reported in this study are not fully representative of the whole picture one would have had, if the full range of procedures were used.

1.9 Ethical considerations

The primary data have information for each of the hospital admissions for the patients from the four schemes used in the analysis. The information available includes the name of the medical institution and that of hospital group where the procedure was performed. The dataset also provide information on the scheme the patient belongs to, as well as the specialist who performed the procedure. The data used for the analysis did not reveal any of the information of the particular persons, hospitals or specialist. The data did not contain any personal medical history of the patients. Having completed the study, the dataset has been given back to Fifth Quadrant.

Information, such as hospital group and scheme, used in the analysis was made anonymous by using generic names as hospital group 1, hospital group 2, hospital group 3, hospital group 4 and scheme 1, scheme 2, scheme 3 and scheme 4. It was not possible to link these generic names to the actual details of the hospitals, schemes or specialists from the analysis. Permission to use the primary dataset was formally granted by Fifth Quadrant.

CHAPTER 2 LITERATURE REVIEW AND SOME THEORETICAL CONSIDERATIONS

Practices in pricing services in the South African healthcare system have undergone some significant changes. Before the democratic transition in 1994, only a very few citizens could afford to belong to the existing medical schemes. Presently, the opportunity is offered to any citizen regardless of their racial classification. The increase in size of the insured population has brought with it the need to regulate and reconfigure the market for healthcare services. The present section reviews some of the major theoretical discourses that have marked the South African healthcare system over the past years. The intention is to bring to the fore the rationale behind the managed care organisational framework and its theoretical relevance to the present study.

2.1 Review of theoretical and empirical literature

Hospital and specialist costs form a big percentage of the total healthcare expenditure in a healthcare system. In developed countries, the market managed reform system has been adopted to contain these costs (Bloomberg, 1994). Bloomberg states that in a managed market, increased competition amongst healthcare providers, leading to provider efficiency, is promoted. Theoretically, in such an environment, healthcare costs are meant to be reduced.

Bloomberg (1994) argues that in analysing this type of reform, there is little evidence to suggest this could work in developing countries. He suggests that it only works in the few rich developed countries where all the "conditions required for successful implementation of these reforms" are present.

According to the Friedman *et al.* (2006), the term "managed care" is defined as "an organized effort by health insurance plans and providers to use financial incentives and organizational arrangements to alter provider and patient behaviour so that healthcare services are delivered and utilized in a more efficient and lower-cost manner".

Managed care techniques in developed countries have been implemented for over 20 years and are constantly evolving, trying to find better ways of containing healthcare costs (Peabody and Luck, 2002). In developing countries, these techniques have now been introduced. Peabody and Luck suggest that different countries used managed care techniques very differently. Some countries, especially developing countries, only use a few techniques, whereas certain countries use more stringent techniques such a Health Maintenance Organizations (HMO). According to Peabody and Luck (2002), the introduction of managed care techniques brought promises of their effectiveness in developed countries, but the extent to which they have helped to curtail health spending in developing countries remains a matter of contentious debate.

For the managed care approach to healthcare to work in developing countries, there are certain preconditions that need to be in place. Peabody and Luck (2002) suggest that these preconditions can be divided into five dimensions of healthcare supply and demand. These dimensions are as follows:

1. Countries must have a sound economic development and growth policies and demand for healthcare services;
2. An adequate population density;
3. An adequate supply of healthcare professionals;
4. Good information systems;
5. Competition amongst healthcare service providers, like hospitals.

These pre-conditions are unsatisfactorily met in the context of South Africa. This cast doubts on the feasibility of this approach in this country. Elsewhere, Peabody and Luck (2002) studied the experience of the utilisation of managed care techniques in developing countries and give examples of how these countries are progressing. It was found that in China, the implementation of managed care techniques, having moved from a completely publicly funded system (communistic system), presented some problems. In the process of trying to reduce healthcare costs by applying managed care principles, they ended up wasting money and this led to even more ineffiencies. Peabody and Luck suggest that it was due to a "mismatch of policy and practice".

In Latin America, managed care techniques, such as Health Maintenance Organisations (HMOs) were introduced. HMOs can be defined as "organizations that assume the risk of delivering both physician and hospital services to their enrolled populations for a fixed sum of money provided on a prepaid basis" (Peabody and Luck, 2002). Managed care techniques were also introduced in South Africa in order to reduce healthcare costs.

There are many reasons why the managed care approach is not working in the developing countries. The preconditions for successful implementation, as listed before, do not occur as stated in many of the developing countries. Peabody and Luck (2002) found that in Macedonia, having moved from the publicly based healthcare system to a system with managed care "features", they found it difficult to operate in such an environment due to a lack of adequate information systems. In Colombia, this problem also keeps the country from succeeding in the managed care environment.

Competition amongst healthcare providers is critical to the success of a managed care program. Lack of competition in Costa Rica, due to the small private sector market, has presented problems in the success of the managed care initiatives introduced in that country (Peabody and Luck, 2002).

In addition to the five dimensions discussed before, Luck and Peabody (2002) suggest in a follow-up article that legislative infrastructure is of imperative value to a successful implementation of a managed healthcare system. It is stated that an effective regulatory framework within a private healthcare

system can only exist with the necessary funds, sufficiently qualified personnel, good governance and a political environment that makes it conducive to enforcing the regulations.

The managed care approach was introduced in South Africa in the mid 1990s in an attempt to reduce the then sky rocketing healthcare costs in the private sector. Managed care techniques such as pre-authorisation of hospital admissions, case management, utilisation review and retrospective review were introduced. These techniques ensure that expensive cost items like hospital events are under the control of the insurer and in this way costs are reduced (Matisonn, 2000). At the time most hospital events were funded on a fee-for-service basis. By incentivising the providers, the insurer negotiates a contract with the healthcare provider if the actual healthcare costs are lower that the expected costs. This method also controls costs.

The South African government intervened in the private healthcare sector with the introduction of the Medical Schemes Act of 1998 in January 2000, attempting to solve some of the problems, like the escalating costs, within the private healthcare sector (Doherty and McLeod, 2003). The Act with all its regulations was somewhat controversial and was welcomed with some resistance (Doherty and McLeod, 2003). The Act made provision for 'open enrolment', which ensured that schemes had to "accept all eligible applicants" and that the premiums could only be differentiated on the basis of income and number of dependants, and not on the age of the person. The "designers of the Act" hoped that this would make provision for a larger proportion of the

country's citizens to be able to afford private healthcare, as this larger risk pool would reduce the costs of medical cover (Doherty and McLeod, 2003). The evidence suggests, however, that costs have not been contained due to a multitude of reasons, some of which are linked to current practices.

Doherty and McLeod (2003) explain that the industry blames the increasing healthcare costs on "unavoidable factors" like new technology, an ageing population and the HIV pandemic. They argue that these are valid factors, but that there are other factors contributing to the "lack of control of healthcare costs". They state that the fee-for-service reimbursement system, which gives too much room to practitioners to shift costs to consumers, still widely used in South Africa, even after the introduction of managed care approaches, encourages the over-servicing of patients by providers and is a factor that contributes to increasing costs. The Medical Schemes Act introduced a set of prescribed minimum benefits (PMBs). It was first introduced as mandatory cover on specific hospital benefits and in January 2004, PMBs for certain chronic conditions were introduced. The government feels that compulsory PMBs and community rating will lower costs, because of the larger risk pool, but others in the industry believe that the introduction of these are causing the costs to continue to escalate (Doherty and McLeod, 2003).

South Africa has a relatively small private healthcare market and it is difficult to have successful managed care initiatives in such an environment. Competition, as already mentioned, is key to the success of this. The lack of competition amongst hospital groups in South Africa also makes it difficult to

control healthcare costs. Overall costs are still escalating (Inggs, 2006) and for medical aid rates to be affordable to the wider South African people, the healthcare costs will have to be curtailed.

Van den Heever (2003) suggests that it is necessary for government to intervene in the provision and financing of healthcare needs as the managed market theory has failed due to factors such as a lack of competition within the healthcare environment. In South Africa there are three major hospital groups dominating the private healthcare market. Van den Heever states that the operation of only three hospital groups reduces the possibility of competition within the healthcare industry. He suggests that increasing the competition will not necessarily provide a solution to this problem and believes that government intervention by setting tariffs will solve the problem of increasing costs.

Eliastam (2003), on the other hand, believes that one of the reason for the huge healthcare costs in South Africa is due to the over servicing of patients and that the introduction of a formalised peer review system could reduce the costs and enhance the quality outcomes within the South African environment.

2.2 Determinants of differentials in the dynamics of healthcare costs

The literature informs on some determinants of the differentials in the healthcare costs. Van den Heever's study (2003) looks at both the demand

and the supply side of the healthcare industry in South Africa. The demand side entails the demand of services from the consumers within the healthcare industry, the beneficiaries from the medical schemes in South Africa, as well as the employers of these beneficiaries. The supply of services into this market comes from the hospitals and specialists, referred to as healthcare providers. For the purpose of this study the supply side will be carefully assessed, and the focus will be on the variations in costs as they actually occur on the ground. This study specifically explores whether there is variation in the admission cost and specialist cost of the four major hospital procedures by looking at particular factors that could influence costs.

2.3 Variations in hospital and specialist costs

Variations have been investigated from different perspectives. Interestingly, some attempts have been made to distinguish hospital costs from specialist costs. Inggs (2006) stresses that the key driver of increases in medical aid contributions is hospital costs. The author interviews the head of benefit and risk at the Board of Healthcare Funders, a group of all the major players of the healthcare industry in South Africa. He alluded to the differences in the costs of hospitals. He states that the ruling of the Competition Commission (around the issue of setting of tariffs within the private healthcare industry) prevents funders and hospital groups from negotiating prices. He also states that hospital groups have been showing exponential increases (Inggs, 2006).

In an interview between Inggs (2006) and one of the executives from the largest hospital groups in South Africa, Netcare, the executive felt that it was not the increases in tariffs that is the reason for the huge profits shown in their company, but a greater number of patients being admitted to hospital. Netcare argues that the patients in its hospitals are older and that according to research done in the United States, older patients spend more on heathcare than their younger counterparts. They also blame medical technology for the increase in healthcare costs in South Africa, implicitly suggesting there could be a certain tendency toward induced demand in the hospital institutions.

The issues of cost variation have been examined from both the intra and inter perspectives. Lee (2002) states that a particular hospital group made headlines in the US State of California because of the huge variations in hospital costs around the country. Like in South Africa, hospital costs have become the top driver of healthcare inflation (Van den Heever, 2003). Even though it could be due to new technology and other factors, this wide variation cannot be entirely explained. Lee (2002) also reports that there are differences in costs for certain procedures across different cities in the State of California in the USA. For example, the cost of a caesarean section is "twice as much in Sacramento than in Los Angeles" and "heart surgery costs three times as much in Sacramento as in San Diego" (Lee, 2002). Depending on the location, consumers have to pay higher premiums. This leads to people becoming unable to afford medical insurance and therefore becoming uninsured. Lee (2002) confirms that the hospitals and specialists may push

up their prices to recover their lost income due to fewer insured people and thus create a vicious cycle of costs spiraling higher and higher.

It has been reported that hospitals and doctors are not really transparent when it comes to making cost and quality of care information available to consumers (Lee, 2002). Lee suggests that the only way the problem of solving hospital cost variation is for all stakeholders to work together. Among others, the consumers need the health plans (the beneficiaries of medical schemes in the South African context) to ensure that the hospitals are not being overpaid by redefining the medical rates.

Lee (2002) also suggests that hospitals and physicians seem not to "embrace a culture of accountability" by informing the consumers how they charge. It is argued that once consumers have information on the quality and efficiency of healthcare services and options, they can make informed decisions and co-operate with their physicians about their medical care to ensure both the health services and financial implications are considered under mutually benefiting conditions.

Van den Heever (2003) suggests that specialists are key managers of directing consumers to hospitals and the author states that these groups of healthcare providers are key in "the direction costs will take in the future". He also states that new technology can influence costs, since the utilisation of this technology is "induced" by specialists driving the process and there are

also cost incentives for them to use such technology. This behaviour will be discussed later in this chapter.

In an article written by the CEO of the Medical Centre at the University of the Witwatersrand, it was suggested that monitoring of the providers' or specialists practices could benefit medical aid members (Eliastam, 2003). He refers to the concept of "potential effect of self regulation on controlling costs". This concept was formulated by a researcher, John Wennberg, at the Dartmouth Medical School, New Hampshire, in the United States of America. These studies showed differences in the practice style of the healthcare providers and facilities, which created variations in utilisation rates in the range of 400% to 700%. This variation was also noticed across geographical regions. One of the conclusions was that peer review of practices in the US could stop over servicing in the industry and thus reduce costs (Eliastam, 2003). Eliastam (2003) brings the discussion back to the South African experience and suggests that this type of intervention for information sharing has resulted in the improvement in the practices of specialists in South Africa. Eliastam suggested that by getting this programme certified by the Council of Health Services Accreditation, and implementing it in the healthcare industry of South Africa, it can be argued that this approach could help. He states that this centre could also help the healthcare industry to move away from the current fee-for-service model to a risk-based fees model using peer review, guidelines and protocols.

Factors like geographical regions can influence the variation in hospital admission costs. In an article published in the "Annals of Internal Medicine" by Shine (2003), he provides insight into the reasons for the variation in costs of care in the different parts of the United States of America. He states that like in real estate, location is a factor that determines how much you pay for a service and that this principle also applies to healthcare costs. The study found that patients in areas with higher expenditure indexes are more likely to consult specialists, whereas those in lower expenditure indexes would rather see a general practitioner. This practice leads to higher costs as specialists charge more than general practitioners.

2.4 Practices of particular procedures

Caesarean section rates provide an illustrative case of the extent to which the demand for healthcare services is driven not only by medical considerations, but also the influence that the practitioners have in the dynamics of the costs of this procedure. Price and Bloomberg (1990) examined the issue of the impact of utilisation of health service on the fee-for-service reimbursement system by comparing the caesarean section rates of white women in private and state hospitals. After assessing these rates for this particular group, Price and Bloomberg (1990) found that the caesarean section rates in South Africa, which is similar elsewhere around the world; are not solely determined by medical factors, but hugely influenced by the healthcare providers (specialists). The frequency of caesarean sections was by far much higher during the weekdays than the weekends (Price and Bloomberg, 1990). A

conclusion was reached that in a fee-for-service environment an increased number of interventions will remain in childbirth by specialists performing caesarean sections instead of normal childbirth.

In a study done by the Canadian Institute for Health Information (2004), it was concluded that more females receive hip replacements than their male counterparts. This suggests the possibility of significant differences between males and females with regard to this procedure, a fact that can be ascertained within the framework of this study. The research shows that since women tend to live longer and are prone to arthritis, the main reason for having this procedure is to restore their quality of life.

2.5 Physician-induced demand

Physician-induced demand is regarded as a practice whereby the patient is advised to undergo a particular medical service based on the information given to him/her by the physician. The trend towards this practice has been observed in many parts of the world including South Africa. It is, however, admitted that this practice remains in the field of hypothesis, as hard evidence to prove it, is still sparse. For example, in Japan the increase in medical expenditure for the elderly was argued to have contributed to the increase in physician-induced demand hypothesis. This hypothesis states, "a physician can induce a patient to undergo more intensive medical treatment based on the fact that the physician has more medical information than the patient" (Izumida *et al.*, 1999). These authors state that in a normal market when the

number of suppliers increases, the price of the service will drop due to competition. In an environment of physician-induced demand, the opposite happens. The observed increase in cost in the context of South Africa could reflect the existence of this practice.

2.6 In conclusion

A gap exists in establishing the factors that influence the variation in the costs of hospitals and specialists. Many studies indicate that there is a problem with hospital costs increasing, but little literature exists to explain the reasons for these spiraling costs and methods to control healthcare costs. The analysis provided in this study attempts to shed light on where differences exist and suggest possible reasons for the lack of control of hospital costs in line with the preconditions of managed care, and the possible reasons for managed care not being successful in South Africa.

CHAPTER 3 METHODOLOGY

3.1 Study perspective

The research used a quantitative analytical framework to examine differing patterns of admission and specialist costs for the selected hospital procedures. The statistical approach included exploratory and predictory analyses, therefore making use of descriptive and correlation analyses of relationships between the selected variables.

3.2 The professional context of the study

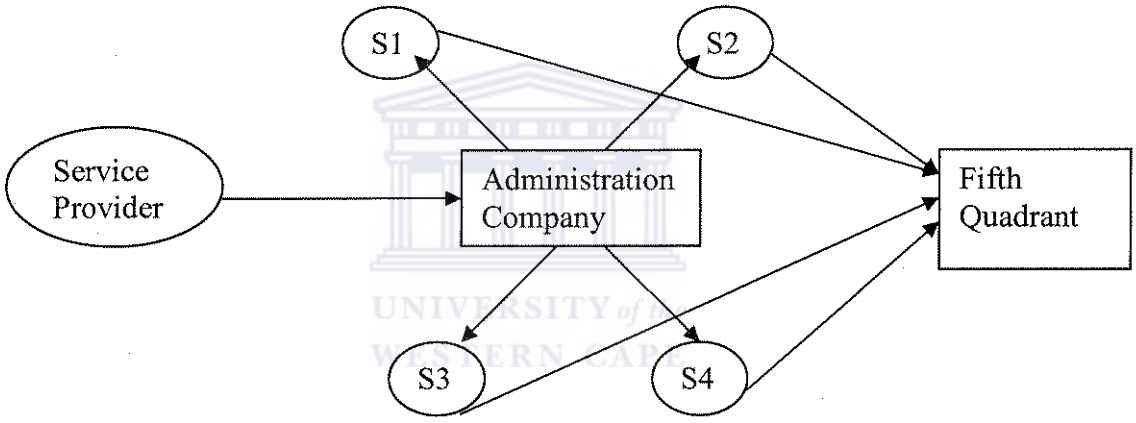
The case study will be for Fifth Quadrant Actuaries and Consultants, a privately owned firm that consults to the four different medical schemes used in the study. One of Fifth Quadrant's functions is to advise on better, more efficient ways of managing healthcare costs. The choice of this organisation as a case study was amply justified by the availability of the data required for the proposed study.

3.3 Data to be used

This study uses secondary data. The dataset contains 6 083 records from admission claims of four medical schemes during 2005. The medical schemes are clients of Fifth Quadrant. The records are created from claims from the service providers on behalf of the beneficiaries of the medical schemes. The

service providers send these claims to the administration company, contracted by the medical schemes, to collect claims, assessing the claims against the benefits of the scheme and then pay the providers. The claims are matched to the beneficiaries' details by using their membership number. The records are made up of all the relevant demographic information on the beneficiaries, details of the healthcare provider and the cost of the procedure.

The following diagram shows the communication path the data takes to get to Fifth Quadrant.



Source: the author

Fifth Quadrant has permission to use the claims data for management purposes. For the purpose of this study, a subset of the data is used. The data are restricted to only four medical schemes and to four hospital procedures.

The four hospital procedures being analysed are as follows:

Cataract removal – performed by an opthalmologist

Hip replacement - performed by an orthopaedic surgeon

Caesarean sections – performed by gynaecologists

Angiograms - performed by a cardiacologist

3.4 Evaluation of the quality of the data

Overall, the data was found to be of good quality. The quality of the data was assessed by looking at the validity and the reliability of the instrument used in the study. Here the instrument refers to the structure of the dataset, the levels of the research problems and the dimensions of the analytical framework. The percentage of missing data was used as an additional way of ensuring that the data are of an acceptable quality.

3.4.1 Validity

The concern over validity arises from the analytical approach used in this study to provide answers to the questions raised. In this regard, the structure of the dataset compels one to focus on two types of validity, namely face and construct validity.

Face validity – The data was collected and captured by healthcare experts with strict attention placed on the regulatory protocols required by the council of medical schemes. Thus, face validity is ensured in the instrument.

Construct validity – The instrumental variables were measured by referring to the theoretical literature established from similar studies conducted elsewhere.

In support of this, special reference could be made to research done in California in the USA, which found that there are variations in hospital costs in the different geographical regions (Lee, 2002). This ties in with one of the working hypotheses of the present study testing for variations in the hospital costs of the major hospital procedures across the different provinces of South Africa. In the construction of the model of analysis, the concern was also focused on the specialist–related cost. The theoretical literature indicates that specialists play an important part in influencing the costs of hospital admissions. According to Shine (2003), the specialists have a "continuous healing relationship" with the patient and are responsible to get the patient the most appropriate care. Since specialists tend to be the drivers of hospital admission costs (Shine, 2003), it is intended in this study to, test whether there is a correlation between the specialist's cost and the hospital costs.

Therefore, the construct validity is theoretically derived from these previously established results.

3.4.2 Reliability of the data

As this study uses secondary data, external reliability cannot be tested directly. Ideally, to assess the reliability of data, the process of data collection is tested by repetition and since the data is from a secondary source, this method is not applicable.

This type of study requires the reliance on similar studies, which used most of the variables of interest to establish reliability. External reliability will be assessed after the study is completed by comparing the findings of this study to that of other studies. If, for the same variables, the findings are the same in the other studies compared, internal reliability will be established. Internal validity will be assessed later when the findings are discussed.

3.4.3 Missing data

Since a very small percentage of the records had missing values (approximately 0.1%), those records were removed from the analysis process. The small percentage of missing data lends support to the previous statement that data are of good quality.

3.5 Description of variables

The instrumental variables used in this study are summarised in Table 1.1. The summary of variables contains information on their definition, level of measurement, value labels and the type of variable. For some of the variables, the value labels are anonymous for convenience. Wherever applicable, explicit mention of names or acronyms has been omitted for ethical reasons. The omissions will be applied throughout the rest of the report.

Table 1.1: List of variables

Variable Name	Definition	Measurement Level	Type of Variable	Values Labels
Hospital Group	A privately owned group of hospitals	Nominal	Independent	HospGroup 1 HospGroup 2 HospGroup 3 HospGroup 4
Specialist Type	The type of Specialist, eg Cardiologist, Physician, etc	Nominal	Independent	Cardiologist Gynaecologist Ophthalmologist Orthopaedic Surgeon
Age	Age Band of Patients	Ordinal	Independent	0-4 5-14 15-24 25-34 35-44 45-54 55-64 65+
Gender	Either Male or Female	Nominal	Independent	Male Female
Member Type	Either Pensioner or Employee	Nominal	Independent	Employee Pensioner
Scheme Name	Name of the medical scheme	Nominal	Independent	Scheme 1 Scheme 2 Scheme 3 Scheme 4
Province of location of Hospital	One of the Provinces of South Africa	Nominal	Independent	Eastern Cape Free State Gauteng Kwazulu Natal Limpopo Mpumalanga Northern Cape Other Western Cape
Chronic Condition	Yes, if patient has a chronic condition. No, if patient does not have a chronic condition	Nominal	Independent	Y N
Procedure Class	The type of procedure performed in hospital	Nominal	Independent	Cardiacs Angiogram Gynaecology Ceasarian delivery Opthalmologist Cataract Orthopaedic Surgeon Hip Replacement
Admission Costs	Total Admission Cost	Ratio	Dependent	
Hospital Cost	Total Cost charged by Hospital iro ward and theatre fees	Ratio	Dependent	
Specialist Cost	The Cost charged by the specialist for the procedure performed	Ratio	Dependent	

3.6 Data analysis

For the purpose of this study, the following analyses were performed.

3.6.1 Frequency distributions

The aim of performing this type of analysis is to profile each of the study variables, as well as the limitations of the variables, in regard to the value labels. The statistic to use is the mean. No outliers were found in the data.

3.6.2 Cross-tabulation

Cross tabulation analysis was used to produce a bivariate frequency distribution of the number of procedures performed according to hospital groups, schemes and province. To establish the correlation between admission and specialist costs, Pearson's correlations coefficients were used.

3.6.3 ANOVA

The ANOVA procedure was used to consolidate the relationships in the cross-tabulation analysis by looking at more than two nominal variables to explore whether there are differences between the variables. All testing was done with the level of significance (α) of 0.05. After establishing differences using ANOVA, methods like the Tukey's multiple comparison tests were used to determine where the differences are, with respect to the costs.

3.6.4 Multiple Regression Analysis

Where the test is significant after performing a one-way ANOVA analysis, regression analysis will be conducted to predict the partial contributions of the specific differences. The aim is to predict the admission and specialist costs on previously analysed relationships between variables. Categorical variables such as hospital group, geographical location, age and gender will be recoded into dichotomous variables to be handled in the regression model.

CHAPTER 4 FINDINGS

This chapter presents the results from the statistical analyses performed in an attempt to answer the research questions as outlined in Chapter 1 and apply the methodological approach proposed in Chapter 3. Different statistical analyses were used, namely univariate distributions, using the mean cost as an indicator, bivariate distributions, in the form of cross tabulation analysis, one-way ANOVA and multiple regressions. Firstly, the distributions of the procedures performed by hospital group, province and scheme are presented.

4.1 Spatial distribution of hospital groups

A hospital group, as defined in Chapter 1, is a group of privately owned hospitals. These hospitals are spread across the country and are more concentrated in certain provinces like Gauteng and, to a lesser extent, the Western Cape. In Table 2.1, the distribution of the hospital groups is presented by province.

Table 2.1: Distribution of hospital group by province

	Hospital group 1	Hospital group 2	Hospital group 3	Hospital group 4	Total
Eastern Cape	24%	1%	6%	1%	9%
Free State	6%	12%	1%	2%	5%
Gauteng	28%	18%	51%	52%	37%
KwaZulu-Natal	17%	6%	20%	11%	15%
Limpopo	1%	7%	1%	3%	3%
Mpumalanga	4%	8%	1%	1%	4%
Northern Cape	1%	6%	0%	0%	2%
North West	12%	8%	11%	11%	10%
Western Cape	7%	34%	9%	19%	16%
Total	100%	100%	100%	100%	100%

This table shows that the Gauteng province has the largest percentage of the hospitals from hospital group 1, hospital group 3 and hospital group 4. The Western Cape has the highest concentration of hospitals from hospital group 2. Hospital group 1 is more evenly spread across the provinces than the other hospital groups. Overall, 37% of the procedures are performed in Gauteng, followed by the Western Cape where 16% of the procedures are performed. These distributional patterns are likely to reflect in the magnitude of admission and specialist costs, respectively.

4.2 Spatial distribution of schemes

The schemes analysed in this study are restricted schemes, usually restricted to a particular employer group. The distribution of the employer groups by province is set out in Table 2.2.

Table 2.2: Distribution of scheme by province

	Scheme 1	Scheme 2	Scheme 3	Scheme 4	Total
Eastern Cape	12%	4%	4%	4%	9%
Free State	7%	3%	1%	1%	5%
Gauteng	29%	48%	26%	22%	37%
KwaZulu-Natal	17%	10%	8%	47%	15%
Limpopo	5%	2%	1%	1%	3%
Mpumalanga	4%	3%	1%	17%	4%
Northern Cape	3%	1%	0%	0%	2%
North West	6%	17%	3%	2%	10%
Western Cape	16%	12%	57%	6%	16%
Total	100%	100%	100%	100%	100%

Similarly to what prevails in the hospital groups, the memberships of these employer groups are concentrated in particular provinces/cities. Scheme 1 and scheme 2 are mostly concentrated in the Gauteng province. Scheme 3

has most of its members in the Western Cape and scheme 4 has most of their members in KwaZulu-Natal.

4.3 Representation of schemes relative to hospital groups

Medical Schemes can contract/negotiate with certain hospital groups for a lower cost per procedure, depending on the buying power the scheme has. The location of the scheme membership also determines the preferred hospital group. Where a particular hospital group is prominent in the province, members are allowed to go to any other hospital group. Table 2.3 presents the distribution of the schemes by hospital group.

Table 2.3: Distribution of scheme relative to hospital group

	Scheme 1	Scheme 2	Scheme 3	Scheme 4	Total
Hospital group 1	27%	24%	30%	23%	26%
Hospital group 2	30%	22%	29%	20%	26%
Hospital group 3	29%	41%	25%	51%	35%
Hospital group 4	14%	13%	17%	6%	13%
Total	100%	100%	100%	100%	100%

This table shows that hospital group 3 is the most frequently used hospital group across the different schemes. More specifically, scheme 2 and scheme 4 had most of their procedures performed at hospital group 3, with 41% and 51% respectively. Scheme 1 had most of its procedures performed at hospital group 2 and scheme 3 had most of its procedures performed at hospital group 3. This is possibly due to the distribution of the schemes members in the vicinities of these hospital groups or because of agreements with the hospital groups.

4.4 Correlation analysis

An important distinction made in the analysis of costs is that between admission and specialist costs. This distinction was made on the premise that an aggregation of both costs would not make it easy to identify the differing patterns as well as their similarities. Overall costs are driven by the practices in place within hospital institutions and specialists. The review of literature suggested that a positive relationship between these two costs. This points to an assessment of possible correlation between them.

In Table 2.4, it can be observed that the Pearson correlation between admission cost and specialist cost is positively correlated with the coefficient of correlation equaling 0.602. It can be concluded that there is a positive relationship between the admission cost and the specialist cost.

Because of the collinearity that exists between the admission and specialist costs, these costs need to be treated separately in the ANOVA and regression analysis.

Table 2.4: Correlation analysis – admission and specialist costs

Correlations

		Specialist Cost	Admission Cost
Pearson Correlation	Specialist Cost	1.000	.602**
	Admission Cost	.602**	1.000
Sig. (2-tailed)	Specialist Cost	.	.000
	Admission Cost	.000	.
N	Specialist Cost	6083	6083
	Admission Cost	6083	6083

**. Correlation is significant at the 0.01 level (2-tailed).

4.5 Differentials in admission and specialist costs

These differentials will be assessed according to the hospital group, province, scheme and some demographic-related risk factors.

4.5.1 Mean admission cost by hospital group

The mean admission cost for the four procedures by hospital group were assessed and graphed as displayed in Figure 1.

Figure 1: Mean admission costs by hospital group and procedure

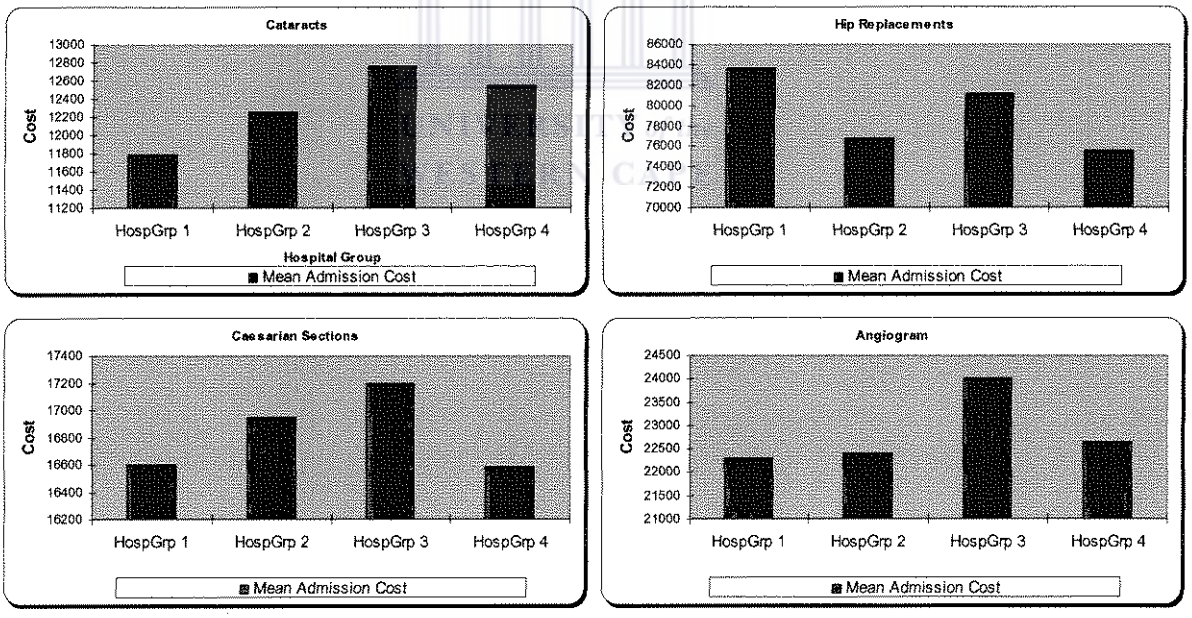


Figure 1 gives an overall look at the difference in the admission costs of the procedures. From the cataracts graph, it can be observed that hospital group

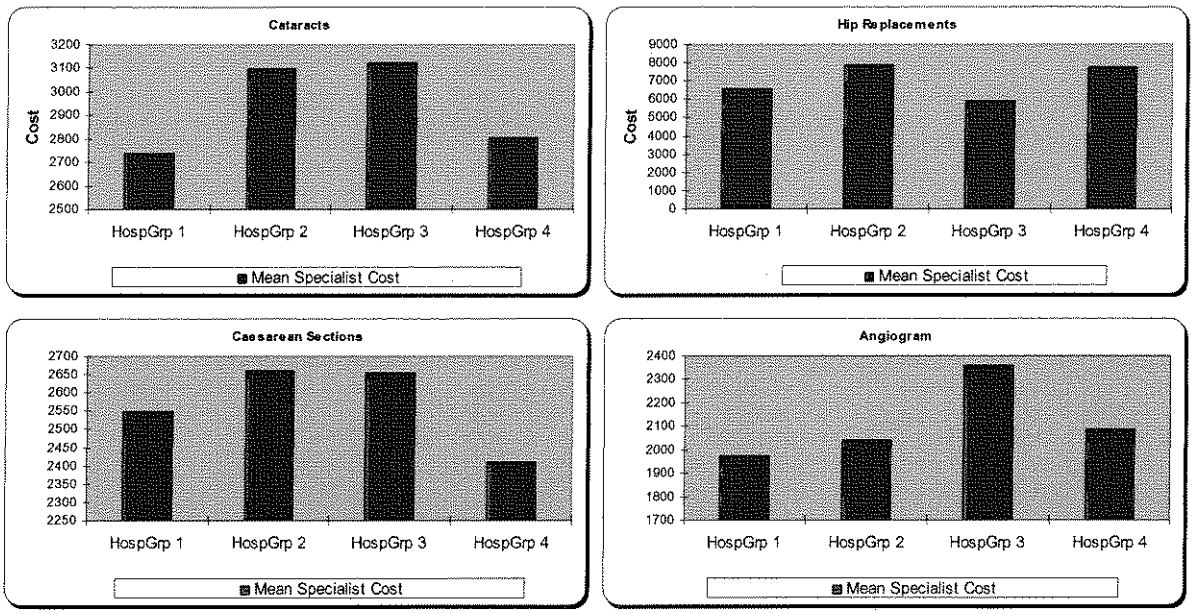
3 has the highest mean admission cost and hospital group 1 has the lowest mean admission cost. The corresponding mean costs are R 12,548 and R 11,783 respectively. In contrast, the situation is markedly different for the hip replacement procedure, where it can be observed that hospital group 1 has the highest mean cost of R83, 578, hospital group 3 the second highest (R 81,129), then hospital group 2 (R 76,801) and hospital group 4 (R 75,517) with the lowest mean cost. As for the caesarean sections, it looks similar to cataracts, but hospital group 4 has the lowest mean cost. For the angiogram procedure, it can be observed that there is little difference between the mean admission cost of hospital group 1 and hospital group 2. The mean cost for these hospital groups differ by R 87. Hospital group 3 again emerges as the dominant one, standing out from the others, followed by hospital group 4.

From the previous results, one can conclude that the mean admission cost of hospital group 3 is dominant for three of the four procedures analysed. The impact of the other hospital groups seems to be different for the different procedures.

4.5.2 Mean specialist cost by hospital group

Figure 2 shows the mean specialist cost by hospital group for the four procedures analysed.

Figure 2: Mean specialist cost by hospital group and procedure



The graph for the cataracts procedure shows similar means for hospital group 2 and hospital group 3. The difference in the mean cost of these two hospital groups is only R 27. Hospital groups 4 and 1 show a considerably lower mean specialist cost to hospital group 2 and hospital group 3. The difference in the mean cost from the highest and lowest cost for the cataracts procedure is R 400. This indicates a substantial difference in the mean specialist cost across the hospital groups analysed. The graph on hip replacements shows a different pattern to that of the cataracts procedure. The highest mean cost for specialists come from hospital groups 2 and 4. Hospital group 3 shows the lowest mean cost for specialists. Specialists in hospital group 2 and hospital group 3 charge the most compared to the other hospital groups for the caesarean sections procedure. The difference in the mean specialist cost is only R6. Hospital group 4 shows the lowest mean cost for caesarean sections. Hospital group 3 has the highest mean cost for specialists

performing angiograms than the other groups with hospital group 1 having the lowest mean cost.

As for the mean admission cost, hospital group 3 is dominant in most of the procedures when looking at the mean specialist cost. This could be due to the relationship between admission and specialist costs. This relationship was established earlier in the correlation analysis.

4.5.3 Mean admission cost by province

The literature reviewed in Chapter 2 suggested that hospital admission costs vary across regions. This variation will be assessed by looking at Table 2.5 showing the mean admission cost, the absolute and percentage difference of an individual province compared to the province with the highest mean admission cost for the procedures analysed across the nine provinces of South Africa.

Table 2.5: Distribution of mean admission cost (absolute and percentage)

Procedure	Province	Mean Admission Cost	Rand Diff relative to highest mean cost	% Diff relative to highest mean cost	Procedure	Province	Mean Admission Cost	Rand Diff relative to highest mean cost	% Diff relative to highest mean cost
Cataract	North West	R 13,663	R -	0%	Hip Replacement	Gauteng	R 87,228	R -	0%
	Gauteng	R 12,853	R 810	-6%		Limpopo	R 86,703	R 525	-1%
	Northern Cape	R 12,709	R 954	-7%		Mpumalanga	R 85,602	R 1,626	-2%
	Limpopo	R 12,655	R 1,007	-7%		Kwazulu Natal	R 76,948	R 10,280	-12%
	Western Cape	R 12,321	R 1,341	-10%		North West	R 76,672	R 10,556	-12%
	Eastern Cape	R 11,945	R 1,718	-13%		Eastern Cape	R 75,713	R 11,515	-13%
	Kwazulu Natal	R 11,856	R 1,807	-13%		Western Cape	R 75,051	R 12,177	-14%
	Mpumalanga	R 11,557	R 2,106	-15%		Northern Cape	R 72,775	R 14,453	-17%
	Free State	R 11,059	R 2,604	-19%		Free State	R 66,227	R 21,001	-24%
Caesarean Section	Kwazulu Natal	R 17,634	R -	0%	Angiogram	Northern Cape	R 26,619	R -	0%
	Free State	R 17,359	R 275	-2%		Limpopo	R 24,890	R 1,729	-6%
	Western Cape	R 17,356	R 278	-2%		Western Cape	R 24,443	R 2,176	-8%
	Limpopo	R 16,980	R 654	-4%		Kwazulu Natal	R 23,326	R 3,294	-12%
	Gauteng	R 16,867	R 767	-4%		North West	R 23,237	R 3,382	-13%
	Northern Cape	R 16,552	R 1,082	-6%		Gauteng	R 23,070	R 3,549	-13%
	Mpumalanga	R 16,349	R 1,286	-7%		Free State	R 22,463	R 4,157	-16%
	Eastern Cape	R 16,280	R 1,354	-8%		Mpumalanga	R 21,415	R 5,205	-20%
	North West	R 16,113	R 1,521	-9%		Eastern Cape	R 19,113	R 7,507	-28%

* R- (zero difference in cost)

For the cataract procedure, the North West province shows the highest mean admission cost and the lowest cost is observed for the Free State, resulting in a range of R 2,604 in absolute terms. Expressed in relative terms, it is 19% lower than the North West province mean admission cost. Table 2.5 suggests that the discrepancy between the provinces is relatively moderate.

The province with the highest mean admission cost of R 87,228 for the hip replacement procedure is Gauteng. The Free State shows the lowest mean cost of R 66,227. The range is R 21,001, 24% below the highest cost of Gauteng. The difference of 7% between the second lowest cost of the Northern Cape and lowest mean cost for the Free State is quite substantial and indicates a large variation in cost. The Free State, as for the cataract procedure, is again the province with the lowest mean cost.

For caesarean sections, KwaZulu-Natal has the highest mean cost, while the North West has the lowest mean cost. The difference between highest and lowest admission cost is 9%. The costs of the angiogram procedure range from R 26,619 for the Northern Cape to R 19,113 for the Eastern Cape, suggesting a 28% (percentage) and R 7,507 (absolute) difference in cost. The angiogram procedure shows considerable and pronounced fluctuations across the provinces. This could be because of the nature of the procedure. This issue will be discussed later.

Overall, the analysis of the mean admission costs across the nine provinces does not show any dominance in a particular province. Specific dominances

within the different procedures can be observed. The statistical significance of these differences will be assessed later using one-way ANOVA tests.

4.5.4 Mean specialist cost by province

Table 2.6 shows the mean specialist cost and the absolute and percentage difference of a province compared to the province with the highest mean specialist cost for the procedures analysed across the nine provinces of South Africa.

Table 2.6: Distribution of mean specialist cost (absolute and percentage)

Procedure	Province	Mean Specialist Cost	Rand Diff relative to highest mean cost	% Diff relative to highest mean cost	Procedure	Province	Mean Specialist Cost	Rand Diff relative to highest mean cost	% Diff relative to highest mean cost
Cataract	Western Cape	R 3,086	R -	0%	Hip Replacement	Limpopo	R 8,730	R -	0%
	Limpopo	R 3,046	R 40	-1%		Gauteng	R 7,835	R 894	-10%
	North West	R 3,036	R 51	-2%		Western Cape	R 7,713	R 1,017	-12%
	Gauteng	R 2,980	R 107	-3%		Northern Cape	R 7,356	R 1,373	-16%
	Northern Cape	R 2,967	R 120	-4%		Kwazulu Natal	R 6,329	R 2,401	-28%
	Kwazulu Natal	R 2,874	R 212	-7%		Mpumalanga	R 6,298	R 2,432	-28%
	Eastern Cape	R 2,807	R 279	-9%		Free State	R 5,690	R 3,040	-35%
	Free State	R 2,544	R 543	-18%		Eastern Cape	R 5,442	R 3,287	-38%
	Mpumalanga	R 2,476	R 610	-20%		North West	R 5,290	R 3,440	-39%
Caesarean Section	Western Cape	R 2,824	R -	0%	Angiogram	Limpopo	R 2,962	R -	0%
	Gauteng	R 2,680	R 143	-5%		Kwazulu Natal	R 2,775	R 187	-6%
	Kwazulu Natal	R 2,665	R 159	-6%		Mpumalanga	R 2,199	R 762	-26%
	North West	R 2,582	R 242	-9%		Western Cape	R 2,132	R 830	-28%
	Mpumalanga	R 2,386	R 437	-15%		North West	R 2,120	R 842	-28%
	Northern Cape	R 2,312	R 511	-18%		Gauteng	R 2,045	R 917	-31%
	Free State	R 2,302	R 522	-18%		Eastern Cape	R 1,845	R 1,117	-38%
	Eastern Cape	R 2,273	R 550	-19%		Northern Cape	R 1,660	R 1,302	-44%
	Limpopo	R 2,128	R 695	-25%		Free State	R 1,659	R 1,302	-44%

* R- (zero difference in cost)

Using the mean as the statistic, one can observe that the specialist cost for the cataract procedure ranges from R 3,086 for the Western Cape to R2,476 for Mpumalanga, which in relative terms represents a gap of 20% in the mean cost. For the hip replacement procedure, specialists charge on average between R 8,730 and R 5,290 in Limpopo and the North West provinces respectively. This relates to a 39% difference in the mean cost. There is a

25% variation in the mean specialist costs for caesarean section procedures. The Western Cape has the highest mean specialist cost of R2,824 and Limpopo has the lowest mean cost of R2,128.

Angiogram procedures have the biggest variation (44%) in the mean specialist costs across the provinces. Limpopo has the highest mean specialist cost for angiograms; it had the lowest mean cost for caesarean sections. There seems to be no consistency across the procedures in terms for the provinces' performance.

4.5.5 Mean admission and specialist costs by geographical location

Most of the admissions for all four procedures occur in the Gauteng province as displayed in Table 2. This is because the majority of the beneficiaries of the different schemes being analysed is located there. The Western Cape province comes second for the number of admissions. Johannesburg and Cape Town are the biggest urban areas in South Africa and these cities are located in the Gauteng and the Western Cape provinces, respectively. In addition, these cities have the majority of hospitals and specialists, making them the most active in terms of patients treated. This position is reinforced by the fact that most of the specialists in these cities are enjoying good reputations as they are amongst the best practitioners in their fields.

In assessing the mean admission and specialist costs by province, it was found that the variation across the province was very different for the four procedures. As this is not showing dominance for a particular province and

since the literature suggests regional variation in costs, the variation between the urbanised areas (Cape Town and Johannesburg) and the rural areas (all other regions) is assessed.

The mean costs for the four different procedures of these two major cities versus all the other cities are compared in the Table 2.7.

Table 2.7: Mean costs by geographical location

	Area	Cataract	Hip replacement	Caesarean sections	Angiogram
Admission Cost	Other Cities	R 12,338	R 81,044	R 16,606	R 22,499
	CPT/JHB	R 12,493	R 77,907	R 17,592	R 24,844
Specialist Costs	Other Cities	R 2,877	R 6,120	R 2,326	R 2,092
	CPT/JHB	R 3,119	R 8,332	R 3,233	R 2,378

The mean admission cost for the cataract, caesarean section and angiogram procedures are higher for Cape Town and Johannesburg compared to the other cities. For hip replacements, the mean admission cost is lower for Cape Town and Johannesburg.

The mean specialist costs for all the procedures are higher for Cape Town and Johannesburg compared to the other cities.

4.5.6 Patterns across the schemes

The four schemes analysed are restricted schemes, restricting their membership to certain groups within a particular employment sector. Scheme 1 consists of members from the financial services sector, scheme 2 is a scheme for employees of the law enforcement sector, scheme 3 consists of employees in the retail sector and scheme 4 has members in the

manufacturing industry. As each of these schemes is made up of particular groups of people and their dependants, the profiles of these schemes are different. An indicator of the risk-related profile is the average age used as a proxy. This determines the claiming patterns of the group. It is known that the higher the age of a group, the more they claim.

Scheme 4 has the highest risk-related profile, as the average age of its beneficiaries is the highest at 36 years and the pensioner ratio is 32%. Scheme 2 has the best risk related profile in terms of the age of its beneficiaries with an average age of 26. Scheme 2 and Scheme 4 have more males than females with a sex ratio of 1.09 and 1.01 respectively. Both Scheme 1 and Scheme 3 have more females and have sex ratios of 0.81 and 0.78 respectively.

Table 2.8 illustrates the number of beneficiaries, the average age of these beneficiaries and the sex ratios of the four schemes.

Table 2.8: Risk profiles

	No of Beneficiaries	Average Age of Beneficiary	Pensioner Ratio	Sex Ratio M:F
Scheme 1	184,887	31	14%	0.81
Scheme 2	424,634	26	16%	1.09
Scheme 3	17,431	29	13%	0.78
Scheme 4	9,650	36	32%	1.01

4.5.7 Mean admission cost by scheme

The section above gives an indication of the type of profile within the schemes assessed in this study, in order to understand the variation in the mean costs reflected in Table 2.9.

Scheme 3 has the highest mean admission cost for the cataract procedure. Scheme 4 has the lowest mean admission costs, a difference of only R 555. Scheme 4 seems to be the dominant group in terms of having the highest mean admission cost for three of the four procedures analysed. Scheme 4 performs more than 50% of the four procedures analysed in this study at hospital group 3, which showed dominance, when looking at the mean cost by hospital groups. Scheme 4 also has the highest risk profile of the four schemes and could explain the high mean admission cost. The older the patient, the longer it takes to recover after a hospital procedure.

Table 2.9 illustrates the variations in the mean admission cost across schemes.

Table 2.9: Distribution of mean admission cost by scheme

	Cataract	Hip replacement	Caesarean section	Angiogram
Scheme 1	R 12,257	R 78,869	R 17,376	R 21,289
Scheme 2	R 12,476	R 80,062	R 16,009	R 25,395
Scheme 3	R 12,689	R 76,159	R 18,691	R 22,987
Scheme 4	R 12,134	R 88,325	R 18,860	R 25,959

4.5.8 Mean specialist cost by scheme

Scheme 3 has the highest mean specialist cost for three of the four procedures analysed. This could be due to the fact that most of the procedures the highest risk profile and the cases are possibly more severe and complicated.

Scheme 4 has the highest mean specialist cost with a cost of R 3,738 for caesarean sections, possibly due to the fact that this scheme has an older group of people who are more likely to have complications in such a procedure at an older age.

Table 2.10 gives the breakdown of the mean specialist cost of the four procedures by scheme.

Table 2.10: Mean specialist cost by scheme

	Cataract	Hip replacement	Caesarean section	Angiogram
Scheme 1	R 2,819	R 6,082	R 2,299	R 2,046
Scheme 2	R 3,030	R 7,782	R 2,883	R 2,234
Scheme 3	R 3,161	R 8,755	R 3,366	R 3,298
Scheme 4	R 2,750	R 7,957	R 3,738	R 2,473

4.6 Differing significant patterns using ANOVA

One of the objectives set out in this study is to explore whether there are significant differences between the different categories structuring the variables. This exploration of relationships was performed for the following variables: hospital groups, provinces and schemes, as well as age, gender and chronic condition for particular procedures, where appropriate. The technique of one-way ANOVA was used for these variables making a distinction between admission and specialist costs. The F-test guided in the establishment of significant differences in the variables. In addition, a post-hoc analysis in the form of a Tukey test was conducted to locate the source of these differences wherever the F-ratio was found to be significant. The post-

hoc Tukey test is widely used and is less sensitive to small numbers than the other post-hoc tests. These analyses were performed separately for the four procedures.

4.6.1 Differing patterns in hospital groups

As was previously mentioned, hospital group has four categories. Hence, the ANOVA tested whether the four categories significantly differ in terms of mean cost. The statistical hypothesis and assumptions underlying the testing and the formulae used are reported in Appendix A.

The results from the ANOVA by hospital groups for the cataract procedure are reported in Table 2.11.

Table 2.11: ANOVA by hospital for the cataract procedure

ANOVA - CATARACT

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Cost	Between Groups	1.3E+08	3	4.4E+07	7.085	.000
	Within Groups	6.0E+09	961	6229862		
	Total	6.1E+09	964			
Specialist Cost	Between Groups	2.8E+07	3	9304856	10.048	.000
	Within Groups	8.9E+08	961	926017.9		
	Total	9.2E+08	964			

Comparing the mean admission and specialist costs of the hospital groups for the cataract procedure shows F-ratios of 7,085 and 10.048 respectively. This was calculated for an alpha level of 0.05. The critical value is 2.60, which indicates that both the F-ratios for mean admission and specialist costs are significant for hospital groups. This implies that there are statistically

significant differences in the mean costs by hospital groups for the cataract procedure. Performing the Tukey procedure assessed the location of these differences. It showed that there is a difference in the mean admission costs between the following hospital groups for the cataract procedure, namely between hospital group 1 and hospital group 3 and between hospital group 4 and hospital group 1. For specialist costs, the differences are between hospital group 1 and hospital group 2, hospital group 1 and hospital group 3, hospital group 2 and hospital group 4 and between hospital group 3 and hospital group 4. The results are reported in section 1.2 in Appendix B.

The results from the ANOVA by hospital groups for the hip replacement procedure are in Table 2.12.

Table 2.12: ANOVA by hospital group for hip replacement procedure

ANOVA - HIP REPLACEMENT

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Fees	Between Groups	2.4E+09	3	8.0E+08	2.002	.114
	Within Groups	9.9E+10	248	4.0E+08		
	Total	1.0E+11	251			
Specialist Fees	Between Groups	1.7E+08	3	5.7E+07	5.570	.001
	Within Groups	2.6E+09	248	1.0E+07		
	Total	2.7E+09	251			

For hip replacements, an F-ratio of 2.002 is observed for the admission costs, which is not statistically significant, since the critical value is 2.60. For specialist costs an F-ratio of 5.570 is observed, which is higher than the critical value of 2.60 and is therefore statistically significant. It can be concluded that the mean costs are significantly different.

The Tukey procedure showed that there was a difference in the mean specialist costs between the hospital groups for the hip replacement procedure, namely between hospital group 1 and hospital group 2 and between hospital group 2 and hospital group 3. The results are reported in section 2.1 in Appendix B.

The results from the ANOVA by hospital groups for the caesarean section procedure are in Table 2.13.

Table 2.13: ANOVA for hospital groups for caesarean section procedure

Caesarean Sections ANOVA - Hospital Groups

		Sum of Squares	df	Mean Square	F	Sig.
Specialist Cost	Between Groups	2.8E+07	3	9235923	6.541	.000
	Within Groups	5.9E+09	4175	1412010		
	Total	5.9E+09	4178			
Total Admission Cost	Between Groups	2.8E+08	3	9.3E+07	6.246	.000
	Within Groups	6.2E+10	4175	1.5E+07		
	Total	6.3E+10	4178			

Performing the one-way ANOVA for the caesarean section procedure shows F-ratios for admission and specialist costs of 6.246 and 6.541 respectively. Since both these F-ratios are above the critical value of 2.60, there are significant differences in the mean costs of both the admission and specialist costs for caesarean sections.

The Tukey procedure showed that the source of differences for admission costs emanated from the differences between hospital group 1 and hospital group 3 and between hospital group 4 and hospital group 3. For specialist costs, the differences were between hospital group 2 and hospital group 4

and between hospital group 3 and hospital group 4. The results are reported in section 3.1 in Appendix B.

The results from the ANOVA by hospital groups for the angiogram procedure are shown in Table 2.14.

Table 2.14: ANOVA for hospital groups for angiogram procedure

ANOVA - ANGIOGRAM

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Fees	Between Groups	4.4E+08	3	1.5E+08	.877	.453
	Within Groups	1.1E+11	683	1.7E+08		
	Total	1.1E+11	686			
Specialist Fees	Between Groups	2.0E+07	3	6695228	4.065	.007
	Within Groups	1.1E+09	683	1647027		
	Total	1.1E+09	686			

ANOVA results for angiogram reveal the existence of significant differences between hospital groups for the specialists cost with a significant F-ratio of 4.065 and a p-value of 0.007. As for the differences in terms of admission costs, the results show a p-value greater than 0.05, suggesting the absence of significance between mean costs. As for the hip replacement procedure, significant differences between hospital groups are observed for specialist costs, but not for admission costs. Tukey shows that the source of differences for specialist costs emanated from the differences between hospital group 1 and hospital group 3 and between hospital group 2 and hospital group 3. The results are reported in section 4.1 in Appendix B.

4.6.2 Differing patterns accross provinces

The results for the ANOVA by province are reflected in Table 2.15.

Table 2.15: ANOVA by province

ANOVA - CATARACT

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Cost	Between Groups	3.4E+08	8	4.2E+07	6.967	.000
	Within Groups	5.8E+09	956	6048308		
	Total	6.1E+09	964			
Specialist Cost	Between Groups	2.2E+07	8	2720678	2.903	.003
	Within Groups	9.0E+08	956	937293.2		
	Total	9.2E+08	964			

ANOVA - HIP REPLACEMENTS

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Fees	Between Groups	1.1E+10	8	1.4E+09	3.806	.000
	Within Groups	9.0E+10	243	3.7E+08		
	Total	1.0E+11	251			
Specialist Fees	Between Groups	2.5E+08	8	3.2E+07	3.124	.002
	Within Groups	2.5E+09	243	1.0E+07		
	Total	2.7E+09	251			

ANOVA -Caesarean Section

		Sum of Squares	df	Mean Square	F	Sig.
Specialist Cost	Between Groups	1.4E+08	8	1.7E+07	12.608	.000
	Within Groups	5.8E+09	4170	1386804		
	Total	5.9E+09	4178			
Total Admission Cost	Between Groups	9.7E+08	8	1.2E+08	8.237	.000
	Within Groups	6.2E+10	4170	1.5E+07		
	Total	6.3E+10	4178			

ANOVA - ANGIOGRAM

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Fees	Between Groups	1.7E+09	8	2.1E+08	1.245	.270
	Within Groups	1.1E+11	678	1.7E+08		
	Total	1.1E+11	686			
Specialist Fees	Between Groups	7.8E+07	8	9702506	6.163	.000
	Within Groups	1.1E+09	678	1574315		
	Total	1.1E+09	686			

Looking at the differing patterns for cataract using the one-way ANOVA, it emerges that the differences are statistically significant with F-ratios of 6.967 and 2.903 with corresponding p-values of 0.000 and 0.003 for admission and specialist costs respectively. To show where these differences are located, the post hoc Tukey procedure is again performed. The source of a significant F-test emanated from the differences between the following provinces. The differences in admission cost were found between the_Eastern Cape and the North West, the Free State and Gauteng, Limpopo and the North West, Gauteng and KwaZulu-Natal, KwaZulu-Natal and the North West, Mpumalanga and the North West and between the Western Cape and the Free State. For specialist costs, the differences were found between the Free Sate and the Western Cape and between Mpumalanga and the Western Cape. The results are reported in section 1.2 in Appendix B.

The one-way ANOVA results for the hip replacement indicate significant differences across the provinces for both the admission and specialist costs. The F-ratios are 3.805 and 3.124 respectively. The post hoc test, using the Tukey procedure, indicated that the source of differences for admission costs emanated from the differences between the Free State and Gauteng and between Gauteng and the Western Cape. For specialist costs the differences were between the Eastern Cape and Gauteng. The results are reported in section 2.2 in Appendix B.

For caesarean sections, the ANOVA showed significant differences for both the admission and specialist costs. The Tukey procedure indicated that the source of differences for admission costs emanated from the differences between the Eastern Cape and the Free State, the Eastern Cape and KwaZulu-Natal, the Eastern Cape and the Western Cape, the Free State and Gauteng, the Free State and the Eastern Cape, the Free State and the North West, Gauteng and the North West, Gauteng and KwaZulu-Natal, KwaZulu-Natal and the North West, KwaZulu-Natal and Mpumalanga and between the North West and the Western Cape. For specialist costs, the differences were between the Eastern Cape and Gauteng, the Eastern Cape and KwaZulu-Natal, the Eastern Cape and the Western Cape, the Free State and Gauteng, the Free Sate and the Western Cape and between KwaZulu-Natal and the Free State. The results are reported in section 3.2 in Appendix B.

Angiogram shows significant differences for only specialist costs and not for admission costs, with F-ratios of 6.163 and 1.245 respectively. The Tukey

procedure, to locate the differences in the specialist costs revealed differences between the Eastern Cape and KwaZulu-Natal, the Eastern Cape and Limpopo, the Free State and KwaZulu-Natal, the Free State and Limpopo, Gauteng and Limpopo, Gauteng and KwaZulu-Natal, the Northern Cape and KwaZulu-Natal and between the Western Cape and KwaZulu-Natal. The results are reported in section 4.2 in Appendix B.

4.6.3 Differing patterns in schemes

The critical value with 3 degrees of freedom is 2.60. If the F-ratio is higher than this critical value, there were significant differences between the Schemes analysed.

Table 2.16: ANOVA by scheme

ANOVA - CATARACT

		Sum of Squares	df	Mean Square	F	Sig.
Specialist Cost	Between Groups	1.3E+07	3	4395322	4.669	.003
	Within Groups	9.0E+08	961	941344.2		
	Total	9.2E+08	964			
Total Admission Cost	Between Groups	1.7E+07	3	5524437	.870	.456
	Within Groups	6.1E+09	961	6350396		
	Total	6.1E+09	964			

ANOVA-HIP REPLACEMENT

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Fees	Between Groups	8.9E+08	3	3.0E+08	.730	.535
	Within Groups	1.0E+11	248	4.1E+08		
	Total	1.0E+11	251			
Specialist Fees	Between Groups	1.9E+08	3	6.5E+07	6.326	.000
	Within Groups	2.5E+09	248	1.0E+07		
	Total	2.7E+09	251			

ANOVA- Caesarean Section

		Sum of Squares	df	Mean Square	F	Sig.
Specialist Cost	Between Groups	5.2E+08	3	1.7E+08	134.202	.000
	Within Groups	5.4E+09	4175	1293874		
	Total	5.9E+09	4178			
Total Admission Cost	Between Groups	2.7E+09	3	8.9E+08	61.754	.000
	Within Groups	6.0E+10	4175	1.4E+07		
	Total	6.3E+10	4178			

ANOVA-ANGIOGRAM

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Fees	Between Groups	2.9E+09	3	9.6E+08	5.862	.001
	Within Groups	1.1E+11	683	1.6E+08		
	Total	1.1E+11	686			
Specialist Fees	Between Groups	2.6E+07	3	8818577	5.385	.001
	Within Groups	1.1E+09	683	1637701		
	Total	1.1E+09	686			

The ANOVA for the admission and specialist costs for the cataract procedure shows F-ratios of 0.870 and 4.669 respectively. This means that there were significant differences in the specialist cost, but not for admission costs. The

Tukey test showed the differences to be between scheme 1 and scheme 2. The results are reported in section 1.3 in Appendix B.

The hip replacement procedure shows p-value of 0.535 for admission costs and 0.000 for specialists cost. If the p-value is less than 0.05, it indicates significant difference in the variable analysed. This means that there were significant differences in the specialist costs, but not in the admission costs. The specific differences, using the Tukey procedure, were between scheme 1 and scheme 2. The results are reported in section 2.3 in Appendix B.

When one assesses the differences in admission and specialist costs for the caesarean sections using one-way ANOVA one finds a p-value of 0.000 for both costs. This suggests significant differences for admission as well as for specialist costs. Performing the post hoc Tukey procedure showed the differences for admission costs to be between scheme 1 and scheme 2, scheme 1 and scheme 3, scheme 1 and scheme 4, scheme 2 and scheme 3, and between scheme 2 and scheme 4. For specialist costs the source of differences are between scheme 1 and scheme 2, scheme 1 and scheme 3, scheme 1 and scheme 4, scheme 2 and scheme 3, and between scheme 2 and scheme 4. The results are reported in section 3.3 in Appendix B.

For angiograms, the results show a p-value of 0.001 for both admission and specialist costs by scheme. The source of these differences in the admission costs, using the Tukey post hoc procedure, were between scheme 1 and scheme 2, scheme 1 and scheme 3, scheme 1 and scheme 4, scheme2 and

scheme 3 and between scheme 2 and scheme 4. For specialist costs, the source of the differences was between scheme 1 and scheme 2, scheme 1 and scheme 3, scheme 1 and scheme 4, scheme 2 and scheme 3 and between scheme 2 and scheme 4. The results are reported in section 4.3 in Appendix B.

4.6.4 Differing patterns in geographical location

As only two groups are compared, Cape Town/Johannesburg and the other cities, an independent sample T-test was performed to establish significant differences between these groups.

The following results for the four different procedures were produced:

Table 2.17: T-test by geographical location

		T-test for equality of means		
		T	**df**	**Sig. (2-tailed)**
Admission Cost	**Cataract**	-0.470	963	0.639
	Hip replacements	1.213	250	0.226
	Caesarean section	-24.148	4177	0.000
	Angiogram	-2.025	685	0.043
Specialist Costs	**Cataract**	-2.969	963	0.003
	Hip replacements	-5.349	250	0.000
	Caesarean section	-7.614	4177	0.000
	Angiogram	-2.470	685	0.014

For both the cataract and hip replacement procedures, the results showed significant differences in the specialist costs, but not in admission costs.

Significant differences were seen in the caesarean section and angiogram procedures in the specialist costs as well as in the admission costs.

4.6.5 Differing patterns for the cataract procedure by age

The prevalence of having cataracts is more likely at an older age, and therefore age is a factor in the likelihood of having such a procedure. The admission and specialist costs for the cataract procedure by the different age groups were investigated to establish whether there are considerable variations in these costs.

Table 2.18 shows the mean admission and specialist costs by age.

Table 2.18: Distribution of mean cost by age

Descriptives

			N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
							Lower Bound	Upper Bound		
Total Admission Cost	New Age Group	0-24	7	15025.00	4739.3833	1791.3185	10641.83	19408.17	9872.00	24820.00
		25-34	11	13269.27	2087.9558	629.5424	11866.57	14671.98	9882.00	15990.00
		35-44	37	13727.81	6433.1553	1057.6042	11582.89	15872.73	9179.00	40865.00
		45-54	95	12834.88	2339.6030	240.0382	12358.28	13311.49	9721.00	22082.00
		55-64	182	12316.90	2170.3453	160.8767	11999.46	12634.33	7683.00	30670.00
		65+	633	12191.54	2148.1106	85.3797	12023.87	12359.20	6703.00	28955.00
		Total	965	12370.26	2519.4892	81.1052	12211.09	12529.42	6703.00	40865.00
Specialist Cost	New Age Group	0-24	7	2434.7143	516.1762	195.0963	1957.3335	2912.0951	1618.00	3067.00
		25-34	11	3434.8182	1453.1120	438.1297	2458.6046	4411.0318	2063.00	7467.00
		35-44	37	3109.8919	1499.2381	246.4732	2610.0210	3609.7628	1618.00	9744.00
		45-54	95	3021.3368	838.6470	86.0434	2850.4957	3192.1780	1970.00	6552.00
		55-64	182	2830.5604	794.5708	58.8975	2714.3464	2946.7745	1618.00	7700.00
		65+	633	2927.8436	994.8376	39.5412	2850.1955	3005.4917	1273.00	9498.00
		Total	965	2927.8819	975.7526	31.4106	2866.2409	2989.5229	1273.00	9744.00

The higher mean costs for admission and specialist costs are seen in those with younger ages. Performing a one-way ANOVA can determine statistically

if any variations exist in the admission and specialist costs for this procedure. The results are shown in Table 2.19.

Table 2.19: ANOVA results by age group

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Cost	Between Groups	1.7E+08	5	3.4E+07	5.403	.000
	Within Groups	6.0E+09	959	6206095		
	Total	6.1E+09	964			
Specialist Cost	Between Groups	8308572	5	1661714	1.752	.120
	Within Groups	9.1E+08	959	948393.3		
	Total	9.2E+08	964			

The critical value with 5 degrees of freedom is 2.21. If the F-ratio is higher than this critical value, there is a significant difference in cost associated with the cataract operation for the six age intervals. The F-ratios observed in the one-way ANOVA performed by age for the admission cost and specialist cost, are 5.403 and 1.752 respectively. It can be concluded that the admission cost is statistically significantly different by age, but not the specialist cost. The Tukey procedure showed that the source of the differences in the admission costs exist between age group 0-24 and age group 65+, age group 35-44 and age group 54-64. The results are reported in section 1.4 in Appendix B.

4.6.6 Differing patterns for the hip replacement procedure by gender

In general, it has been found that hip replacements are more prominent amongst women than their male counterparts (Canadian Institute for Health Information, 2004). Table 2.20 shows the mean costs by gender.

Table 2.20: Mean costs by gender

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Total Admission Fees	Male	118	81049.90	24761.76	2279.50
	Female	134	78650.85	14880.90	1285.51
Specialist Fees	Male	118	6952.99	3528.28	324.80
	Female	134	7069.86	3090.82	267.01

To assess whether there are differences in the costs of hip replacements between females and males, an independent sample T-test was performed. The results in Table 2.21 did not show significant differences in either the admission costs or the specialist costs.

Table 2.21: T-test by gender

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Mean	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Total Admission Fees	Equal variances assumed	12.568	.000	.945	250	.346	2399.05	2539.83	-2603.15	7401.24
	Equal variances not assumed			.917	186.646	.360	2399.05	2617.00	-2763.65	7561.75
Specialist Fees	Equal variances assumed	1.636	.202	-.280	250	.779	-116.87	416.95	-938.05	704.32
	Equal variances not assumed			-.278	234.396	.781	-116.87	420.46	-945.24	711.51

4.6.7 Differing patterns for caesarean sections and age group

As the risks associated with pregnancies and delivery for older women are higher than younger women, it justifies establishing whether there are differences for caesarean sections and age. A one-way ANOVA was performed to show whether there are differences in the admission cost. A post hoc Tukey was also being performed to locate the differences. Table 2.2 shows the results of the ANOVA by age group. The results are reported in section 3.4 in Appendix B.

Table 2.22: ANOVA by age group

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
TOTCOST	Between Groups	1.1E+09	3	3.6E+08	24.489	.000
	Within Groups	6.2E+10	4175	1.5E+07		
	Total	6.3E+10	4178			
SPECCOST	Between Groups	3.4E+07	3	1.1E+07	8.115	.000
	Within Groups	5.9E+09	4175	1410422		
	Total	5.9E+09	4178			

The results showed significant differences for both the admission and specialist costs; therefore age is a determining factor in the cost of a caesarean section procedure.

4.6.8 Differing patterns for angiogram and chronic condition

A T-test was performed to establish whether differences could be observed between the members with and without chronic conditions. Table 2.23 shows the results.

Table 2.23: T-test by chronic condition

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Mean	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Total Admission Fees	Equal variances assumed	5.183	.023	1.478	685	.140	1768.7904	1197.1317	-581.6976	4119.2785
	Equal variances not assumed			1.881	363.583	.061	1768.7904	940.4445	-80.6031	3618.1840
Specialist Fees	Equal variances assumed	1.493	.222	.829	685	.408	99.3915	119.9206	-136.0646	334.8477
	Equal variances not assumed			.902	266.102	.368	99.3915	110.1605	-117.5055	316.2886

From Table 2.23, no statistical significance was found for both the admission and specialist costs. We thus concluded that the patient's health status as defined in Chapter 1 does not influence the costs for the angiogram procedure.

From the fore going results, it has emerged that the admission costs are likely to be determined by the type of hospital group, geographical location and the age of the patients. As for the specialist costs, the data has revealed that the most influential variables are the geographical location, age and gender. Drawing from these insights, one can establish that the variables above have some critical pertinence to predict separately these costs.

4.7 Linear Regression Analysis

One of the objectives of the study is to predict the admission and specialist cost, based on particular factors that possibly influence these costs. As there is a correlation between the admission and the specialist costs, the linear

regression models were done separately. Thus the dependent variables used in the regression models will be either the admission cost or the specialist cost. The independent variables will be those variables found statistically significant in the ANOVA process for the different procedures. Independent variables, such as hospital group, geographical location, age and gender will be entered into the model. As indicated in the methodology chapter, categorical variables such as hospital group, province, age and gender have been recoded into dichotomous variables to be handled in the regression model. These variables have been recoded. Hospital group 3 showed dominance, so the variable, hospital group, was recoded as 1 for hospital group 3 and all the other hospital groups were recoded 0. As for the variable, province, it was recoded into 2 modalities, 1 being the major urban areas, namely Johannesburg and Cape Town, and 0 for all the other areas. The variable, age groups, was recoded by coding age groups below the age of 45 as 0 and the other age groups were recoded as 1. The variable, gender, only had two categories and there was therefore no need to recode this variable.

The equation of a linear regression model is as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \xi$$

Where β_0 is a constant, β_1 is the coefficient of X_1, β_2 is the coefficient of X_2, β_3 is the coefficient of X_3 and ξ is the variable error (Dawson and Trapp, 2004).

Tables 2.24 and 2.26 show the results from the regression for both the admission and specialist costs. The independent variables were handled in

the model using the SPSS procedure ENTER, which enters the variable as a block.

Table 2.24: Regression model results - admission cost

Hospital Procedure	Independent Variable	Coefficients	Significance value
Cataract	Constant	12910.83	0.000*
	Hospital Group (X_1)	178.58	0.002*
	Geographical Location (X_2)	199.95	0.562
	Age (X_3)	233.77	0.000*
Hip replacement	Constant	84742.48	0.00*
	Hospital Group (X_1)	1366.42	0.654
	Geographical Location (X_2)	-3014.17	0.25
	Age (X_3)	-1746.28	0.55
	Gender (X_4)	-1864.48	0.478
Caesarean section	Constant	17265.34	0.000*
	Hospital Group (X_1)	400.68	0.001*
	Geographical Location (X_2)	982.46	0.000*
	Age (X_3)	-1016.88	0.000*
Angiogram	Constant	21827.39	0*
	Hospital Group (X_1)	1725.25	0.086
	Geographical Location (X_2)	2111.35	0.071
	Age (X_3)	1524.24	0.129
	Gender (X_4)	-567.89	0.578

* Significant Values

Regression equations for admission costs:

Cataract

Y = 12910.83 +178.58HOSPITAL GROUP + 233.77AGE + ξ

Caesarean section

$Y = 17265.34 + 400.68$ HOSPITAL GROUP + 982.46GEOGRAPHICAL LOCATION -1016.88 AGE + ξ

The regression equations generated by the regression model for the different procedures are listed above. For the cataract procedure, hospital group and age are predictors of the admission costs. For the caesarean section procedure, hospital group, geographical location and age are predictors of the admission cost. None of the independent variables entered into the regression model for the hip replacement and angiogram procedures were significant and thus the admission costs cannot be predicted for these two procedures.

The R^2 represents the percentage of total variation in admission cost (Y) explained by the predictory variables (X_i), listed in table 2.24. Table 2.25 shows the results for the four different procedures.

Table 2.25: R^2 for admission cost by procedure

Procedure	R^2 value
Cataracts	2.8%
Hip replacements	1.1%
Caesarean sections	2.7%
Angiograms	0.8%

The R^2 values for the admission cost for the different procedures are low. This may be due to the spurring effect of regulation that tends to lessen the effect of other factors.

Some of the underlying assumptions regarding the normality and the linearity of the coefficients of the linear regression were tested and to some extent confirmed. The results are reported in sections 1.5, 2.5, 3.5 and 4.5 in Appendix B.

Table 2.26: Regression model results - specialist cost

Hospital Procedure	Independent Variable	Coefficients	Significance value
Cataract	Constant	2914.58	0.000*
	Hospital Group (X_1)	284.13	0.000*
	Geographical Location (X_2)	246.19	0.001*
	Age (X_3)	-135.64	0.133
Hip replacement	Constant	6430.66	0.000*
	Hospital Group (X_1)	-1277.76	0.007*
	Geographical Location (X_2)	2106.14	0.000*
	Age (X_3)	200.99	0.655
	Gender (X_4)	-53.77	0.894
Caesarean section	Constant	2467.13	0.000*
	Hospital Group (X_1)	2.23	0.951
	Geographical Location (X_2)	913.17	0.000*
	Age (X_3)	-182.23	0.000*
Angiogram	Constant	2014.90	0.000*
	Hospital Group (X_1)	335.34	0.001*
	Geographical Location (X_2)	278.65	0.017*
	Age (X_3)	2.26	0.982
	Gender (X_4)	-43.65	0.667

*Significant Values

Regression equations for specialist costs:

Cataract

Y = 2914.58+284.13HOSPITAL GROUP+246.19EOGRAPHICAL REGION + ξ

Hip replacement

Y = 6430.66-1277.80HOSPITAL GROUP + 2106.10GEOGRAPHICALREGION + ξ

Caesarean section

Y = 2467.13 + 913.17GEOGRAPHICAL REGION -182.23AGE + ξ

Angiogram

Y = 2014.90 + 335.34 HOSPITAL GROUP + 278.65 GEOGRAPHICAL REGION + ξ

For all four of the procedures, regression equations were generated from the regression model. When predicting specialist costs, hospital group and geographical locations are predictors for the cataract, angiogram and hip replacement procedures. For the caesarean section procedure, geographical location and age are the predictors of the specialist costs.

In the present case, R^2, an indication of the percentage of total variation in specialist cost (Y) explained by the predictory variables (Xi), is presented in Table 2.27.

Table 2.27: R^2 for specialist cost by procedure

	R^2 Value
Cataracts	3.3%
Hip replacements	13%
Caesarean sections	12.6%
Angiograms	1.7%

The R^2 values for the specialist cost for the different procedures are low. This may be due to the spurring effect of regulation that tends to lessen the effect of other factors.

Some of the underlying assumptions regarding the normality and the linearity of the coefficients for the linear regression were tested and to some extent confirmed. The results are reported in sections 1.6, 2.6, 3.6 and 4.6 in Appendix B.

CHAPTER 5 DISCUSSION AND CONCLUDING REMARKS

At the outset of this study, the research questions were aimed at investigating the extent to which the costs of hospital procedures are related, to hospital group, spatial location, scheme and some other demographical characteristics. More specifically, the study explored the relationship between admission costs and specialist costs for the selected hospital procedures. In addition, the study also explored the relationship between patient health status, including age, and admission costs for the selected procedures. Is there any relationship between patient health status and the admission cost for specific procedures?

To investigate these questions, assumptions were made around variations associated with such factors as hospital group, province, schemes and specified demographic profiles.

One of the main objectives of the study was to explore the magnitude of variations and to establish the extent to which admission and specialist costs incurred by patients for the four investigated major hospital procedures analysed statistically differ in terms of costs across the hospital groups, provinces, schemes and demographic-related risk profiles. A distinction was made between specialists and admission costs. Variations were structurally apprehended through differentials and were assessed by making distinctions according to the hospital group where the procedures were performed, the spatial or geographical location of the facilities, the employer group and the

demographic-related risk profiles of the patients. A related objective was to predict the admission and specialist costs using multiple linear regressions.

The theoretical framework underpinning this study was that of the managed care approach, with the assumption that as the quality of healthcare is improved, cost reduction will be a result. This reduction was intended to reflect in some harmonisation of costs across the variables of differentiation. South Africa introduced managed care techniques with the hope that these techniques would help reduce healthcare costs. Divergent results, however, have been observed due to a lack of competition in the private healthcare sector in South Africa. Previous studies have shown that costs are continuously increasing, possibly due to a lack of competition in the industry and perhaps induced utilisation of specialists.

It was established from the literature review that gaps exist in the current stock of knowledge, one of these being, for instance, the lack of distinction made between the admission and specialist costs. Furthermore no distinctions are made in the literature by geographical location, hospital group and scheme. There is indeed limited knowledge on the variation in healthcare costs in South Africa.

The research was concerned with four major hospital procedures. The selection was based on some considerations supported by the literature review and time constraints. The analysis emphasised exploratory and predictory approaches to identifying the differentials and disparities of the costs in four major hospital procedures using univariate and bivariate

analysis, analysis of variance (ANOVA) and multiple linear regressions. The source of the data was hospital claims data for 2005 for all the patients who had been admitted for one of the four procedures analysed. The sample was a purposive sample of the four restricted schemes assessed in the study. The data was formatted in excel and converted into SPSS for analysis.

5.1 Summary of the major findings

Looking at the four major procedures, the data displayed a certain dominance observed in three out of the four procedures by one of the hospital groups for admission costs. Most of the procedures were performed at this hospital group. This could indicate a monopoly and that this hospital group has captivated a market, especially in the Gauteng province. This trend was reported elsewhere by Peabody and Luck (2002) in a different context. The Analysis of Variance (ANOVA) and Tukey analysis provided substantial evidence of this dominance of hospital group 3, indicating that there were significant differences between hospital group 3 and the rest of the hospital groups.

When looking at the province as a determining factor, significant differences were found for admission costs for three of the four procedures. For specialists costs significant differences were found for all of the procedures. The angiogram procedure showed significant differences for specialist costs only. This implies that the costing across the province is driven largely by a lack of harmonisation. Adding to this, the significant F-ratios for the specialist

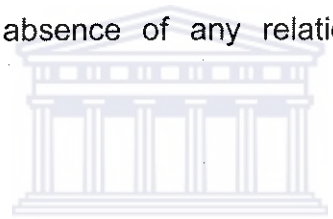
costs lend support to the fact that specialist costs are different across provinces. Specialist costs need to be considered separately to admission costs. It is the author's opinion that these disparities in cost require public intervention to ensure harmonisation across the different provinces.

No obvious dominance of a particular province was observed when performing the Tukey procedure to determine where the source of the significant differences was for both the admission and specialist costs. It was suspected that using province as a determining factor could hide the effect of the major urban areas within South Africa. To remedy this, a decision was made to isolate this factor by using two groups, i.e. Cape Town and Johannesburg as one category and the rest of the areas as another category. Performing a T-test showed a significant difference in the specialist costs between these groups for all the procedures analysed. An explanation for this could be that the biggest and best specialists are found in these two major cities and since there is a demand for their services and prices are not regulated; specialists can charge any rate for their services.

The ANOVA showed significant difference by scheme for the specialist costs for all of the procedures analysed. Only two of the four procedures showed significant differences for the admission costs. The four schemes used in the study are restricted schemes from different employment sectors. The schemes have very different risk profiles, mainly constituted from the age and gender of their employees. In the linear regression model, age was used as a proxy for scheme. Age was found to be a determining factor of admission

costs for two of the four procedures and for only one procedure for the specialist costs.

Certain procedures are influenced by specific factors like gender or age. Since it was found in literature that gender could have an impact on the probability of having a hip replacement, a T-test was performed to establish if there are significant differences in the mean admission and specialist costs. It was found that there are no significant differences between males and females having hip replacements for both admission and specialist costs. The relationship between chronic condition status and cost was tested using a T-test for the angiogram procedure. It was found that the T-test was not significant, suggesting the absence of any relationship between chronic condition and cost.



5.2 Drawing some lessons from the study insights

From an analytical perspective, this study has highlighted the importance of the distinguishing admission costs from specialist costs and analysing these costs separately. This distinction was useful, especially in predicting these costs, as different factors in regression analysis impact on these costs.

Equally important, the fact that significant differences exist between provinces provides some indications that the pricing of medical services by specialists is not spatially harmonised. In line with this, this finding can also be regarded as a major contribution of this study to better understand the ways in which

space matters in the determination of specialist cost. One would imply that specialists are acting independently as they tend to dictate their own framework for setting the price of their services. This also seems to indicate that no regulatory framework seems to be in place to prescribe the limit to their actions. This is an area of urgent policy intervention to regulate specialist tariffs.

5.3 The way forward: Recommendations for policy and research directions

The findings of this study suggest some recommendations for future policy and research are part. From a general standpoint, knowledge remains thin about cost variation of hospital procedures. The existence of such variations shows that the costs are not standardised. The lack of standardisation of healthcare costs, especially specialist costs as the key drivers of hospital admissions, has reflected in the increases in medical scheme contributions being much higher than the consumer price index (CPI). The reason that specialists can charge such high rates is because of the demand for their services. In the two major cities of South Africa, Johannesburg and Cape Town, specialists have captivated the market and have possibly exploited it.

One may see as a positive development, the recent move from the government to consider the possible introduction of regulating mechanisms with the aim to legislate tariffs for the specialist rates. To make this work, all the stakeholders (regulators, the medical associations and the funders) must

work together in order to arrive at some common grounds as to how best such an arrangement would work. There are a number of factors, which could influence prices "formation" for the service, as outlined by Van den Heever (2003). These include market-related factors like the Rand-Dollar exchange rate in terms of the specialised equipment used in this industry and medical inflation rate together with headline inflation. The healthcare funders (medical schemes) need to contract with specialists to provide services at set rates based on volume and the demand for such services.

Medical schemes can place restrictions by introducing co-payments on certain hospital procedures, which are not medically justified, for example, procedures like elective caesarean sections. For this type of procedure, there are some reasons to argue that the growing costs are likely driven by induced demand. This assertion is supported by our findings and from others sources (see for example, Price and Bloomberg, 1990).

With regard to future research, the findings of this study suggest that the role of specialists and their influence on healthcare costs in South Africa can be investigated further. To a large extent, the evidence points to the fact that specialists are the key cost drivers and determine how patients spend their healthcare benefits. The induced utilisation of specialists is evident from the literature (Price Bloomberg, 1990) and this aspect was touched upon through the examination of patients of caesarean sections in this study. This practice can be investigated in the future. The factors associated with cost as identified in the study provided a partial picture of the dynamics underlying the

differentials and disparities in costs for specialists. Despite this limitation, they do provide a strong indication about the need to conduct further inquiries to fully understand these dynamics.

Specific research questions around the induced demand of caesarean sections and the impact on the overall healthcare costs could help medical schemes to structure maternity benefits in a cost-effective way. Medical schemes could possibly contract with gynaecologists to negotiate alternate reimbursement methods like discounted rates based on factors like number of members within the medical schemes, their sex ratio within the scheme, etc.

Managed care organisations promulgate interventions, but seldom measure or evaluate these interventions. Measuring evidence-based intervention by managed care organisations for their disease management programmes could be an effective way of quantifying the savings these companies claim to generate for the medical schemes. This also requires engaging in evaluation based on sound methodology.

Government would like to regulate tariffs charged by specialists (Van den Heever, 2003), but Eliastam (2003) suggests that this type of regulation is not "sufficiently effective" and that "voluntary self-regulation" would be more effective. Surveying the specialists could be useful in determining whether this is a method that the medical fraternity would like to pursue, and how this could possibly be done. There are a relatively small number of specialists in South Africa and if governments were to start interfering with how specialists

charge for their services, there could be a threat of these specialists leaving the country to practise elsewhere. This could be a concern facing the regulators. Government should be working with the different medical practitioner associations like the South African Medical Association (SAMA) and the Board of Healthcare Funders (BHF) to find solutions to the healthcare problems.

This study was concerned with the disparities in costs of hospital procedures and not with the quality of care provided whilst in hospital. Research on the relationship between the cost of hospital procedure and the quality of care received whilst admitted for such a procedure could also be part of the issues of interest. This type of study could perhaps explain why there are cost variations and could also provide a good basis of understanding the variation from the perspective of the demand side. To put this in context, one can refer to the study conducted by the World Bank (Lindelow, 2003), which emphasises on the importance of quality for a better understanding of spatial variations in the utilisation of health services.

Another interesting piece of research would be to investigate/track the hospital admission costs over time to see what the influence of medical inflation is on costs. The type of relationship between medical inflation and headline inflation can be explored. These trends could provide some of the reasons why healthcare costs are soaring and possibly provide solutions or forecasts of what can be expected in the future.

APPENDIX A

The formulae used in calculating one-way ANOVA

Source of Variation	Sums of Squares	Degrees of Freedom	Mean Squares	F-ratios
Between groups	$SS_A = \Sigma \frac{(\Sigma X_{ij})^2}{N_j} - \frac{\Sigma X_{ij})^2}{N}$	k -1	$MS_A = \frac{SS_A}{k-1}$	$F = \frac{MS_A}{MS_E}$
Error	$SS_E = SS_T - SS_A$	N – k	$MS_E = \frac{SS_E}{N-k}$	
Total	$SS_T = \Sigma X_{ij}^2 - \frac{(\Sigma X_{ij})^2}{N}$	N – 1		

Reference: (Dawson Trapp, 2004)

Assumptions of one-way ANOVA

- Normality of the variable error ξ_{ij}'s distributed as $N(0,\sigma^2)$, use of material which, in the absence of different treatments would give a normal distribution of results.
- Independent random samples: randomly distributed layout of treatments.
- Equal population variances or standard deviations.
- H_0 (null hypothesis) population means are equal
- Additivity – There is not interaction between the treatment and response.

APPENDIX B

1. Cataract SPSS Output

1.1 Hospital group

Descriptives

			N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
							Lower Bound	Upper Bound		
Total Admission Cost	Hospital Group	HospGrp 1	234	11782.90	2996.6955	195.9001	11396.94	12168.86	7010.00	40865.00
		HospGrp 2	165	12252.72	2603.9292	202.7156	11852.45	12652.99	9179.00	30670.00
		HospGrp 3	273	12753.49	2372.5422	143.5928	12470.80	13036.19	8659.00	36069.00
		HospGrp 4	293	12548.45	2070.2102	120.9430	12310.42	12786.48	6703.00	26790.00
		Total	965	12370.26	2519.4892	81.1052	12211.09	12529.42	6703.00	40865.00
Specialist Cost	Hospital Group	HospGrp 1	234	2737.1154	881.3618	57.6164	2623.5996	2850.6311	1562.00	8195.00
		HospGrp 2	165	3095.2182	1224.0287	95.2905	2907.0638	3283.3726	1618.00	9744.00
		HospGrp 3	273	3122.4432	1038.8329	62.8730	2998.6636	3246.2228	1618.00	9498.00
		HospGrp 4	293	2804.7201	762.2549	44.5314	2717.0769	2892.3633	1273.00	8237.00
		Total	965	2927.8819	975.7526	31.4106	2866.2409	2989.5229	1273.00	9744.00

ANOVA - CATARACT

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Cost	Between Groups	1.3E+08	3	4.4E+07	7.085	.000
	Within Groups	6.0E+09	961	6229862		
	Total	6.1E+09	964			
Specialist Cost	Between Groups	2.8E+07	3	9304856	10.048	.000
	Within Groups	8.9E+08	961	926017.9		
	Total	9.2E+08	964			

Multiple Comparisons

Dependent Variable		(I) Hospital Group	(J) Hospital Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Total Admission Cost	Tukey HSD	HospGrp 1	HospGrp 2	-469.8238	253.732	.249	-1121.67	182.0230
			HospGrp 3	-970.5971*	222.359	.000	-1541.84	-399.3503
			HospGrp 4	-765.5531*	218.828	.003	-1327.73	-203.3767
		HospGrp 2	HospGrp 1	469.8238	253.732	.249	-182.0230	1121.6706
			HospGrp 3	-500.7733	246.123	.175	-1133.07	131.5261
			HospGrp 4	-295.7293	242.938	.616	-919.8462	328.3876
		HospGrp 3	HospGrp 1	970.5971*	222.359	.000	399.3503	1541.8438
			HospGrp 2	500.7733	246.123	.175	-131.5261	1133.0727
			HospGrp 4	205.0440	209.958	.763	-334.3450	744.4330
		HospGrp 4	HospGrp 1	765.5531*	218.828	.003	203.3767	1327.7294
			HospGrp 2	295.7293	242.938	.616	-328.3876	919.8462
			HospGrp 3	-205.0440	209.958	.763	-744.4330	334.3450
	Bonferroni	HospGrp 1	HospGrp 2	-469.8238	253.732	.386	-1140.62	200.9763
			HospGrp 3	-970.5971*	222.359	.000	-1558.45	-382.7407
			HospGrp 4	-765.5531*	218.828	.003	-1344.08	-187.0308
		HospGrp 2	HospGrp 1	469.8238	253.732	.386	-200.9763	1140.6238
			HospGrp 3	-500.7733	246.123	.253	-1151.46	149.9110
			HospGrp 4	-295.7293	242.938	1.000	-937.9932	346.5346
		HospGrp 3	HospGrp 1	970.5971*	222.359	.000	382.7407	1558.4535
			HospGrp 2	500.7733	246.123	.253	-149.9110	1151.4575
			HospGrp 4	205.0440	209.958	1.000	-350.0284	760.1164
		HospGrp 4	HospGrp 1	765.5531*	218.828	.003	187.0308	1344.0754
			HospGrp 2	295.7293	242.938	1.000	-346.5346	937.9932
			HospGrp 3	-205.0440	209.958	1.000	-760.1164	350.0284
Specialist Cost	Tukey HSD	HospGrp 1	HospGrp 2	-358.1028*	97.824	.001	-609.4164	-106.7892
			HospGrp 3	-385.3278*	85.728	.000	-605.5668	-165.0888
			HospGrp 4	-67.6048	84.367	.854	-284.3467	149.1372
		HospGrp 2	HospGrp 1	358.1028*	97.824	.001	106.7892	609.4164
			HospGrp 3	-27.2250	94.891	.992	-271.0023	216.5522
			HospGrp 4	290.4980*	93.663	.010	49.8754	531.1207
		HospGrp 3	HospGrp 1	385.3278*	85.728	.000	165.0888	605.5668
			HospGrp 2	27.2250	94.891	.992	-216.5522	271.0023
			HospGrp 4	317.7231*	80.947	.001	109.7666	525.6796
		HospGrp 4	HospGrp 1	67.6048	84.367	.854	-149.1372	284.3467
			HospGrp 2	-290.4980*	93.663	.010	-531.1207	-49.8754
			HospGrp 3	-317.7231*	80.947	.001	-525.6796	-109.7666
	Bonferroni	HospGrp 1	HospGrp 2	-358.1028*	97.824	.002	-616.7237	-99.4819
			HospGrp 3	-385.3278*	85.728	.000	-611.9705	-158.6851
			HospGrp 4	-67.6048	84.367	1.000	-290.6488	155.4393
		HospGrp 2	HospGrp 1	358.1028*	97.824	.002	99.4819	616.7237
			HospGrp 3	-27.2250	94.891	1.000	-278.0904	223.6404
			HospGrp 4	290.4980*	93.663	.012	42.8790	538.1170
		HospGrp 3	HospGrp 1	385.3278*	85.728	.000	158.6851	611.9705
			HospGrp 2	27.2250	94.891	1.000	-223.6404	278.0904
			HospGrp 4	317.7231*	80.947	.001	103.7200	531.7262
		HospGrp 4	HospGrp 1	67.6048	84.367	1.000	-155.4393	290.6488
			HospGrp 2	-290.4980*	93.663	.012	-538.1170	-42.8790
			HospGrp 3	-317.7231*	80.947	.001	-531.7262	-103.7200

*. The mean difference is significant at the .05 level.

1.2 Province

Descriptives

			N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
							Lower Bound	Upper Bound		
Total Admission Cost	Province	Eastern Cape	78	11944.82	2138.8471	242.1767	11462.59	12427.06	7701.00	19866.00
		Free State	51	11059.06	2093.6470	293.1692	10470.21	11647.91	7010.00	22816.00
		Gauteng	328	12852.99	2796.8972	154.4328	12549.18	13156.80	6703.00	40865.00
		Kwazulu Natal	203	11855.59	1718.6172	120.6233	11617.74	12093.43	9125.00	21544.00
		Limpopo	42	12655.48	1678.6745	259.0251	12132.36	13178.59	8783.00	18306.00
		Mpumalanga	31	11557.00	1422.9400	255.5676	11035.06	12078.94	9781.00	16165.00
		Northern Cape	20	12708.90	4374.5875	978.1875	10661.53	14756.27	9686.00	30670.00
		North West	47	13662.68	4097.1390	597.6291	12459.72	14865.65	8717.00	28955.00
		Western Cape	165	12321.23	2130.0179	165.8217	11993.81	12648.65	8581.00	20665.00
		Total	965	12370.26	2519.4892	81.1052	12211.09	12529.42	6703.00	40865.00
Specialist Cost	Province	Eastern Cape	78	2807.2564	767.9197	86.9498	2634.1173	2980.3956	1618.00	6872.00
		Free State	51	2543.6275	591.6354	82.8455	2377.2273	2710.0276	1562.00	5136.00
		Gauteng	328	2979.6921	947.1019	52.2950	2876.8151	3082.5691	1273.00	9498.00
		Kwazulu Natal	203	2873.9606	953.0934	66.8940	2742.0604	3005.8608	1618.00	9744.00
		Limpopo	42	3046.3095	718.1927	110.8195	2822.5049	3270.1141	1853.00	5150.00
		Mpumalanga	31	2476.2581	235.7226	42.3370	2389.7943	2562.7218	2279.00	3114.00
		Northern Cape	20	2966.7500	711.2373	159.0375	2633.8807	3299.6193	2040.00	5726.00
		North West	47	3035.7021	1039.9893	151.6980	2730.3498	3341.0544	2228.00	7467.00
		Western Cape	165	3086.3030	1292.9246	100.6540	2887.5581	3285.0479	1618.00	9156.00
		Total	965	2927.8819	975.7526	31.4106	2866.2409	2989.5229	1273.00	9744.00

ANOVA - CATARACT

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Cost	Between Groups	3.4E+08	8	4.2E+07	6.967	.000
	Within Groups	5.8E+09	956	6048308		
	Total	6.1E+09	964			
Specialist Cost	Between Groups	2.2E+07	8	2720678	2.903	.003
	Within Groups	9.0E+08	956	937293.2		
	Total	9.2E+08	964			

Multiple Comparisons

Dependent Variable: Total Admission Cost

Tukey HSD

(I) Province	(J) Province	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Eastern Cape	Free State	885.7617	442.873	.543	-487.9119	2259.4353
	Gauteng	-908.1703	309.810	.081	-1869.12	52.7777
	Kwazulu Natal	89.2343	327.623	1.000	-926.9651	1105.4337
	Limpopo	-710.6557	470.691	.851	-2170.61	749.3003
	Mpumalanga	387.8205	522.158	.998	-1231.77	2007.4147
	Northern Cape	-764.0795	616.407	.948	-2676.01	1147.8498
	North West	-1717.860*	454.125	.005	-3126.44	-309.2857
	Western Cape	-376.4098	337.933	.972	-1424.59	671.7680
Free State	Eastern Cape	-885.7617	442.873	.543	-2259.44	487.9119
	Gauteng	-1793.932*	370.181	.000	-2942.14	-645.7290
	Kwazulu Natal	-796.5274	385.213	.496	-1991.35	398.2991
	Limpopo	-1596.417*	512.447	.048	-3185.89	-6.9455
	Mpumalanga	-497.9412	560.090	.994	-2235.19	1239.3079
	Northern Cape	-1649.841	648.853	.212	-3662.41	362.7251
	North West	-2603.622*	497.274	.000	-4146.03	-1061.21
	Western Cape	-1262.171*	394.019	.037	-2484.31	-40.0316
Gauteng	Eastern Cape	908.1703	309.810	.081	-52.7777	1869.1183
	Free State	1793.9320*	370.181	.000	645.7290	2942.1351
	Kwazulu Natal	997.4046*	219.624	.000	316.1909	1678.6184
	Limpopo	197.5147	403.047	1.000	-1052.63	1447.6597
	Mpumalanga	1295.9909	462.111	.114	-137.3535	2729.3352
	Northern Cape	144.0909	566.441	1.000	-1612.86	1901.0384
	North West	-809.6900	383.572	.466	-1999.43	380.0468
	Western Cape	531.7606	234.726	.363	-196.2969	1259.8180
Kwazulu Natal	Eastern Cape	-89.2343	327.623	1.000	-1105.43	926.9651
	Free State	796.5274	385.213	.496	-398.2991	1991.3539
	Gauteng	-997.4046*	219.624	.000	-1678.62	-316.1909
	Limpopo	-799.8900	416.896	.601	-2092.99	493.2081
	Mpumalanga	298.5862	474.238	.999	-1172.37	1769.5438
	Northern Cape	-853.3138	576.377	.865	-2641.08	934.4515
	North West	-1807.095*	398.098	.000	-3041.89	-572.3017
	Western Cape	-465.6441	257.781	.678	-1265.21	333.9232
Limpopo	Eastern Cape	710.6557	470.691	.851	-749.3003	2170.6117
	Free State	1596.4174*	512.447	.048	6.9455	3185.8892
	Gauteng	-197.5147	403.047	1.000	-1447.66	1052.6303
	Kwazulu Natal	799.8900	416.896	.601	-493.2081	2092.9881
	Mpumalanga	1098.4762	582.335	.623	-707.7704	2904.7228
	Northern Cape	-53.4238	668.149	1.000	-2125.84	2018.9939
	North West	-1007.205	522.202	.594	-2626.93	612.5250
	Western Cape	334.2459	425.046	.997	-984.1312	1652.6230
Mpumalanga	Eastern Cape	-387.8205	522.158	.998	-2007.41	1231.7736
	Free State	497.9412	560.090	.994	-1239.31	2235.1902
	Gauteng	-1295.991	462.111	.114	-2729.34	137.3535
	Kwazulu Natal	-298.5862	474.238	.999	-1769.54	1172.3714
	Limpopo	-1098.476	582.335	.623	-2904.72	707.7704
	Northern Cape	-1151.900	705.352	.787	-3339.71	1035.9137
	North West	-2105.681*	569.029	.007	-3870.66	-340.7056
	Western Cape	-764.2303	481.418	.812	-2257.46	728.9983
Northern Cape	Eastern Cape	764.0795	616.407	.948	-1147.85	2676.0088
	Free State	1649.8412	648.853	.212	-362.7251	3662.4074
	Gauteng	-144.0909	566.441	1.000	-1901.04	1612.8567
	Kwazulu Natal	853.3138	576.377	.865	-934.4515	2641.0791
	Limpopo	53.4238	668.149	1.000	-2018.99	2125.8415
	Mpumalanga	1151.9000	705.352	.787	-1035.91	3339.7137
	North West	-953.7809	656.584	.877	-2990.33	1082.7668
	Western Cape	387.6697	582.299	.999	-1418.46	2193.8038
North West	Eastern Cape	1717.8603*	454.125	.005	309.2857	3126.4350
	Free State	2603.6220*	497.274	.000	1061.2110	4146.0330
	Gauteng	809.6900	383.572	.466	-380.0468	1999.4268
	Kwazulu Natal	1807.0946*	398.098	.000	572.3017	3041.8876
	Limpopo	1007.2047	522.202	.594	-612.5250	2626.9343
	Mpumalanga	2105.6809*	569.029	.007	340.7056	3870.6561
	Northern Cape	953.7809	656.584	.877	-1082.77	2990.3285
	Western Cape	1341.4505*	406.625	.027	80.2094	2602.6917
Western Cape	Eastern Cape	376.4098	337.933	.972	-671.7680	1424.5876
	Free State	1262.1715*	394.019	.037	40.0316	2484.3113
	Gauteng	-531.7606	234.726	.363	-1259.82	196.2969
	Kwazulu Natal	465.6441	257.781	.678	-333.9232	1265.2114
	Limpopo	-334.2459	425.046	.997	-1652.62	984.1312
	Mpumalanga	764.2303	481.418	.812	-728.9983	2257.4589
	Northern Cape	-387.6697	582.299	.999	-2193.80	1418.4644
	North West	-1341.451*	406.625	.027	-2602.69	-80.2094

*. The mean difference is significant at the .05 level.

1.3 Schemes

Descriptives

			N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
							Lower Bound	Upper Bound		
Total Admission Cost	Scheme	Scheme 1	432	12256.94	2818.4160	135.6011	11990.42	12523.47	7701.00	40865.00
		Scheme 2	455	12475.65	2258.7817	105.8933	12267.55	12683.75	6703.00	36069.00
		Scheme 3	35	12689.43	2775.0184	469.0637	11736.18	13642.68	8581.00	21779.00
		Scheme 4	43	12133.65	1550.1162	236.3905	11656.60	12610.71	9742.00	16712.00
		Total	965	12370.26	2519.4892	81.1052	12211.09	12529.42	6703.00	40865.00
Specialist Cost	Scheme	Scheme 1	432	2818.8125	706.5123	33.9921	2752.0016	2885.6234	1618.00	8195.00
		Scheme 2	455	3030.3297	1151.2397	53.9710	2924.2658	3136.3935	1273.00	9744.00
		Scheme 3	35	3161.2286	1518.1812	256.6195	2639.7151	3682.7421	1618.00	8237.00
		Scheme 4	43	2749.6744	473.5395	72.2141	2603.9405	2895.4084	1907.00	3933.00
		Total	965	2927.8819	975.7526	31.4106	2866.2409	2989.5229	1273.00	9744.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Cost	Between Groups	1.7E+07	3	5524437	.870	.456
	Within Groups	6.1E+09	961	6350396		
	Total	6.1E+09	964			
Specialist Cost	Between Groups	1.3E+07	3	4395322	4.669	.003
	Within Groups	9.0E+08	961	941344.2		
	Total	9.2E+08	964			

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Scheme	(J) Scheme	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Total Admission Cost	Scheme 1	Scheme 2	-218.7039	169.284	.568	-653.5989	216.1911
		Scheme 3	-432.4841	442.877	.763	-1570.25	705.2813
		Scheme 4	123.2933	402.969	.990	-911.9464	1158.5330
	Scheme 2	Scheme 1	218.7039	169.284	.568	-216.1911	653.5989
		Scheme 3	-213.7802	442.037	.963	-1349.39	921.8280
		Scheme 4	341.9972	402.045	.830	-690.8711	1374.8655
	Scheme 3	Scheme 1	432.4841	442.877	.763	-705.2813	1570.2496
		Scheme 2	213.7802	442.037	.963	-921.8280	1349.3884
		Scheme 4	555.7774	573.693	.767	-918.0589	2029.6137
	Scheme 4	Scheme 1	-123.2933	402.969	.990	-1158.53	911.9464
		Scheme 2	-341.9972	402.045	.830	-1374.87	690.8711
		Scheme 3	-555.7774	573.693	.767	-2029.61	918.0589
Specialist Cost	Scheme 1	Scheme 2	-211.5172*	65.176	.006	-378.9568	-44.0775
		Scheme 3	-342.4161	170.513	.185	-780.4690	95.6368
		Scheme 4	69.1381	155.148	.970	-329.4412	467.7174
	Scheme 2	Scheme 1	211.5172*	65.176	.006	44.0775	378.9568
		Scheme 3	-130.8989	170.189	.868	-568.1212	306.3234
		Scheme 4	280.6553	154.792	.267	-117.0110	678.3215
	Scheme 3	Scheme 1	342.4161	170.513	.185	-95.6368	780.4690
		Scheme 2	130.8989	170.189	.868	-306.3234	568.1212
		Scheme 4	411.5542	220.878	.244	-155.8899	978.9982
	Scheme 4	Scheme 1	-69.1381	155.148	.970	-467.7174	329.4412
		Scheme 2	-280.6553	154.792	.267	-678.3215	117.0110
		Scheme 3	-411.5542	220.878	.244	-978.9982	155.8899

*. The mean difference is significant at the .05 level.

1.4 Age

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Cost	Between Groups	1.7E+08	5	3.4E+07	5.403	.000
	Within Groups	6.0E+09	959	6206095		
	Total	6.1E+09	964			

1.5 Admission Cost Regression

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	GENDER, Area, AGE1, HOSPGRP1[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: TOTCOST

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.166[a]	.028	.023	2489.7306	.028	6.796	4	960	.000

a. Predictors: (Constant), GENDER, Area, AGE1, HOSPGRP1

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.7E+08	4	4.2E+07	6.796	.000[a]
	Residual	6.0E+09	960	6198759		
	Total	6.1E+09	964			

a. Predictors: (Constant), GENDER, Area, AGE1, HOSPGRP1

b. Dependent Variable: TOTCOST

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	13468.392	336.724		39.998	.000	12807.592	14129.192					
	AGE1	-823.405	233.316	-.112	-3.529	.000	-1281.272	-365.538	-.113	-.113	-.112	.999	1.001
	HOSPGRP1	551.942	178.231	.099	3.097	.002	202.175	901.709	.096	.099	.099	.997	1.003
	Area	120.991	199.545	.019	.606	.544	-270.604	512.586	.015	.020	.019	.997	1.003
	GENDER	-362.566	161.798	-.071	-2.241	.025	-680.084	-45.047	-.072	-.072	-.071	.999	1.001

a. Dependent Variable: TOTCOST

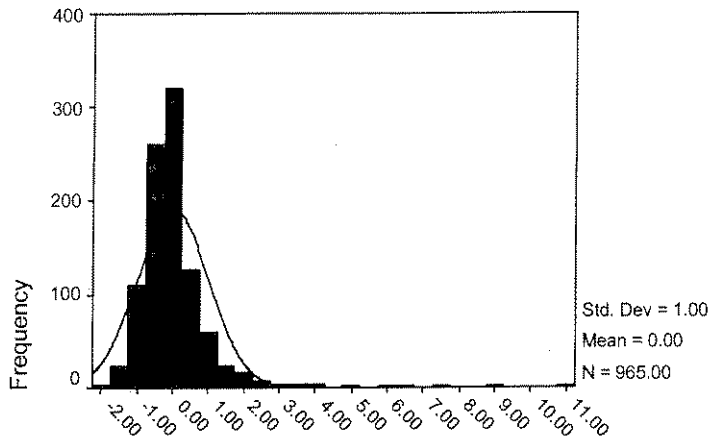
Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions				
				(Constant)	AGE1	HOSPGRP1	Area	GENDER
1	1	3.447	1.000	.00	.01	.02	.02	.01
	2	.808	2.065	.00	.00	.26	.69	.00
	3	.592	2.412	.01	.02	.70	.28	.01
	4	.114	5.490	.01	.70	.00	.00	.31
	5	3.749E-02	9.589	.98	.27	.01	.01	.67

a. Dependent Variable: TOTCOST

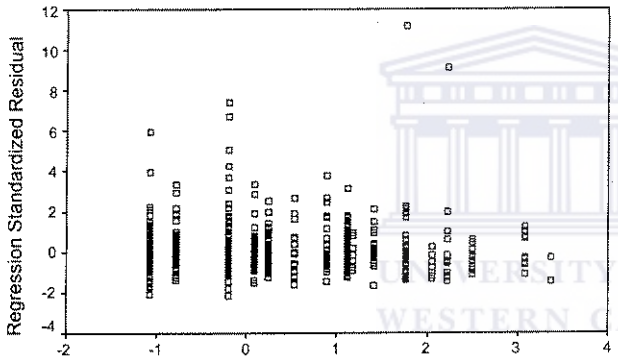
Histogram

Dependent Variable: TOTCOST



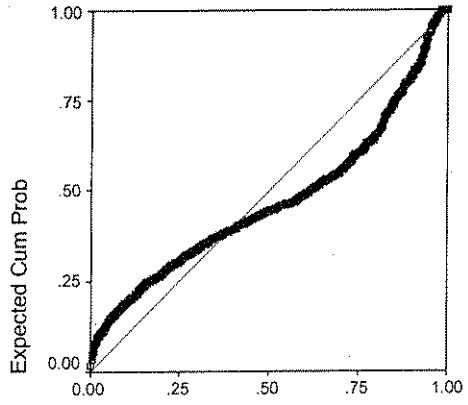
Scatterplot

Dependent Variable: TOTCOST



Normal P-P Plot of Regression Stanc

Dependent Variable: TOTCOST



1.6 Specialist Cost Regression

Descriptive Statistics

	Mean	Std. Deviation	N
SPECCOST	2927.8819	975.7526	965
AGE1	.8632	.3438	965
HOSPGRP1	.2829	.4506	965
Area	.20	.40	965
GENDER	1.57	.50	965

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.182[a]	.033	.029	961.5170	.033	8.189	4	960	.000

a. Predictors: (Constant), GENDER, Area, AGE1, HOSPGRP1

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.0E+07	4	7570844	8.189	.000[a]
	Residual	8.9E+08	960	924515.0		
	Total	9.2E+08	964			

a. Predictors: (Constant), GENDER, Area, AGE1, HOSPGRP1

b. Dependent Variable: SPECCOST

Coefficients[a]

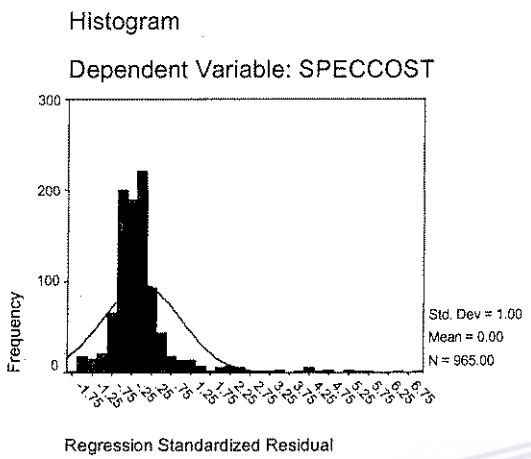
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1	(Constant)	3119.285	130.040		23.987	.000	2864.089	3374.482					
	AGE1	-132.332	90.105	-.047	-1.469	.142	-309.158	44.493	-.048	-.047	-.047	.999	1.001
	HOSPGRP1	286.406	68.832	.132	4.161	.000	151.328	421.484	.125	.133	.132	.997	1.003
	Area	247.988	77.063	.102	3.218	.001	96.757	399.219	.095	.103	.102	.997	1.003
	GENDER	-133.112	62.485	-.068	-2.130	.033	-255.736	-10.489	-.065	-.069	-.068	.999	1.001

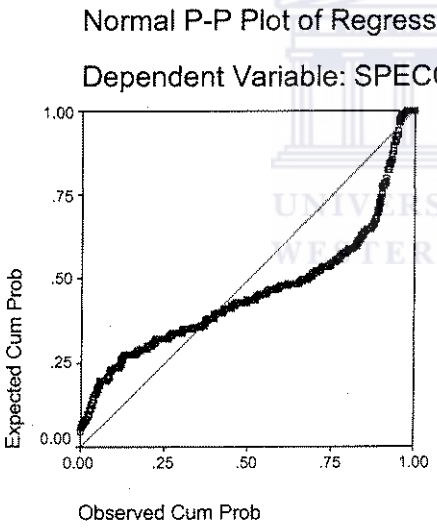
a. Dependent Variable: SPECCOST

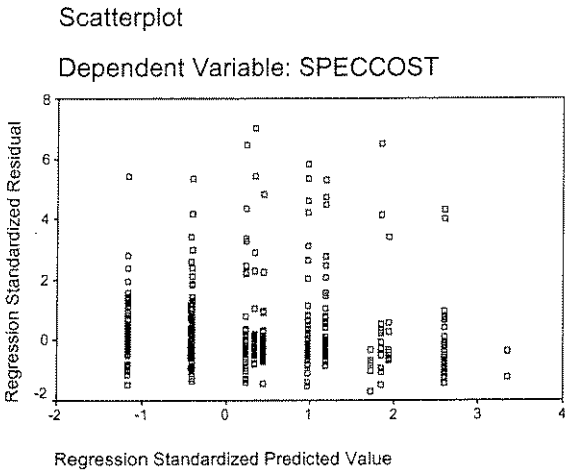
Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions				
				(Constant)	AGE1	HOSPGRP1	Area	GENDER
1	1	3.447	1.000	.00	.01	.02	.02	.01
	2	.808	2.065	.00	.00	.26	.69	.00
	3	.592	2.412	.01	.02	.70	.28	.01
	4	.114	5.490	.01	.70	.00	.00	.31
	5	3.749E-02	9.589	.98	.27	.01	.01	.67

a. Dependent Variable: SPECCOST







2. Hip replacement SPSS Output

2.1 Hospital group

Descriptives

			N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
							Lower Bound	Upper Bound		
Total Admission Cost	Hospital Group	Hospgrp1	77	83578.00	19965.96	2275.33	79046.28	88109.72	44216	161796
		Hospgrp2	103	76800.81	16457.42	1621.60	73584.37	80017.24	31197	124899
		Hospgrp3	57	81128.98	25395.09	3363.66	74390.76	87867.21	11451	186706
		Hospgrp4	15	75517.40	19107.94	4933.65	64935.77	86099.03	47839	103056
		Total	252	79774.21	20114.29	1267.08	77278.75	82269.68	11451	186706
Specialist Cost	Hospital Group	Hospgrp1	77	6533.58	2702.17	307.94	5920.27	7146.90	3096	16789
		Hospgrp2	103	7883.13	3625.92	357.27	7174.48	8591.78	3025	21464
		Hospgrp3	57	5912.28	2328.19	308.38	5294.53	6530.03	2521	13237
		Hospgrp4	15	7717.73	5044.43	1302.46	4924.22	10511.24	2957	17054
		Total	252	7015.13	3296.71	207.67	6606.13	7424.14	2521	21464

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Cost	Between Groups	2.4E+09	3	8.0E+08	2.002	.114
	Within Groups	9.9E+10	248	4.0E+08		
	Total	1.0E+11	251			
Specialist Cost	Between Groups	1.7E+08	3	5.7E+07	5.570	.001
	Within Groups	2.6E+09	248	1.0E+07		
	Total	2.7E+09	251			

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Hospital Group	(J) Hospital Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Total Admission Cost	Hospgrp1	Hospgrp2	6777.19	3012.256	.110	-961.39	14515.78
		Hospgrp3	2449.02	3493.729	.897	-6526.49	11424.53
		Hospgrp4	8060.60	5643.162	.482	-6436.87	22558.07
	Hospgrp2	Hospgrp1	-6777.19	3012.256	.110	-14515.78	961.39
		Hospgrp3	-4328.18	3300.833	.556	-12808.13	4151.77
		Hospgrp4	1283.41	5525.815	.996	-12912.60	15479.41
	Hospgrp3	Hospgrp1	-2449.02	3493.729	.897	-11424.53	6526.49
		Hospgrp2	4328.18	3300.833	.556	-4151.77	12808.13
		Hospgrp4	5611.58	5802.335	.768	-9294.81	20517.98
	Hospgrp4	Hospgrp1	-8060.60	5643.162	.482	-22558.07	6436.87
		Hospgrp2	-1283.41	5525.815	.996	-15479.41	12912.60
		Hospgrp3	-5611.58	5802.335	.768	-20517.98	9294.81
Specialist Cost	Hospgrp1	Hospgrp2	-1349.54*	483.622	.027	-2591.98	-107.10
		Hospgrp3	621.30	560.923	.685	-819.73	2062.33
		Hospgrp4	-1184.15	906.017	.558	-3511.74	1143.44
	Hospgrp2	Hospgrp1	1349.54*	483.622	.027	107.10	2591.98
		Hospgrp3	1970.85*	529.953	.001	609.38	3332.31
		Hospgrp4	165.39	887.177	.998	-2113.79	2444.58
	Hospgrp3	Hospgrp1	-621.30	560.923	.685	-2062.33	819.73
		Hospgrp2	-1970.85*	529.953	.001	-3332.31	-609.38
		Hospgrp4	-1805.45	931.572	.212	-4198.69	587.79
	Hospgrp4	Hospgrp1	1184.15	906.017	.558	-1143.44	3511.74
		Hospgrp2	-165.39	887.177	.998	-2444.58	2113.79
		Hospgrp3	1805.45	931.572	.212	-587.79	4198.69

*. The mean difference is significant at the .05 level.

2.2 Province

Descriptives

			N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
							Lower Bound	Upper Bound		
Total Admission Cost	Province	Eastern Cape	23	75712.91	14081.11	2936.12	69623.78	81802.04	47328	104142
		Free State	19	66226.58	12640.21	2899.86	60134.19	72318.97	44216	93879
		Gauteng	89	87227.90	23770.56	2519.67	82220.58	92235.22	23472	186706
		Kwazulu Natal	27	76947.74	18147.79	3492.54	69768.71	84126.77	11451	110412
		Limpopo	3	86702.67	7685.28	4437.10	67611.15	105794.18	77925	92222
		Mpumalanga	15	85601.60	16802.99	4338.51	76296.42	94906.78	64746	124899
		Northern Cape	5	72774.60	5654.68	2528.85	65753.50	79795.70	65546	80618
		North West	16	76671.56	20442.02	5110.51	65778.78	87564.35	47839	122074
		Western Cape	55	75050.51	16246.27	2190.65	70658.53	79442.49	31197	119744
		Total	252	79774.21	20114.29	1267.08	77278.75	82269.68	11451	186706
Specialist Cost	Province	Eastern Cape	23	5442.48	1739.21	362.65	4690.39	6194.57	2521	9340
		Free State	19	5689.68	1564.15	358.84	4935.79	6443.58	3340	8211
		Gauteng	89	7835.42	3455.52	366.28	7107.50	8563.33	2957	21464
		Kwazulu Natal	27	6328.93	2584.99	497.48	5306.34	7351.51	3048	11520
		Limpopo	3	8729.67	5658.74	3267.07	-5327.57	22786.91	4497	15157
		Mpumalanga	15	6297.67	3010.35	777.27	4630.59	7964.75	3025	13355
		Northern Cape	5	7356.40	2081.43	930.84	4772.01	9940.79	5106	10012
		North West	16	5290.00	2512.13	628.03	3951.38	6628.62	2957	12115
		Western Cape	55	7713.16	3933.56	530.40	6649.77	8776.55	2521	19129
		Total	252	7015.13	3296.71	207.67	6606.13	7424.14	2521	21464

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Cost	Between Groups	1.1E+10	8	1.4E+09	3.806	.000
	Within Groups	9.0E+10	243	3.7E+08		
	Total	1.0E+11	251			
Specialist Cost	Between Groups	2.5E+08	8	3.2E+07	3.124	.002
	Within Groups	2.5E+09	243	1.0E+07		
	Total	2.7E+09	251			

Multiple Comparisons

Dependent Variable: Total Admission Cost

Tukey HSD

(I) Province	(J) Province	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Eastern Cape	Free State	9486.33	5974.347	.812	-9044.49	28017.16
	Gauteng	-11514.99	4507.717	.206	-25496.71	2466.74
	Kwazulu Natal	-1234.83	5468.217	1.000	-18195.77	15726.11
	Limpopo	-10989.75	11829.562	.991	-47681.88	25702.37
	Mpumalanga	-9888.69	6395.710	.834	-29726.46	9949.09
	Northern Cape	2938.31	9509.039	1.000	-26556.17	32432.80
	North West	-958.65	6273.573	1.000	-20417.59	18500.29
	Western Cape	662.40	4785.293	1.000	-14180.29	15505.10
Free State	Eastern Cape	-9486.33	5974.347	.812	-28017.16	9044.49
	Gauteng	-21001.32*	4870.198	.001	-36107.37	-5895.27
	Kwazulu Natal	-10721.16	5770.677	.643	-28620.25	7177.93
	Limpopo	-20476.09	11972.379	.740	-57611.19	16659.02
	Mpumalanga	-19375.02	6656.157	.086	-40020.63	1270.59
	Northern Cape	-6548.02	9686.131	.999	-36591.80	23495.76
	North West	-10444.98	6538.886	.807	-30726.85	9836.89
	Western Cape	-8823.93	5128.192	.734	-24730.20	7082.34
Gauteng	Eastern Cape	11514.99	4507.717	.206	-2466.74	25496.71
	Free State	21001.32*	4870.198	.001	5895.27	36107.37
	Kwazulu Natal	10280.16	4234.076	.269	-2852.81	23413.13
	Limpopo	525.23	11312.141	1.000	-34561.99	35612.46
	Mpumalanga	1626.30	5378.765	1.000	-15057.19	18309.78
	Northern Cape	14453.30	8857.078	.787	-13018.98	41925.58
	North West	10556.34	5232.945	.531	-5674.86	26787.53
	Western Cape	12177.39*	3305.304	.007	1925.22	22429.56
Kwazulu Natal	Eastern Cape	1234.83	5468.217	1.000	-15726.11	18195.77
	Free State	10721.16	5770.677	.643	-7177.93	28620.25
	Gauteng	-10280.16	4234.076	.269	-23413.13	2852.81
	Limpopo	-9754.93	11728.019	.996	-46132.09	26622.24
	Mpumalanga	-8653.86	6205.884	.900	-27902.85	10595.13
	Northern Cape	4173.14	9382.415	1.000	-24928.59	33274.87
	North West	276.18	6079.934	1.000	-18582.15	19134.50
	Western Cape	1897.23	4528.457	1.000	-12148.83	15943.29
Limpopo	Eastern Cape	10989.75	11829.562	.991	-25702.37	47681.88
	Free State	20476.09	11972.379	.740	-16659.02	57611.19
	Gauteng	-525.23	11312.141	1.000	-35612.46	34561.99
	Kwazulu Natal	9754.93	11728.019	.996	-26622.24	46132.09
	Mpumalanga	1101.07	12188.114	1.000	-36703.19	38905.33
	Northern Cape	13928.07	14073.622	.987	-29724.53	57580.67
	North West	10031.10	12124.469	.996	-27575.74	47637.95
	Western Cape	11652.16	11425.588	.984	-23786.95	47091.27
Mpumalanga	Eastern Cape	9888.69	6395.710	.834	-9949.09	29726.46
	Free State	19375.02	6656.157	.086	-1270.59	40020.63
	Gauteng	-1626.30	5378.765	1.000	-18309.78	15057.19
	Kwazulu Natal	8653.86	6205.884	.900	-10595.13	27902.85

Multiple Comparisons

Dependent Variable: Specialist Cost

Tukey HSD

(I) Province	(J) Province	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Eastern Cape	Free State	-247.21	989.100	1.000	-3315.13	2820.72
	Gauteng	-2392.94*	746.288	.036	-4707.72	-78.15
	Kwazulu Natal	-886.45	905.306	.988	-3694.46	1921.57
	Limpopo	-3287.19	1958.476	.760	-9361.86	2787.48
	Mpumalanga	-855.19	1058.860	.997	-4139.49	2429.11
	Northern Cape	-1913.92	1574.296	.953	-6796.96	2969.12
	North West	152.48	1038.639	1.000	-3069.10	3374.06
	Western Cape	-2270.69	792.243	.097	-4728.01	186.64
Free State	Eastern Cape	247.21	989.100	1.000	-2820.72	3315.13
	Gauteng	-2145.73	806.299	.162	-4646.66	355.19
	Kwazulu Natal	-639.24	955.381	.999	-3602.58	2324.09
	Limpopo	-3039.98	1982.121	.840	-9187.99	3108.02
	Mpumalanga	-607.98	1101.979	1.000	-4026.03	2810.06
	Northern Cape	-1666.72	1603.615	.982	-6640.70	3307.27
	North West	399.68	1082.564	1.000	-2958.14	3757.51
	Western Cape	-2023.48	849.012	.293	-4656.89	609.93
Gauteng	Eastern Cape	2392.94*	746.288	.036	78.15	4707.72
	Free State	2145.73	806.299	.162	-355.19	4646.66
	Kwazulu Natal	1506.49	700.984	.440	-667.78	3680.76
	Limpopo	-894.25	1872.813	1.000	-6703.22	4914.71
	Mpumalanga	1537.75	890.497	.730	-1224.33	4299.83
	Northern Cape	479.02	1466.358	1.000	-4069.23	5027.27
	North West	2545.42	866.355	.080	-141.79	5232.62
	Western Cape	122.25	547.219	1.000	-1575.07	1819.58
Kwazulu Natal	Eastern Cape	886.45	905.306	.988	-1921.57	3694.46
	Free State	639.24	955.381	.999	-2324.09	3602.58
	Gauteng	-1506.49	700.984	.440	-3680.76	667.78
	Limpopo	-2400.74	1941.665	.949	-8423.27	3621.78
	Mpumalanga	31.26	1027.433	1.000	-3155.56	3218.08
	Northern Cape	-1027.47	1553.332	.999	-5845.49	3790.55
	North West	1038.93	1006.581	.983	-2083.22	4161.07
	Western Cape	-1384.24	749.721	.651	-3709.67	941.20
Limpopo	Eastern Cape	3287.19	1958.476	.760	-2787.48	9361.86
	Free State	3039.98	1982.121	.840	-3108.02	9187.99
	Gauteng	894.25	1872.813	1.000	-4914.71	6703.22
	Kwazulu Natal	2400.74	1941.665	.949	-3621.78	8423.27
	Mpumalanga	2432.00	2017.838	.956	-3826.79	8690.79
	Northern Cape	1373.27	2329.998	1.000	-5853.76	8600.30
	North West	3439.67	2007.301	.738	-2786.44	9665.77
	Western Cape	1016.50	1891.595	1.000	-4850.72	6883.72
Mpumalanga	Eastern Cape	855.19	1058.860	.997	-2429.11	4139.49
	Free State	607.98	1101.979	1.000	-2810.06	4026.03
	Gauteng	-1537.75	890.497	.730	-4299.83	1224.33

2.3 Schemes

Descriptives

			N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
							Lower Bound	Upper Bound		
Total Admission Cost	Scheme	Scheme 1	117	78869.29	22392.61	2070.20	74769.00	82969.58	11451	186706
		Scheme 2	121	80062.04	18361.28	1669.21	76757.13	83366.96	23472	144058
		Scheme 3	4	76158.75	7914.68	3957.34	63564.91	88752.59	69127	86791
		Scheme 4	10	88325.30	14342.31	4535.44	78065.44	98585.16	72630	124899
		Total	252	79774.21	20114.29	1267.08	77278.75	82269.68	11451	186706
Specialist Cost	Scheme	Scheme 1	117	6082.32	2676.05	247.40	5592.31	6572.33	2521	16789
		Scheme 2	121	7781.74	3576.04	325.09	7138.07	8425.40	2957	21464
		Scheme 3	4	8754.75	4257.16	2128.58	1980.75	15528.75	5182	14189
		Scheme 4	10	7957.40	3565.19	1127.41	5407.02	10507.78	4055	13686
		Total	252	7015.13	3296.71	207.67	6606.13	7424.14	2521	21464

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Cost	Between Groups	8.9E+08	3	3.0E+08	.730	.535
	Within Groups	1.0E+11	248	4.1E+08		
	Total	1.0E+11	251			
Specialist Cost	Between Groups	1.9E+08	3	6.5E+07	6.326	.000
	Within Groups	2.5E+09	248	1.0E+07		
	Total	2.7E+09	251			

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Scheme	(J) Scheme	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Total Admission Cost	Scheme 1	Scheme 2	-1192.75	2612.213	.968	-7903.61	5518.11
		Scheme 3	2710.54	10244.138	.994	-23607.00	29028.08
		Scheme 4	-9456.01	6637.653	.484	-26508.37	7596.35
	Scheme 2	Scheme 1	1192.75	2612.213	.968	-5518.11	7903.61
		Scheme 3	3903.29	10238.539	.981	-22399.86	30206.44
		Scheme 4	-8263.26	6629.009	.597	-25293.41	8766.89
	Scheme 3	Scheme 1	-2710.54	10244.138	.994	-29028.08	23607.00
		Scheme 2	-3903.29	10238.539	.981	-30206.44	22399.86
		Scheme 4	-12166.55	11918.996	.737	-42786.85	18453.75
	Scheme 4	Scheme 1	9456.01	6637.653	.484	-7596.35	26508.37
		Scheme 2	8263.26	6629.009	.597	-8766.89	25293.41
		Scheme 3	12166.55	11918.996	.737	-18453.75	42786.85
Specialist Cost	Scheme 1	Scheme 2	-1699.42*	414.461	.000	-2764.18	-634.65
		Scheme 3	-2672.43	1625.364	.354	-6848.05	1503.18
		Scheme 4	-1875.08	1053.149	.283	-4580.66	830.49
	Scheme 2	Scheme 1	1699.42*	414.461	.000	634.65	2764.18
		Scheme 3	-973.01	1624.476	.932	-5146.35	3200.32
		Scheme 4	-175.66	1051.777	.998	-2877.72	2526.39
	Scheme 3	Scheme 1	2672.43	1625.364	.354	-1503.18	6848.05
		Scheme 2	973.01	1624.476	.932	-3200.32	5146.35
		Scheme 4	797.35	1891.102	.975	-4060.95	5655.65
	Scheme 4	Scheme 1	1875.08	1053.149	.283	-830.49	4580.66
		Scheme 2	175.66	1051.777	.998	-2526.39	2877.72
		Scheme 3	-797.35	1891.102	.975	-5655.65	4060.95

*. The mean difference is significant at the .05 level.

2.4 Gender

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Total Admission Cost	Male	118	81049.90	24761.76	2279.50
	Female	134	78650.85	14880.90	1285.51
Specialist Cost	Male	118	6952.99	3528.28	324.80
	Female	134	7069.86	3090.82	267.01

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Mean	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Total Admission Cost	Equal variances assumed	12.568	.000	.945	250	.346	2399.05	2539.83	-2603.15	7401.24
	Equal variances not assumed			.917	186.646	.360	2399.05	2617.00	-2763.65	7561.75
Specialist Cost	Equal variances assumed	1.636	.202	-.280	250	.779	-116.87	416.95	-938.05	704.32
	Equal variances not assumed			-.278	234.396	.781	-116.87	420.46	-945.24	711.51

2.5 Admission cost Regression

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	AGE1, area, HOSPGRP1, GENDER[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Admission Cost

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.107[a]	.011	-.005	20160.79	.011	.711	4	247	.585

a. Predictors: (Constant), AGE1, area, HOSPGRP1, GENDER

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.2E+09	4	2.9E+08	.711	.585[a]
	Residual	1.0E+11	247	4.1E+08		
	Total	1.0E+11	251			

a. Predictors: (Constant), AGE1, area, HOSPGRP1, GENDER

b. Dependent Variable: Admission Cost

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	84742.479	4452.054		19.034	.000	75973.648	93511.311		
	HOSPGRP1	1366.423	3045.428	.028	.449	.654	-4631.897	7364.743	.994	1.006
	area	-3014.172	2616.408	-.073	-1.152	.250	-8167.487	2139.143	.995	1.005
	GENDER	-1864.484	2621.858	-.046	-.711	.478	-7028.534	3299.565	.942	1.061
	AGE1	-1746.282	2919.172	-.039	-.598	.550	-7495.926	4003.362	.943	1.060

a. Dependent Variable: Admission Cost

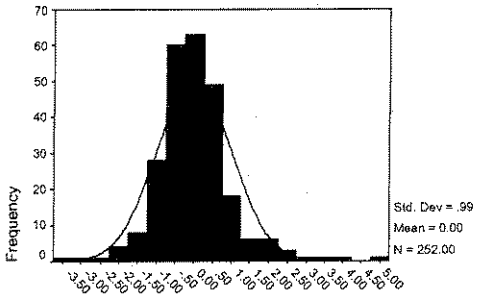
Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions				
				(Constant)	HOSPGRP1	area	GENDER	AGE1
1	1	3.476	1.000	.01	.02	.03	.01	.02
	2	.773	2.120	.00	.82	.12	.00	.00
	3	.527	2.568	.01	.11	.79	.01	.08
	4	.176	4.450	.07	.03	.05	.11	.90
	5	4.779E-02	8.529	.91	.02	.01	.87	.00

a. Dependent Variable: Admission Cost

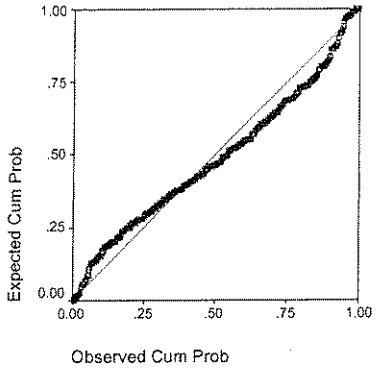
Histogram

Dependent Variable: TOTALFEE



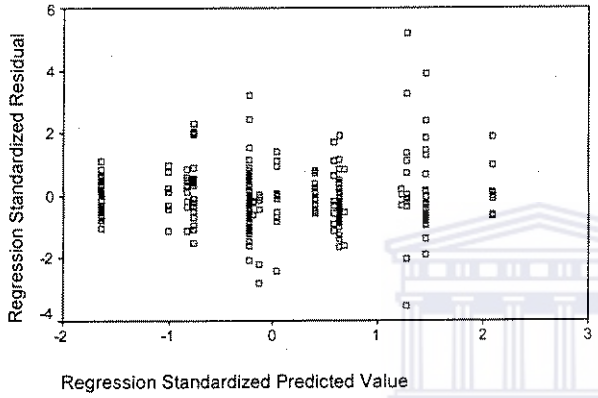
Normal P-P Plot of Regression Stand

Dependent Variable: TOTALFEE



Scatterplot

Dependent Variable: TOTALFEE



2.6 Specialist cost regression

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	AGE1, area, HOSPGRP1, GENDER[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Specialist Cost

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.361[a]	.130	.116	3099.76	.130	9.227	4	247	.000

a. Predictors: (Constant), AGE1, area, HOSPGRP1, GENDER

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.5E+08	4	8.9E+07	9.227	.000[a]
	Residual	2.4E+09	247	9608541		
	Total	2.7E+09	251			

a. Predictors: (Constant), AGE1, area, HOSPGRP1, GENDER

b. Dependent Variable: Specialist Cost

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	6430.659	684.513		9.395	.000	5082.432	7778.886		
	HOSPGRP1	-1277.760	468.241	-.162	-2.729	.007	-2200.015	-355.505	.994	1.006
	area	2106.140	402.278	.311	5.236	.000	1313.807	2898.473	.995	1.005
	GENDER	-53.769	403.116	-.008	-.133	.894	-847.752	740.215	.942	1.061
	AGE1	200.985	448.829	.027	.448	.655	-683.035	1085.005	.943	1.060

a. Dependent Variable: Specialist Cost

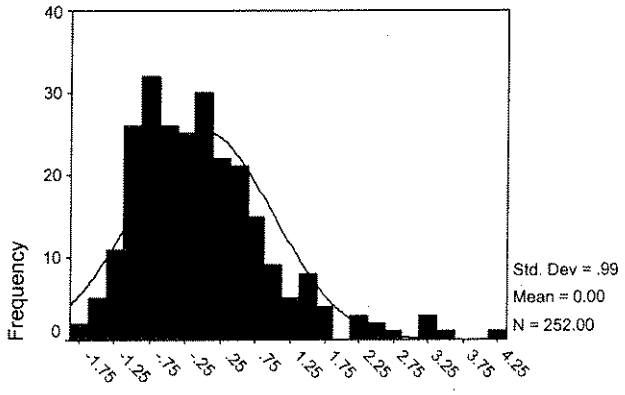
Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions				
				(Constant)	HOSPGRP1	area	GENDER	AGE1
1	1	3.476	1.000	.01	.02	.03	.01	.02
	2	.773	2.120	.00	.82	.12	.00	.00
	3	.527	2.568	.01	.11	.79	.01	.08
	4	.176	4.450	.07	.03	.05	.11	.90
	5	4.779E-02	8.529	.91	.02	.01	.87	.00

a. Dependent Variable: Specialist Cost

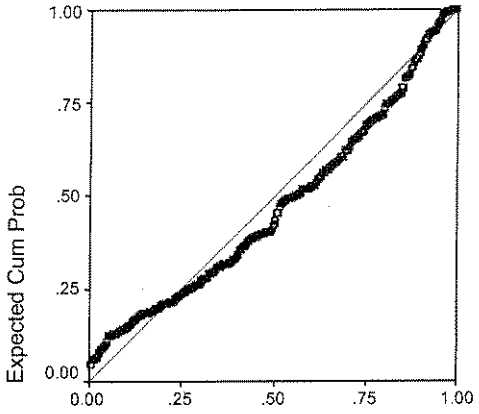
Histogram

Dependent Variable: SPECFEES



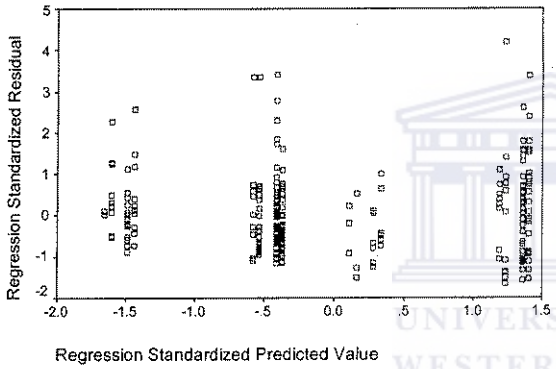
Normal P-P Plot of Regression Stanc

Dependent Variable: SPECFEES



Scatterplot

Dependent Variable: SPECFEES



3. Caesarean section SPSS Output

3.1 Hospital group

Descriptives

			N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
							Lower Bound	Upper Bound		
Total Admission Cost	Hospital Group	HospGrp 1	1109	16595.71	5098.2727	153.0937	16295.32	16896.10	3066.00	103846.00
		HospGrp 2	1142	16950.47	3070.0735	90.8481	16772.22	17128.72	2481.00	60576.00
		HospGrp 3	1487	17195.98	3483.8597	90.3452	17018.76	17373.20	2579.00	49967.00
		HospGrp 4	441	16583.67	3294.3191	156.8723	16275.36	16891.98	2906.00	35388.00
		Total	4179	16904.98	3872.2073	59.8994	16787.54	17022.41	2481.00	103846.00
Specialist Cost	Hospital Group	HospGrp 1	1109	2546.7033	1117.2213	33.5485	2480.8775	2612.5291	1533.00	7800.00
		HospGrp 2	1142	2660.2067	1231.0094	36.4274	2588.7344	2731.6789	684.00	8105.00
		HospGrp 3	1487	2653.7989	1313.1943	34.0544	2586.9991	2720.5988	324.00	11700.00
		HospGrp 4	441	2408.8050	707.9483	33.7118	2342.5488	2475.0612	671.00	8287.00
		Total	4179	2601.2759	1190.6417	18.4181	2565.1666	2637.3852	324.00	11700.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Cost	Between Groups	2.8E+08	3	9.3E+07	6.246	.000
	Within Groups	6.2E+10	4175	1.5E+07		
	Total	6.3E+10	4178			
Specialist Cost	Between Groups	2.8E+07	3	9235923	6.541	.000
	Within Groups	5.9E+09	4175	1412010		
	Total	5.9E+09	4178			

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Hospital Group	(J) Hospital Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Total Admission Cost	HospGrp 1	HospGrp 2	-354.7580	162.941	.130	-773.3596	63.8437
		HospGrp 3	-600.2729*	153.346	.001	-994.2247	-206.3211
		HospGrp 4	12.0384	217.582	1.000	-546.9370	571.0139
	HospGrp 2	HospGrp 1	354.7580	162.941	.130	-63.8437	773.3596
		HospGrp 3	-245.5149	152.072	.370	-636.1927	145.1629
		HospGrp 4	366.7964	216.686	.327	-189.8765	923.4693
	HospGrp 3	HospGrp 1	600.2729*	153.346	.001	206.3211	994.2247
		HospGrp 2	245.5149	152.072	.370	-145.1629	636.1927
		HospGrp 4	612.3113*	209.566	.018	73.9291	1150.6936
	HospGrp 4	HospGrp 1	-12.0384	217.582	1.000	-571.0139	546.9370
		HospGrp 2	-366.7964	216.686	.327	-923.4693	189.8765
		HospGrp 3	-612.3113*	209.566	.018	-1150.69	-73.9291
Specialist Cost	HospGrp 1	HospGrp 2	-113.5033	50.097	.106	-242.2030	15.1964
		HospGrp 3	-107.0956	47.147	.105	-228.2167	14.0255
		HospGrp 4	137.8983	66.896	.166	-33.9595	309.7562
	HospGrp 2	HospGrp 1	113.5033	50.097	.106	-15.1964	242.2030
		HospGrp 3	6.4077	46.755	.999	-113.7067	126.5222
		HospGrp 4	251.4017*	66.620	.001	80.2517	422.5516
	HospGrp 3	HospGrp 1	107.0956	47.147	.105	-14.0255	228.2167
		HospGrp 2	-6.4077	46.755	.999	-126.5222	113.7067
		HospGrp 4	244.9939*	64.431	.001	79.4675	410.5204
	HospGrp 4	HospGrp 1	-137.8983	66.896	.166	-309.7562	33.9595
		HospGrp 2	-251.4017*	66.620	.001	-422.5516	-80.2517
		HospGrp 3	-244.9939*	64.431	.001	-410.5204	-79.4675

*. The mean difference is significant at the .05 level.

3.2 Province

Descriptives

			N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
							Lower Bound	Upper Bound		
Total Admission Cost	Province	Eastern Cape	350	16280.27	4401.7148	235.2816	15817.52	16743.02	3066.00	79611.00
		Free State	211	17359.17	6892.5323	474.5015	16423.77	18294.56	3896.00	103846.00
		Gauteng	1599	16867.22	3198.6888	79.9922	16710.32	17024.13	3061.00	49967.00
		Kwazulu Natal	554	17634.08	4578.8869	194.5383	17251.95	18016.20	2481.00	82116.00
		Limpopo	124	16979.81	4060.9581	364.6848	16257.94	17701.68	3805.00	52778.00
		Mpumalanga	157	16348.54	4487.0805	358.1080	15641.17	17055.90	4549.00	60576.00
		Northern Cape	64	16552.33	1353.6610	169.2076	16214.19	16890.46	13771.00	20737.00
		North West	503	16113.47	3738.5818	166.6951	15785.96	16440.97	2579.00	54663.00
		Western Cape	617	17355.61	2758.1896	111.0405	17137.55	17573.68	2906.00	33165.00
		Total	4179	16904.98	3872.2073	59.8994	16787.54	17022.41	2481.00	103846.00
Specialist Cost	Province	Eastern Cape	350	2273.2171	784.2985	41.9225	2190.7646	2355.6697	1533.00	6418.00
		Free State	211	2301.7536	619.9381	42.6783	2217.6208	2385.8863	1618.00	5970.00
		Gauteng	1599	2680.2808	1330.8427	33.2815	2615.0009	2745.5607	542.00	9661.00
		Kwazulu Natal	554	2664.8285	1222.3889	51.9343	2562.8158	2766.8412	324.00	11700.00
		Limpopo	124	2128.2016	514.3692	46.1917	2036.7679	2219.6353	1618.00	3903.00
		Mpumalanga	157	2386.1783	876.7148	69.9695	2247.9685	2524.3881	1570.00	7241.00
		Northern Cape	64	2312.2656	526.2972	65.7871	2180.8005	2443.7307	1618.00	4037.00
		North West	503	2581.8151	1118.6722	49.8791	2483.8175	2679.8127	705.00	8632.00
		Western Cape	617	2823.6418	1294.8913	52.1304	2721.2670	2926.0166	736.00	7800.00
		Total	4179	2601.2759	1190.6417	18.4181	2565.1666	2637.3852	324.00	11700.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Cost	Between Groups	9.7E+08	8	1.2E+08	8.237	.000
	Within Groups	6.2E+10	4170	1.5E+07		
	Total	6.3E+10	4178			
Specialist Cost	Between Groups	1.4E+08	8	1.7E+07	12.608	.000
	Within Groups	5.8E+09	4170	1386804		
	Total	5.9E+09	4178			

Multiple Comparisons

Dependent Variable: Total Admission Cost

Tukey HSD

(I) Province	(J) Province	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Eastern Cape	Free State	-1078.894*	335.179	.035	-2118.53	-39.2609
	Gauteng	-586.9531	226.943	.192	-1290.87	116.9644
	Kwazulu Natal	-1353.804*	262.582	.000	-2168.26	-539.3450
	Limpopo	-699.5350	401.897	.721	-1946.11	547.0400
	Mpumalanga	-68.2636	369.394	1.000	-1214.03	1077.4980
	Northern Cape	-272.0567	522.813	1.000	-1893.68	1349.5677
	North West	166.8062	267.687	.999	-663.4853	997.0978
	Western Cape	-1075.343*	257.340	.001	-1873.54	-277.1446
Free State	Eastern Cape	1078.8944*	335.179	.035	39.2609	2118.5280
	Gauteng	491.9414	281.672	.717	-381.7297	1365.6124
	Kwazulu Natal	-274.9099	311.103	.994	-1239.87	690.0488
	Limpopo	379.3594	435.151	.994	-970.3630	1729.0818
	Mpumalanga	1010.6308	405.325	.235	-246.5767	2267.8384
	Northern Cape	806.8378	548.789	.870	-895.3570	2509.0325
	North West	1245.7007*	315.423	.003	267.3422	2224.0591
	Western Cape	3.5516	306.691	1.000	-947.7221	954.8253
Gauteng	Eastern Cape	586.9531	226.943	.192	-116.9644	1290.8706
	Free State	-491.9414	281.672	.717	-1365.61	381.7297
	Kwazulu Natal	-766.8513*	189.589	.002	-1354.91	-178.7976
	Limpopo	-112.5819	358.490	1.000	-1224.52	999.3589
	Mpumalanga	518.6895	321.631	.798	-478.9240	1516.3030
	Northern Cape	314.8964	490.232	.999	-1205.67	1835.4650
	North West	753.7593*	196.598	.004	143.9666	1363.5520
	Western Cape	-488.3897	182.259	.155	-1053.71	76.9274
Kwazulu Natal	Eastern Cape	1353.8044*	262.582	.000	539.3450	2168.2638
	Free State	274.9099	311.103	.994	-690.0488	1239.8686
	Gauteng	766.8513*	189.589	.002	178.7976	1354.9050
	Limpopo	654.2694	382.049	.739	-530.7440	1839.2827
	Mpumalanga	1285.5408*	347.696	.007	207.0804	2364.0012
	Northern Cape	1081.7477	507.714	.452	-493.0453	2656.5407
	North West	1520.6106*	236.847	.000	785.9737	2255.2475
	Western Cape	278.4615	225.087	.948	-419.6987	976.6218
Limpopo	Eastern Cape	699.5350	401.897	.721	-547.0400	1946.1100
	Free State	-379.3594	435.151	.994	-1729.08	970.3630
	Gauteng	112.5819	358.490	1.000	-999.3589	1224.5228
	Kwazulu Natal	-654.2694	382.049	.739	-1839.28	530.7440
	Mpumalanga	631.2714	462.022	.910	-801.7959	2064.3388
	Northern Cape	427.4783	591.900	.998	-1408.44	2263.3918
	North West	866.3412	385.575	.375	-329.6088	2062.2913
	Western Cape	-375.8078	378.465	.987	-1549.70	798.0887
Mpumalanga	Eastern Cape	68.2636	369.394	1.000	-1077.50	1214.0252
	Free State	-1010.631	405.325	.235	-2267.84	246.5767
	Gauteng	-518.6895	321.631	.798	-1516.30	478.9240
	Kwazulu Natal	-1285.541*	347.696	.007	-2364.00	-207.0804
	Limpopo	-631.2714	462.022	.910	-2064.34	801.7959
	Northern Cape	-203.7931	570.330	1.000	-1972.80	1565.2175
	North West	235.0698	351.567	.999	-855.3965	1325.5362
	Western Cape	-1007.079	343.754	.082	-2073.31	59.1539
Northern Cape	Eastern Cape	272.0567	522.813	1.000	-1349.57	1893.6811
	Free State	-806.8378	548.789	.870	-2509.03	895.3570
	Gauteng	-314.8964	490.232	.999	-1835.47	1205.6722
	Kwazulu Natal	-1081.748	507.714	.452	-2656.54	493.0453
	Limpopo	-427.4783	591.900	.998	-2263.39	1408.4252

Multiple Comparisons

Dependent Variable: Specialist Cost

Tukey HSD

(I) Province	(J) Province	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Eastern Cape	Free State	-28.5364	102.639	1.000	-346.8959	289.8231
	Gauteng	-407.0637*	69.495	.000	-622.6193	-191.5081
	Kwazulu Natal	-391.6114*	80.409	.000	-641.0174	-142.2053
	Limpopo	145.0155	123.070	.961	-236.7142	526.7452
	Mpumalanga	-112.9612	113.117	.986	-463.8195	237.8971
	Northern Cape	-39.0485	160.097	1.000	-535.6269	457.5299
	North West	-308.5980*	81.972	.005	-562.8522	-54.3438
	Western Cape	-550.4247*	78.803	.000	-794.8512	-305.9982
Free State	Eastern Cape	28.5364	102.639	1.000	-289.8231	346.8959
	Gauteng	-378.5272*	86.254	.000	-646.0652	-110.9893
	Kwazulu Natal	-363.0750*	95.267	.004	-658.5673	-67.5826
	Limpopo	173.5519	133.253	.931	-239.7638	586.8677
	Mpumalanga	-84.4248	124.120	.999	-469.4104	300.5608
	Northern Cape	-10.5121	168.052	1.000	-531.7629	510.7388
	North West	-280.0616	96.590	.089	-579.6572	19.5341
	Western Cape	-521.8883*	93.916	.000	-813.1899	-230.5866
Gauteng	Eastern Cape	407.0637*	69.495	.000	191.5081	622.6193
	Free State	378.5272*	86.254	.000	110.9893	646.0652
	Kwazulu Natal	15.4523	58.056	1.000	-164.6232	195.5277
	Limpopo	552.0792*	109.778	.000	211.5776	892.5808
	Mpumalanga	294.1025	98.491	.070	-11.3895	599.5945
	Northern Cape	368.0152	150.120	.256	-97.6176	833.6480
	North West	98.4657	60.203	.785	-88.2667	285.1981
	Western Cape	-143.3610	55.812	.200	-316.4740	29.7520
Kwazulu Natal	Eastern Cape	391.6114*	80.409	.000	142.2053	641.0174
	Free State	363.0750*	95.267	.004	67.5826	658.5673
	Gauteng	-15.4523	58.056	1.000	-195.5277	164.6232
	Limpopo	536.6269*	116.992	.000	173.7488	899.5050
	Mpumalanga	278.6502	106.473	.179	-51.5990	608.8993
	Northern Cape	352.5629	155.474	.362	-129.6746	834.8004
	North West	83.0134	72.528	.967	-141.9492	307.9760
	Western Cape	-158.8133	68.927	.339	-372.6059	54.9793
Limpopo	Eastern Cape	-145.0155	123.070	.961	-526.7452	236.7142
	Free State	-173.5519	133.253	.931	-586.8677	239.7638
	Gauteng	-552.0792*	109.778	.000	-892.5808	-211.5776
	Kwazulu Natal	-536.6269*	116.992	.000	-899.5050	-173.7488
	Mpumalanga	-257.9767	141.482	.667	-696.8146	180.8612
	Northern Cape	-184.0640	181.253	.985	-746.2626	378.1346
	North West	-453.6135*	118.072	.004	-819.8407	-87.3863
	Western Cape	-695.4402*	115.895	.000	-1054.91	-335.9663
Mpumalanga	Eastern Cape	112.9612	113.117	.986	-237.8971	463.8195
	Free State	84.4248	124.120	.999	-300.5608	469.4104
	Gauteng	-294.1025	98.491	.070	-599.5945	11.3895
	Kwazulu Natal	-278.6502	106.473	.179	-608.8993	51.5990
	Limpopo	257.9767	141.482	.667	-180.8612	696.8146
	Northern Cape	73.9127	174.648	1.000	-467.7987	615.6241
	North West	-195.6368	107.658	.671	-529.5624	138.2889
	Western Cape	-437.4635*	105.265	.001	-763.9684	-110.9586

3.3 Scheme

Descriptives

			N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
							Lower Bound	Upper Bound		
Total Admission Cost	Scheme	Scheme1	2255	17376.36	4184.1772	88.1124	17203.57	17549.15	2481.00	103846.00
		Scheme2	1681	16008.81	3298.9586	80.4624	15851.00	16166.63	2579.00	54663.00
		Scheme3	187	18691.27	3010.6000	220.1569	18256.94	19125.59	3677.00	32682.00
		Scheme4	56	18859.50	3168.4195	423.3979	18010.99	19708.01	13905.00	32707.00
		Total	4179	16904.98	3872.2073	59.8994	16787.54	17022.41	2481.00	103846.00
Specialist Cost	Scheme	Scheme1	2255	2299.3796	750.1189	15.7964	2268.4027	2330.3565	324.00	8287.00
		Scheme2	1681	2883.3397	1412.5968	34.4536	2815.7632	2950.9161	679.00	9661.00
		Scheme3	187	3365.8877	1807.7408	132.1951	3105.0932	3626.6822	1618.00	11700.00
		Scheme4	56	3737.7857	1776.0644	237.3366	3262.1526	4213.4189	1618.00	7241.00
		Total	4179	2601.2759	1190.6417	18.4181	2565.1666	2637.3852	324.00	11700.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Cost	Between Groups	2.7E+09	3	8.9E+08	61.754	.000
	Within Groups	6.0E+10	4175	1.4E+07		
	Total	6.3E+10	4178			
Specialist Cost	Between Groups	5.2E+08	3	1.7E+08	134.202	.000
	Within Groups	5.4E+09	4175	1293874		
	Total	5.9E+09	4178			

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Scheme	(J) Scheme	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Total Admission Cost	Scheme1	Scheme2	1367.5447*	122.140	.000	1053.7636	1681.3257
		Scheme3	-1314.910*	288.447	.000	-2055.94	-573.8808
		Scheme4	-1483.142*	512.766	.020	-2800.46	-165.8291
	Scheme2	Scheme1	-1367.545*	122.140	.000	-1681.33	-1053.76
		Scheme3	-2682.454*	292.193	.000	-3433.11	-1931.80
		Scheme4	-2850.687*	514.883	.000	-4173.44	-1527.94
	Scheme3	Scheme1	1314.9095*	288.447	.000	573.8808	2055.9382
		Scheme2	2682.4542*	292.193	.000	1931.7997	3433.1086
		Scheme4	-168.2326	577.397	.991	-1651.59	1315.1207
	Scheme4	Scheme1	1483.1421*	512.766	.020	165.8291	2800.4551
		Scheme2	2850.6868*	514.883	.000	1527.9351	4173.4385
		Scheme3	168.2326	577.397	.991	-1315.12	1651.5859
Specialist Cost	Scheme1	Scheme2	-583.9601*	36.654	.000	-678.1244	-489.7958
		Scheme3	-1066.508*	86.562	.000	-1288.89	-844.1287
		Scheme4	-1438.406*	153.879	.000	-1833.73	-1043.09
	Scheme2	Scheme1	583.9601*	36.654	.000	489.7958	678.1244
		Scheme3	-482.5480*	87.686	.000	-707.8161	-257.2800
		Scheme4	-854.4460*	154.514	.000	-1251.40	-457.4942
	Scheme3	Scheme1	1066.5081*	86.562	.000	844.1287	1288.8875
		Scheme2	482.5480*	87.686	.000	257.2800	707.8161
		Scheme4	-371.8980	173.274	.139	-817.0457	73.2497
	Scheme4	Scheme1	1438.4061*	153.879	.000	1043.0864	1833.7259
		Scheme2	854.4460*	154.514	.000	457.4942	1251.3979
		Scheme3	371.8980	173.274	.139	-73.2497	817.0457

*. The mean difference is significant at the .05 level.

3.4 Age

Descriptives

			N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for		Minimum	Maximum
							Lower Bound	Upper Bound		
Total Admission Cost	New Age Group	0-24	517	16094.82	2621.0417	115.2733	15868.36	16321.28	3896.00	40325.00
		25-34	2774	16817.16	3587.1785	68.1083	16683.61	16950.71	2481.00	82116.00
		35-44	881	17605.78	4870.3857	164.0875	17283.73	17927.82	3677.00	103846.00
		45-54	7	23340.29	15599.26	5895.9659	8913.4548	37767.12	3284.00	52778.00
		Total	4179	16904.98	3872.2073	59.8994	16787.54	17022.41	2481.00	103846.00
Specialist Cost	New Age Group	0-24	517	2393.2244	938.6122	41.2801	2312.1266	2474.3221	679.00	9515.00
		25-34	2774	2605.0829	1208.8295	22.9515	2560.0791	2650.0867	679.00	11700.00
		35-44	881	2713.9489	1252.0471	42.1825	2631.1588	2796.7390	324.00	8287.00
		45-54	7	2278.0000	621.2029	234.7926	1703.4863	2852.5137	1618.00	3300.00
		Total	4179	2601.2759	1190.6417	18.4181	2565.1666	2637.3852	324.00	11700.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Cost	Between Groups	1.1E+09	3	3.6E+08	24.489	.000
	Within Groups	6.2E+10	4175	1.5E+07		
	Total	6.3E+10	4178			
Specialist Cost	Between Groups	3.4E+07	3	1.1E+07	8.115	.000
	Within Groups	5.9E+09	4175	1410422		
	Total	5.9E+09	4178			

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) New Age Group	(J) New Age Group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Total Admission Cost	0-24	25-34	-722.3425*	183.947	.000	-1194.91	-249.7771
		35-44	-1510.955*	212.739	.000	-2057.49	-964.4216
		45-54	-7245.466*	1461.161	.000	-10999.2	-3491.69
	25-34	0-24	722.3425*	183.947	.000	249.7771	1194.9078
		35-44	-788.6127*	148.501	.000	-1170.12	-407.1088
		45-54	-6523.123*	1453.198	.000	-10256.4	-2789.81
	35-44	0-24	1510.9551*	212.739	.000	964.4216	2057.4887
		25-34	788.6127*	148.501	.000	407.1088	1170.1166
		45-54	-5734.510*	1457.123	.000	-9477.91	-1991.11
	45-54	0-24	7245.4656*	1461.161	.000	3491.6943	10999.24
		25-34	6523.1231*	1453.198	.000	2789.8076	10256.44
		35-44	5734.5105*	1457.123	.000	1991.1128	9477.9081
Specialist Cost	0-24	25-34	-211.8585*	56.891	.001	-358.0122	-65.7048
		35-44	-320.7246*	65.795	.000	-489.7549	-151.6942
		45-54	115.2244	451.904	.994	-1045.73	1276.1803
	25-34	0-24	211.8585*	56.891	.001	65.7048	358.0122
		35-44	-108.8660	45.928	.083	-226.8565	9.1244
		45-54	327.0829	449.441	.886	-827.5465	1481.7123
	35-44	0-24	320.7246*	65.795	.000	151.6942	489.7549
		25-34	108.8660	45.928	.083	-9.1244	226.8565
		45-54	435.9489	450.655	.768	-721.7986	1593.6965
	45-54	0-24	-115.2244	451.904	.994	-1276.18	1045.7315
		25-34	-327.0829	449.441	.886	-1481.71	827.5465
		35-44	-435.9489	450.655	.768	-1593.70	721.7986

*. The mean difference is significant at the .05 level.

3.5 Admission cost regression

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	AGE1, area, HOSPGRP1[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: TOTCOST

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.165[a]	.027	.026	3820.6188	.027	38.863	3	4175	.000

a. Predictors: (Constant), AGE1, area, HOSPGRP1

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.7E+09	3	5.7E+08	38.863	.000[a]
	Residual	6.1E+10	4175	1.5E+07		
	Total	6.3E+10	4178			

a. Predictors: (Constant), AGE1, area, HOSPGRP1

b. Dependent Variable: TOTCOST

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	17265.340	137.299		125.750	.000		
	HOSPGRP1	400.679	124.182	.050	3.227	.001	.988	1.012
	area	982.461	129.312	.117	7.598	.000	.989	1.011
	AGE1	-1016.877	144.753	-.107	-7.025	.000	.996	1.004

a. Dependent Variable: TOTCOST

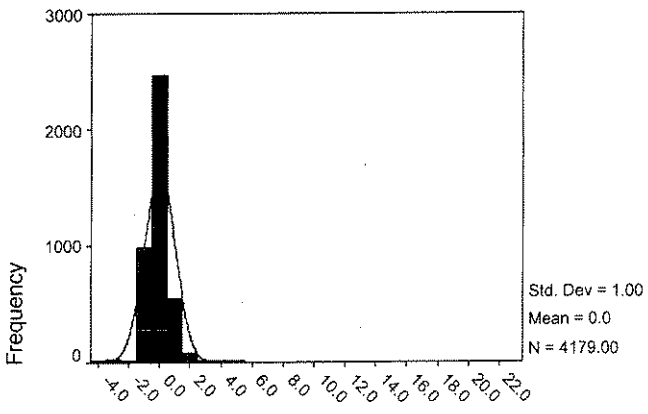
Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions			
				(Constant)	HOSPGRP1	area	AGE1
1	1	2.769	1.000	.02	.05	.05	.02
	2	.613	2.126	.00	.28	.79	.01
	3	.510	2.331	.05	.65	.15	.10
	4	.109	5.044	.93	.02	.02	.87

a. Dependent Variable: TOTCOST

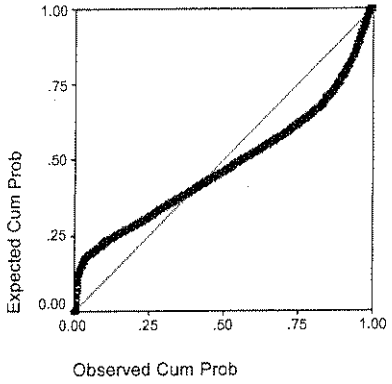
Histogram

Dependent Variable: TOTCOST



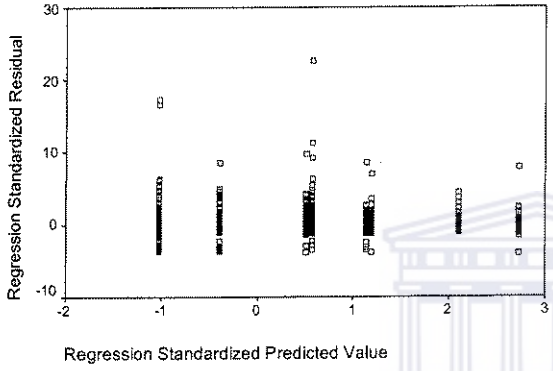
Normal P-P Plot of Regression Stand

Dependent Variable: TOTCOST



Scatterplot

Dependent Variable: TOTCOST



3.6 Specialist cost regression

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	AGE1, area, HOSPGRP1[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: SPECCOST

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.356[a]	.126	.126	1113.2447	.126	201.378	3	4175	.000

a. Predictors: (Constant), AGE1, area, HOSPGRP1

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.5E+08	3	2.5E+08	201.378	.000[a]
	Residual	5.2E+09	4175	1239314		
	Total	5.9E+09	4178			

a. Predictors: (Constant), AGE1, area, HOSPGRP1

b. Dependent Variable: SPECCOST

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	2467.130	40.006		61.669	.000		
	HOSPGRP1	2.228	36.184	.001	.062	.951	.988	1.012
	area	913.171	37.679	.353	24.236	.000	.989	1.011
	AGE1	-182.226	42.178	-.063	-4.320	.000	.996	1.004

a. Dependent Variable: SPECCOST

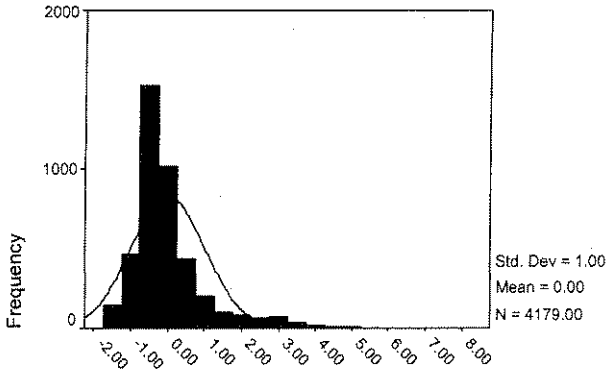
Collinearity Diagnostics[a]

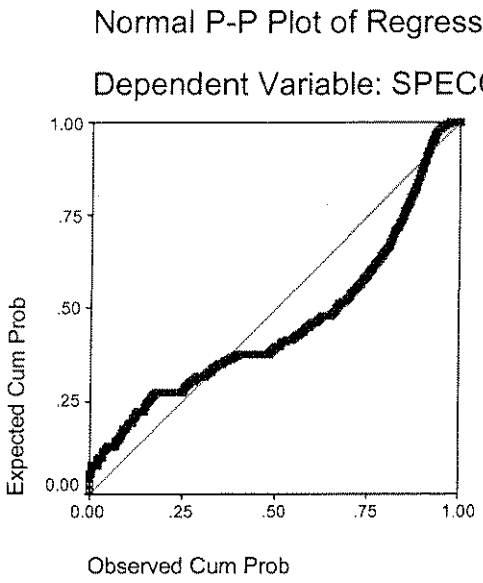
Model	Dimension	Eigenvalue	Condition Index	Variance Proportions			
				(Constant)	HOSPGRP1	area	AGE1
1	1	2.769	1.000	.02	.05	.05	.02
	2	.613	2.126	.00	.28	.79	.01
	3	.510	2.331	.05	.65	.15	.10
	4	.109	5.044	.93	.02	.02	.87

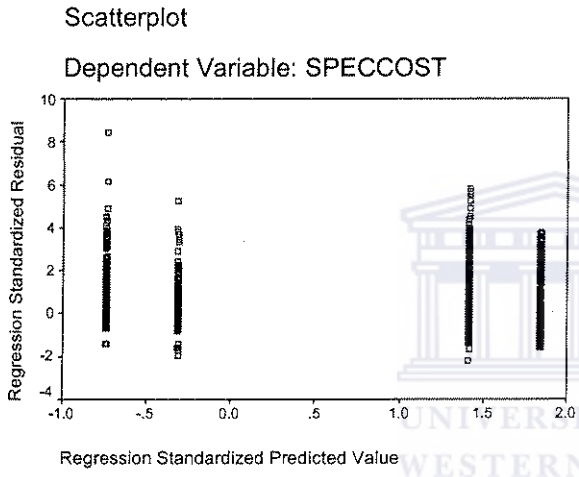
a. Dependent Variable: SPECCOST

Histogram

Dependent Variable: SPECCOST







4. Angiogram SPSS output

4.1 Hospital group

Descriptives

			N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
							Lower Bound	Upper Bound		
Total Admission Cost	Hospital Group Code	Hospgrp1	163	22301.72	11182.81	875.9050	20572.06	24031.39	1866.00	107515.00
		Hospgrp2	184	22388.51	10995.75	810.6172	20789.15	23987.87	4421.00	74810.00
		Hospgrp3	282	24004.08	12971.02	772.4128	22483.63	25524.53	2966.00	115481.00
		Hospgrp4	58	22631.26	20627.32	2708.4995	17207.58	28054.94	11483.00	154476.00
		Total	687	23051.57	12911.09	492.5889	22084.41	24018.73	1866.00	154476.00
Specialist Cost	Hospital Group Code	Hospgrp1	163	1974.2945	1113.9196	87.2489	1802.0027	2146.5863	848.00	8115.00
		Hospgrp2	184	2037.2554	1066.1159	78.5951	1882.1863	2192.3245	848.00	5901.00
		Hospgrp3	282	2360.8440	1451.2993	86.4236	2190.7241	2530.9639	848.00	11113.00
		Hospgrp4	58	2086.0517	1475.2178	193.7056	1698.1630	2473.9405	849.00	8982.00
		Total	687	2159.2635	1291.9381	49.2905	2062.4851	2256.0418	848.00	11113.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Cost	Between Groups	4.4E+08	3	1.5E+08	.877	.453
	Within Groups	1.1E+11	683	1.7E+08		
	Total	1.1E+11	686			
Specialist Cost	Between Groups	2.0E+07	3	6695228	4.065	.007
	Within Groups	1.1E+09	683	1647027		
	Total	1.1E+09	686			

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Hospital Group Code	(J) Hospital Group Code	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Total Admission Cost	Hospgrp1	Hospgrp2	-86.7869	1389.128	1.000	-3655.50	3481.9284
		Hospgrp3	-1702.354	1270.696	.538	-4966.82	1562.1073
		Hospgrp4	-329.5347	1974.551	.998	-5402.22	4743.1541
	Hospgrp2	Hospgrp1	86.7869	1389.128	1.000	-3481.93	3655.5023
		Hospgrp3	-1615.567	1223.882	.550	-4759.76	1528.6272
		Hospgrp4	-242.7478	1944.755	.999	-5238.89	4753.3929
	Hospgrp3	Hospgrp1	1702.3541	1270.696	.538	-1562.11	4966.8155
		Hospgrp2	1615.5671	1223.882	.550	-1528.63	4759.7614
		Hospgrp4	1372.8194	1862.006	.882	-3410.74	6156.3746
	Hospgrp4	Hospgrp1	329.5347	1974.551	.998	-4743.15	5402.2235
		Hospgrp2	242.7478	1944.755	.999	-4753.39	5238.8884
		Hospgrp3	-1372.819	1862.006	.882	-6156.37	3410.7358
Specialist Cost	Hospgrp1	Hospgrp2	-62.9610	138.042	.968	-417.5965	291.6745
		Hospgrp3	-386.5495*	126.273	.012	-710.9502	-62.1488
		Hospgrp4	-111.7572	196.218	.941	-615.8478	392.3333
	Hospgrp2	Hospgrp1	62.9610	138.042	.968	-291.6745	417.5965
		Hospgrp3	-323.5885*	121.621	.039	-636.0379	-11.1391
		Hospgrp4	-48.7963	193.257	.994	-545.2800	447.6874
	Hospgrp3	Hospgrp1	386.5495*	126.273	.012	62.1488	710.9502
		Hospgrp2	323.5885*	121.621	.039	11.1391	636.0379
		Hospgrp4	274.7922	185.034	.447	-200.5661	750.1506
	Hospgrp4	Hospgrp1	111.7572	196.218	.941	-392.3333	615.8478
		Hospgrp2	48.7963	193.257	.994	-447.6874	545.2800
		Hospgrp3	-274.7922	185.034	.447	-750.1506	200.5661

*. The mean difference is significant at the .05 level.

4.2 Province

Descriptiv

			N	Mea	Std Deviatio	Std.	95% Interval for Lowe Boun	Uppe Boun	Minimu	Maximu
Tota Admissi Cos	Provinc	Eastern	68	19112.7	7169.074	869.378	17377.4	20848.0	3815.0	41236.0
		Free	44	22462.9	11519.2	1736.589	18960.7	25965.1	6461.0	65957.0
		Gauten	220	23070.0	11868.6	800.184	21493.0	24647.1	2966.0	115481.0
		KZ	106	23325.9	13746.1	1335.147	20678.5	25973.2	3200.0	101589.0
		Limpop	20	24890.3	12032.2	2690.488	19259.0	30521.5	3669.0	51978.0
		Mpumalan	19	21414.7	9607.975	2204.220	16783.8	26045.6	4421.0	49226.0
		Norther Cap	15	26619.4	14805.5	3822.767	18420.4	34818.4	14708.0	68032.0
		North	58	23237.2	11139.0	1462.624	20308.4	26166.1	3656.0	74645.0
		Weste Cap	137	24442.9	16782.7	1433.845	21607.4	27278.5	1866.0	154476.0
		Tota	687	23051.5	12911.0	492.588	22084.4	24018.7	1866.0	154476.0
Speciali Cos	Provinc	Eastern	68	1844.750	773.256	93.771	1657.582	2031.918	848.0	4281.0
		Free	44	1659.340	661.540	99.731	1458.214	1860.467	848.0	3275.0
		Gauten	220	2044.877	1168.127	78.755	1889.662	2200.092	848.0	8115.0
		KZ	106	2774.896	1740.409	169.043	2439.714	3110.078	927.0	11113.0
		Limpop	20	2961.750	1373.866	307.205	2318.760	3604.739	1215.0	6700.0
		Mpumalan	19	2199.473	1231.194	282.455	1606.056	2792.890	1087.0	5901.0
		Norther Cap	15	1659.866	517.381	133.587	1373.350	1946.382	1032.0	2843.0
		North	58	2119.706	1266.455	166.293	1786.709	2452.704	848.0	7676.0
		Weste Cap	137	2131.985	1309.776	111.901	1910.692	2353.278	848.0	8982.0
		Tota	687	2159.263	1291.938	49.290	2062.485	2256.041	848.0	11113.0

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Cost	Between Groups	1.7E+09	8	2.1E+08	1.245	.270
	Within Groups	1.1E+11	678	1.7E+08		
	Total	1.1E+11	686			
Specialist Cost	Between Groups	7.8E+07	8	9702506	6.163	.000
	Within Groups	1.1E+09	678	1574315		
	Total	1.1E+09	686			

Multiple Comparisons

Dependent Variable: Total Admission Cost
Tukey HSD

(I) Province	(J) Province	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Eastern Cape	Free State	-3350.234	2494.438	.918	-11087.3	4386.8436
	Gauteng	-3957.366	1788.854	.397	-9505.91	1591.1801
	KZN	-4213.204	2003.142	.471	-10426.4	2000.0052
	Limpopo	-5777.579	3279.566	.708	-15949.9	4394.7547
	Mpumalanga	-2302.016	3345.591	.999	-12679.1	8075.1101
	Northern Cape	-7506.746	3677.761	.514	-18914.2	3900.6808
	North West	-4124.538	2304.418	.689	-11272.2	3023.1494
	Western Cape	-5330.265	1912.523	.119	-11262.4	601.8688
Free State	Eastern Cape	3350.2340	2494.438	.918	-4386.84	11087.31
	Gauteng	-607.1318	2129.162	1.000	-7211.22	5996.9587
	KZN	-862.9700	2312.123	1.000	-8034.55	6308.6141
	Limpopo	-2427.345	3476.908	.999	-13211.8	8357.0893
	Mpumalanga	1048.2177	3539.253	1.000	-9929.60	12026.03
	Northern Cape	-4156.512	3854.771	.977	-16113.0	7799.9522
	North West	-774.3041	2577.533	1.000	-8769.12	7220.5122
	Western Cape	-1980.031	2234.072	.994	-8909.52	4949.4612
Gauteng	Eastern Cape	3957.3658	1788.854	.397	-1591.18	9505.9117
	Free State	607.1318	2129.162	1.000	-5996.96	7211.2224
	KZN	-255.8382	1524.365	1.000	-4984.01	4472.3338
	Limpopo	-1820.214	3011.090	1.000	-11159.8	7519.3808
	Mpumalanga	1655.3495	3082.871	1.000	-7906.89	11217.59
	Northern Cape	-3549.380	3440.499	.983	-14220.9	7122.1253
	North West	-167.1723	1903.012	1.000	-6069.81	5735.4609
	Western Cape	-1372.899	1403.159	.988	-5725.12	2979.3248
KZN	Eastern Cape	4213.2039	2003.142	.471	-2000.01	10426.41
	Free State	862.9700	2312.123	1.000	-6308.61	8034.5540
	Gauteng	255.8382	1524.365	1.000	-4472.33	4984.0101
	Limpopo	-1564.375	3143.126	1.000	-11313.5	8184.7594
	Mpumalanga	1911.1877	3211.957	1.000	-8051.44	11873.82
	Northern Cape	-3293.542	3556.630	.992	-14325.3	7738.1684
	North West	88.6659	2105.715	1.000	-6442.70	6620.0275
	Western Cape	-1117.061	1667.763	.999	-6290.02	4055.8936
Limpopo	Eastern Cape	5777.5794	3279.566	.708	-4394.75	15949.91
	Free State	2427.3455	3476.908	.999	-8357.09	13211.78
	Gauteng	1820.2136	3011.090	1.000	-7519.38	11159.81
	KZN	1564.3755	3143.126	1.000	-8184.76	11313.51
	Mpumalanga	3475.5632	4130.333	.996	-9335.62	16286.75
	Northern Cape	-1729.167	4403.702	1.000	-15388.3	11929.93
	North West	1653.0414	3343.204	1.000	-8716.68	12022.76
	Western Cape	447.3146	3086.164	1.000	-9125.14	10019.77
Mpumalanga	Eastern Cape	2302.0163	3345.591	.999	-8075.11	12679.14
	Free State	-1048.218	3539.253	1.000	-12026.0	9929.5964
	Gauteng	-1655.350	3082.871	1.000	-11217.6	7906.8884
	KZN	-1911.188	3211.957	1.000	-11873.8	8051.4425
	Limpopo	-3475.563	4130.333	.996	-16286.7	9335.6200
	Northern Cape	-5204.730	4453.091	.963	-19017.0	8607.5626
	North West	-1822.522	3407.996	1.000	-12393.2	8748.1673
	Western Cape	-3028.249	3156.238	.989	-12818.1	6761.5544
Northern Cape	Eastern Cape	7506.7461	3677.761	.514	-3900.68	18914.17
	Free State	4156.5121	3854.771	.977	-7799.95	16112.98
	Gauteng	3549.3803	3440.499	.983	-7122.13	14220.89
	KZN	3293.5421	3556.630	.992	-7738.17	14325.25
	Limpopo	1729.1667	4403.702	1.000	-11929.9	15388.27
	Mpumalanga	5204.7298	4453.091	.963	-8607.56	19017.02
	North West	3382.2080	3734.619	.993	-8201.58	14965.99
	Western Cape	2176.4813	3506.391	1.000	-8699.40	13052.37
North West	Eastern Cape	4124.5380	2304.418	.689	-3023.15	11272.23
	Free State	774.3041	2577.533	1.000	-7220.51	8769.1203
	Gauteng	167.1723	1903.012	1.000	-5735.46	6069.8054
	KZN	-88.6659	2105.715	1.000	-6620.03	6442.6957
	Limpopo	-1653.041	3343.204	1.000	-12022.8	8716.6789
	Mpumalanga	1822.5218	3407.996	1.000	-8748.17	12393.21
	Northern Cape	-3382.208	3734.619	.993	-14966.0	8201.5783
	Western Cape	-1205.727	2019.703	1.000	-7470.30	5058.8503
Western Cape	Eastern Cape	5330.2648	1912.523	.119	-601.8688	11262.40
	Free State	1980.0309	2234.072	.994	-4949.46	8909.5229
	Gauteng	1372.8990	1403.159	.988	-2979.32	5725.1228
	KZN	1117.0609	1667.763	.999	-4055.89	6290.0153
	Limpopo	-447.3146	3086.164	1.000	-10019.8	9125.1392
	Mpumalanga	3028.2486	3156.238	.989	-6761.55	12818.05
	Northern Cape	-2176.481	3506.391	1.000	-13052.4	8699.4040
	North West	1205.7268	2019.703	1.000	-5058.85	7470.3039

Multiple Comparisons

Dependent Variable: Specialist Cost

Tukey HSD

(I) Province	(J) Province	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Eastern Cape	Free State	185.4091	242.758	.998	-567.5619	938.3800
	Gauteng	-200.1273	174.091	.967	-740.1107	339.8562
	KZN	-930.1462*	194.945	.000	-1534.81	-325.4779
	Limpopo	-1117.000*	319.167	.014	-2106.97	-127.0303
	Mpumalanga	-354.7237	325.592	.976	-1364.62	655.1763
	Northern Cape	184.8833	357.919	1.000	-925.2853	1295.0520
	North West	-274.9569	224.266	.951	-970.5685	420.6547
	Western Cape	-287.2354	186.126	.835	-864.5495	290.0787
Free State	Eastern Cape	-185.4091	242.758	.998	-938.3800	567.5619
	Gauteng	-385.5364	207.210	.641	-1028.25	257.1725
	KZN	-1115.555*	225.015	.000	-1813.49	-417.6181
	Limpopo	-1302.409*	338.372	.004	-2351.95	-252.8699
	Mpumalanga	-540.1328	344.439	.822	-1608.49	528.2260
	Northern Cape	-.5258	375.146	1.000	-1164.13	1163.0751
	North West	-460.3660	250.845	.659	-1238.42	317.6880
	Western Cape	-472.6445	217.419	.423	-1147.02	201.7324
Gauteng	Eastern Cape	200.1273	174.091	.967	-339.8562	740.1107
	Free State	385.5364	207.210	.641	-257.1725	1028.2452
	KZN	-730.0190*	148.351	.000	-1190.16	-269.8741
	Limpopo	-916.8727*	293.039	.046	-1825.80	-7.9451
	Mpumalanga	-154.5964	300.024	1.000	-1085.19	775.9988
	Northern Cape	385.0106	334.829	.966	-653.5383	1423.5595
	North West	-74.8296	185.201	1.000	-649.2728	499.6135
	Western Cape	-87.1081	136.555	.999	-510.6657	336.4495
KZN	Eastern Cape	930.1462*	194.945	.000	325.4779	1534.8146
	Free State	1115.5553*	225.015	.000	417.6181	1813.4925
	Gauteng	730.0190*	148.351	.000	269.8741	1190.1638
	Limpopo	-186.8538	305.888	1.000	-1135.64	761.9302
	Mpumalanga	575.4225	312.587	.655	-394.1388	1544.9838
	Northern Cape	1115.0296*	346.131	.035	41.4256	2188.6336
	North West	655.1893*	204.928	.037	19.5584	1290.8202
	Western Cape	642.9108*	162.306	.002	139.4799	1146.3418
Limpopo	Eastern Cape	1117.0000*	319.167	.014	127.0303	2106.9697
	Free State	1302.4091*	338.372	.004	252.8699	2351.9483
	Gauteng	916.8727*	293.039	.046	7.9451	1825.8003
	KZN	186.8538	305.888	1.000	-761.9302	1135.6378
	Mpumalanga	762.2763	401.963	.616	-484.5056	2009.0583
	Northern Cape	1301.8833	428.567	.060	-27.4179	2631.1845
	North West	842.0431	325.360	.191	-167.1361	1851.2223
	Western Cape	829.7646	300.345	.127	-101.8248	1761.3540

4.3 Scheme

Descriptives

			N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
							Lower Bound	Upper Bound		
Total Admission Cost	Scheme	Scheme1	389	21289.26	11041.67	559.8351	20188.57	22389.95	1866.00	107515.00
		Scheme2	252	25394.60	14608.31	920.2369	23582.23	27206.97	3656.00	154476.00
		Scheme3	13	22987.31	6260.8610	1736.4504	19203.91	26770.71	12615.00	33181.00
		Scheme4	33	25958.61	17804.76	3099.4115	19645.31	32271.90	4540.00	101589.00
		Total	687	23051.57	12911.09	492.5889	22084.41	24018.73	1866.00	154476.00
Specialist Cost	Scheme	Scheme1	389	2046.4370	1077.7291	54.6430	1939.0035	2153.8705	848.00	8115.00
		Scheme2	252	2233.5516	1513.3911	95.3347	2045.7937	2421.3094	848.00	11113.00
		Scheme3	13	3298.0000	1776.8666	492.8141	2224.2504	4371.7496	1437.00	6024.00
		Scheme4	33	2473.3636	1312.4659	228.4710	2007.9835	2938.7438	848.00	6538.00
		Total	687	2159.2635	1291.9381	49.2905	2062.4851	2256.0418	848.00	11113.00

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Total Admission Cost	Between Groups	2.9E+09	3	9.6E+08	5.862	.001
	Within Groups	1.1E+11	683	1.6E+08		
	Total	1.1E+11	686			
Specialist Cost	Between Groups	2.6E+07	3	8818577	5.385	.001
	Within Groups	1.1E+09	683	1637701		
	Total	1.1E+09	686			

Multiple Comparisons

Tukey HSD

Dependent Variable	(I) Scheme	(J) Scheme	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Total Admission Cost	Scheme1	Scheme2	-4105.340*	1033.114	.000	-6759.44	-1451.24
		Scheme3	-1698.048	3602.142	.965	-10952.1	7555.9754
		Scheme4	-4669.346	2316.428	.182	-10620.3	1281.6337
	Scheme2	Scheme1	4105.3396*	1033.114	.000	1451.2352	6759.4439
		Scheme3	2407.2915	3633.668	.911	-6927.72	11742.31
		Scheme4	-564.0069	2365.154	.995	-6640.17	5512.1536
	Scheme3	Scheme1	1698.0481	3602.142	.965	-7555.98	10952.07
		Scheme2	-2407.292	3633.668	.911	-11742.3	6927.7238
		Scheme4	-2971.298	4183.546	.893	-13719.0	7776.3714
	Scheme4	Scheme1	4669.3464	2316.428	.182	-1281.63	10620.33
		Scheme2	564.0069	2365.154	.995	-5512.15	6640.1673
		Scheme3	2971.2984	4183.546	.893	-7776.37	13718.97
Specialist Cost	Scheme1	Scheme2	-187.1146	103.484	.269	-452.9672	78.7381
		Scheme3	-1251.563*	360.814	.003	-2178.51	-324.6187
		Scheme4	-426.9266	232.029	.255	-1023.02	169.1629
	Scheme2	Scheme1	187.1146	103.484	.269	-78.7381	452.9672
		Scheme3	-1064.448*	363.972	.018	-1999.51	-129.3915
		Scheme4	-239.8120	236.910	.742	-848.4405	368.8164
	Scheme3	Scheme1	1251.5630*	360.814	.003	324.6187	2178.5072
		Scheme2	1064.4484*	363.972	.018	129.3915	1999.5053
		Scheme4	824.6364	419.052	.200	-251.9214	1901.1941
	Scheme4	Scheme1	426.9266	232.029	.255	-169.1629	1023.0162
		Scheme2	239.8120	236.910	.742	-368.8164	848.4405
		Scheme3	-824.6364	419.052	.200	-1901.19	251.9214

*. The mean difference is significant at the .05 level.

4.4 Chronic Condition

Group Statistics

	Chronic Condition?	N	Mean	Std. Deviation	Std. Error Mean
Total Admission Fees	Yes	539	23432.62	13798.45	594.3413
	No	148	21663.83	8866.6082	728.8307
Specialist Fees	Yes	539	2180.6753	1329.6775	57.2733
	No	148	2081.2838	1144.7951	94.1016

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Mean	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Total Admission Fees	Equal variances assumed	5.183	.023	1.478	685	.140	1768.7904	1197.1317	-581.6976	4119.2785
	Equal variances not assumed			1.881	363.583	.061	1768.7904	940.4445	-80.6031	3618.1840
Specialist Fees	Equal variances assumed	1.493	.222	.829	685	.408	99.3915	119.9206	-136.0646	334.8477
	Equal variances not assumed			.902	266.102	.368	99.3915	110.1605	-117.5055	316.2886

4.5 Admission cost regression

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	GENDER, HSPGRP 1, AGE1[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: TOTALFEE

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.091[a]	.008	.004	12885.46	.008	1.911	3	683	.126

a. Predictors: (Constant), GENDER, HSPGRP1, AGE1

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.5E+08	3	3.2E+08	1.911	.126[a]
	Residual	1.1E+11	683	1.7E+08		
	Total	1.1E+11	686			

a. Predictors: (Constant), GENDER, HSPGRP1, AGE1

b. Dependent Variable: TOTALFEE

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	22080.793	1594.102		13.852	.000		
	AGE1	1742.832	998.324	.067	1.746	.081	.972	1.028
	HSPGRP1	1795.274	1005.263	.068	1.786	.075	.988	1.012
	GENDER	-494.724	1022.139	-.019	-.484	.629	.983	1.017

a. Dependent Variable: TOTALFEE

Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions			
				(Constant)	AGE1	HSPGRP1	GENDER
1	1	3.043	1.000	.01	.03	.03	.01
	2	.604	2.244	.00	.24	.65	.00
	3	.298	3.196	.05	.72	.28	.09
	4	5.468E-02	7.460	.94	.01	.04	.90

a. Dependent Variable: TOTALFEE

4.6 Specialist cost regression

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	GENDER, HSPGRP 1, AGE1[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: SPECFEES

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.131[a]	.017	.013	1283.5606	.017	3.995	3	683	.008

a. Predictors: (Constant), GENDER, HSPGRP1, AGE1

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.0E+07	3	6581324	3.995	.008[a]
	Residual	1.1E+09	683	1647528		
	Total	1.1E+09	686			

a. Predictors: (Constant), GENDER, HSPGRP1, AGE1

b. Dependent Variable: SPECFEES

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	2048.338	158.793		12.899	.000		
	AGE1	31.104	99.446	.012	.313	.755	.972	1.028
	HSPGRP1	344.581	100.137	.131	3.441	.001	.988	1.012
	GENDER	-33.997	101.818	-.013	-.334	.739	.983	1.017

a. Dependent Variable: SPECFEES

Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions			
				(Constant)	AGE1	HSPGRP1	GENDER
1	1	3.043	1.000	.01	.03	.03	.01
	2	.604	2.244	.00	.24	.65	.00
	3	.298	3.196	.05	.72	.28	.09
	4	5.468E-02	7.460	.94	.01	.04	.90

a. Dependent Variable: SPECFEES

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