



**Strathmore**  
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**INSURANCE POLICIES FOR FERTILITY TREATMENTS**

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## **DEDICATION**

I wish to dedicate this work to my parents who have made inestimable sacrifices to ensure that I reach this far. I would also like to dedicate it to my two sisters for all their support.

## **ACKNOWLEDGMENT**

I would like to thank God for everything He has done for me until this point.

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## ABSTRACT

In Kenya there are over 3 million people who suffer from infertility. According to the Nairobi IVF fertility center, fertility treatments can range anywhere from Ksh 10,000 to Ksh 480,000 per cycle. This is expensive for the average Kenyan and as a result it denies deserving couples the opportunity to bear a child. Various studies have also shown that infertility also affects the mental health of many couples with one study even claiming that infertility has the same psychological effects with cancer patients. Insurance companies however have the ability to assist these couples in offsetting some of the costs of seeking treatments for infertility treatments. This study therefore focuses on pricing an insurance policy for fertility treatments. When pricing the policy, the method used involved calculating the standard risk premium followed by getting the office premium. This study goes on to find the premium based on various demographic factors that may affect infertility such as age, education, occupation and marital status.

# CHAPTER ONE: INTRODUCTION

## 1.1 Background information

WHO defines infertility as the inability of a sexually active non-contracepting couple to achieve pregnancy in one year? Infertility affects both men and women the ratio 1:3 where for every man diagnosed with infertility there are 3 women who are infertile. A woman is said to be infertile if she has tried to conceive for over a year if she is under the age of 35 and if she tries to conceive for 6 months and is over the age of 35. Infertility can either be primary or secondary.

- Primary infertility is when a couple is unable to conceive after trying for 12 months without the use of contraception
- Secondary infertility is when they had previously conceived but are no longer able to.

Infertility may be caused by a number of issues it is however very difficult to determine the cause of infertility. In men infertility may be as a result of underlying medical conditions such as cancer and diabetes, hormonal imbalance, genetic factors, use of steroids, age, excessive consumption of alcohol and mental stress. Infertility in women can also have an array of causes such as age, excessive smoking and alcohol consumption, ovulation disorders, diet and mental stress.

Treatment for infertility depends on a number of factors for example gender, age, how long one has been trying to conceive, individual's overall health and personal preference. Some of the fertility treatments that couples may be offered include use of fertility drugs, surgical procedures and assisted conception. Assisted conception is usually expensive and includes treatment such as in-vitro fertilization (IVF), intrauterine insemination (IUI), sperm/egg donation and assisted hatching.

In 2002 WHO stated that infertility is a disability (impairment of a function) and has ranked as the 5<sup>th</sup> highest serious global disability to persons under the age of 60. In Africa approximately 10% of couples have high infertility with a number of couples stating that infertility affects their quality of life. This may be

because in most parts of Africa patriarchal ways still prevail therefore having children is seen as a social obligation. As a result, not having a child affects the couples mental health. A study done showed that a people with infertility had similar psychological effects with cancer patients.

In addition to all the stigma faced with involuntary childlessness couples are also faced with the issue of limited access to infertility treatment. This may be due to a number of factors such a delayed diagnosis of infertility, lack of facilities offering fertility services and the main issue being high cost of infertility treatments. For example, a study done by the advanced fertility center in Chicago stated that "in the US the average cost of fertility treatment is about \$11,000 to \$12,000" making fertility treatments unavailable to a large number of couples. This is quite unfortunate as access to fertility treatment should depend on the need of the couple rather than factors such as the cost of the treatment.

Health insurance is insurance that covers the whole or part of the risk of an individual incurring medical expense. One can get health insurance either individually, through their employer or state provided. Health insurance products are divided into indemnity-based products where the insurer reimburses the policyholder the medical costs incurred or fixed benefit-based products where a lumpsum is paid under the policy.

For the longest time insurance companies have not offered covers for fertility treatment. This is because there are many fallacies surrounding fertility treatments. For example, infertility is believed to be a "rich persons" disease associated with women putting off having children until they are older. This has been the general assumption even though studies have shown that women of lower socioeconomical status have a harder time conceiving but are faced with the barrier of high cost of infertility treatments. Insurance companies have also shied away from the idea of providing covers for fertility treatment because of the belief that ART (assisted reproductive technology) is

experimental. Insurance companies as well may choose not to cover fertility treatments because it is usually seen as a “woman’s health issue” companies therefore did not see the need of providing a cover for a niche group this is despite the fact that nearly half of the infertility issues are due to male infertility. Insurance companies as well felt that because of the high costs of ART’s healthcare costs will increase as a result health insurance premium. However, research done in Massachusetts found that increasing premiums by 1% allowed 6.1 million infertile Americans to have insurance cover for this condition.

Over the few years however many insurance companies have covered fertility treatments. In the US for example many states have put in place regulations to ensure that insurance companies cover infertility treatments. This has been beneficial to both parties. For example, research done in countries that have covers for infertility treatment has shown that use of ART’s has resulted in a reduction in multiple births. Multiple births can be risky to the mother as they are faced with the issues of hypertension, gestational diabetes as well as facing the risks of premature births and death. The cost of delivering multiple births as well was said to be four times the cost of delivering a single infant. Providing covers for infertility treatment is said to have reduced the cost of providing coverage, this is due to the fact that couples were now choosing treatments based on the appropriateness to the issue they had rather than what they could afford as a result there was a higher rate of success. There was also less biasedness when it came to covering health insurance. It was argued that it was unfair for couples who cannot conceive to pay for other people’s childbirths and maternity yet the insurance refuses to pay for fertility treatments for couples that were unable to have children.

There however been some arguments against insurance companies providing covers for fertility treatments. Further studies have shown that even as more insurance companies provide covers for fertility treatments majority of the people who were utilizing it were educated and well-off women. This was the case because even with state regulations only private insurers offered covers

for fertility treatments. That meant that those with state provided insurance still did not have access to fertility treatments. Subsequently, they believed that older women delayed motherhood only to use fertility treatments when they are settled. There was also a debate on whether fertility treatment should be prioritized when costs of other medical care is increasing.

## **1.2 Statement of the problem**

In Kenya, and most parts of Africa infertility treatment is not covered by insurance. There is also no law that mandates insurance companies to provide covers for fertility treatments. The primary objective of this paper is therefore to create an insurance product that will cover infertility treatments and determine how to price the product. For insurance companies, like most business, operate with the aim of making profits the price on the product must therefore be fitting. To get an accurate price for the product analysis of the market must be done. This will involve looking at who the target audience for the product is based on variables such as gender, economic status, educational background. A feasibility analysis will also need to be done. Looking at the technical and economic risks involved will help with figuring out the budget and as a result an appropriate price.

Pricing of such a product can prove to be complex because the insurance company must find a way to cover the needs of the clients without the cost of covering them being too high this is despite the fact that research has shown that couples will need more than one cycle of fertility treatment. For example, with IVF treatments in order to improve your odds couples must go through at least three IVF cycles. In addition to that most couples found that after successful fertility treatment they were able to get pregnant without the help of fertility treatment. Looking at these factors together with demographic, economical and geographical factors will help determine an appropriate price for the product.

## **1.3 Objectives**

### **1.3.1 General objectives**

The general objective of this study is to price an insurance product that helps offset the financial burden of receiving fertility treatment for couples in developing countries.

### **1.3.2 Specific objectives**

- To develop a fertility insurance product
- To price a marketable and competitive product
- Answering the question should infertility treatments be integrated into existing healthcare insurance policies?

## **1.4 Significance of the research**

The number of people who are infertile in developing countries is relatively large and is set to increase in the coming years. After years of research and development scientists came up with treatment to assist infertile couples conceive. The methods used are however expensive making it hard for certain groups of people to receive treatment. In addition to that the people who may be able to pay for the treatment may face financial pressures. With the use of insurance covers couples are able to reduce these financial pressures, couples who were not able to previously afford treatment may now be able to receive treatment.

The aim of this study is therefore to price a product that makes fertility treatment affordable and attainable to couples who are infertile as well as being profitable to the insurance company.

## CHAPTER TWO: LITERATURE REVIEW

### 2.1 Theoretical and empirical framework

After years of experimenting and research the first form of fertility treatment was conducted and ever since then over eight million children have been born. Regardless of the large number of children born from ART's it is still a fairly new concept to many. A number of research papers have however been done each with a different perspective. The goal of this literature review is to review and analyze the different arguments for and against providing insurance covers for fertility treatments

When mentioning infertility treatments, the first thing that will always be brought up is the high cost of fertility treatments. The costs of ART's are so expensive such that if a family was to pursue treatment it would cost them more than half the average annual income of the individual (Collins,2002). According to a study by Ombelet, et al (2019), the only true hope for Africans struggling with unintended childlessness lies in the introduction of affordable ART services. This study sought to find different strategies that can be used to reduce the cost of infertility care such as a one stop clinic for the diagnosis of infertility, low-cost protocols for IVF and simplified IVF laboratory procedures. The idea of low-cost IVF however does not mean that everyone will be able to afford it (Pennings,2008) as majority of people in developing countries are living in poverty (World Bank,2020). In addition to that not all patients with infertility can be treated with the same amount of money for example male factor fertility is not charged the same as females, HIV positive individuals are also charged more (Pennings,2008)

Studies done have also shown that the introduction of fertility treatments exacerbates moral hazard (Bundorf,2008). Moral hazard in insurance is the risk that the party has not entered into a contract in good faith such that they act in a different way now that they are protected than they would have if they had not been insured. This in turn increases the cost to the insurer. An example of moral hazard with providing insurance for fertility treatments is that individuals may delay childbirth increasing the need for fertility treatments. Existing empirical literature however shows inconclusive findings on whether younger women delayed childbirth in response to insurance coverage (Bundorf,2008). Another risk that studies have shown to be faced by insurers is adverse selection. This

risk occurs when high risk individuals purchase insurance. The difference between moral hazard and adverse selection is with moral hazard the person changes their behavior once they have already purchased the product adverse selection exists due to lack of symmetry in information between the insurer and the insured party. According to a study done adverse risk is likely to occur because people may have private information about their fertility and their desire for children that is highly predictive of their utilization (Bundorf,2008).

It was also brought up in a number of studies that the utilization of fertility treatments to conceive resulted in high rates of multiple births (Bundorf,2008). Multiple births are where a mother delivers two or more children. Research done by Stanford has shown that multiple births have a higher risk of complication, such as premature births and birth defects, as compared to regular births. Study by Bundorf, et al (2008) shows that there was substantial evidence that fertility treatments generate a large number of multiple births without a corresponding increase in birth rates. This was especially the case for women between the ages of 25 and 39.

There were a number of concerns that were brought up in the different studies. One of these being overpopulation. It is argued that any child added to an already excessive population growth is one too many (Pennings,2008). Arguments from certain authors however shows that introduction of infertility treatment does not have any impact of overpopulation as a very small percentage of the population can afford treatment (Penning,2008). In addition, it was also stated that there are more ethical ways of controlling overpopulation that does not include restricting fertility treatments. One study by Pennings, et al (2008) even raised the question on why the burden of overpopulation must be carried by the infertile alone. Another concern that

was brought up is that infertility in developing countries is a social problem with childless women frequently getting stigmatized, isolated and neglected resulting in physical and psychological violence, polygamy and even suicide (Ombelet,2019). The main question being asked is whether a medical solution should be provided for a social problem. It was however suggested that ART'S should be complementary to other ethically acceptable socio-cultural solutions to infertility (Ombelet,2019). Some studies suggested that infertility should be incorporated into healthcare programmes (Ombelet,2019) urging that policy makers should recognize infertility treatment as a health issue in developing countries. Some authors however questioned this by bring about the question on whether the government should spend their money trying to resolve problems such as poverty and hunger rather or spend money on expensive high technology programmes for non-life-threatening conditions such as infertility (Pennings,2008).

Providing insurance for fertility treatments however poses some challenges. A study done by Ombelet, (2019) shows that there are some hurdles met such as lack of well-trained fertility specialists, embryologists and IVF nurses. This is as a result of few training programmes for example in Africa the only available training centers exist in South Africa and Egypt. Another hurdle met was the lack of consistent supply of quality drugs. This is because a number of the drugs are imported. Frequent delays and high import duties contribute to the high cost of treatment (Adageba, et al,2015). Due to the fact that a number of the equipment used is imported some companies as well struggle with maintenance. Another hurdle met was that most of the patients in developing countries lacked knowledge or were extremely desperate leading to exploitation of the patients. According to a study done (Pennings,2008) there has been concern about the high rates of medical malpractice in the management of infertility in developing countries. There was also a study that showed concern with utilization (Shmidt,2011) with significant evidence showing that educated people utilized fertility treatments more than uneducated people. In the study done by Bundorf (2008), they also found that with private insurance employers passed the cost of the benefit to the workers

in the form of higher wages. The wage difference however did not affect the supply of labor. It was therefore translated that the lack of decrease in labor supply showed that the value of the incremental coverage exceeded the cost.

Pricing of a health insurance product is very important because it affects consumer purchase as well as the profitability of the insurer. According to a paper done by Outreville, 1998, he states that correct pricing of insurance contracts is the foundation of the existence of insurance contracts. When pricing a product there are a number of objectives that need to be met:

- The payments generated need to be sufficient enough to cover the current and future benefits and costs
- Premiums need to correspond with the expected loss and expenses.

According to a study done by PSC (2005), this can be achieved through the use of estimates such as sales, set up costs, ongoing expenses and capital requirements. This together with other variables such as age, education, health, gender, marital status and income.

## **2.2 Knowledge gap**

With existing literature there exists a large gap in documenting the utilization and effects of insurance policies for fertility treatments in developing countries. In addition to that there is lack of literature showing the development of such products and how to price them. This study aims at bridging that gap by focusing on pricing and development of an insurance policy for fertility treatments.

## CHAPTER THREE: METHODOLOGY

The process of deriving the premiums can be summarized into the following steps (Richardson, 2011):

- Data collection and analysis
- Setting assumptions
- Calculating the risk premium
- Calculating office premiums
- Reviewing the experience and re-pricing

### 3.1 Research design

There are various designs to a research topic. A reliable and valid design is needed to ensure the success of the study. The design of the research is usually broadly divided into qualitative and quantitative research. Qualitative research mostly produces descriptive data whereas quantitative data mostly produces numerical data. In order to obtain the objectives of this study use of both quantitative and qualitative research methods will be used.

### 3.2 Population and sample selection

The population of this study will be from Kenya. This research paper focuses on the provision of insurance policies for fertility treatments for a developing country.

When selecting a sample, the technique used is purposive sampling. This sampling method involves using judgment to pick a sample size that is useful for the purpose of the study. Due to the fact that the product is targeting a certain group of the population the sample selected will depend on various homogenous groups such as age, education, income and gender.

### 3.3 Data collection

The most important component of the premium to be charged to the policyholder is the expected cost of future claims. It is therefore important that this estimate is as accurate as possible. To ensure accuracy, there arises the need to use statistics which are relevant, reliable, accessible and consistent. For the purpose of this study secondary data is used. This is due to the fact that secondary data is readily available in addition when receiving secondary data, the data is usually already refined making it easier to use and understand.

### **3.3.1 Analysis of data**

Data analysis involves taking raw data and converting it into useful information. When analysis the data the first step to analysis will be to check the validity of the data this involves looking for missing data as well as errors in the data. The next step will involve splitting the data into homogenous groups such as by age, policy type, education, gender and income. The data can now be analyzed and used to identify present trends and predict future trends. In addition, necessary adjustments to the data can be made. Once analysis is done the data can be used to derive the assumptions to be used.

### **3.3.2 Setting assumptions**

Actuarial assumptions will be used in most areas of actuarial work, namely in pricing and reserving. These assumptions involve mathematical and statistical models designed to evaluate risks and probabilities of a particular event. When setting assumptions, it is important to consider what the assumptions will be used for, which assumptions have been the most significant, is there consistency between the assumptions and regulatory constraints. The assumptions used can be grouped into three categories demographic assumptions, financial assumptions and other assumptions.

Demographic assumptions cover anything that directly affects the future likelihood of a claim. This includes incidence rates, transfer probabilities, mortality rates, lapse rates as well as social and economic influences. The claim incidents are usually based on adjustments to a standard (insured lives) table in pricing where calculation of suitable adjustments is done through the use of experience analysis on the company's data.

Financial assumptions involve setting assumptions in regard to the expenses, expense inflation, commission rates, and investment income and tax rates.

The other assumptions include making assumptions based on expected sales volumes, expected mix of business sold, reserving requirements, capital margin requirements and profit requirements.

### **3.3.3 Calculating the risk premium**

The risk premium of a policy is equivalent to the annual cost of future claims under the policy (Richardson,2011).

Standard Risk Premium (claims of cost per exposure)

The formula for the standard risk premium is given by:

$$\text{Risk premium} = \text{Frequency} * \text{severity}$$

$$\text{Frequency} = \text{Number of claims} / \text{Earned lives}$$

$$\text{Severity} = \text{Amount of claims} / \text{Number of claims}$$

Therefore:

$$\text{Risk Premium} = \text{Amount of claims} / \text{Earned lives}$$

The claim frequency and average severity when pricing this product will be dependent on a number of factors such as age, demography, gender, policy type and the sum insured. This is because insurers must charge different premiums to different individuals.

### 3.3.4 Calculating the office premium

To calculate office premiums for a product, P:

$$P = RP + L$$

Where:

**RP= risk premium**

**L=loading for expenses, profit and commissions**

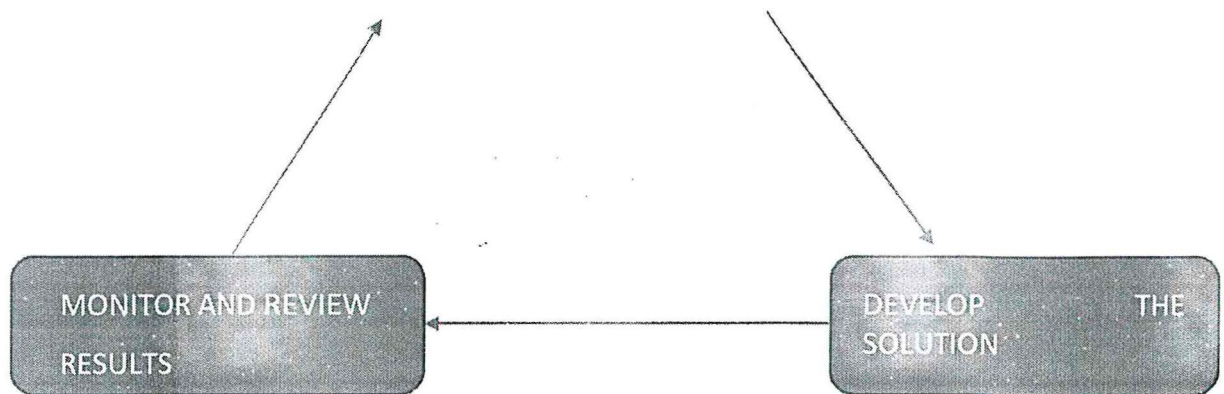
In order to ensure that the premium paid is being used to pay for as much healthcare services as possible, the expenses need to be kept as low as possible (Matthews, 2011).

### 3.3.5 Reviewing the experience and repricing

Like any other product a review must be done to figure out what to change about the product. Just as it is shown in the actuarial control cycle as below

**Fig 3.1:**





It is vital that insurers monitor their experience by comparing the actual claims costs with the expected costs that were calculated when pricing the policy (Richardson,2011). This allows the insurer to look at whether the premiums charged was sufficient to cover all the expenses and claim they can therefore make changes to the premiums so that the insurer can avoid losses. It is also important in comparing the cost and the expenses to make sure the company is not running at a loss.

There are two ways of analysis that can be done when monitoring. One being claims analysis. This involves looking at the trends in claims that occur over a period of time this can help give an indication on the benefit escalation. An expense analysis can also be done; this compares the loadings in the premium

### 3.4. Data analysis

The findings from the secondary sources are as shown below.

The population for the pricing model follows the following demographics.

Population

Maya et al. (2010) “within the Sub-Saharan Africa region, the prevalence was lowest in East Africa and Southern Africa. Kenya, Zimbabwe, and Rwanda all had low prevalence’s of primary infertility in Sub-Saharan Africa in ... (1.0%–1.1%)”. This was for the case of primary infertility while for secondary infertility the prevalence was up to 6% of the population. With this in mind then a total of 3,325,000 people is infertile in Kenya. This data might have changed over the years but gives a good representation of the infertility rate in Kenya.

The process of treatment includes several steps which are individual or couples seeking infertility treatment get medical tests and advice on reproduction without the need of additional medical treatment. The next step is the application of infertility drugs that help in the stimulation of egg production. This involves thousands of monies from the couple’s pocket. If treatment methods become unsuccessful and there is no reproduction success, an ART procedure can be performed by the specialist under the agreement of the patient. ART involves the removal of the egg surgically and combining it with the sperm in the laboratory.

The treatment for fertility related diseases has a population of  $N$  patients (childless couples). These childless couples seek treatment. The lifetime utility of the child they wish to bear is  $B$ . The couple fertility vary innately and can be represented as  $t$ . Very low and very high fertility couples do not gain much from using the clinics services. The clinic collects a price of  $p$  for each use of its services, and couples pay the additional fee  $d$  (for drugs and other expenses) for their use.

Making  $x = p+d$  be the total expense for a cycle of treatment. We then take the assumption that all the couples are charged the same price for the treatment. Those seeking for treatment have to share their income between fertility treatment and their daily consumption expenses. The assets owned by the couple is  $A$ . The consumption factor is given by the increasing, strictly concave function  $u$ .

Depending on a couple's infertility treatment choice, utility from consumption is either  $u(A - p - d)$  or  $u(A)$ . Let  $u(p) = u(A) - u(A - p - d)$  represent the lost utility from consumption when a couple pays  $p + d$  for infertility treatment.

The clinic faces demand  $D(p; k) = N [t_2 - t_1]$ . Assume that the clinic has a marginal cost of treating one additional couple equal to  $c(k)$ , and this is independent of quantity. Profit is  $D(p; k) [p - c(k)] - F(k)$ ; where  $F$  is fixed cost. Both  $c$  and  $F$  are increasing and convex in  $k$ . For a given  $k$ , the clinic sets  $p$  by making a simple trade-off between expanding market share and collecting a high margin from its patients.

The cost shifters for the fertility treatment are the equipment used and the personnel caring for the couples.

| Demographic Factors                       | Female |      | Male  |      |
|---|--------|------|-------|------|
|   | Freq.  | %    | Freq. | %    |
| <b>Age in years (n=79)</b>                |        |      |       |      |
| < 20                                      | 4      | 5.1  | -     | -    |
| 20 – 24                                   | 8      | 10.1 | -     | -    |
| 25 – 29                                   | 24     | 30.4 | 12    | 15.2 |
| 30 – 34                                   | 27     | 34.2 | 22    | 27.8 |
| 35 – 39                                   | 7      | 8.9  | 27    | 34.2 |
| 40 – 44                                   | 9      | 11.4 | 7     | 8.9  |
| 45 – 49                                   | -      | -    | 5     | 6.3  |
| > 49                                      | -      | -    | 6     | 7.6  |
| <b>Marital Status(n=79)</b>               |        |      |       |      |
| Married (Monogamous)                      | 74     | 93.7 | 70    | 88.6 |
| Married (Polygamous)                      | 2      | 2.5  | 5     | 6.3  |
| Single                                    | 1      | 1.3  | 1     | 1.3  |
| Cohabiting                                | 1      | 1.3  | 1     | 1.3  |
| Divorced/Separated                        | 1      | 1.3  | 2     | 2.5  |
| <b>Ever Attended School(n=79)</b>         |        |      |       |      |
| Yes                                       | 78     | 98.7 | 75    | 94.9 |
| No  | 1      | 1.3  | 4     | 5.1  |
| <b>Education Level (n=79)</b>             |        |      |       |      |
| Primary                                   | 27     | 34.2 | 18    | 22.8 |
| Post Primary                              | 1      | 1.3  | 3     | 3.8  |
| Secondary                                 | 25     | 31.6 | 36    | 45.6 |
| College                                   | 23     | 29.1 | 17    | 21.5 |
| University                                | 3      | 3.8  | 5     | 6.3  |
| <b>Occupation(n=79)</b>                   |        |      |       |      |
| Unemployed, looking for work              | 16     | 20.3 | 2     | 2.5  |
| Unemployed, not looking for work          | 3      | 3.8  | -     | -    |
| Self Employed                             | 36     | 45.6 | 38    | 48.1 |
| Salaried Employment                       | 22     | 27.8 | 36    | 45.6 |
| Casual laborer                            | 1      | 1.3  | 3     | 3.8  |
| Other                                     | 1      | 1.3  | -     | -    |
| <b>Number of times Married(n=79)</b>      |        |      |       |      |
| Once                                      | 70     | 88.6 | 57    | 72.2 |
| Twice                                     | 7      | 8.9  | 18    | 22.8 |
| More than two times                       | 1      | 1.3  | 2     | 2.5  |
| Never                                     | 1      | 1.3  | 2     | 2.5  |
| <b>Smoking of Cigarettes n =79 (Yes)</b>  |        |      |       |      |
|   | 6      | 7.6  | 22    | 27.8 |
| <b>Taking Alcohol n=79 (Yes)</b>          |        |      |       |      |
|   | 12     | 15.2 | 29    | 36.7 |
| <b>Exposure to heavy metal n=79 (Yes)</b> |        |      |       |      |
|   | 2      | 2.5  | 11    | 13.9 |

**Figure 3.2 Social, economic and demographic Characteristics of infertile couples**

The first demographic is age. The highest frequency for infertility is between the age of 30 and 44. This means that the price will be higher for this age. Insurance companies look at your age because that can predict the likelihood that you'll need to use the insurance. With health insurance, younger people are less likely to need medical care, so their premiums are generally cheaper. Premiums increase as people age and have a higher chance of needing more medical services.

The same will be the case for all the other demographic factors such that the demographic factor with the highest percentage frequency will be charged higher for example a female that went to school until secondary level and is self-employed in a monogamous marriage will be charged a higher premium than a female that never went to school and is in a polygamous marriage.

Assuming that fertility treatments cost 1,100,000 as stated in a study as the average cost of fertility treatments, one is able to calculate the premiums to be paid. The risk premiums were calculated using the frequencies shown in *fig 3.2* and the values shown below:

| demographic factors             | Frequency        |                | Risk premium |       |
|---------------------------------|------------------|----------------|--------------|-------|
|                                 | female frequency | male frequency | females      | males |
| age                             |                  |                |              |       |
| <20                             | 5.10%            | 0.00%          | 0.04         | 0.00  |
| 20-24                           | 10.10%           | 0.00%          | 0.07         | 0.00  |
| 25-29                           | 30.40%           | 15.20%         | 0.21         | 0.11  |
| 30-34                           | 34.20%           | 27.80%         | 0.24         | 0.20  |
| 35-39                           | 8.90%            | 34.20%         | 0.06         | 0.24  |
| 40-44                           | 11.40%           | 8.90%          | 0.08         | 0.06  |
| 45-49                           | 0.00%            | 6.30%          | 0.00         | 0.04  |
| >49                             | 0.00%            | 7.60%          | 0.00         | 0.05  |
| Marital Status                  |                  |                |              |       |
| married(monogamous)             | 93.70%           | 88.60%         | 0.66         | 0.62  |
| married(polygamous)             | 2.50%            | 6.30%          | 0.02         | 0.04  |
| single                          | 1.30%            | 1.30%          | 0.01         | 0.01  |
| cohabitating                    | 1.30%            | 1.30%          | 0.01         | 0.01  |
| divorced/separated              | 1.30%            | 2.50%          | 0.01         | 0.02  |
| ever attended school            |                  |                |              |       |
| yes                             | 98.70%           | 94.90%         | 0.69         | 0.67  |
| no                              | 1.30%            | 5.10%          | 0.01         | 0.04  |
| education level                 |                  |                |              |       |
| primary                         | 34.20%           | 22.90%         | 0.24         | 0.16  |
| post primary                    | 1.30%            | 1.80%          | 0.01         | 0.03  |
| secondary                       | 31.60%           | 45.60%         | 0.22         | 0.32  |
| college                         | 29.10%           | 21.50%         | 0.20         | 0.15  |
| university                      | 1.80%            | 6.30%          | 0.03         | 0.04  |
| occupation                      |                  |                |              |       |
| unemployed,looking for work     | 20.30%           | 2.50%          | 0.14         | 0.02  |
| unemployed,not looking for work | 1.80%            | 0.00%          | 0.03         | 0.00  |
| self-employed                   | 45.60%           | 48.10%         | 0.32         | 0.34  |
| salaried employment             | 27.80%           | 45.60%         | 0.20         | 0.32  |
| casual labourer                 | 1.30%            | 1.80%          | 0.01         | 0.03  |
| other                           | 1.30%            | 0.00%          | 0.01         | 0.00  |
| Number of times married         |                  |                |              |       |
| Once                            | 88.60%           | 72.20%         | 0.62         | 0.51  |
| Twice                           | 8.90%            | 22.90%         | 0.06         | 0.16  |
| More than two times             | 1.30%            | 2.50%          | 0.01         | 0.02  |
| Never                           | 1.30%            | 2.50%          | 0.01         | 0.02  |
| Smoking cigarettes[yes]         | 7.60%            | 27.80%         | 0.05         | 0.20  |
| Taking alcohol[yes]             | 15.20%           | 36.70%         | 0.11         | 0.26  |

Figure 3.3 Risk premium of policy

The risk premium was calculated by multiplying the frequency by severity. Average severity is the amount of loss associated with an insurance claim. It is calculated by dividing the total amount of loss an insurance cover receives by the number of claims made against policies that it underwrites. For the purpose of this study, data from the Insurance regulation Authority and specifically for Jubilee insurance was used. The data was from the annual reports published in 2019. The severity used was 0.703646 that was arrived at by dividing the incurred claims for that year and the net earned premiums.

$$\text{Severity} = 3,701,399,000 / 5,266,310,000 = 0.703646$$

Summation of the risk premium and the loadings for expenses, commissions and profits or losses gave us the office premiums. When getting loadings, a 20% that is set by the Insurance Regulatory authority was used for commissions, an assumed loading of 15% for expenses and 5% for profits. The office premiums are as shown below:

| demographic factors             | Risk premium |       | Office premium |       |
|---------------------------------|--------------|-------|----------------|-------|
|                                 | females      | males | females        | males |
| age                             |              |       |                |       |
| <20                             | 0.04         | 0.00  | 0.39           | 0.35  |
| 20-24                           | 0.07         | 0.00  | 0.42           | 0.35  |
| 25-29                           | 0.21         | 0.11  | 0.56           | 0.46  |
| 30-34                           | 0.24         | 0.20  | 0.59           | 0.55  |
| 35-39                           | 0.06         | 0.24  | 0.41           | 0.59  |
| 40-44                           | 0.08         | 0.06  | 0.43           | 0.41  |
| 45-49                           | 0.00         | 0.04  | 0.35           | 0.39  |
| >49                             | 0.00         | 0.05  | 0.35           | 0.40  |
| Marital Status                  |              |       |                |       |
| married(monogamous)             | 0.66         | 0.62  | 1.01           | 0.97  |
| married(polygamous)             | 0.02         | 0.04  | 0.37           | 0.39  |
| single                          | 0.01         | 0.01  | 0.36           | 0.36  |
| cohabitating                    | 0.01         | 0.01  | 0.36           | 0.36  |
| divorced/separated              | 0.01         | 0.02  | 0.36           | 0.37  |
| ever attended school            |              |       |                |       |
| yes                             | 0.69         | 0.67  | 1.04           | 1.02  |
| no                              | 0.01         | 0.04  | 0.36           | 0.39  |
| education level                 |              |       |                |       |
| primary                         | 0.24         | 0.16  | 0.59           | 0.51  |
| post primary                    | 0.01         | 0.03  | 0.36           | 0.38  |
| secondary                       | 0.22         | 0.32  | 0.57           | 0.67  |
| college                         | 0.20         | 0.15  | 0.55           | 0.50  |
| university                      | 0.03         | 0.04  | 0.38           | 0.39  |
| occupation                      |              |       |                |       |
| unemployed,looking for work     | 0.14         | 0.02  | 0.49           | 0.37  |
| unemployed,not looking for work | 0.03         | 0.00  | 0.38           | 0.35  |
| self-employed                   | 0.32         | 0.34  | 0.67           | 0.69  |
| salaried employment             | 0.20         | 0.32  | 0.55           | 0.67  |
| casual labourer                 | 0.01         | 0.03  | 0.36           | 0.38  |
| other                           | 0.01         | 0.00  | 0.36           | 0.35  |
| Number of times married         |              |       |                |       |
| Once                            | 0.62         | 0.51  | 0.97           | 0.86  |
| Twice                           | 0.06         | 0.16  | 0.41           | 0.51  |
| More than two times             | 0.01         | 0.02  | 0.36           | 0.37  |
| Never                           | 0.01         | 0.02  | 0.36           | 0.37  |
| Smoking cigarettes(yes)         | 0.05         | 0.20  | 0.40           | 0.55  |
| Taking alcohol(yes)             | 0.11         | 0.26  | 0.46           | 0.61  |

Figure 3.4 Risk premium and office premiums of infertile couples

Based on the values of office premiums it was possible to get the premiums that would be paid based on various demographic factors for example:

a) A female between the age of 35 and 39, in a monogamous marriage, has studied until university level, is employed and earning a salary and takes alcohol.

$$= (0.4126*1.00932*1.04449*0.37673*0.5456137*0.4569) * 1,100,000=44,945$$

b) A female between the age of 35 and 39, is single, has studied until university level, is employed and earning a salary and takes alcohol

$$= (0.4126*0.35914*1.04449*0.37673*0.5456137*0.4569) * 1,100,000=15,992$$

c) A female between the age of 35 and 39, is monogamous, has studied until university level, is unemployed and looking for work and takes alcohol

$$= (0.4126*1.0093*1.0444*0.37673*0.4928*0.45695*1.0001) * 1,100,000=40,604$$

d) A man between the age of 40 and 44, that is in a monogamous relationship, has studied until university but is unemployed and looking for work, smokes cigarettes and takes alcohol

$$= (0.4126*0.9734309*1.0177*0.3943297*0.36759*0.545613*0.60823) * 1,100,000=20,596$$

e) A man between 40 and 44, that is in a monogamous relationship, has studied until but is employed and earning a salary, does not smokes cigarettes and takes alcohol

$$= (0.4126*0.9734309*1.0177*0.3943297*0.6708*0.545613*0.60823) * 1,100,000=39,477$$

f) A woman between the age of 35 and 39, in a monogamous relationship, has studied until university is employed and earning a salary, smokes cigarettes and takes alcohol

$$= (0.4126*1.00931*1.04449*0.376738*0.545613*0.403477*0.4569) * 1,100,000=18,134$$

g) A woman between age 35 and 39, in a monogamous relationship, has studied until university is employed and earning a salary, does not smoke cigarettes and does not take alcohol

$$= (0.4126*1.00931*1.04449*0.376738*0.545613*1.000169*0.94669) * 1,100,000 = 93,130$$

h) A man between the age of 35 and 39, in a monogamous relationship, did not go to school, is a casual laborer and does not smoke or take alcohol

$$= (0.5906471*0.9734*0.38588*0.37673*0.85803*0.7954) * 1,100,000 = 62,750.76$$

i) A man between the age of 35 and 39, in a monogamous relationship, did not go to school, is a casual laborer and takes alcohol and smokes

$$= (0.5906471*0.9734*0.38588*0.37673*0.54516*0.608) * 1,100,000 = 30,513$$

j) A woman between the age of 30 and 34, who is single, studied until university level is unemployed but looking for work and does not smoke or take alcohol

$$= (0.59064*0.3594*1.0444*0.3767*0.4928*1.00016*0.9466) * 1,100,000 = 42,848$$

k) A woman between the age of 30 and 34, who is single, studied until university level is unemployed but looking for work and smoke and take alcohol

$$= (0.59064*0.3594*1.0444*0.3767*0.4928*0.4034*0.456) * 1,100,000 = 8,343.33$$

| Individual  | A   | B   | C   | D   | E   | F   | G   | H   | I   | J   | K   |
|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Monogamous  | Yes | -   | Yes | Yes | Yes | Yes | Yes | Yes | Yes | -   | -   |
| Single      | -   | Yes | -   | -   | -   | -   | -   | -   | -   | Yes | Yes |
| School      | Yes | Yes | Yes | Yes | Yes | Yes | Yes | -   | -   | Yes | Yes |
| No school   | -   | -   | -   | -   | -   | -   | -   | Yes | Yes | -   | -   |
| Employed    | Yes | Yes | -   | -   | Yes | Yes | Yes | Yes | Yes | -   | -   |
| Unemployed  | -   | -   | Yes | Yes | -   | -   | -   | -   | -   | Yes | Yes |
| Smoker      | -   | -   | -   | Yes | Yes | Yes | -   | -   | Yes | -   | Yes |
| Non-smoker  | Yes | Yes | Yes | -   | -   | -   | Yes | Yes | -   | Yes | -   |
| Drinker     | Yes | Yes | Yes | Yes | Yes | Yes | -   | -   | Yes | -   | Yes |
| Non-drinker | -   | -   | -   | -   | -   | -   | Yes | Yes | -   | Yes | -   |

**Figure 3.5 Demographic characteristics of individuals seeking insurance policies for fertility treatments**

The above individuals however have options in regard to which insurance companies they choose and more often than not they will consider an option that means they pay less premiums. Assuming the same rate for loading for all the companies and a standard price of the treatments, one can get the premiums that infertile individuals could pay for various insurance companies. For the purpose

of this study, we used Jubilee insurance, AAR Insurance and Resolution health. A table for the different premiums that would be paid by the above individuals is shown below:

|              | Jubilee | AAR    | Resolution |
|--------------|---------|--------|------------|
| Individual A | 44,945  | 24,477 | 41,635     |
| Individual B | 15,993  | 9,695  | 15,074     |
| Individual C | 40,604  | 21,553 | 37,679     |
| Individual D | 20,956  | 12,416 | 48,956     |
| Individual E | 39,478  | 20,499 | 33,764     |
| Individual F | 18,134  | 10,723 | 17,038     |
| Individual G | 93,130  | 44,188 | 85,316     |
| Individual H | 62,750  | 27,541 | 38,739     |
| Individual I | 30,153  | 19,254 | 29,568     |
| Individual J | 42,848  | 16,752 | 29,163     |
| Individual K | 8,343   | 5,482  | 7,935      |

**Figure 3.6 Table of different premiums to be paid by individuals in different insurance companies**

The difference in premiums can be seen for individuals based on their various demographic factors. From the premiums above we can also see the demographic factors that will affect the prices of the products the most. For example, Individual C and individual A share the same demographic factors except the fact that individual C is unemployed whereas individual A is employed. However, A pays a higher premium. This trend can also be seen in individual D and E. We can then conclude that employed individuals pay more premiums than unemployed individuals.

To note is that men tend to pay higher premiums than women this is probably because the success rate for treatment for women is higher than for men.

The premium calculations confirmed some of the objectives set out by pricing for different individuals. For example, the marital status of the policy holders matters when pricing this product. This is seen where the only difference between individual A and individual B is that A is in a monogamous relationship whereas B is single. Individual A however pays more in premiums than individual B. This tends to be the trend when pricing premiums for such individuals in medical insurance.

There were however some notable outliers when pricing this product. For example, the premium calculations showed that people who smoked and consumed alcohol paid less in premiums as compared to those who did not

smoke or drink. This is not the true position as the lifestyle of an individual matters when pricing the medical products. By looking at individual A and F where the only difference was that individual F smoked and took alcohol, yet they paid less in premiums. Other outliers that came about included the large values in premiums that should not have been there for example looking at individual G they are supposed to pay an annual premium of 93,130 if they chose Jubilee insurance as their insurance provider which is much larger than the other premiums calculated.

The different insurance companies also have different premiums offered for these individuals. Assuming that the chosen individuals are price sensitive then they may decide to choose AAR as their insurance provider. It is however important to note that the reason why the prices for AAR may be significantly lower than other providers is because they made large losses in the year 2019.

### **3.5 Conclusions and recommendations**

#### **3.5.1 Conclusion**

Introduction of a policy that covers infertility treatment will be beneficial not only to the insurance company but to the millions of Kenyans who will now have access to affordable fertility treatments. This will encourage people to conceive more and seek help for issues that involve infertility. The availability of a policy for fertility treatments will also mean that the benefit that people receive for regular medical insurance can be enhanced encouraging more people to take up more medical insurance.

With this study developing and pricing the product was possible (*see figure 3.5*) with the average premiums' payable being about Ksh 40,000 which is quite reasonable for treatment worth Ksh 1,100,000. The product is however more expensive than some of the other healthcare insurance products however the need for the product gives it the competitive edge it needs. To give the product a more competitive edge insurance companies should aim at pricing the product between ksh 15,000 and ksh 20,000. Use of reinsurance may help insurance companies to achieve this.

In addition, the following demographic and financial factors need to be considered while developing the product; Age, marital status, education levels, occupation and lifestyle, severity and frequency of claims and loading. The study was focused on pricing an insurance policy for fertility treatment in Kenya. The concept of fertility treatments in Kenya is relatively new to majority of people including insurance companies. Further research showed that only C.I.C insurance had made steps in covering fertility treatments.

It is because of the lack of coverage of such a product that made pricing the policy difficult. In addition to that data from medical insurance tends to be difficult to get due to ethical issues in regard to disclosing both the company's and client's information. If more data was available, then the premium amounts could be different. Limitations in the availability of data as well brought about a number of outliers. For example, when calculating the premiums people who smoked cigarettes and consumed alcohol paid less in premiums which should not be the case. This difference may have come about due to the lack of adequate data on people who do not take alcohol as we made the assumption that if the probability if someone not drinking is equal to one minus the probability of drinking but that is not the case. The causality error however was only noted when dealing with females and may have also contributed to the unusually large values noted in *figure 3.6*. Further studies can be done to show why this should or should not be the case.

The policy was also priced assuming that only infertile couples will take up the product there are however certain factors that could lead to infertility in the future. Couples who are unsure of their fertility status may also choose to take up the product. Lack of data to get the frequency of such couples meant that it was not possible to price the product for those couples.

Availability of the data in the future could mean that the premium amounts could vary.

In addition to that the health insurance industry in Kenya tends to be a loss-making industry therefore pricing the product such that the insurance company is not making any more losses was difficult, but the data provided allowed for the pricing of the product to a satisfactory level.

### **3.5.2 Limitations and Recommendations**

Availability of data was limited in addition to that the data used was also collected over a short period of time. For a more accurate representation of the premiums that should be paid a large data set is required

Availability of limited data also meant that it was hard to estimate whether the product should be priced as a rider to an already existing policy or as a stand-alone policy. Further studies can be undertaken on this.

Further studies can also be undertaken to check the impact of lifestyle habits on the premiums. This is an outlier from this project using the data available and comparing it to the industry good practice. Further data collection methods should be used to as to get more accurate representations of that demographic factor. In addition to that the relationship between individuals who drink and smoke or do not drink or smoke should be investigated further.

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## APPENDIX

### SUMMARY OF MEDICAL INSURANCE BUSINESS REVENUE FOR THE YEAR 2019

| APPENDIX 34: SUMMARY OF MEDICAL INSURANCE BUSINESS REVENUE ACCOUNTS FOR THE YEAR ENDED 31.12.2019 |                           |                 |                 |                       |                            |                   |                           |
|---|---------------------------|-----------------|-----------------|-----------------------|----------------------------|-------------------|---------------------------|
| Company   | Net Earned Premium Income | Incurred Claims | Net Commissions | Expense of Management | Underwriting Profit/(Loss) | Investment Income | Profit transferred to P&L |
| <b>INSURERS</b>   |                           |                 |                 |                       |                            |                   |                           |
| AAR INSURANCE KENYA   | 3,015,485                 | 1,656,901       | (158,164)       | 1,057,071             | 459,677                    | 249,176           | 708,853                   |
| JUBILEE HEALTH INSURANCE  | 5,260,310,000             | 3,701,399,000   | 102,825,000     | 943,438,000           | 512,648,000                | 492,276           | 1,004,923                 |
| RESOLUTION INSURANCE COMPANY  | 1,556,248                 | 1,065,106       | (86,632)        | 750,540               | (172,765)                  | 72,817            | (99,948)                  |
| Amounts in Thousand Shillings   |                           |                 |                 |                       |                            |                   |                           |