Application of Standard Actuarial Pricing Techniques for Health Microinsurance Schemes

by

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Abstract

Microinsurance is growing in usage as a tool to help poor communities mitigate the risks they face. Health microinsurance schemes are used to manage the burden of high healthcare costs for poor families when a family member falls ill.

Health microinsurance schemes often have limited financial resources; therefore if the premiums it collects are insufficient, the scheme could be forced to close. Robust pricing techniques would be helpful in ensuring that these health microinsurance schemes are able to cover their claims and running costs.

This dissertation explored the application of standard pricing techniques, which are usually used for pricing conventional health insurance schemes, to health microinsurance schemes. This demonstrated the techniques that are most suitable for these microinsurance schemes.

The dissertation described the steps the author took to estimate the premiums for two microinsurance schemes. The author undertook the pricing exercise by researching available data, deriving the relevant pricing assumptions and building a pricing model for each of the schemes. The methodology adopted by the author was based on techniques that would be used to estimate premiums for conventional schemes.

The premiums estimated using the standard techniques were comparable with those that might be used in practice. The study found that national statistical data was the most useful and readily available data, assumptions often need to be adjusted to reflect the characteristics of the community and the formula model approach was suitable because of its simplicity. However, there were techniques, such as expenses analysis, that were not used in the study but could be useful for producing more accurate premium estimates for microinsurance schemes.

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1   Introduction

1.1   Aim

The aim of this research paper is to explore the pricing techniques suitable for setting premiums for a health microinsurance scheme.

1.2   Background of Health Microinsurance

Microinsurance services low income communities that are unable to afford traditional insurance products. It is aimed at providing coverage for low-income households but it is not limited to a specific product or product line.

Generally these low-income communities are in developing countries and are not serviced by the conventional insurance market or social insurance schemes because the premiums are unaffordable or their income is irregular. This is because most of the people in these communities are part of the informal employment sector or the agricultural sector. They are often referred to as the working poor (Morgan, 2010). According to Kalra (2010) the potential microinsurance market is made up of approximately four billion people. These are people who live on less than $4 a day (in 2005 dollars based on purchasing power parity).

According to Cohen and Sebstad (2005), health risks are identified as one of the most significant risks to low income households. People in poor communities often need to sell some of their most valuable assets such as livestock in order to pay for healthcare when a family member falls ill. The World Bank estimates that more than 100 million people are pushed into poverty each year because of healthcare costs (The World Bank, 2010). Microinsurance can help manage these health risks and so prevent these households from falling back into abject poverty.

A Health Microinsurance Scheme (HMIS) is a microinsurance scheme that provides healthcare cover for its members. HMIS generally operate by collecting premiums for a group of individuals in order to pay for the provision of healthcare services of the persons in the group, when needed. The premiums collected from the members may not cover the full cost of the scheme; the extra costs may be covered by a subsidy from the government or a charity organisation. There are some schemes that aim to operate on a fully funded basis i.e. with the premiums collected covering the full costs and even providing a profit for providers.

Health microinsurance schemes that have limited access to subsidies or may be fully self funded need to ensure that premiums are calculated so that they accurately reflect the expected costs. Good pricing techniques will make schemes more viable which will help strengthen the communities they service.

1.3 Issues with pricing Health Microinsurance Schemes

There are several issues with HMIS that distinguish them from regular health insurance schemes. Firstly, the resulting premiums need to be affordable for very low-income groups so that there is little scope for large margins for data or model errors. The data available is likely to be scarce and incomplete as experience statistics for the low-income groups may not be readily available especially if the product is being offered to the group for the first time. As so little is initially known about these low-income groups, their behaviour is often difficult to predict. The behaviour of conventional policyholders may not be applicable and the scheme providers may only fully understand the low-income group's behaviour once the scheme has been operational for some time. Finally, the risk of illness for these low-income groups may be higher than for conventional policyholders because of their poor socio-economic background.

Currently there are no established actuarial practices specifically suited for pricing health microinsurance schemes. The techniques currently used for such schemes are developed on a case by case basis. While some literature provides guidance for scheme management and administration there is no guidance specifically for actuarial pricing. This research will aim to explore pricing techniques that are used for HMIS.

Ideally the pricing techniques suitable for pricing HMIS should result in premiums that are affordable for the scheme members but that are sufficient to cover expected claims under the scheme. The techniques should be easily adaptable for changes in the product design and they should not be overly complicated or difficult to explain to less trained staff who might be required to make changes to the model without the actuary's assistance.

The above criteria are difficult to measure until the scheme is underway and has been operational for some years. This research will focus on the criteria that can be measured at the present time, such as affordability of the resulting premiums and simplicity of the methodology.

1.4 Actuarial Pricing Techniques

Actuaries have developed ways of estimating the expected future costs under health insurance policies. The technique will depend on the type of policy. This study will look at two types of policies:

- Group private medical insurance (PMI)
- Cash plan

For the group PMI scheme and the cash plan, actuaries will calculate a risk premium that represents the future cost of claims under the policy. The risk premium is then increased to include the costs of selling and administering the policy, the cost of holding capital and reserves, and a profit margin – this gives the office premium. In conventional insurance schemes this office premium is what the scheme member will pay.

1.5 Study Design

The study will focus on conducting a pricing exercise on two new health microinsurance schemes in order to demonstrate how the standard pricing techniques can be used.

The author will collect information on the proposed scheme on the administration, the product design and the target population as well as data on the costs of medical care in the area where the scheme will operate.

The research will explore data collection and analysis, assumptions setting, model choice and estimating future claims and expenses.

1.6 Structure

The paper will firstly describe the HMIS that will be priced in chapter 2 and then will go on to introduce the actuarial pricing techniques that might be used in chapter 3. Chapters 4, 5 and 6 will describe the actual pricing process from data collection to assumption setting and modelling. Chapter 7 will discuss how the schemes might review their experience in the future. Chapter 8 gives a summary of the techniques and conclusions that might be drawn and chapter 9 lists the references used in the paper. The paper has one appendix that shows some of the data and assumptions used in pricing the schemes.

1.7   Sources of Data and Information

Microinsurance is a relatively new type of insurance and as a result there is not a vast amount of literature available to be used for this research. The main sources of information were:

1. MicroEnsure – MicroEnsure is a non-profit insurance intermediary that deals exclusively with the microinsurance industry. This company provided information on two of the schemes they will launch in 2011 as well as the pricing models used to set the premiums for these schemes to assist in this study.

2. Discussions with Will de Klerk, Healthcare Vice-President of MicroEnsure

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9. Discussions and presentations at the International Microinsurance Conference – Learning Sessions held at the Staple Inn Actuarial Society, London on 30 June 2011.

1.8   Problems and Limitations

As this research proposes to look at just two health microinsurance schemes it can only offer limited insight into how these techniques would be used for schemes that differ from the schemes that are examined in the study.

2 Health Microinsurance Schemes

This study will be examining pricing techniques for two new health microinsurance schemes managed by MicroEnsure:

1.   Kilimanjaro Native Cooperative Union (KNCU) Health Plan
2.   Philippines Hospital Cash Plan

This chapter describes the key features of health microinsurance schemes and gives details of the two schemes, including background on the target population, benefits under the schemes, and eligibility criteria for joining the schemes and how premiums will be collected. All this information forms part of the data needed to calculate the appropriate premiums for the scheme.

2.1   General Features of Health Microinsurance Schemes

2.1.1   HMIS Target Market

The HMIS target market is made up of low-income individuals in developing countries, where there is limited access to healthcare services and they are not serviced by the conventional insurance industry. People in the target market are likely to form part of the informal or agricultural sector of the economy – so they may not have regular incomes. As they have limited disposable incomes it is important that the insurance is seen as offering value for money and this might only be done by offering additional benefits that do not require a claim.

Many people in the target market may find it difficult to trust insurance providers, particularly if these providers are foreign institutions.

2.1.2   HMIS Product and Scheme Design

The main issues with providing health microinsurance are:

*   Target market may not be able to read or fully understand the product documentation
*   Target market may not be able to afford to pay premiums on a regular basis
*   Healthcare facilities may be inaccessible to the target market
*   Distributor may not be able to earn the trust of the target market
*   There is no healthcare data for pricing the product accurately
*   Healthcare cost may be too high and might be subject to a high inflation rate

- The product may not meet the expectation of members, for example because of too many exclusions under the policy. This will lead to very low renewal rates.

- Lack of systems to properly record member data and claims data.

- Target market may have high rates of illnesses due to lack of access to healthcare or poor living conditions.

- The product will be most attractive to people in the target population that have the highest risk of illness. This is known as anti-selection.

- The target market may act dishonestly in order to prevent paying high premiums. For example, members may only register a few of their children in the scheme but claim benefits for unregistered children if the situation arises.

Several of these issues are addressed by adapting the product and scheme design so that it is suitable for the target market. Firstly, before a scheme is implemented the provider should ensure that there are healthcare facilities accessible to the target market. They should also conduct initial market research to learn about the target market, establish which benefits they would find most useful and how much they might be willing to pay for the insurance (Wipf, Liber and Churchill, 2006). The market research might also be used to collect data about the target market that will be useful in pricing such as incidence rates for the illnesses that might be covered.

According to Churchill (2011), the product design should be simple with few exclusions and with documentation that considers the level of literacy of the target market. The product should also be compulsory within the group to prevent only sick persons taking up the product, which would result in very high claims and consequently a very expensive product. The premium collection method should be flexible to adapt to changes in income patterns of the target market. The product's benefits should include some which are not dependent on claiming in order to demonstrate value to members who have not had a reason to claim. For example, the health scheme might offer a free annual check-up.

The scheme should use a distribution channel with ties to the target community that have already been established. The provider should also ensure the scheme is monitored by a comprehensive data collection system and that the administration staff are fully trained in its usage. The schemes management system should dissuade dishonest behaviour where possible. The scheme might require a photo card to be made for each member and their registered family members to prevent any unregistered family from claiming.

2.1.3   HMIS Regulatory Environment

As microinsurance schemes are usually implemented in developing countries, regulators in these territories often do not have the resources to establish regulation specifically for microinsurance. Some notable exceptions are India and the Philippines.

2.2   Kilimanjaro Native Cooperative Union (KNCU) Health Plan

The health plan is the result of a partnership between MicroEnsure and the PharmAccess Foundation. PharmAccess is a Dutch non-profit organisation which, according to its website, aims to improve access to quality healthcare in sub-Saharan Africa. This health plan was launched in early 2011.

The KNCU is a union of Arabica coffee growers that live and farm in rural north Tanzania in the Kilimanjaro region. The union is made up of 67 cooperative societies with approximately 75,000 members and is the oldest cooperative union in Africa.

PharmAccess will be providing the healthcare through its network of hospitals and clinics and its staff as well as subsidising the cost of the scheme. PharmAccess will also provide training for the medical staff and fund the start-up cost of the scheme. The features of the health plan were taken from MicroEnsure Tanzania (2011).

The health plan provides primary care including outpatient services, medication and HIV/AIDS consultation as well as inpatient maternity care such as ante-natal and post-natal care, normal delivery, emergency caesarean-sections and neonatal care. The benefits and premiums are denominated in Tanzanian Shillings (TZS). Benefits also include an annual check-up for all members over 50 years of age. There is an annual limit on benefits per person of TZS 500,000 (equivalent to £184.37[1]).

The plan's inpatient care is carried out at local dispensaries or at a local health centre. The inpatient maternity care is carried out at the district hospital or the Kilimanjaro Christian Medical Centre.

Each of the KNCU cooperative societies will hold a vote on if they wish to join the health plan. If more than half a society's members vote in favour of joining then all of that society's members must join. Each member of the society and their household family members must then enrol in the scheme. Family members that live in another home in the member's village

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[1] The exchange rate used is £1 = TZS 2711.97 as at 24 August 2011

may also choose to join, but they must then also enrol their entire households. Each society acts like a group policyholder and so this product is most similar to a group PMI scheme.

Premiums for this scheme are expected to be at a flat rate, therefore independent of the enrolee's age or sex. This flat rate premium structure is adopted as it is often easier for staff and clients to understand (Wipf, Liber and Churchill, 2006). The health plan's cover is annually renewable and the premiums will be collected during the harvest time directly from the farmer's revenue through the KNCU.

Tanzania currently has no regulation in place for microinsurance schemes.

2.3 The Philippines Hospital Cash Plan

This product will be compulsory for borrowers who have completed two or more loan cycles with a specified microfinance institution (MFI) in the Philippines when it is launched in late 2011. The product will be underwritten by Hollard Insurance while MicroEnsure will administer the scheme. The features of the cash plan described below were taken from the Microinsurance Manual for Hospital Cash Insurance (2011).

The cash plan provides a fixed cash payment for every day the insured or his covered family members spends in a hospital. Payment is only triggered after 24 hours of in-hospital treatment. The benefits and premiums are denominated in Philippines Pesos (PHP). There is an annual limit on the payments. The product also offers a transportation allowance for each occurrence of hospitalisation and a daily companion allowance to allow one of the patient's family members to be able to stay near the hospital.

There are four levels of cover offered: Low, Medium, High and Maxi each with varying levels of benefit are shown in Table 1. The annual limit under the High plan is PHP 50,000; this is equivalent to £714.00[2].

Table 1. Philippines Cash Plan Schedule of Benefits

PHP	Low	Medium	High	Maxi
Annual Limit Sum Insured	10,000	25,000	50,000	150,000
Cash Benefit – Day 1	500	1,000	2,000	3,000
Cash Benefit – Day 2 onwards	500	1,000	1,000	2,000
Transport Allowance	250	250	250	500
Companion Allowance			200	735

Source: MicroEnsure Philippines (2011)

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[2] The exchange rate used is £1 = PHP 70.03 as at 24 August 2011

The borrower must be between the ages of 18 and 65 years and be in a normal state of health when he or she first enrols in the cash plan. This means that he or she must be able to pursue his or her usual livelihood. All the borrower's dependent, unmarried children and siblings between the ages of 6 months and 25 years must also be enrolled in the plan. The borrower's spouse and dependent parents between the ages of 18 and 65 years must also be enrolled.

The policy is annually renewable. Premiums will be set for each level as a flat rate per family of four with an additional premium for each additional dependent. The total annual premium will be divided across the loan term and premiums will be collected at the time of the loan repayments.

The Philippines introduced a regulatory framework for microinsurance in January 2010. The regulation includes a capital requirement for companies only engaged in microinsurance business set as 50% of the capital requirement for conventional insurance companies.

2.4 Summary

The above two schemes are examples of health microinsurance schemes; however they are not representative of all the various types of microinsurance schemes that might be implemented. These schemes were chosen as they have several features which differ from each other. Table 2 summarises the different features of each scheme.

Table 2. Scheme Features Summary

	KNCU Health Plan	**The Philippines Cash Scheme**
Scheme Type	Private Medical Insurance for outpatient care and maternity	Cash scheme for inpatient care
Method of Financing	Subsidies by a charity	Self- funded for profit
Distributor	Agricultural union	Microfinance institution
Policy Type	Group policy	Individual family policy
Premium Type	Annual premium collected at harvest time	Monthly premium collected with loan repayments
Regulatory Environment	Unregulated	Subject to microinsurance specific regulation

Sources: MicroEnsure Tanzania (2011) and MicroEnsure Philippines (2011)

3 Introduction to Actuarial Pricing Techniques

This chapter gives an overview of the pricing techniques used to price health insurance products. The details of these techniques will be set out in chapters 4, 5 and 6. They are drawn from The Actuarial Education Company (2010).

Actuaries use a series of steps to derive an appropriate price for insurance policies. Firstly, they use a suitable model to project the cost of the future claims under the policy; this cost is called the risk premium. This risk premium is then increased to cover the company's future expenses, the cost of capital and reserves, and the required profit margin to give the gross or office premium which is ultimately charged to the policyholder.

Pricing a product an ongoing process and like most actuarial work can be viewed in the context of the Actuarial Control Cycle. The Actuarial Control Cycle is illustrated as follows:

Figure 1. The Actuarial Control Cycle
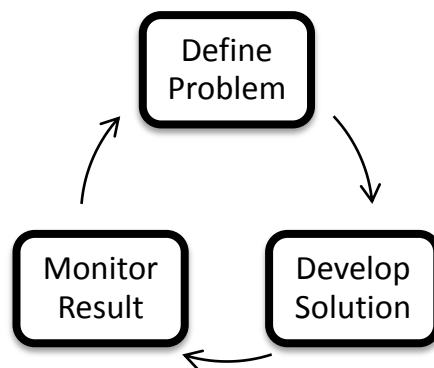
Source: Bellis, Lyon, Klugman and Shepherd (2010).

The cycle is carried out in an environment with external forces which the actuary must consider, as well as the requirements for the actuary to act with professionalism.

For pricing, the problem is calculating suitable premiums that satisfy the company's profitability requirements. The solution is to develop a robust pricing model to calculate these premiums. Monitoring the results will include evaluating the company's experience and comparing this with the assumptions used in the pricing model.

The process of deriving the premiums has been divided into the following steps for the purpose of this research:

1. Data collection and analysis
2. Setting assumptions

3. Choosing an appropriate pricing model
4. Calculating the risk premium
5. Calculating the office premium
6. Reviewing the experience and re-pricing

Since the microinsurance schemes examined in this study are new, steps 1 to 5 can be described in detail. The research will comment on step 6, but will be unable to demonstrate how the techniques are used for the two microinsurance schemes, since there will be no experience to review at this stage.

4 Data Collection and Analysis

This chapter describes the data that might be used in pricing health insurance and comments on the suitability for use in pricing the two microinsurance schemes in this study.

Data needs to be collected and analysed to derive the assumptions needed for the pricing model. Cichon et al (1999) give four types of data that are essential for modelling a health scheme as:

1. *Population data* – This is essentially data on the target population of the scheme and will include information on the size, age and sex structure of the population as well as size of households and income.
2. *Utilisation and infrastructure data* – This data includes the incidence rates or utilisation rates for the various benefits under the scheme and information on the available medical infrastructure such as number of outpatient units, medical staff, hospital beds and hospitals by type.
3. *Price data* – This includes information on the cost of the healthcare benefits under the scheme.
4. *Expenditure and revenue data* – This is data on the expenses that will be incurred in running the scheme.

4.1 Sources of Data

There are several sources of data that can be used to set values for the model's assumptions, each with its merits and drawbacks. Chapter 11 of The Actuarial Education Company (2010) set out the main sources of data for pricing described in this section. According to Morgan and Meerschaert (2010), incidence rate or utilisation rate data is usually the most difficult data set to obtain for HMIS. The best source for this and the other types of data is the company's own data from previous experience with the same or similar products. The company's own data will already reflect the company's underwriting standards, policy conditions, claim management and distribution method. Other sources of data would need to be adjusted to reflect these company specific features.

4.1.1 Company Data and Market Research Data

For population and utilisation data the company's own experience would be most relevant if the target population for the products being priced are the same as the company's current policyholders. It will also be most ideal if the new product is the same or very similar to the

product from which the data is being drawn. Unfortunately, these conditions rarely exist and it is more likely that the company's own data will need to be adjusted for the differences between the new product being priced and the existing product whose experience provides the data. Furthermore, companies usually have a limited volume of data or none at all if it is a new company or a new line of business.

For the microinsurance schemes, past company data is non-existent as both these schemes are new for the territories. In this case the company may conduct market research on its target group to gain the data that it is missing (Morgan and Meerschaert, 2010). Some microinsurance schemes may not have sufficient budget to commission detailed market research and the company will be forced to combine its limited knowledge of the target population with data from other sources.

Some research into the KNCU scheme gave information on the average size of the unions and the makeup of the average households and their income. The healthcare provider also gave data on the infrastructure of the health facilities and staffing levels for the facilities that will be used under the scheme. The healthcare provider also agreed to set fees for the various benefits. Information on the incidence rates or utilisation rates as well as data on the age and sex structure of the target population was not readily available.

The MFI will have more detailed information on the target population of the Philippines cash scheme as they will already have been customers of the MFI for at least a year. However utilisation and infrastructure data was unavailable from this source.

4.1.2   National Statistical Data

National statistical data is also a possible source of data and is likely to be of a sufficient volume to be more credible than the company's own data. This is often available from government statistical agencies or world bodies such as the World Health Organisation (WHO). However there are several issues that might arise with the use of population statistics. The national experience may not reflect the experience of the target market, for example in the UK mortality for insured lives is often lighter than for the whole of the UK. This is because insured lives are usually underwritten to exclude the unhealthiest persons and people with insurance are likely to be from a higher socio-economic bracket so have exposure to better healthcare. Also the target market could be from a region that has better or worse morbidity or mortality than the country as a whole. National statistical data is often more useful if it is broken down by region, age groups and socio-economic groups.

The applicability of national statistical data may be questionable as definitions of diseases may not be the same as for the product. National statistical data may also not be in a suitable format and is most likely to be out-of-date by the time it is published as it could take several years to collect and analyse the data.

For microinsurance national statistical data is often the most credible source of available data for the incidence rates and utilisation rates as well as the population data. This was the case for the KNCU scheme, where incidence rates were derived from the utilisation data found in the Ministry of Health and Social Welfare Tanzania (2006) and Ministry of Health and Social Welfare Tanzania (2008). These documents show utilisation data for 2004 and 2006 respectively, see Appendix I, Table 7.

The projections of the total population for mainland Tanzania in 2004 and 2006 were 36,021,238 and 38,277,506 respectively. The population of Kilimanjaro was projected to be 2,368,114 in 2006. These projections were published by the Tanzania National Website (n.d.).

Data on the age and sex structure of the population was taken from National Bureau of Statistics Tanzania (2011). This is shown in Appendix I, Table 8. Data on maternal and female health was also taken from the National Bureau of Statistics Tanzania (2011), shown in Appendix I, Table 9.

WHO data was also useful as data on preterm or premature births was difficult to obtain. The incidence of preterm birth in East Africa is 14.3% according to a WHO article by Beck et al (2010).

National statistical data in the form of the National Statistics Office Philippines (2009) was the most credible source of data for utilisation and infrastructure for the Philippines cash scheme. The data from these surveys will be used in conjunction with the data already gathered on the target populations of the schemes.

4.1.3   Industry Data

Market data may be available if several of the companies in the insurance industry decide to combine their data experience to create data relevant to insured lives in the market. This type of market data can be very useful as it will reflect the target market more accurately than population data; and because the data is from several companies there is likely to be a sufficient volume of data to make the resulting analysis credible. An example of market data in the UK is the mortality data available from the Continuous Mortality Investigation (CMI). However, market data will also need to be adjusted to reflect the company's specific features.

Industry data tends to be unavailable for microinsurance schemes as these schemes are usually in countries without an established insurance market or without an existing insurance market for the target population. This was the case with both the KNCU and Philippines cash schemes.

4.1.4   Overseas Data

Actuaries can use data from overseas companies or overseas national statistics. In this case the data will be less relevant but may be the only available source. This can be very useful for schemes in territories that have a similar demographic to an overseas territory with a well-developed insurance market. Overseas data can also be used to supplement the national statistical data. Overseas data should be adjusted to reflect the differences in culture, state provision, market practices and legislation and policy conditions from the target market.

The KNCU health plan offers cover for life threatening surgeries; however the national statistical data did not have any information on the rates of such surgeries in the Kilimanjaro region. Data was found for a hospital in another town in Tanzania. According to Galukande et al (2010), the rate of essential surgeries at the Bagamoyo District Hospital in 2007 was 0.38%. Bagamoyo is a coastal town in Tanzania close to the capital Dar es Salaam. It was the only data on major surgeries available for Tanzania and although it is not overseas data it is an example of using data from a different territory to derive assumptions.

No overseas data was used for the Philippines cash scheme as the Philippians national statistics data was sufficient.

4.1.5   Other Data Sources

Lastly, insurers could also use data from reinsurers and consultants who may have access to data from various other companies. Reinsurer and consultant data will also require adjustments to reflect the company's specific features. Access to reinsurer and consultant data may be too costly for most microinsurance schemes so this source may not be feasible.

Price data such as the benefit cost and commission rates will be known when setting up the scheme. The benefit costs will be established with the healthcare provider and the commission rates set with the broker in advance of the start of the scheme.

PharmAccess, the healthcare provider in the KNCU scheme, provided an estimate on how the various utilisation rates might be split between the 4 healthcare facilities: the dispensary (Disp.), the local healthcare centre (H.C.), the district hospital (D.H.) and the Kilimanjaro Christian Medical Centre (KCMC). These estimates are shown in Appendix I, Table 11.

PharmAccess has also agreed benefit costs for the provision of each healthcare benefit to the target population. This is shown in Appendix I, Table 12.

For a cash scheme such as in the Philippines the benefit cost is a predefined benefit amount for each day spend in the hospital.

Expenditure data is usually taken from the company's past experience. Companies will periodically analyse their expenses to determine how the expenses are split between acquisition and renewal expenses and fixed and variable expenses. The company's latest expense analysis will be the best source for setting its expense assumptions. If the company has no expense experience it may be able to use data from a reinsurer or consultant or market data in the form of information from publically available returns of other companies in the market.

For the KNCU and Philippines cash schemes, MicroEnsure may be able to rely on its experience in administering other microinsurance schemes across the globe to estimate its expenditure. Most microinsurance providers do not have access to this type of experience and will need to make assumptions about the costs of administering such a scheme, without investigations to support these assumptions.

Actuarial techniques provide several options for obtaining data that could be used in pricing microinsurance schemes. However, the most useful source of utilisation data for such schemes appears to be national statistics. Any data source that is used will need to be adjusted for factors that the actuary observes about the scheme or expects to occur as a result of the scheme being established.

4.2   Analysis of Data

Analysis of the data used for setting assumptions is done in the following steps:

1. Validate the data for accuracy and appropriateness, i.e. check for data errors and missing data.
2. Split the data into homogenous groups, for example, by sex, age, type of policy, distribution channel, or territory. Each group should have a sufficient volume of data.
3. Analyse the data to identify trends and necessary adjustments.

As so little data is available for the microinsurance schemes steps 2 and 3 will not be practical. Since utilisation rates for the schemes are not available by age or sex, the data cannot be split further.

The only sequential data that was found was the 2006 and 2008 Tanzania Health Abstracts. Analysing these will help guide the adjustments that could be made to assumptions to reflect the fact that the scheme will be written in 2011.

After the data has been collected and analysed, the data will be used to derive assumptions to be used in the pricing model.

5   Setting Assumptions

This chapter examines how the assumptions used in pricing are derived from the data that has been collected. It also illustrates the derivation of pricing assumptions for the two microinsurance schemes.

The main assumptions for PMI and cash schemes can be grouped as follows:

Demographic assumptions – For PMI and cash schemes this includes claim incidence rates.

Financial assumptions – For PMI this will include the cost of each benefit and benefit inflation. Cash schemes give a known fixed benefit. Financial assumptions also include expenses, expense inflation, commission rates, investment income, tax rates, expected sales volumes, expected mix of business sold, reserving requirements, capital margin requirements and profit requirements.

Once the data has been collected and analysed, the actuary must make best estimates of the parameters based of the analysis of the data. The actuary must then consider what the future social and economic conditions will be when the new product being priced will be sold. Adjustments to the best estimates will be made to reflect the future conditions.

5.1   Demographic Assumptions

Incidence rates are usually based on adjustments to a standard (insured lives) table in pricing conventional health products. For example, the incidence rate for a life aged x, ix, could be defined as:

$$i_x = a\, i_x^{\,s} + b$$

where:
a and b are the adjustment constants
$i_x^{\,s}$ is the incidence rate for a life aged x from a standard insured lives table.

The adjustments could be based on the company's own experience in the same or a similar contract. Adjustments may also be to reflect future expected experience.

For the microinsurance schemes incidence rates may be derived from the utilisation data collected through the market survey or from the national statistics data. This will be done by adjusting the utilisation rates based on other information about the target population (Morgan and Meerschaert, 2010).

5.1.1   KNCU Health Plan

The 2006 outpatient utilisation rate from the Ministry of Health and Social Welfare Tanzania (2008) was 1.05 visits per person per year for illness that will be covered by the scheme. Similarly the 2004 outpatient utilisation rate from the Ministry of Health and Social Welfare Tanzania (2006) was 0.77 visits per person per year. Assuming a straight-line trend in the utilisation rates gives a projected utilisation rate in 2011 of 1.75. However, as this rate represents the whole Tanzania mainland it will need to be adjusted to reflect the expected utilisation in the Kilimanjaro region and the expected behaviour of the target population. According to practitioners in the microinsurance industry, utilisation rates for new schemes in rural areas are often much higher than the national average. This is because these communities had little or no access to healthcare facilities before the scheme began and therefore there will be some "pent-up demand" for services. This is where people who may be suffering with milder ailments for some time will now seek medical help as there is now a facility to do so.

The 2011 projected utilisation rate is adjusted as follows to give the incidence rates for outpatient care of the scheme:

- 55% increase to allow for people shifting from being uninsured to being insured. This 55% increase is based on the difference in the outpatient utilisation rates of insured persons and uninsured persons from a 2006 Low-Income Medical Insurance survey in South Africa in 2006 (Morgan and Meerschaert, 2010).
- 10% increase for pent-up demand – arbitrarily chosen
- 10% contingency loading – arbitrarily chosen

This gives:

Outpatient incidence rate = 1.75 X 155% X 110% X 110% = 3.27

This outpatient incidence rate and the other data sources were used to derive incidence rates for each benefit under the KNCU scheme. A breakdown of the incidence rates for each benefit is given in Appendix I, Table 10.

The healthcare provider, PharmAccess, also made assumptions on how utilisation would be split between the local dispensaries, the health centres, the district hospital and the Kilimanjaro Christian Medical Centre for each benefit. This assumption would have been based on the charities experience in healthcare provision in other territories.

5.1.2   Philippines Cash Plan

The raw claim frequency of hospital admissions from the Philippines National Statistics Office (2009) is 4.05% per annum; this was adjusted as follows:

- 36% increase to allow people shifting from being uninsured to insured. This 36% increase is based on the difference in the hospital inpatient utilisation rates of insured persons and uninsured persons from a 2006 Low-Income Medical Insurance survey in South Africa in 2006 (Morgan and Meerschaert, 2010).
- 10% increase for pent-up demand
- 10% contingency loading

This gives:

Adjusted claim frequency per person= 4.05% X 136% X 110% X 110% = 6.66%

However as the premium rate we want to calculate is for a family of four persons, we need to find the adjusted claim frequency per 4 persons. This is given by:

Adjusted claim frequency per family of 4 = 4 X 6.66% = 26.66%

The health survey also included a distribution for the number of days of hospitalisation, shown in Table 3.

Table 3. Distribution of Number of Days of Hospitalisation

Number of Days in Hospital	Probability
0	0.4%
1	12.6%
2	14.8%
3	23.6%
4	11.4%
5	10.1%
6+	26.4%
Missing	0.8%

Source: National Statistics Office Philippines (2009) Table 14.8 (Length of Stay)

The cash plan's claim amounts are not solely dependent on the number of days spent in hospital. There are also allowances and an annual limit for each level of cover. The distribution of days in hospital was used to derive a distribution of claim amounts for each level of cover. This is shown in Appendix 1, Table 13.

As incidence rate tables are unavailable for most microinsurance schemes, the conventional practice of using tables and adjusting the values for expected experience, as described at the start of this section is not feasible. This means more estimation is necessary and the

assumptions are subject to more uncertainty. Simply loading the assumptions with high contingency margins may result in premiums that are too high and therefore not affordable for the scheme members.

In order to gauge the extent of the effect each assumption will have on the final premium, the actuary could run sensitivity tests on the assumptions as part of the final modelling stage.

5.2   Financial Assumptions

For PMI policies the benefit cost may be given by the hospital providers and for a cash scheme the benefit will be a fixed known amount. This information is available for both the KNCU and Philippines cash schemes.

Benefit inflation could be derived from the past inflation of benefit costs from the provider for PMI. Cash schemes will not have benefit inflation. As the KNCU scheme is new there is no data on benefit inflation; however as the scheme is annually renewable the premium might be adjusted if benefit costs rise to unexpected levels in subsequent years.

Expense assumptions are usually based on the company's recent expenses analysis for similar policies. The results of the expenses analysis will be adjusted for inflation between the time the analysis applied to the time the new product will be sold. The company will assign values for acquisition expenses, i.e. expenses incurred when setting up the product and selling the product. Some of these expenses will be a fixed charge per policy, such as the cost to load the policy into the company's computer system and some will be proportional to the size of the policy, such as the underwriting costs. There will also be administration or renewal expenses that could be a fixed charge or proportional to the policy size, or both.

Again, as both schemes are new, directly relevant expense experience is not available; however, as MicroEnsure has experience relating to other schemes in various other territories this could be used to project costs under these new schemes. In most circumstances new microinsurance schemes will not have this experience to draw upon. In this case some investigation will be necessary to project the costs that will be incurred under the new scheme.

Expenses inflation, like benefit inflation, is unlikely to be applicable to PMI and cash schemes as these policies are normally annual.

Commission will be set as the percentage rate of the policy premium that the distributor will charge the company.

The company's profit requirement could be set as a required proportion of the net present value (NPV) from the contract to the premium received under the contract. The risk discount rate at which the company will calculate the NPV will also need to be chosen. The risk discount rate will be set at the company's investor's expected rate of return.

Expenses and commission under the KNCU plan have been set at a flat 20% of the premium. The scheme is not expected to make a profit as it is subsidized.

For the Philippines cash scheme, the expenses, commission and profit are as follows:

Table 4. Philippines Cash Plan Expenses, Commission and Profit Loading

Item	% of Office Premium
Policy Tax	5%
Collection Fee	5%
Administration Charge	10%
Brokerage Charge	10%
Distributor Commission	5%
Underwriting Profit Loading	13%
Total	**48%**

Source: MicroEnsure PHP Cash Hospital Plan Model

Deriving assumptions for the HMIS involved cruder adjustments than would be made in pricing conventional products. This is because the data available for the microinsurance schemes were less directly applicable to the scheme than they would have been in a conventional setting.

The result is assumptions with greater margins for uncertainty – so prudent assumptions rather than best estimate are used. This leads to higher premiums that may not be acceptable to the target population or the subsidising body. The next chapter describes the pricing model that will utilise these assumptions.

6 The Pricing Model

This chapter describes the model or calculation used to derive an office premium for a health insurance product as described in chapter 15 of The Actuarial Education Company (2010). As in previous chapters it includes a demonstration of the techniques as they were used in the two microinsurance schemes.

The pricing model can be based on either of the following approaches:

- Formula Approach
- Cashflow Approach

6.1 The Formula Approach

This is the simpler of the two pricing techniques that can be used and is based on the principle that the present value of the office premium must be equal to or exceed the present value of expected claims and expenses less the present value of any non-premium income such as investment income. This is called the equation of value. The equation is as follows:

$$PV(Claims) + PV(Comm) + PV(Exp) - PV(Inv) = PV(OP) - PV(Pro)$$

where:

PV(Claims) is the present value of the expected claims

PV(Comm) is the present value of the commission

PV(Exp) is the present value of the expected expenses

PV(Inv) is the present value of the expected investment income

PV(OP) is the present value of the annual office premium

PV(Pro) is the present value of the expected profit

The profit to the insurer will be set in terms of a proportion of the annual premium, for example the target profit could be 30% of the annual premium. The equation of value will then be solved to find the annual premium, based on the estimated values of the expected claims, commission, expenses and investment income.

Reserves are usually ignored in the formula approach and other outgo such as tax can be considered by adjusting the discount rate used in calculating the present values. The approach also does not allow for capital requirements and the proper timing of events such as claim payments.

Similarly the equation of value for the risk premium is as follows:

Present Value (Expected Claims) = Present Value (Annual Risk Premium)

This approach is most suitable for short-tem annually renewable products with no long term guarantee of premiums.

6.2   The Cashflow Approach

This approach usually uses a spreadsheet model to project the various cashflows under the policy. The cashflows include premiums, expenses, commission, claims, contribution to reserves and capital, interest on reserves, risk charge deductions and tax. These cashflows are modelled for each time period to give the net cashflow, CFt, in each time period. The net cashflow is calculated as follows:

$$CF_t = \text{Income for time period t} - \text{Outgo for time period t}$$

The income would include the premium and interest while the outgo would include the claim payments, expenses and commission.

The cashflow model looks at a sample policyholder or model point that would represent a typical policyholder and uses a starting test premium estimate to calculate the net cashflows under the policy. These net cashflows are then discounted at the risk discount rate to give the present value of the future profits under the policy or simply the net present value. The company may set as a target for its profit that the net present value under each policy be at least a certain fixed percentage of the premium. The actuary will adjust the test premium until the company's profit target is achieved.

This method allows for the premium to be tested for sensitivity to changes in various assumptions used to project the cashflows. The method also allows features such as options to be accurately modelled using stochastic methods.

The cashflow approach is most suitable for long-term contracts because it can properly allow for the timing of cashflows, reserves and capital. It may be used for short-term products to determine the adequacy of premiums in the long term if the product has premium guarantees or limited scope to increase premiums on a yearly basis.

6.3   Modelling for Health Microinsurance

The formula approach could be used to establish a suitable office premium as the health microinsurance products have a term of only one year, in other words, they are annually

renewable. The cashflow approach could then be used to determine the suitability of the premiums over the long-term and to test the effect of changes to the product design.

This research used the formula approach to determine the premiums for the KNCU and Philippines cash schemes. As both these schemes are annually renewable the effect of discounting and investment income were ignored so that the resulting equation of values was simply:

Annual Office Premium = Annual Risk Premium + Expenses + Commission + Profit Loading

where:

Annual Risk Premium = Expected Claims

This office premium will not be the amount ultimately charged to the members of the KNCU scheme as there is a subsidy from PharmAccess that will cover 70% of the total cost of the premium. For the Philippines cash scheme members will pay the office premiums as calculated.

The microinsurance pricing model will also include sensitivity tests on the assumptions.

6.4 Risk Premium Calculation

The risk premium of a policy is equivalent to the annual cost of future claims under the policy. For private medical insurance the risk premium is calculated using the following formula.

$$\text{Standard Risk Premium} = \sum RP_k = \sum i_k \times AC_k$$

where:

RP_k is the risk premium for benefit k

i_k is the incidence rate for benefit k

AC_k is the average claim cost for benefit k

The risk premium is then adjusted to reflect the past experience of the group PMI scheme. This is only useful if the scheme has past experience to draw upon. For new schemes the standard risk premium calculated above will be used.

For cash schemes the risk premium calculation is similar:

$$\text{Standard Risk Premium} = f \times \text{Expected Benefit Amount}$$

where:

f is the frequency of hospital admissions

The expected benefit amount for the cash scheme is calculated as:

$$Expected\ Benefit\ Amount = \sum p_k \times B_k$$

where:

p_k is the probability that the length of hospitalisation is k days

B_k is the benefit that is accrued for hospitalisation of k days

6.4.1   KNCU Health Plan

The Standard Risk Premium for the KNCU scheme can be using the PMI formula above. For each benefit the risk premium is given by:

$$RP_k = i_k \times \{(Disp.Split_k \times Disp.Cost_k) + (H.C.Split_k \times H.C.Cost_k) + (D.H.Split_k \times D.H.Cost) +$$
$$(KCMCSplit_k \times KCMCCost_k)\}$$

where:

i_k is the incidence rate for benefit k. These are shown in Appendix I, Table 10.

$Disp.Split_k$, $H.C.Split_k$, $D.HSplit_k$ and $KCMCSplit_k$ are the utilisation split percentages for benefit k for the dispensary, the health centre, the district hospital and the Kilimanjaro Christian Medical Centre respectively. These are shown in Appendix I, Table 11.

$Disp.Cost_k$, $H.C.Cost_k$, $D.HCost_k$ and $KCMCCost_k$ are the costs of benefit k for the dispensary, the health centre, the district hospital and the Kilimanjaro Christian Medical Centre respectively. These are shown in Appendix I, Table 12.

This gives a standard risk premium of TZS 28,637 (£10.56) per person per year. This was rounded to TZS 30,000 (£11.06) as an extra contingency loading.

6.4.2   Philippines Cash Plan

The Philippines cash scheme uses the standard risk premium formula for cash schemes shown above. The frequency of hospital admissions for a family of 4 was calculated as 26.66% in section 5.1.2. An expected benefit amount was calculated for each level of cover offered, using the data in Appendix I, Table 13. These calculations resulted in following risk premiums for each of the product categories, shown in Table 5.

Table 5. Philippines Cash Plan Risk Premiums

Product Category	Risk Premium (PHP)	Risk Premium £
Low	1,020	14.57
Medium	1,974	28.19
High	2,628	37.53
Maxi	5,623	80.29

6.5   Office Premium Calculation

The office premium for the product, P is given by:

$$P = RP + L$$

where:
RP if the standard risk premium for the group or individual
L is the loading for expenses, commission and profit

As described in section 5.2, expenses can be loaded as a fixed fee per policy, or a charge proportional to the premium or sum insured or a combination of these two. The commission is usually a charge proportional to the premiums collected and the profit loading may also be proportional to premium.

In microinsurance the expenses and commission might be a very large proportion of the office premium as the microinsurance risk premium is likely to be very small (Matthews, 2011). This is because the expense of administering a microinsurance scheme may not be significantly less than the expenses incurred in conventional insurance. Office premiums for microinsurance are usually very sensitive to changes in expense and commission levels.

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).

Profits for microinsurance are created through small margins on each policy coupled with a high volume of policies sold (Morgan, 2010). This is especially important as it demonstrates that the product represents value to the target market, thus the profit loading will be only a small proportion of the office premium.

For the KNCU scheme MicroEnsure has agreed that the expenses, commission and profit loadings should only be 20% of the office premiums. This makes the risk premium 80% of the office premium, therefore the office premium is calculated as follows:

Office Premium = Risk Premium / 80% = TZS 30,000 / 80% = TZS 37,500

The office premium for the KNCU scheme of TZS 37,500 is equivalent to £13.83.

For the Philippines cash scheme the expenses, commission and profit loading were all set as proportions of the final office premiums as shown in section 5.2. In total, the various expenses, commission and profit loading was 48% of the office premium.

So for the Low product category the office premium is calculated as follows:

$$Office\ Premium_{LOW} = Risk\ Premium_{LOW} / (1\text{-}48\%) = PHP\ 1,020 / 52\% = PHP\ 1,962$$

The full list of office premiums are shown in Table 6.

Table 6. Philippines Cash Plan Office Premiums

Product Category	Office Premium (PHP)	Office Premium £
Low	1,962	28.02
Medium	3,796	54.21
High	5,054	72.17
Maxi	10,813	154.41

According to the National Statistical Office Philippines (2011), poor families had an annual income of PHP 62,000 in 2009. Therefore the resulting office premiums for the Low and Medium plans represent approximately 3% and 6% of a poor family's annual income and appear affordable.

6.6 Summary

The formula approach was the more suitable for modelling the risk premiums for the microinsurance products; however the cashflow approach may be useful in examining the long-term solvency of a scheme. The formula approach provides a simple, cost and time effective method for calculating the premiums, while the cashflow approach may be unnecessarily complicated for annually renewable products which generally have low reserves. However, given the uncertainty in the claims experience a reserve for premium deficiency should be considered especially as there is limited scope for increasing the premiums from year to year.

The calculation of the loadings for expenses, commission and profit was rudimentary and did not utilise the more refined actuarial techniques, such as expense loadings from expenses analysis or projections. This may result in products that are more susceptible to the risk of expenses overruns or if the loading was very prudent, the scheme may represent bad value for money. The flat percentage expense loading could also result in cross-subsidisation of product categories for the Philippines cash scheme (Wipf and Garand, 2006).

It is interesting to note that for the KNCU scheme the modelling techniques used in this study produced premiums that equal to those MicroEnsure intends to use in practice. For the Philippines cash scheme, the study's premiums were an average of 43% higher than the premiums being proposed to be used in practice. This was mainly as a result of different

assumptions in the model used by MicroEnsure. The true success of the pricing model techniques will only be known when the scheme has some experience to determine whether or not their actual premiums were sufficient to cover the claims. This is discussed in the next chapter.

7   Reviewing Experience

It is vital that schemes monitor their experience by comparing the actual claims costs with the expected costs that were calculated when pricing the scheme. This will allow the provider to identify if the premiums collected were sufficient to cover its claims and expenses; and to adjust the premiums for the following year to avoid further losses. The provider must also monitor the expense to ensure the actual costs incurred during the year did not exceed the expenses assumed in pricing.

A comprehensive data collection system should be in place to record all the member data and claims data under the microinsurance schemes. This should enable experience analysis on the claims and the expenses under the scheme. Chapter 28 of The Actuarial Education Company (2010) explain the following on claims and expense analyses.

7.1   Claims Analysis

Claims analysis involves comparing the expected claims or risk premium amount to the actual claims incurred in the past year. The actual claims should be divided by type of policyholder, type of policy, type of medical facility used and, for PMI policies, into benefit procedure. Claims should only be split into homogenous sub-groups if each sub-group has credible amounts of data.

Analysing claims experience after a few years will allow the actuary to observe any trends in claims amounts. This might give an indication of any benefit escalation or if the general health of the target population is improving. This is especially important for health microinsurance schemes where the success of the scheme might be measured by health improvements in the target market.

7.2   Expense Analysis

The expense analysis will compare the loadings in the premium for expenses with the actual expenses incurred over the year. This will allow the company to determine if it had any expense overruns in the year and will allow the actuary to adjust the expense loading for the future to avoid overruns.

The main items of expense are staff salaries, property costs or overheads, information technology costs and investment costs. These actual expenses, excluding commission, should be split into the following groups:

- *Initial expenses* – those which are incurred when a policy starts, such as sales literature and the cost of initially putting the claim into the administration system.
- *Renewal expenses* – those which are incurred when a policy is renewed, such as reminding the policyholder of the policy and offering renewal terms.
- *Termination expenses* – those which are incurred when a policy terminates.
- *Claims expenses* – those which are incurred when a claim is made such as claims payment costs and the cost of inputting the claim into the administration system.

The initial, renewal and termination expenses can be further split according to if the expenses are proportional to the volume of contracts, the premium amount or the sum insured. The resulting expenses splits can give the expenses per policy, per premium amount and per sum insured. These expenses could be compared with the expense loading in the premium assumptions.

The expense analysis can also be used to identify trends in the expenses, or expense inflation if the analysis is done over a number of years.

Experience analysis will form the basis for the next pricing exercise as the results of the analyses can be used to set the assumptions for the pricing model.

8 Summary and Conclusion

Health microinsurance schemes provide an essential service to low-income communities in developing countries. Proper pricing techniques will help ensure the survival of many schemes and even allow them to expand their services.

This research has demonstrated the use of actuarial pricing techniques for two new schemes that give the reader an example of which standard techniques will be useful and which ones are not yet applicable in this industry.

8.1 Main Findings

When gathering data for pricing a health microinsurance scheme, the best source is usually national statistical data. If there is a lack of data at a national level, then the actuary may use data from an overseas scheme or national data from overseas. The overseas territory would need to have similar demography to the scheme's territory.

In setting assumptions, the adjustments to the data will need to consider the differences between the data source and the target market. This may require several rudimentary adjustments; however once they can be justified they could be regarded as satisfactory until more relevant data is available. The assumptions may also be adjusted for contingency margins, but these cannot be so large that they produce unaffordable premiums.

The formula approach pricing model is more appropriate for pricing short-term health microinsurance products than the cashflow model. The cashflow model is often favoured for pricing conventional products as it allows flexibility in the timing of cashflows and it can properly allow for interest, reserves and tax. Short-term health microinsurance schemes often have very simple timings of cashflows and do not need to allow for interest, reserves or tax, so the cashflow method is not necessary. The cashflow method can be used to model the solvency of the microinsurance scheme but this is not directly related to setting the premiums for the scheme.

Experience analysis is vital for microinsurance schemes to ensure that their premiums remain sufficient for the level of claims the scheme incurs. The process for the analyses will depend on the quality of the data stored in the schemes administration system.

8.2 Outlook

As actuaries become more involved in the microinsurance industry, more sophisticated methods may become the norm in pricing health microinsurance schemes. The benefits of these techniques must be compared with the additional costs to schemes for the actuarial input.

As these schemes develop and grow the scheme management may need to focus on proper capital and risk management. For example, the KNCU scheme holds no reserves or capital and is only backed by the funds available from the charity, if the scheme was to have a greater take-up rate than expected the charity may be unable to subsidise premiums to the extent originally thought. The scheme would then need to consider reinsuring some of its risks and holding reserves for adverse experience. Actuarial investigations in these areas could be used to guide management to the most desirable solutions to reduce these risks.

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Appendix I – Data and assumptions used in pricing the schemes

1. KNCU Health Plan

Table 7. Outpatient Disease Cases

Disease	Number of Cases	
	2006	2004
Malaria	15,362,094	10,859,524
Acute Respiratory Infections	5,644,171	4,004,162
Pneumonia	3,076,769	1,592,722
Diarrhoea	2,450,008	1,694,167
Intestinal Worms	1,555,725	1,405,082
Eye Infections	1,036,786	687,440
Skin Infections	1,049,648	474,723
Ear Infections	585,969	225,440
Anaemia	656,593	467,570
Urinary Tract Infections	983,920	304,184
Minor Surgical Conditions	1,087,344	364,585
Undiagnosed	870,339	967,380
Fungal Infection	403,811	151,510
Gastrointestinal Disease	328,823	42,360
Pelvic Inflammatory Disease	306,165	348,070
Genital Discharge Syndrome	302,626	180,338
Genital Ulcer Disease	218,412	324,922
Malnutrition	174,428	61,968
Burns	135,730	44,994
Asthma	348,869	173,596
Skin disease	137,817	84,746
Neuroses	51,518	23,912
Psychoses	29,086	14,729
Sexually Transmitted Infections	51,199	17,194
Eye Disease	77,707	47,193
Nutritional disorders	75,240	111,796
Schistosomiasis	183,394	82,177
Oral disorders	244,762	606,129
Poisoning	99,456	486,736
Epilepsy	141,974	199,813
Dental Caries	199,087	31,687
Periodontal Disease	24,921	30,147
Cardiovascular Hypertension	141,422	40,607
Cardiovascular Disease	81,787	191,021
Tuberculosis	157,670	12,596
Peptic Ulcers	22,245	17,958
Typanosomiasis	59,988	-
HIV/AIDS	46,495	22,323
Diabetes	18,974	14,085
Thyroid Diseases	17,132	57,805
Leprosy	32,575	38,368
Vitamin A deficiency	15,215	50,418

Joint Disorder	23,572	127,523
Other	1,763,215	1,141,084
Total Cases	40,274,681	27,824,784

Source: Ministry of Health and Social Welfare (2008) Annexes 1 and 2 and Ministry of Health and Social Welfare (2006) Annex 1

The Ministry of Health and Social Welfare (2008) also indicated that there were 9,309 X-ray examinations in Kilimanjaro in 2006, in Table 3.2.

Data on the age and sex structure in rural Tanzania was found in the National Bureau of Statistics Tanzania (2011), shown in Table 8.

Table 8. Rural Population by Age and Sex

	Rural		
Age	**Male**	**Female**	**Total**
<5	18.6	17.5	18.0
5-9	17.8	16.0	16.9
10-14	14.9	14.2	14.5
15-19	10.2	8.6	9.4
20-24	6.1	7.0	6.6
25-29	5.2	6.3	5.8
30-34	5.1	5.4	5.2
35-39	4.3	5.5	5.0
40-44	3.7	3.7	3.7
45-49	3.1	3.1	3.1
50-54	2.4	3.1	2.8
55-59	1.9	2.3	2.1
60-64	1.8	2.2	2.0
65-69	1.4	1.6	1.5
70-74	1.4	1.6	1.5
75-79	0.8	0.9	0.8
80 +	1.1	1.0	1.0

Source: National Bureau of Statistics Tanzania (2010) Table 2.1 Rural

The health data shown in Table 9 was also available from the National Bureau of Statistics Tanzania (2011):

Table 9. Tanzania Demographic and Health Survey 2010 Data

Item	Rate	Source
Birth Rate	0.39%	Table 4.1 Crude Birth Rate – Rural Mainland
Perinatal Mortality	3.3%%	Table 8.5 Perinatal mortality rate – Rural Mainland
Proportion of C-section deliveries	11%	Table 9.6 Percentage delivered by C-section - Kilimanjaro
Proportion of married women	63%	Table 5.2 Total number of married women/ Total number of all women
Proportion of sexually active unmarried women	7%	Table 5.2 Total number of sexually active unmarried women/ Total number of all

		women
Proportion of married women that use a modern method of contraception	50%	Table 5.3 Any modern method - Kilimanjaro

The overall outpatient incidence rate was 3.27. The incidence rates for the individual benefits shown in Table 10 were derived from this overall rate as well as the other data above.

Table 10. Incidence Rates for each Benefit

Benefit	Incidence Rate	Comments
CONSULTATIONS		
Consultation at dispensary / health centre (primary level)	3.269	Overall outpatient incidence rate
Consultation in hospital after referral - general	0.326	10% of non pregnancy consultations. 10% arbitrarily chosen
Consultation in hospital after referral - pregnancy related	0.004	Birth rate
DRUGS		
Drugs from formulary - PRIMARY LEVEL	3.269	Overall outpatient incidence rate
Drugs from formulary - REFERRAL LEVEL	0.326	10% of non pregnancy consultations
Drugs hypertension	0.012	Hypertension incidence rate
Medication for asthma	0.028	Asthma incidence rate
HEALTH PROMOTION		
Health promotion: yearly check up 50+	0.117	Proportion of over 50s in population
Family planning incl. condoms	0.080	Proportion of sexually active unmarried women and married women that use contraceptives between ages 15 and 50
Maternal Health		
PRENATAL CARE and DELIVERY		
Antenatal care visits & examinations	0.156	4 visits times birth rate
Supply of nutritional supplements / drugs	0.039	Birth rate
Normal delivery / Assisted delivery	0.035	Proportion of normal deliveries times birth rate
Caesarean section delivery (in case of complications)	0.004	Proportion of C-sections times birth rate
Admissions	0.009	2 admissions times C-sections
Evacuation of retained products of conception	0.004	Proportion of C-sections times birth rate
NEONATAL SERVICES		
Perinatal care	0.001	Perinatal mortality times birth rate
Premature care (by referral + consensus of medical board)	0.006	Preterm incidence rate times birth rate

Growth monitoring & nutritional care	0.078	2 visits times birth rate
PREVENTIVE CARE		
Immunization	0.039	Birth rate
HIV/AIDS Treatment, care and support		
Voluntary counselling and testing for HIV (rapid test)	0.388	Proportion of people between ages 15 and 50
Laboratory investigations and diagnostics test		
Laboratory investigations and diagnostics test - PRIMARY LEVEL	3.269	Overall outpatient incidence rate
Laboratory investigations and diagnostics test - REFERRAL LEVEL	1.632	Referral rate times 5
Radiology investigations		
X-ray	0.002	X-ray incidence rate
Ultrasound	0.004	C-section rate
Inpatient Services		
Admissions	0.009	Maternity admission rate
Surgery		
Wound care at Primary Level	0.100	10% - arbitrarily chosen
Minor surgery after authorisation	0.088	Minor surgical incidence rate
Major surgery after authorisation - only when life threatening; at tertiary hospital	0.004	Rate of essential surgeries

PharmAccess provided an estimate on how the various utilisation rates might be split between the 4 healthcare facilities: the dispensary (Disp.), the local healthcare centre (H.C.), the district hospital (D.H.) and the Kilimanjaro Christian Medical Centre (KCMC). These estimates are shown in Table 11.

Table 11. Utilisation Split by Healthcare Facility

Benefit	Disp.	H.C.	D.H.	KCMC
CONSULTATIONS				
Consultation at dispensary / health centre (primary level)	40%	60%		
Consultation in hospital after referral - general			100%	
Consultation in hospital after referral - pregnancy related			90%	10%
DRUGS				
Drugs from formulary - PRIMARY LEVEL	60%	40%		
Drugs from formulary - REFERRAL LEVEL			95%	5%
Drugs hypertension	40%	60%		
Medication for asthma	30%	70%		
HEALTH PROMOTION				
Health promotion: yearly check up 50+	50%	50%		
Family planning incl. condoms	50%	50%		
Maternal Health				

PRENATAL CARE and DELIVERY				
Antenatal care visits & examinations	50%	30%	20%	
Supply of nutritional supplements / drugs	50%	30%	20%	
Normal delivery / Assisted delivery		50%	50%	
Caesarean section delivery (in case of complications)			95%	5%
Admissions			95%	5%
Evacuation of retained products of conception	50%	30%	20%	
NEONATAL SERVICES				
Perinatal care		60%	40%	
Premature care (by referral + consensus of medical board)			90%	10%
Growth monitoring & nutritional care	60%	40%		
PREVENTIVE CARE				
Immunization	60%	40%		
HIV/AIDS Treatment, care and support				
Voluntary counselling and testing for HIV (rapid test)	50%	50%		
Laboratory investigations and diagnostics test				
Laboratory investigations and diagnostics test - PRIMARY LEVEL	20%	80%		
Laboratory investigations and diagnostics test - REFERRAL LEVEL			95%	5%
Radiology investigations				
X-ray			95%	5%
Ultrasound			95%	5%
Inpatient Services				
Admissions			95%	5%
Surgery				
Wound care at Primary Level	50%	50%		
Minor surgery after authorisation			95%	5%
Major surgery after authorisation - only when life threatening; at tertiary hospital			95%	5%

PharmAccess also provided estimates of the cost for each benefit at the 4 healthcare facilities. This is shown in Table 12 below.

Table 12. Benefit Costs

Benefit	Disp.	H.C.	D.H.	KCMC
CONSULTATIONS	TZS	TZS	TZS	TZS
Consultation at dispensary / health centre (primary level)	500.00	600.00	800.00	1,500.00
Consultation in hospital after referral - general	500.00	600.00	800.00	1,500.00
Consultation in hospital after referral - pregnancy related	500.00	600.00	800.00	1,500.00

DRUGS				
Drugs from formulary - PRIMARY LEVEL	1,250.00	2,500.00	3,750.00	5,000.00
Drugs from formulary - REFERRAL LEVEL	1,250.00	2,500.00	3,750.00	5,000.00
Drugs hypertension	8,250.00	8,250.00	8,250.00	8,250.00
Medication for asthma	52,000.00	52,000.00	52,000.00	52,000.00
HEALTH PROMOTION				
Health promotion: yearly check up 50+	500.00	600.00	800.00	1,500.00
Family planning incl. condoms	500.00	600.00	800.00	1,500.00
Maternal Health				
PRENATAL CARE and DELIVERY				
Antenatal care visits & examinations	3,000.00	3,100.00	3,300.00	4,000.00
Supply of nutritional supplements / drugs	5,000.00	5,000.00	5,000.00	
Normal delivery / Assisted delivery	9,000.00	9,000.00	9,000.00	9,000.00
Caesarean section delivery (in case of complications)			76,000.00	101,000.00
Admissions		5,000.00	5,000.00	5,000.00
Evacuation of retained products of conception	1,000.00	16,000.00	31,000.00	46,000.00
NEONATAL SERVICES				
Perinatal care	3,000.00	3,100.00	3,300.00	1,500.00
Premature care (by referral + consensus of medical board)		5,000.00	5,000.00	5,000.00
Growth monitoring & nutritional care	500.00	600.00	800.00	1,500.00
PREVENTIVE CARE				
Immunization	500.00	600.00	800.00	1,500.00
HIV/AIDS Treatment, care and support				
Voluntary counselling and testing for HIV (rapid test)	500.00	600.00	800.00	1,500.00
Laboratory investigations and diagnostics test				
Laboratory investigations and diagnostics test - PRIMARY LEVEL	2,000.00	2,500.00	3,000.00	4,000.00
Laboratory investigations and diagnostics test - REFERRAL LEVEL	2,000.00	2,500.00	3,000.00	4,000.00
Radiology investigations				
X-ray	5,000.00	5,000.00	5,000.00	5,000.00
Ultrasound	10,000.00	10,000.00	10,000.00	10,000.00
Inpatient Services				
Admissions		5,000.00	5,000.00	5,000.00
Surgery				
Wound care at Primary Level	2,000.00	2,000.00	5,000.00	10,000.00
Minor surgery after authorisation			30,000.00	45,000.00
Major surgery after authorisation - only when life threatening; at tertiary hospital			75,000.00	100,000.00

2. Philippines Hospital Cash Plan

Table 13. Distribution of Claim Amounts

Days in Hospital	Probability	Claim Amount			
		Low	Medium	High	Maxi
0	0.40%	0	0	0	0
1	12.60%	750	1,250	2,450	4,235
2	14.80%	1,250	2,250	3,650	6,970
3	23.60%	1,750	3,250	4,850	9,705
4	11.40%	2,250	4,250	6,050	12,440
5	10.10%	2,750	5,250	7,250	15,175
6	1.06%	3,250	6,250	8,450	17,910
7	1.06%	3,750	7,250	9,650	20,645
8	1.06%	4,250	8,250	10,850	23,380
9	1.06%	4,750	9,250	12,050	26,115
10	1.06%	5,250	10,250	13,250	28,850
11	1.06%	5,750	11,250	14,450	31,585
12	1.06%	6,250	12,250	15,650	34,320
13	1.06%	6,750	13,250	16,850	37,055
14	1.06%	7,250	14,250	18,050	39,790
15	1.06%	7,750	15,250	19,250	42,525
16	1.06%	8,250	16,250	20,450	45,260
17	1.06%	8,750	17,250	21,650	47,995
18	1.06%	9,250	18,250	22,850	50,730
19	1.06%	9,750	19,250	24,050	53,465
20	1.06%	10,250	20,250	25,250	56,200
21	1.06%	10,750	21,250	26,450	58,935
22	1.06%	11,250	22,250	27,650	61,670
23	1.06%	11,750	23,250	28,850	64,405
24	1.06%	12,250	24,250	30,050	67,140
25	1.06%	12,750	25,250	31,250	69,875
26	1.06%	13,250	26,250	32,450	72,610
27	1.06%	13,750	27,250	33,650	75,345
28	1.06%	14,250	28,250	34,850	78,080
29	1.06%	14,750	29,250	36,050	80,815
30	1.06%	15,250	30,250	37,250	83,550
31	0.02%	15,750	31,250	38,450	86,285
32	0.02%	16,250	32,250	39,650	89,020
33	0.02%	16,750	33,250	40,850	91,755
34	0.02%	17,250	34,250	42,050	94,490
35	0.02%	17,750	35,250	43,250	97,225
36	0.02%	18,250	36,250	44,450	99,960
37	0.02%	18,750	37,250	45,650	102,695
38	0.02%	19,250	38,250	46,850	105,430
39	0.02%	19,750	39,250	48,050	108,165
40	0.02%	20,250	40,250	49,250	110,900
41	0.02%	20,750	41,250	50,450	113,635
42	0.02%	21,250	42,250	51,650	116,370
43	0.02%	21,750	43,250	52,850	119,105

44	0.02%	22,250	44,250	54,050	121,840
45	0.02%	22,750	45,250	55,250	124,575
46	0.02%	23,250	46,250	56,450	127,310
47	0.02%	23,750	47,250	57,650	130,045
48	0.02%	24,250	48,250	58,850	132,780
49	0.02%	24,750	49,250	60,050	135,515
50	0.02%	25,000	50,000	61,250	138,250
51	0.02%	25,000	50,000	62,450	140,985
52	0.02%	25,000	50,000	63,650	143,720
53	0.02%	25,000	50,000	64,850	146,455
54	0.02%	25,000	50,000	66,050	149,190
55	0.02%	25,000	50,000	67,250	150,000
56	0.02%	25,000	50,000	68,450	150,000
57	0.02%	25,000	50,000	69,650	150,000
58	0.02%	25,000	50,000	70,850	150,000
59	0.02%	25,000	50,000	72,050	150,000
60	0.02%	25,000	50,000	73,250	150,000
61	0.02%	25,000	50,000	74,450	150,000
62	0.02%	25,000	50,000	75,000	150,000
63	0.02%	25,000	50,000	75,000	150,000
64	0.02%	25,000	50,000	75,000	150,000
65	0.02%	25,000	50,000	75,000	150,000