

Pricing Micro-insurance Products

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Microinsurance (MI) has been developing rapidly since the early 1990's in many countries and is being recognized as an important service to address the financial security needs of the poor. Pricing for microinsurance is often set on a "community rate" basis. In the beginning stages many MI programs underestimate the technical rigor that is required to price products correctly—many yield to the temptation of simply duplicating products and rates from the commercial insurance market or from other MI programs without realizing or considering the underlying assumptions and basis of those rates.

The main objective of this note is to give the reader some basic insights into how MI products are priced, how to design and maintain databases so that these become increasingly invaluable for pricing purposes, and to illustrate some pricing examples derived from several MI Case Studies.

I. Data Requirements

Premium rates are established by the actuary using available experience data. In the early days of the MI program when there is still no specific data available about the proposed participants and their expected claims, population statistics and data from similar MI programs have to be used to the extent that this is available. The actuary must then rely on observations and assumptions about the participants and their proposed or ongoing program in order to adjust and adapt that information as he/she prepares the premium rates.

The preference of actuaries is to utilize the specific data of the group or population to be insured since this will result in much more reliable and accurate rates. From the beginning then, it should be clear that **one of the key determinants of the MI program's long term success is a properly designed and well maintained database and management information system (MIS) for capturing and screening the data used in subsequent pricing reviews.**

The main objectives of an MIS are to accumulate data and to assist with managing the MI in a professional, efficient, and technically prudent manner.

Great care and time must be invested in the design phase of the database since it is the foundation of a good MIS. The following tables of information must be included (at minimum):

a) Institutional and branch information- if the MI is servicing several institutions then the details of each institution needs to be maintained.

b) MI participants' information- Who is covered? What are the attributes of the participants? At minimum, the following attributes must be included:

- Unique identifier or key
- Name
- Date of birth
- Gender
- Date of enrolment in the MI
- Civil status

- Number of children (calculated field if beneficiary and covered dependents history is kept).
- Residence- urban or rural, city, province
- For health coverage, a recent photo should be on file for printing ID Cards.
- Primary occupation / livelihood.
- Etc.

c) Beneficiaries and covered dependents- For health insurance the following are needed for each covered dependent:

- Name
- Unique identifier or key of the participant
- Gender
- Date of birth
- Photograph
- Relationship to the participant
- Etc.

d) Coverage history- What are the coverage details? A coverage history for each enrolled person has to be kept, not just the coverage currently in effect. If a change is made to an individual's coverage then a new record should be created in the coverage history table with the effective date of the change as one of the fields in the record.

Aside from monitoring and for administration purposes, the main objective of keeping a coverage history is to enable the reconstruction of a complete history of each person's exposure to every covered risk so that expected claims can be calculated by the actuary for comparison to the actual claims experience (more on this in the next section). In fact, software applications can be developed to monitor the expected claims vs. actual claims on an ongoing basis- this is a very powerful tool to assist the MI Management.

e) Contributions history- For each product a contributions/premium payment history must be kept for each insured, including at the following fields: payment date, payment amount, receipt number if applicable, etc. Aside from administration purposes the premiums history will be used to study the pattern of dropouts (lapses and surrenders), which in turn will affect the pricing of many products. For savings products the exact equity value will depend on the timing of premium payments.

f) Claims history- Who claimed? When did they die or become sick or hospitalized? What amount did they claim? What was the incurred cost, covered or not? What was the method of treatment? What was the cause of death or hospitalization? When was the claim received? What was eventually paid, and on what date? For health claims, the cause of claim should be recorded in International Claims Diagnostic format and charges should be broken down by benefit category.

The claims experience is crucial for ongoing management and monitoring purposes and is a primary source of information for pricing.

g) Product Rules / Policy history- The coverage rules for each product must be defined and kept. Although the coverage history described above could also be used to capture product rules, it is much more efficient to separate general types of coverage information which does not

vary too much between individuals and maintain this in a separate set of tables. This is needed to complete the expected claims information mentioned in Section d) above.

All records should be kept indefinitely (either in the current database or in an archive) for cumulative experience and actuarial analysis. The data should be carefully managed just like any other resource of the MI.

As much as possible, standard coding values and formats should be used in order to simplify queries and to improve consistency. For example, participants' occupations should be selected from a menu of standard occupation codes rather than typing it each time.

Actuaries are very concerned with the way data is collected and managed because erroneous and incomplete data can be more of a liability than an asset if misinterpreted. In order to ensure the completeness and integrity of the data, robust controls and thorough cross checks should be built into the MIS. All data should also be verified as much as possible against other independent systems such as accounting. For example, premiums, commissions, and claims must be balanced against the accounting system at the end of each accounting period to make sure that there is consistency between the two systems (which is also a very useful integrity check of the accounting). Further, database changes should be monitored and confirmed regularly against manual systems.

II. Pricing Components, Key Factors and Methodology

The primary objectives in establishing premium rates is to ensure that these are sufficient to realize the MI's aims and obligations in the long run while at the same time maintaining equity among the various participants. Rates can either vary by age (age-structured) or remain level for all participants, often called "community rating"; the latter is used in the majority of MI programs. If community rates are to be used then it is advisable to impose a maximum entry age and perhaps also a maximum coverage age- otherwise the rates will probably be too high which in turn will affect the marketing of the MI program. An alternative to a maximum coverage age is a declining schedule of benefits for the older participants.

There are several components and factors to be considered in establishing premium rates. Each of these components must be carefully calculated from the experience data and/or from other available information. As mentioned above, to the extent that specific data is unavailable the actuary must make reasonable assumptions based on his/her experience, on industry studies and on observations from similar MI programs. It is very important to note that in MI product design, communication methods and many other factors will impact the observed experience.

The main components for pricing life and savings products are the following:

a. **Rate of mortality-** typically the actuary chooses an appropriate mortality table prepared by collaborating companies within the insurance industry and adapts this to the MI group. In the absence of industry tables, population tables prepared by World Health Organization (WHO) or others may also be used and adapted to the particular group of MI participants, although this is not the optimum approach.

The selection and adaptation of the mortality table is one of the more critical steps in the pricing process. Ideally, the final table should be tested against the database of participants by calculating expected claims and number of deaths over a selected retrospective study period and comparing these results to the actual experience in the same period. This comparison

should be conducted if possible over each risk subgroup such as those defined by a combination of age, gender and geographic location. This test will determine the appropriateness of the mortality model and is only possible if the MI has accumulated reliable data as described in the previous section.

The actual-to-expected claims test can be performed iteratively until the selection of mortality table and required adjustments are completed. The final result is the mortality pricing model for the MI group.

The MI participation level is a very important consideration in preparing the mortality model. **Mandatory participation of all eligible members of the target group is recommended.** If participation is elective then **adverse selection**¹ will significantly increase the expected mortality rate.

Another very important factor is the **expected trend in mortality**. In that regard the actuary must take into account the influx of new participants in the next few months or years. For example, if the projected growth of the MI is “high”, and if the new participants are a targeted segment of the population such as younger women entrepreneurs (typically the target population of MFIs) then the average mortality rate will likely decrease or remain stable over time. Conversely, very low growth rates of the MI will likely result in an increased average mortality rate as the average age increases. For age-structured rates this is less of a concern, however for level community rates the future trends in expected mortality must be very carefully factored in.

The enrolment date, gender, and date of birth of the MI participant is used to prepare a demographic profile of new participants, which is useful for projecting future mortality trends of the group.
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Upon completion of the mortality model the actuary will calculate the **expected claims** component of the premium rate, taking into account the product features and benefits payable contingent on death.

b. Rate of dropouts- The rate of dropouts (lapses and surrenders) is another very significant factor in price determination. A lapse here means that premium payment is late beyond the grace period (which is normally 30-60 days), whereas a surrender is notice of termination or non-renewal beyond the allowable reinstatement period.

It is crucial for the actuary to be able to prepare a schedule of dropout rates by age, gender and time since enrolment, and correspondingly, to understand what proportion of the lapses will reinstate their coverage within the allowable reinstatement period. This information can be derived from the contributions history database described in the previous section.

Depending on the product, the dropout rates and pattern can either improve or decrease the profitability of the MI program. For all products, a high rate of dropouts will increase expenses, however if the product has an equity component of which a portion is forfeited through early surrender then a high surrender rate can actually improve profitability. The actuary may choose to use some of this projected forfeited equity to fund other benefits and thus reduce the overall premium rates.

¹ Adverse selection, also called anti-selection refers to the tendency of higher risk individuals to participate more readily in the MI than those with average or lower risk of claiming.

c. **Risk load-** Actuaries use risk mathematics to compute an appropriate risk premium which is meant to answer for adverse deviations from expected claims over the short to medium term. Expected claims computed from experience and mortality tables will likely never be realized exactly² and the risk load is a provision to lessen the financial impact in cases when the actual claims exceed expected claims.³

In general, the experience of larger groups of homogeneous participants (in terms of age, gender, health, occupation, etc) and with identical coverage is less likely to deviate significantly from the expected claims than that of smaller groups, groups with a diverse participants or groups with several coverage options.

d. **Uncertainty load-** The actuary may include an amount to compensate for the uncertainty. In general, the more assumptions have to be made and the less reliable and sparser the data the greater the uncertainty.

e. **Profit or contribution to MI surplus and equity-** To grow the MI some profits are needed. The desired profit may be expressed either as a load or as a separate component of the net rate.

f. **Expenses-** The expected expenses incurred in marketing, underwriting, claims payment, premium collection and administration must be loaded unto the final net rate. In practice the entire expenses of the MI organization are projected and then allocated between the various products and programs, although allocation should ideally be on the basis as incurred.

Other important factors (some already mentioned above) that affect the rates are in summary as follows:

g. **Expected investment earnings** are used in combination with expected mortality rates to prepare the net rates for life insurance before expense loading.⁴ The actuary therefore needs to consider carefully how excess premiums will be invested before these are used to fund MI expenses and incurred claims. The quality, liquidity, and rates of return of investments are all important.

The main risk in pricing long term MI savings products is the assumed investment earnings. Long term fixed rate guarantees are especially dangerous if the asset used to invest premiums (such as 20-30 year bonds) is not identified and purchased at the time of the guarantee. Interest rate environments can drop relatively quickly and so it may be impossible to invest in assets that provide sufficient returns needed to fund the rate guarantees. A shortfall of just a few basis points will likely lead to MI bankruptcy over time due to effect of compound interest. One solution is to link rate guarantees to investment instruments such as government issued bonds or 5-year average term deposits in commercial banks.

² Technically, the expected claims computed from the data can be regarded as an estimate of the mean of the true underlying claims distribution.

³ The risk load is computed by first expressing a desired probability of having sufficient net premium to cover all claims over a defined period, typically 1-5 years.

⁴ More precisely, expected investment earnings in combination with expected mortality rates are used to calculate the **actuarial present value** of expected claims, which is then used to derive the rates.

h. **Product design** features affect all the pricing components. One common product is level term life insurance- If the coverage is linked to loans of an MFI the risks covered are predominantly women since these are typically the target clientele of most MFIs. By also providing coverage to spouses and children of the MFI clients the risk pool is significantly altered, especially since most male spouses are older on average and because males usually have higher mortality rates.

i. **Timing and frequency of premium payments** has to be factored into the premium rates. For example if the annual premium payable at the beginning of the coverage year is P the equivalent monthly premium is higher than $P/12$ because of the additional collection expenses (twelve transactions rather than just one), due to lost interest earnings and very importantly due to the fact that those dying will not complete the monthly premium payments.

j. Clearly the **size of the MI group** affects the expense levels due to economies of scale, and it will greatly influence the required risk load discussed above.

k. **Participation rates** affect the mortality rates, morbidity rates and the expenses. A community with 100% participation will have lower per capita claims expenses than a community with only 10% participation. In the latter case it is primarily families that believe they will receive a benefit that enroll in the insurance programs- this is the adverse selection effect mentioned earlier.

l. **Growth of the MI and inflow of new participants** is a critical factor in mortality trends. The addition of older or younger insured populations can change the expected mortality of the group.

m. **Stability of the group** will affect the dropout rates. A group with low renewal rates is likely to experience higher mortality and morbidity as an element of adverse selection takes hold.

n. The **livelihoods, occupations and activities of the participants** greatly affect the health, mortality and morbidity rates and thus the expected claims.

o. Perhaps one of the most important factors is the **premium collection system** since this has an enormous effect on expenses and lapse rates.

p. **Waiting periods and pre-existing illness exclusions** will help to reduce the rates.

q. **Inflation rates** will affect expenses and perhaps benefits depending on the product design. Inflation rates will usually have an effect on investment earnings as well.

III. Pricing Health Insurance

Most of the discussion in the previous section applies to pricing health insurance as well, however there some additional considerations and issues that make pricing health insurance especially challenging:

a. Expected claims costs are computed using a combination of morbidity rates, claims incidence for each benefit category, and claims amount distribution by benefits category. These should ideally be available by age, gender, and geographic location. For this purpose there is nothing

Claims expenses must be separated in the database as described in Section 2 because this will enable the actuary to price each benefit category.
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comparable to an extensive and consistent database as described in the section above, which is used to estimate these distributions.

b. Incidence rates are dependent on the insureds' utilization rates and utilization trends- and these can change significantly in a very short time. Utilization is dependent on prevailing overall health, access to services, understanding of the insured how to use services, the dignity with which services are provided and many other factors.

c. Inflation rates of benefits are a key consideration in the case of health- it is very difficult to predict and is usually much higher than the Consumer Price Index (CPI) for several reasons. To decrease the uncertainty in pricing, the product should be designed with maximums for each benefits category as well as an overall annual maximum. Another method is to negotiate and pay fixed tariffs for such services as surgeries.

d. Co-payments have an enormous affect on the rates because these result in decreased incidence and shorter hospitalization confinements. The claims database can be utilized to determine the effects of deductibles and co-insurance on the premium rates. In many cases the poor are hesitant to use health services as they lose several days income and increase travel expenditures, effectively creating a "hidden" co-insurance or deductible.

e. The geographic location of the insured normally has a significant effect on access to service thus affecting the pricing.

IV. Modeling Techniques

Actuarial modeling is an excellent approach to business planning and pricing since it captures numerous and complex interactions of many different parameters. **Models are not a substitute for credible data but rather enable the actuary to leverage the available data.**

Comprehensive models can reveal issues that are otherwise difficult to imagine, allow the user to test "what if" scenarios, and can be used for ongoing monitoring and detection of developing trends. As well, multiple products can be priced at once. The expenses of the organization can be entered based on the past experience and based on the MI business plans.

The model should use the current database for evaluating key parameters. For example, demographic profiles, incidence rates, lapse rates etc. can be updated before running the model.

The outputs of a quality model include prospective Income Statements, Balance Sheets, and Cashflow Statements. **These outputs are indicative in nature and one must be careful to limit their interpretations.**

Generally the user adjusts the premium rates and product features until the projected statements look reasonable.

V. Some Case Study Examples

The MI example here experienced significant growth in the number of insured lives over the years. Detailed data is only available on the demographics of the insured population since 2003. The table below illustrates the evolution of the number insured and the actual mortality rate experienced.

Evolution of life mortality rate		
Year	Number insured	Rate per Thousand
1998	25,000	19.3
1999	31,000	14.2
2000	30,000	12.1
2001	29,000	11.6
2002	93,000	4.3
2003	110,000	3.7
2004	104,000	4.7
2005	117,000	3.2

We can hypothesize that the high mortality rate in the early years was due to adverse selection. In 2002 there was a large effort by the MI to increase enrollment and this likely resulted in many younger members becoming insured which impacted positively on the mortality experience.

For pricing purposes, the base mortality rate of 3.2 per thousand would likely be the starting point in a pricing review for this MI- The actuary would however add a risk load and perhaps also an uncertainty load based on his / her confidence level with regards to the credibility of that rate.

An integral part of the pricing review would be a review of the MI's future marketing plans in order to establish whether there would be continued efforts to improve the participation rates in communities already being targeted, and/or whether the MI would expand the program to other communities.

The second example is an MI providing hospitalization coverage for children up to a maximum of Rs 2,000 per household. The experience is as follows:

Year	Actual Claims Cost per Insured
1	Rs 97
2	Rs 85
3	Rs 70

Over the three year period the claim cost decreased significantly as the participation rate of families in the community increased. Similar to the first example, the actuary would consider the growth and participation trends in a pricing review.

The third example is a large health insurance plan that saw claims increase dramatically in the second year. This plan provides surgical coverage for specific illnesses.

Year	Actual Claims Cost per Insured
1	Rs 65
2	Rs 95

In this case the insured population had an improved understanding of the insurance program in year 2. While there was an increase in the insured population in the second year, the claims costs were lower in the first year because the covered population did not have a clear

understanding of the benefits. Since tariffs were already fixed, claims costs did not increase as a result of inflation. The actuary would need to thoroughly study the situation on the ground in order to hypothesize the developing utilization trends for subsequent years.

The fourth example is a MFI offering coverage to their women-borrowers in the first year. Since experience was favorable they decided to include husbands in year 2 which resulted in the claims cost per insured to more than double.

Year	Actual Claims Cost per Insured
1	Rs 22
2	Rs 59

VI. Summary

The key summaries in this brief paper are as follows:

- Pricing MI products is very technical and requires assistance from an actuary.
- The actuary has to consider the whole package, target market, product design, marketing and communication, administration and claims service to set an appropriate premium. These parameters must be monitored periodically to anticipate changes in pricing.
- Accurate pricing begins with a quality database. The database should be designed with input from an actuary to ensure that the data captured is relevant for pricing purposes.
- Data must be carefully managed as any other resource.
- Health insurance is more difficult to price. Rates should be reviewed every 6-12 months because utilization and inflation trends can change very rapidly.
- MI modeling techniques can be used to price products more accurately, produce business plans, and to detect developing trends.

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From 1981 to 2000 worked for a cooperative insurance company as Group Actuary, Director of Marketing and Vice-President of Group insurance as well as an advisor to developing cooperative insurers. From 2001, Denis had been an independent consultant, focusing on the Canadian group insurance industry and international microinsurance programs. Canadian assignments have included strategic reviews, capital management, training, product development, pricing, mergers, insurance company start up and the development of the first Canadian disability incidence and continuance study. International assignments for BearingPoint, CGAP, ILO, ILO-STEP, GTZ, CCA and ICMIF have been in India, Pakistan, Nepal, Sri Lanka, Bangladesh, Philippines, Benin, Rwanda, and Barbados on all aspects of micro insurance.

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