

Actuarial Society of India

Examinations

May 2006

ST1 – Health Insurance

Indicative Solution

Sol 1a)

The issues that confront us in using hospital statistics and those from the research papers can be broadly classified into the following headings.

- i. Relevance of these statistics
- ii. Adjustments that are to be made to these statistics
- iii. How to use these statistics to derive incidence rates for insured lives

Relevance of published statistics

- Most of these statistics tend to provide the number of incidences or patterns in incidences and deaths/recoveries from incidences of such illnesses
- Might be outdated
- Data might not be broad based (might be focused on a few geographical areas, a few specified hospitals)
- Credibility that can be attached to the statistics – are these peer reviewed, have these been accepted by reputed institutes, how much of credibility can be attached to the statistics given the number of incidences or the size of the cohort analysed.

Adjustments to be made

- Trimming: Prune irrelevant statistics
- Grouping: Consolidated results from similar studies. Also consider the illnesses that are included in the product.
- Trending: Use other available information on medical trends to measure the possible effect of these developments on the data assimilated as above. Also check whether, in light of these medical advancements, the research and hence the results are still relevant.

How to derive incidence rates from published hospital statistics / research papers

- In most of the cases, lives exposed need to be estimated. This would be difficult to estimate in case of hospital statistics but can be estimated based on the scope of the research. In most cases it would be ideal to use the population statistics as a whole unless the research covers all geographical areas.
- The “first-ever” adjustment is necessary to account for the fact that the majority of critical illness products only pay on the first occurrence of an illness. Population morbidity statistics usually compile first and subsequent incidences of an illness, for example myocardial infarctions. Thus, this adjustment reduces the incidence rate for pricing purposes.
- It is also necessary to account for overlaps between conditions, such as the overlap between myocardial infarction and coronary bypass surgery.
- The adjustment from general population to insured population is necessary for a number of reasons. Foremost is the effect of underwriting (selection). Also, the insured population is generally wealthier and healthier than the general population, and this would tend to decrease incidence rates. However, certain consideration must also be given to possible anti-selection. Finally, it is necessary to adjust for various contractual terms and conditions, such as the discrepancy between the insured

definition of illness and the clinical definition of illness (or the definition used by government or other statistical offices).

- Since a critical illness is only paid in the event the insured survives 30 or 60 days (in most products), the incidence rate would then be reduced for deaths occurring within this Survival Period. The mortality after a critical illness is also affected, and this needs to be reflected in the pricing of mortality benefits, especially if the critical illness is of the acceleration type.
- An adjustment for smoking is also necessary as there is a very strong correlation between various illnesses and smoking. In particular, the insured population may proportionally have fewer smokers than the general population, and this will normally improve insured incidence rates.
- Medical and morbidity trending is necessary to account for medical advances since the date of exposure from which statistics were derived. For example, the statistics may not account for earlier detection of tumours, more routine heart surgery, advances in organ transplants, and genetic testing. The effect of this adjustment depends on the disease. This trending would not necessarily be restricted till the date of pricing the product but need to be till the next review date.
- Various other adjustments may be made, such adding security margins for rate guarantees.

(15)

Sol 1) b (i)

Cons:

A cautious approach needs to be adopted to use the base tables in other countries for the following reasons:

- Certain ethnic groups seem to be more prone to certain type of illnesses. Thus the effect of including or excluding certain illnesses might have different impact on the rates based on the target ethnic groups.
- Placing value on the assumptions that we require to make to convert these rates to those that are applicable in the native country might be difficult due to the same reason for which we look at rates applicable abroad, namely, lack of credible data in the native country.
- Rates that are applicable abroad might be partly influenced by the regulatory regime which might be very different from those applicable in the native country. Similarly, certain terms that are applicable elsewhere might not be applicable in the native country and this might have an impact on rates which might not be easy to quantify.
- The other reasons are :
 - Different target market used in derivation of the base table
 - Different effect of medical selection
 - Different risk management practices (and hence claim admission)

- Might be outdated and trending since the mid year of investigation might require the effect of medical advancements (which might be different in the two countries being compared).

Pros:

- Can provide an useful in comparing the rates that we derive using local data
- Can be used to for trending – more so if medical developments in the native country follow developments in other developed countries.
- Can be used to find out the effect of waiting periods, survival periods and terms of the contract on pricing. This could be used in product design if not in pricing.

(4)

Sol 1 (b) (ii)

(One suggested method is described below – credit to be given for sound alternative methods. But cautious approach needs to be take to avoid giving too much of credit to answers that list the factors that are need to be considered while deriving the rates. The student is expected to provide an approach to deriving these rates rather that factors that need to be considered.)

A very rough first step to deriving pricing incidence rates is to estimate the population critical illness rates based on population incidence rates applicable in other countries.

The general relationship, for example in the case of Cancer as shown below, is to establish an equation between the ratio of incidence rates (i_x) and known mortality rates (q_x) between two countries (in the equation, the other country is denote as X). The advantage here is that cause of death statistics are available for most countries, of course in consideration of the age-structure of the population. Some care must be taken, as cause of death statistics may not always be very reliable.

$$\frac{\text{Can } i_x^{\text{India}}}{\text{Can } i_x^{\text{C}}} = \frac{\text{Can } q_x^{\text{India}}}{\text{Can } q_x^{\text{C}}}$$

However caution needs to be exercised as the proportion of persons dying after being inflicted by an illnesses might be very different in the two countries. This could be because differences in health care in the two countries.

Various adjustments are then necessary to arrive at a pricing incidence rate basis. Thus incidence rates for the population can be derived. The other adjustments as mentioned above in 1 a(ii) needs to be made to derive a base table.

(6)

Sol 1 (c) (i)**Accelerated CI:**

Benefit when paid:

On the occurrence of the CI and admission of the claim by the life company or on earlier death

Amount paid

Could be the full death cover amount or a proportion of the same

Cover termination

If full sum assured is paid on CI, cover ceases after the life company admits the occurrence of the CI. If partial sum assured paid, death cover for the unpaid portion of the sum assured continues as per the policy conditions.

Additional CI:

Benefit when paid:

Once on the occurrence of the CI and admission of the claim by the life company and

Another payment on subsequent death within the term of the policy

Amount paid

Benefit payable on CI could be the full death cover amount or a proportion of the same

Stand Alone benefit

A policy which provides cover against occurrence of CI (subject to the claim eligibility conditions which includes a survival period) during the term of the policy. Referred to as stand alone as life cover is not provided simultaneously under the same policy contract.

(6)

Sol (c) (ii)

The base table for death benefit includes deaths from persons who were affected by one of the listed critical illnesses and who would have been eligible for a claim payment under the accelerated critical illness benefit (if there was one). When pricing the acceleration benefit the overlap of the CI and the death risk theoretically leads to a reduction of the risk rates of the underlying life insurance. However, instead of changing the actuarial pricing of the main insurance, the more practicable approach to account for the overlap is to directly discount the CI rates. Consequently the rates of the life risk bear the part of the CI risk, which is the risk of death following a CI and the combined life and CI rates fully cover the packaged life and CI prepayment risks.

However this is not the case with Stand alone CI and hence the incidence rates will need to include these deaths for which would otherwise be eligible for CI claim too.

The other factors are:

- These products attract different target segments in the market and hence different levels of class selection
- Risk selection process (inclusive of underwriting practices) might be different
- Effect of survival period.

(4)

Sol (c) (iii)

Stand alone rates need to be adjusted for the effect of survival period (include persons who are affected by one of the listed CI but die within the survival period). This could be achieved by dividing the stand alone rates by the probability of surviving the survival period.

To calculate Accelerated incidence rates, the Dash & Grimshaw model may be used. The additional risk, over and above the mortality risk, for products which have an Accelerated benefit is

$$i_x - k_x q_x \text{ where,}$$

i_x is the smoothed incidence rate for the Critical Illness concerned ,

k_x is the proportion of deaths due to the Critical Illness concerned,

q_x is the population mortality rate.

(5)

Sol 1(d)

Proposal A: With reviewable premiums the company would not be exposed to the risk that future experience was worse than expected. For guaranteed rates it will either have costed the guarantee directly or used prudent critical illness assumptions when setting the premiums. It will be able to remove this charge or margin from the premiums for reviewable rates. It would therefore be able to charge lower premiums for reviewable rates

However, potential policyholders may not like the potential for future increases in premiums. Whether or not the availability of reviewable rates would improve new business volumes would depend on whether the reduction in premiums appeared more attractive than the value placed on having guaranteed rates. The relative attractiveness of the cost of reviewable and guaranteed rates will partly depend on whether people think that future premiums are likely to rise or fall

If other companies offer reviewable rates then these rates may be more accepted in the marketplace. It would also give an indication of whether there was a genuine demand for such a product. If no other companies offered the product, then the company would need to undertake some market research to determine whether there might be a demand.

The company would also need to consider whether the business sold on reviewable rates would simply replace that which it would have otherwise sold on guaranteed rates. If so, then it would not be worth developing the new option unless greater profit could be made on reviewable rates.

The company would need to consider whether it had the systems capability to actually change the premiums in light of bad experience.

This proposal is likely to involve development expense which would have to be justified by potential increases in business volumes. The reviews themselves will also lead to an increase in expenses.

It also needs to consider potential bad publicity from future increases in premiums and be sure that it would actually carry out these increases in practice (if required). If it would not, then the rates are not really reviewable.

It would need to make sure that marketing material and policy conditions clearly sets out the potential for increases in premium and what would cause these so that policyholders expectations were framed appropriately. For example, it would need to be clear about how much of a change in experience would generate a change in premium. The company needs to decide on how frequently it will carry out reviews. Also, in order to sell, it may need to guarantee a period at the start of the policy during which it would not change the premiums. It would need to consider whether it would also reduce premiums in light of good experience, set this out clearly, and be prepared to do it in practice.

It needs to make sure that it monitors experience appropriately in order to identify changes in experience as soon as possible. Even then, there will still be a time lag between identifying bad experience and actually changing premiums so the premiums will be guaranteed to a limited degree. This guarantee would have to be priced into the rates.

If significant increases are required in the future then some policies will lapse which otherwise would not have. Thus, persistency experience would tend to be worse than for guaranteed premiums leading to lower profits. Also, the policies which lapsed would tend to be those in better health so the critical illness claims experience of the remaining policies would worsen further, requiring further increases in premium.

There might also be a lapse and re-entry issue for existing policyholders on guaranteed rates if they perceive the new reviewable rates as being better value.

Reviewable rates may be less capital intensive i.e. lower margins in reserves and solvency margin.

The company may need to make this change in order to be able to reinsure the business.

Proposal B: If attractive to potential policyholders, then this could increase sales since maintenance of real cover will help meet policyholder needs, although it is unlikely to be sufficient in itself.

Each year's increase is at the policyholder's discretion. The policyholder is more likely to increase their premium if they are in bad health. This anti-selection risk is likely to lead to poorer experience.

The risk could be reduced by making policyholders choose at outset whether they want an automatic increase each year. Or the company could prohibit any increase if one was not taken in the previous year. Or the company could offer a larger one-off increase in the event of lifestyle changing events such as parenthood or marriage.

If inflation is high then the financial impact of anti-selection would be greater. So the company could limit the increase to the lower of inflation and $x\%$.

The company would have to allow for the potentially worse experience when setting the premium rates.

In theory, the cost of critical illness cover will increase with age so if the sum assured increases in line with inflation then, all other things being equal, the premium should increase by more than the sum assured. To allow for the fact that the premiums increase at the same rate, the premium at outset would have to be higher than for a policy without this option.

To do this, the company would have to make an assumption about how many increases will be effected by each policyholder. This will be difficult to predict making it more likely that actual experience will differ from that assumed. If the assumption is too prudent then the policies will not sell but a best estimate assumption brings about a relatively high probability of losses due to more increases being effected than expected. The company would also need to assume a rate of price inflation (consistent with other financial assumptions) when setting the premium.

Expenses will also be incurred at each indexation which would need to be allowed for in the premiums. The company might introduce a minimum % increase to ensure that expenses are covered. The company will also need to consider whether initial commission would be paid on each increase option.

The company will want to adapt its systems to ensure that the process for taking out an increase is as automated as possible.

The indexation option may afford the company an opportunity to communicate with the customer and possibly cross-sell.

The company will need to decide what to do for policies which were originally rated.

The anti-selection issues mean that underwriting may need to be tighter (i.e. lower medical limits); this may deter sales.

The options will have to be reserved for appropriately; this may increase new business strain.

(10)
[50]

Sol 2) a) Subdivision of claims data

Age at inception
 Sex
 Smoker status
 Current age (or elapsed duration of policy)
 Duration of claim
 Policy term
 Deferred period
 Occupational group
 Ratio of benefit to income
 Type of sickness/injury
 Date of termination of claim
 Reason for termination of claim
 Sales Channel
 Geographic location

(4)

Sol 2) b) Reasons for deficits

The company's claims experience may be worse than the industry average.

There are a number of possible causes:

The product's price may be too high to attract many people. In that case, buyers of the product might tend to be those people who believe they are likely to claim and who might be rated by other offices with lower premium rates.

Underwriting standards may be different (lighter) than average. This would naturally lead to a higher claims rate.

Claims admission rules may be more generous than average. This would lead to higher claims inception rates.

Claims management may be less active than average. This would mean that claims termination rates are worse.

The replacement ratio (benefit relative to income) may be higher than average. (Industry statistics are available that show that there is a correlation between replacement ratio and cost of claims.)

The company may have a higher than average share, in its business, of those policies/policyholders whose claims experience is poor. This might be due to random fluctuations in experience or selective withdrawals of 'good' lives or the target market including sales in a region suffering localised economic recession.

This could come about through features of the policy design that encourage anti-selection.

Anti-selection is a particularly high risk for business sold through insurance intermediaries.

Features of the product which might encourage anti-selection are:

The high replacement ratio (70%).

Inclusion of 4 week deferred period class.

Own occupation definition of incapacity, for all occupational groups.

Fixed relationship between female and male rates (+50%).

Inflation may be higher than allowed for in the premium rates. This will affect both the current claim amounts and the reserve for claims in payment.

(6)

Sol 2) c) Changes to design and pricing

Review the sensitivity of sales to price. This would show whether a lower priced product would attract more people to buy or an increased price would be sustainable.

Review underwriting standards, including proposal form questions and medical evidence limits, against market practice.

Review claims admission procedures, including requirements for medical certification and tests.

Review occupational classifications. Especially in respect of target market.

Review maximum age at entry &/or termination age.

Develop new claims management techniques, such as rehabilitation counselling.

Reduce the maximum benefit relative to income.

Introduce an offset from the benefit in respect of State incapacity benefits payable.

Introduce a waiting period before first claim on a new policy permitted.

Remove 4 week deferred period business if this has higher claims deficit than other business. Consider restricting the product's availability to certain occupation groups only.

Change the definition of incapacity, for some or all occupation groups, to be more restrictive, e.g. an "all work" or functional assessment test.

Review the relationship between female and male rates. (+50% may not be sufficient.)

Remove premium rate Guarantee

Change to a Unit linked product with variable morbidity charges.

Limit the price indexation of benefits and premiums, e.g. a maximum increase of 6% per annum.

(5)

Sol 2) d) Problems and actions

Reducing the price may lead to lapse and re-entry, causing a loss to the company. This might be reduced if some of the benefits of the revised contract were less generous, e.g. limited price indexation, lower maximum benefit.

Raising underwriting standards may require recruitment or training of more medical underwriters. This will take time and increase costs. It will also reduce sales but hopefully exclude unprofitable ones.

Use of a standard underwriting manual such as a reinsurer's manual would reduce the need for senior underwriting skills.

Changing claims admission and management procedures would need to apply to in force business, as well as new business, in order to have any short term benefit for the company.

The extent of such changes would therefore be constrained by contract terms and PRE.

However some possible changes such as rehabilitation counselling are a benefit to the claimant, as well as being a claims control tool.

In practice claims management will need to be flexible, as the right approach to help one claimant back to work may be wrong for another.

A lower maximum benefit, or a State benefit offset, would probably reduce sales by insurance intermediaries sharply as replacement ratio is a competitive factor in the insurance intermediary market.

However the company may still achieve similar sales volumes through its own distribution channels.

Restricting the definition of incapacity may add to complexity and the cost of the claims function, as two different sets of rules will be in operation.

A definition based on testing may be unpopular with claimants.

A compromise might be for example “own occupation” definition for the first year of claim, followed by “all work” if a claim is to continue.

Unit linked product development will incur costs but the product may be more Capital efficient.

Reinsurer’s data may be available to assist in the development

Lower sales volumes could result in expense overruns.

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[20]

Sol 3) (iii) Factors to be considered by the insurer

Policy design

The policy provides security for the insured except for the risk that his or her health deteriorates so that the care that can be provided by the home, to which they were originally admitted, is no longer able to care for them.

Assuming that the original benefit will continue in payment, the increased costs of providing care in a more appropriate home will need to be paid by the insured, either directly or through the purchase of another immediate-needs policy. Alternatively the insured may end up with inappropriate care.

The policy is new, and so policyholders will have no other policies with which it can be compared.

As a result of this lack of competition, it will probably be sufficient for the insurer to make sure that the policy provides good care, rather than the very best quality care.

The policy is providing indemnity rather than cash benefits, and so the insurer is exposed to the risk of any change in nursing care fees.

In part this is controlled by the contractual relationship with the organizations managing the homes.

If the insured can arrange contracts with prices fixed for the expected duration of care in a home of a given type, then part of this risk will be controlled.

The insurer is exposed to counterparty risks (eg the risk that an organisation running the homes becomes insolvent).

Not only will the insurer want competitive contracts with the organisations, it will also want to ensure that the organisations provide good quality care and are run on sound financial principles.

Care costs are likely to inflate at a higher rate than general price inflation, because the largest component of the organisations' costs will be salaries for medically trained staff. The insurer should therefore build realistic wage inflation into the negotiated contracts with the organisations running the homes.

It should be a condition of the policy that any statutory care benefits received by the insured are offset against the benefits provided by the policy.

The insured will perceive that the insurer, rather than the organisation, is the provider of care. So any inadequacies in care may be blamed on the insurer. So the insurer is exposed to the risk of losing its reputation or being involved in protracted disputes about the care provided.

Underwriting

These policies would be subject to medical underwriting in order to establish the degree of impairment of the insured and thus the single premium that should be charged.

To avoid selection against the office, the insurer should require that a policy is taken out within a short period, say 30 days, of the person being admitted to the nursing home.

Policies could be issued after this 30-day deadline provided they were subject to detailed underwriting. This is to prevent those in better health (and thus expecting to receive more support than the average life) selecting against the office.

The underwriting procedures for these policies will be different from those used for the insurer's current product range. There must be sufficient trained staff to cope with the new underwriting procedures.

There will be no need for financial underwriting because the indemnity benefit is being paid directly to the providers.

Pricing

The insurer is exposed to the risk of lives living longer than expected. This may result from the mortality of nursing home residents improving, perhaps as the result of advances in medical technology. Any mortality rates reflecting current experience should allow for future improvements.

The policy is new, and so there will be limited data on which to determine prices.

It may be possible to use national data on the mortality of those in nursing homes and to adjust them for the selective effects of the policy (e.g. the policy will tend to be bought by those with greater wealth and by those who feel they have a relatively good life expectancy), and consequently with lighter mortality than the national rates.

The standard of care provided by the homes (assuming it is of good quality) may further improve mortality rates.

The policy-maintenance expenses will be low. There are no renewal premiums to collect. The limited number of homes with which the insurer has contracts will submit bills for care costs. The insurer does not have to monitor the insured's health.

Expenses will be limited to queries, terminations, *etc.*

The major part of the expenses will be the expenses of the initial sale. Commission will need to cover the costs of advice. This may be more involved than for other health and care policies because the insured will be frail and explanations and arrangements may be protracted. However, the saving in marketing costs will probably offset any increased selling costs because potential purchasers can be identified at little or no cost at their time of admission to a care home.

Despite the fact that the product has a single premium, it may be capital intensive because supervisory reserves and the initial expenses are likely to exceed the single premium.

This initial capital strain may be mitigated by suitable reinsurance contracts.

The purchase price of the care benefits would depend on the type of nursing home to which the insured has been admitted, age, sex and the type and extent of the insured's impairment.

The insurer needs to determine the size of the contingency loadings needed in the premiums. The contractual arrangement with the care home organisations reduces the impact of the guaranteed benefits, but the insurer will need to consider how sensitive profit levels are the key assumptions being made.

The insurer should consider the extent to which cross-subsidies are appropriate (e.g. younger policyholders subsidising older policyholders, females subsidising males). Cross-subsidies may enable the insurer to use a simpler rating structure or to attract more business in total.

The policies are of a relatively short term so investing funds in fixed-interest and index-linked government and corporate bonds would be appropriate. The expected return should be reflected in the pricing basis.

Selling

The product has a complex structure, and so the insurer may wish to restrict sales to insurance intermediaries to whom it has provided training and advice. This would act to prevent mis-selling and possible damage to the reputation of the product and the insurer.

Explicitly offering cover on the "life of another" may widen the market and offer the possibility of increased sales.

Administration

Administrative systems should be capable of making payments to care providers, dealing with enquiries from policyholders, for example.

[15]

Sol 4)

Addressing the concern for quality of care

Reasons why existing customers are concerned about quality

Quality standards simply may not have been high enough to satisfy those policyholders who have expressed their concerns.

The results of the quality assessments may be out of date, so that standards may have fallen in certain hospitals that met the criteria when they were last reviewed.

It may be the result of random fluctuations. A few policyholders have been dissatisfied, but the majority may have been happy with the care in the hospitals.

However, perhaps the most likely explanation is that the measure of quality from the consumers' viewpoint is *different* to that used in the healthcare industry.

Those funding healthcare, for example, will be concerned with the efficient running of the hospital and the efficient treatment of patients. For the most part they will be concerned with costs rather than the quality of treatment.

For example, a hospital might be judged on the:

- number of bed days it offers each year
- number of patients it treats per available bed day
- average cost of each type of treatment or operation.

A patient, however, may be more concerned with:

- the non-recurrence of symptoms following treatment
- the average length of stay in hospital
- the comfort of the hospital stay.

Although there will be some overlap, any statistics published by a hospital monitoring organisation are unlikely to be focused solely on patient concerns.

In addition, some data may only be available on a regional or national basis and so it will not be possible to identify hospitals from the approved list.

Ensuring quality

The reasons for the concerns of the existing policyholders should be identified and addressed.

Quality standards should be reviewed to ensure they are up to date and relevant for policyholders.

Measures could be imposed as part of the insurer's contract with an approved hospital. Ideally, the criteria for approval should be set by the insurer, but with the requirement for quality of care from the individual patient's point of view kept firmly in mind.

For example, contractual standards could be imposed on:

- size of rooms
- standard of decoration
- facilities provided
- level of nursing cover
- standards of cleanliness
- standards of catering.

A further standard could be based on a measure of patient satisfaction of the company's policyholders. This could be from the results of a short questionnaire given to patients about that hospital stay. Each hospital might need to meet a certain level of satisfaction to remain on the list.

They should still also include standards related to the quality of medical care, such as non-recurrence rates.

However, the insurer will also need to bear in mind the need to control costs, and so keep premiums competitive. Therefore, standards to do with cost efficiency may also be required.

Hospitals could be asked to provide regular monitoring data as part of the process of contract renewal.

This information could be supplemented by the results of periodical inspections of hospitals (although this might be expensive).

All these measures would increase overhead costs, but this should be offset by increased volumes of sales and increased persistency. The greater opportunity to control treatment costs might also help reduce claims costs.

The company needs to be careful because if it formally approves a hospital, it might become legally responsible for the quality of care in it, and so the legal position needs to be checked.

Policy design suggestions

Offer a restricted range of hospitals, so that insured patients have less choice, but at a higher level of quality.

Could offer several hospital lists, so that policyholders can have a greater choice of hospitals, but can choose the level of comfort they want, for an increased premium.

Include extra benefits aimed at enhancing the quality of the patient's experience. For example transport to and from hospital, or flowers to welcome a patient home. These benefits should have a high perceived value to the customer for relatively low cost.

Marketing suggestions

The company should place greater emphasis in its marketing on the quality of care, to reflect consumer opinion.

Once the concern around quality of care in the approved hospitals has been addressed, the company can promote and describe these quality standards specifically in its literature.

Statistical data from feedback on quality from customers, such as results of the patient satisfaction questionnaires mentioned above, could be used in marketing.

The responses from the questionnaire could be used to generate case studies and similar marketing stories. The insurer would need to address data protection issues in these cases.

Give greater emphasis to quality in the renewal documentation, so as to encourage persistency.

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