



Institute of Actuaries of Australia

# Actuarial Methods in Health Insurance Provisioning, Pricing and Forecasting

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### Abstract

The purpose of this paper is to investigate the actuarial methods currently in use for health insurance advice by Appointed Actuaries to private health insurance funds.

The focus is reserving, pricing and forecasting methods and models used by actuaries when advising private health insurance funds principally often when performing the functions required of the health insurance Appointed Actuary.

The content covered includes reserving, risk margins, premium liabilities, the liability adequacy test under the AIFRS compliant AASB1023, contribution pricing and forecasting. The April 2007 issues of the broader health reforms and the impact of the introduction of risk equalization to the reinsurance pool are not dealt with as they are not central to the main focus of the subject matter and they are covered under the Contemporary Issues in Health session.

The background material includes research from health fund annual accounts, PHIAC's annual and statistical reports and a short form survey of current actuarial practice in health insurance.

The paper is intended to provide useful and current information both for experienced health insurance actuarial practitioners and those considering becoming involved in this developing practice area. The author hopes the paper will be of interest and that, by reviewing the methods currently in use, it will provide a compass bearing for future development and consolidation of health insurance actuarial methods.

*Key words: Actuarial methods, appointed actuary, contribution rates, expense assumptions, forecasting, future claim liabilities, outstanding claims, pricing, provisioning, reserving, risk margins.*

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## 1. Introduction

Actuaries in Australia have been involved in providing advice to health insurance funds for several decades. The number of actuaries advising private health insurance funds and their level of involvement has increased significantly in recent years. The evolution of the role of actuaries in health insurance over the past several decades was discussed in my paper Lurie (2005) to the 2005 Biennial Convention.

While a small select group of actuaries have practiced and specialised in health insurance work for well over 10 years, the majority of actuaries working in health insurance have come to this practice area in the last decade from other practice areas such as life insurance, superannuation and general insurance. As a result the methods in use today reflect a level of diversity to some extent dependent on their initial field of practice.

As the health insurance market is somewhat concentrated in the six largest insurers, the type and scope of advice given by actuaries to the large players is likely to be different to that required and affordable by the boards and management of medium and smaller insurers. This difference in an environment of the uniform regulatory framework for all insurers, irrespective of size, may also be a worthwhile topic of discussion. The survey of appointed actuaries included as part of the research for this paper investigated whether the methods in use varied by size of fund.

At 30 June 2006 Australian health insurers had to report in terms of accounting standard AASB1023 for the first time. This coincided with a major revision of the standard and the associated disclosure requirements, in compliance with the Australian equivalents of the International Financial Reporting Standards (AIFRS). The move to AASB1023 had an impact on the methods used by health insurance actuaries and the level and content of the disclosure in health insurers annual accounts.

## 2. Outstanding claim provisions

### *Purpose of outstanding claim provisions*

The main purposes of a health insurer when assessing provisions for its liabilities are :

- assessment of profitability for the annual report
- assessment of solvency
- business planning
- contribution rate reviews
- claim management.

There are a number of standards which need to be complied with when doing an actuarial valuation. These are the regulatory, accounting, taxation and actuarial standards. There is generally a degree of consistency between these standards but they do reflect the objectives and perspectives of their governing bodies ie PHIAC the regulator, Australian Accounting Standards Board, the Australian Taxation Office and the Institute of Actuaries of Australia.

### *Identification of provision components*

At a given date, a health insurer's outstanding claim liabilities are the amounts it is liable to pay on claims arising up to that date. Outstanding claims include :

- claims which have been reported and have not yet been settled
- claims which have been incurred but not yet reported
- claims which have been closed which may need to be reopened.

In addition to benefit payments to members, the fund may incur other claim related expenses such as claim dispute fees, legal fees and general third party costs. It may also receive recoveries or refunds from third parties such as workers compensation, motor vehicle compulsory third party, public liability insurers or for claims paid but subsequently reversed such as hospital, medical and other ancillary expenses.

The provision for outstanding claims has the following components :

*provision for outstanding claims* = central estimate + administration expense allowance  
+ risk equalisation allowance + risk margin

where

*central estimate* = an unbiased estimate of the liability which contains no intentional over or under estimation

*administration expense allowance* = the estimated management and administrative expenses in relation to the discharge of the claims liabilities in the central estimate.

*risk equalisation allowance* = the amount estimated to be paid to or recovered from the risk equalisation trust fund (RETF) to equalise the hospital claim exposure to the high claiming portions of the fund's membership in respect of the central estimate

*risk margin* = the positive addition to the central estimate to allow for the uncertainties in the valuation and to achieve a liability estimate suitable for the purposes of the valuation.

#### *Valuation data, stages and model*

The actuary is responsible for the appropriateness of the data collected and used to determine the assumptions in the valuation model. Reasonable steps should be taken to verify the overall consistency of the valuation data with the health fund's financial records and with the data supplied for earlier valuations.

The calculation of the central estimate will require the data to be sub-divided into categories which exhibit similar claim features. Trends in claim reporting, claim frequency per member and claim payment and other features such as seasonality, changes in benefit design, claim handling processes and the mix of products and members, should also be considered.

The stages involved in an actuarial valuation of outstanding claim and future claim liabilities are similar to actuarial valuations for other types of liabilities :

- clarify the terms of reference and scope
- collect the necessary data
- analyse the experience
- select the valuation model
- select the valuation assumptions
- perform the valuation calculations and projections
- reconcile the results with the previous investigation
- analyse variability and sensitivity
- reach conclusions and results
- present a written report

Having collected appropriate data, validated it and analysed the experience, the actuary then needs to select an appropriate valuation model and use the claim and member experience analysis to populate the model parameters and assumptions. The actuary may consider more than one model in arriving at a central estimate and may even use a blend of complimentary models dependent on how the nature and features of the claims and member experience analysis best fit the design attributes of the available models.

A major challenge for the actuary is getting sufficient data and information about the two most recent months of service as these months generally comprise around 80% or more of the provision and they are subject to higher level of uncertainty than older months of service as a result of variability in processing leads and lags. Appropriate model selection is of utmost importance in dealing with this material source of variability. Processing leads and lags can also potentially impact the payment pattern of claim by month of development and fairly small changes can have geared material effect on the assessed provision even in instances when the underlying incurred cost has remained stable.

#### *Valuation models*

There is a variety of valuation methods available for use when valuing a health insurer's claim liabilities. The methods can be broadly classified as follows :

- the chain ladder method and its variations
- the payments per claim incurred methods (both in ordinary time and operational time)
- the ultimate loss ratio and Bornhuetter-Ferguson (budgeted IBNR) methods
- case estimate based methods.

Annuity methods are used in general insurance valuation work for classes with annuity types of benefit payment eg weekly compensation and ongoing medical costs in workers compensation. However annuity based methods do not currently appear to be used in health insurance. One can envisage that annuity methods could be useful when pricing and forecasting future benefit incurred costs for sub-groups of high risk exposure, chronic condition and recurring treatment members.

The short survey of health fund appointed actuaries supporting this paper received 7 responses (including from the author). These responses covered 6 of the 8 large funds (\$200 million or more in annual contributions) and 9 of the 30 small to medium sized funds. The table below shows the results obtained from the survey. Bear in mind that some actuaries use different methods for the hospital, medical and ancillary valuation categories and some use more than one method per valuation category. So the aggregate number of methods in use can exceed the number of funds surveyed.

**Actuarial Methods in Health Insurance Provisioning, Pricing and Forecasting**

Item		Major funds (>=\$200 million in conts)	Other funds (<\$200 million in conts)
<b>Outstanding claim provisions</b>	Total funds	6	9
<b>valuation categories :</b>			
	hospital, medical & ancillary	3	6
	hospital and ancillary only	2	2
	more than three	1	1
		6	9
<b>valuation methods :</b>			
	chain ladder (a)	4	7
	PPCI/PPCR (b)	1	3
	loss ratio (c)	1	
	projected case estimates (PCE) (d)	1	
		7	10

**Notes :** (a) = most funds used an adjusted chain ladder method. In one case the two most recent months of service are separately forecast for hospital services. In another case the hospital and medical assessments for the three most recent months use case estimates.

(b) = PPCI is the payments per claim incurred method and PPCR is the payments per claim reported method

(c) = one fund uses the loss ratio method for the most recent month of service and the chain ladder for older months

(d) = this fund uses case estimate for the three most recent months of service and the chain for older months

The survey shows that half the large funds and two-thirds of the medium/small funds use three valuation benefit categories, 2 of the large and 2 of the medium/small funds use just two valuation categories and 1 each use more than three valuation categories. The funds using more than three valuation groups sub-divided accommodation costs under hospital and split ancillary benefits into dental and other valuation categories.

The chain ladder method features strongly as the valuation method of choice as it is used for close to 60% of large funds and 70% of medium/small funds. Note that the adjusted form of the chain ladder is most often used and for two large funds the chain ladder is replaced by other methods for the most recent months of service. The payment per claim methods are used for 1 large fund and 3 medium/small funds. The single usage each of the claim ratio and the projected case estimates method are supplemental to the chain ladder method.

While I would have much preferred a higher response rate to the survey, there is no reason to suspect that the above results are not indicative of current common practice.

*Brief description of methods*

*Case estimates* are generally used for estimating the cost of reported claims. This is particularly useful for short-tail classes where most claims are settled quickly and the amount of the claims is easy to determine. The unknown IBNR (incurred but not reported) claim numbers need to be estimated and valued. This can usually be done for short tail classes from the claim data in the weeks following the valuation date. So prima facie it would seem that case estimate methods would be the natural and ideal choice for health insurers. However this is not so, because the claim administration process is so

quick, often involving real time electronic processing, that in most instances there is no need to make an estimate of the cost of a reported claim. The large health fund which uses a projected case estimate method is doing so for hospital and medical claims, rather cleverly using the high percentage of pre-treatment quotations as the case estimate.

*The chain ladder method* was the original run-off technique developed. It is a simple method which is based on the premise that the distribution of delays between claim occurrence and payment remains relatively stable over time. This premise implies that the underlying claim and membership experience remains unchanged and no allowance is made for changes in mix of risks, portfolio/membership size, claim frequency or participation rates etc. The chain ladder method is based on cumulative payment data. The payments made in each development year are a step up the ladder until the ultimate claim cost is reached at the top of the ladder. The adjustment most often made to this method is to allow for past CPI inflation. The bluntness of the chain ladder as a valuation tool needs to be considered in times of changing claim and membership growth experience. In these instances, the averaging period for the development pattern needs to be suitable to reflect current trends. The cumulative payment based chain ladder does not use the number of services, an important data item for actuarial valuations.

*The payments per claim methods* have largely replaced the chain ladder method for actuarial valuations in general insurance. The chain ladder is now used only for claim reporting rates to assist with INBR claim estimation. The two methods currently used are PPCI (payments per claim incurred) and PPCR (payments per claim reported). In these methods, all claim payments are brought to current values and divided by the numbers of claims incurred (or reported) in their respective months of service. By this means a pattern of past payments per claim incurred was derived in respect of each month of service. These payment patterns are then extended into future years and used to project future payments. The chain ladder method is used to project the future number of IBNR claims.

*The ultimate loss ratio* and *Bornhuetter-Ferguson (budgeted IBNR)* methods use the claim ratio on reported claims to develop an ultimate expected claim cost. These methods are most appropriate to classes of insurance where there is minimal data in the early periods of development such as often arises for the one to three most recent months of service.

### 3. Future claim/contribution provisions

#### *Purpose of future claim/contribution provisions*

The main purposes of a health insurer when assessing future claim liabilities are the same as for outstanding claims provisions above:

- assessment of profitability for the annual report
- assessment of solvency
- business planning
- contribution rate reviews
- claim management.

#### *Identification of provision components*

At a given date, a health insurer's future claim liabilities are the amounts it is liable to pay on claims arising after that date in respect of contributions in advance and any constructive obligation under sections 10 and 17 of AASB137 Provisions, Contingent Liabilities and Contingent Assets. Future claims include :

- future claims arising in respect of contributions in advance
- future claims for constructive obligation contributions expected but not yet paid to the next 1 April rate review date.

In addition to benefit payments to members, the fund will incur policy administration and contribution collection expenses and claim related expenses such as claim dispute fees, legal fees and general third party costs. It may also receive recoveries or refunds from third parties.

The constructive obligation arises due to AASB137 requiring an Australian company to recognise a liability where it creates a valid expectation to other parties (eg its existing market/membership) that it will accept certain responsibilities (eg that a product or service will continue to be available at a certain price for some future period of time).

The provision for future claims has the following components :

*provision for future claims* = central estimate + administration expense allowance + risk equalisation allowance + risk margin

where

*central estimate* = an unbiased estimate of the liability for future claims which contains no intentional over or under estimation

*administration expense allowance* = the estimated management and administrative expenses in relation to contribution collection, policy administration and the discharge of the claims liabilities in the central estimate

*risk equalisation allowance* = the amount estimated to be paid to or recovered from the risk equalisation trust fund (RETF) to equalise the hospital claim exposure to high claiming portions of the fund's membership in respect of the central estimate.

*risk margin* = the positive addition to the central estimate to allow for the uncertainties in the projected cost of future claims and to achieve an incurred cost estimate suitable for the purposes assessing future claims.

#### *Valuation data, stages and model*

The actuary is responsible for the appropriateness of the data collected and used to determine the assumptions in the valuation model. In addition to the outstanding claim valuation data, the actuary will need data on contributions in advance, deferred acquisition costs, intangibles, forecast contributions, claims and expenses from the paid to date to the next 1 April rate review date.

The calculation of the central estimate will require the data to be sub-divided into categories which exhibit similar claim features. In this case as contributions are usually only allocated at hospital and ancillary level, only these two valuation categories would be used. Trends in claim reporting, claim frequency per member and claim payment and other features such as seasonality, changes in benefit design, claim handling processes and the mix of products and members, should also be considered.

The stages involved in an actuarial valuation of outstanding claim and future claim liabilities are similar to actuarial valuations for other types of liabilities as listed above in section 2 of this paper.

Having collected appropriate data, validated it and analysed the experience, the actuary then needs to select an appropriate valuation model for estimating the future claim liabilities. The actuarial valuation of the outstanding claim liabilities will be the starting point from which the actuary will form a view of the likely claim ratios that it is reasonable to adopt for the period of the future claim liability. The claim experience and trend analysis underlying the outstanding claim valuation will inform this claim ratio assessment.

*Valuation models*

The valuation methods available for assessing the future claims liability are essentially an extension of the outstanding claim valuation methods or an output from the forecast of the future income and outgo experience of the health insurer. The methods can be broadly classified as follows :

- the claim ratio implied by the recent claims experience
- the incurred cost of future claims as projected by a recent forecast model.

The table below shows the results obtained from the survey conducted in support of this paper. Bear in mind that some actuaries use different methods for the hospital, medical and ancillary valuation categories and some use more than one method per valuation category. So the aggregate number of methods in use can exceed the number of funds surveyed.

Item	Major funds (>=\$200 million in conts)	Other funds (<\$200 million in conts)
<b>Premium liabilities (PL)</b>		
<b>PL categories :</b>		
hospital & ancillary separately	6	8
hospital & ancillary combined		1
other - specify		
	6	9
<b>PL methods :</b>		
claim ratio (a)	3	3
forecast model (b)	3	6
contributions in advance	5	8
constructive obligation (AASB137) (c)	6	9
DAC	4	2
other - specify		

- Notes :**
- (a) = the claim ratio used varies from that of the last 6 to 12 months of service to that implied by the period to the next April or the next 12 months of service
  - (b) = using the forecast model generally over the incidence period of the future claims
  - (c) = one large and one medium/small fund use estimate contributions from the valuation date to the next 1 April thereby contributions in advance are implicitly included

The survey shows that most funds assess the future claim liability separately for hospital and ancillary. Only one medium/small fund uses the package policy approach and combines hospital and ancillary when assessing the future claim liability. A number of medium/small funds responded that this assessment was done separately by class and this response has been counted with the 'hospital and ancillary separately' group.

The claim ratio and forecast methods are used equally by the large funds but the medium/small funds more often use the forecast method. At least one large and one medium/small fund used a prospective claim ratio. So if the methods for future claims are classified as retrospective (claim ratio) and prospective (forecast), the usage of the

prospective method dominates. It would also be fair to assume that when the claim ratio approach is used, the adopted claim ratios would be chosen to reflect the expected future experience.

All funds assess the future claims liability based on both contributions in advance and those implied by the constructive obligation. One medium/small fund uses a stronger basis by taking in contributions to one year following the next 1 April rate review date. This may arise if the appointed actuary and/or the fund want to make allowance for the potential level of uncertainty in its next rate review projections.

Two-thirds of the large funds use deferred acquisition costs (DAC) when assessing the future claims liability but, not surprisingly, less than a quarter of the medium/small funds find this necessary or worthwhile.

#### 4. Pricing and forecasting

##### *Purpose of pricing and forecasting*

The main purposes of a health insurer when assessing contribution rates and performing forward forecasts are similar to those of insurance liability assessments but with a somewhat different focus :

- contribution rate reviews
- assessment of future profitability, solvency and capital adequacy and sustainability
- business planning

##### *Identification of pricing and forecasting components*

The pricing components are similar to those of the future claim liability as evidenced by the number of funds which use the forecast of the future incurred cost of claims as input to the future claim liability. In addition allowance is often made in pricing for a gross margin contribution at product or table level. This may be done by a contingency loading to cover variability risk, shareholder return for listed funds, internal generation of capital and other items as required. In this way the pricing and forecasting work can proceed together, with proposed contribution rate increase scenarios being tested by the forecast model.

This may be done at gross contribution margin level to examine the relative gross margin across products/tables. At some stage in the forecast process it will become necessary to make allowance for expenses and investment return to build a pro forma income statement and balance sheet. This is required if the future sustainability and solvency/capital adequacy of the fund are being investigated. This should be common practice when determining contribution rates.

The pricing of contribution rates has the following components :

*pricing of contribution rates* = central estimate of future claims + administration expense allowance + risk equalisation allowance + risk margin - investment income allowance.

where each item is defined as in the sections above. Administration expenses include all expenses and investment income may be on the subset of the fund's assets which relates directly to the health insurance business and its accumulated surpluses/capital.

*Pricing and forecasting data, stages and model*

As mentioned above in sections 2 and 3, the actuary is responsible for the appropriateness of the data collected and used to determine the assumptions in the valuation model, pricing and forecasting model. In addition to the insurance liability valuation data, the actuary will need further detail on investment earnings, the asset/investment portfolio and other material balance sheet items.

The pricing and forecast work will require the data to be sub-divided into categories which exhibit similar claim features. More detail is likely here than for the liability valuations eg at table and jurisdiction level. Once again trends in claim reporting, claim frequency per member and claim payment and other features such as claim experience by State/region, seasonality, changes in benefit design, claim handling processes and the mix of products and members, should be considered.

*Pricing and forecasting models*

The pricing and forecasting methods are essentially an extension and enhancement of the insurance liability methods. When investigating solvency and capital adequacy, the model would be extended to include the components of the PHIAC standards as reflect in the PHIAC2 return, expanded to include the future period of the forecast.

The table below shows the results obtained from the survey conducted in support of this paper. Bear in mind that some actuaries use different methods for the hospital, medical and ancillary valuation categories and some use more than one method per valuation category. So the aggregate number of methods in use can exceed the number of funds surveyed.

## Actuarial Methods in Health Insurance Provisioning, Pricing and Forecasting

Item	Major funds (>=\$200 million in conts)	Other funds (<\$200 million in conts)
<b>Pricing and forecasting (P&amp;F)</b> Total funds	6	9
<b>P&amp;F categories :</b>		
table by State	4	1
table nationally		6
hospital, medical & ancillary (a)	1	1
other - specify (b)	2	1
	7	9
<b>P&amp;F methods :</b>		
liability valn + claim frequency + member projn (c)	4	8
drawing rate method	1	
adjusted drawing rate method (d)	1	
ave claim size x claim frequency x membership		1
	6	9

**Notes :** (a) = three pricing categories done by State with national assumptions

(b) = for one large fund : hospital in 4 sub-categories, medical in 2 sub-categories, ancillary in 9 sub-categories and protheses separately.  
for the other large fund and the medium/small : hospital in 2 sub-categories, medical in 1 sub-category and ancillary in 2 sub-categories

(c) = the risk equalisation transfer is explicitly calculated for at least 2 funds

(d) = chain ladder development factors used to spread drawing rate forecasts

The table above shows that most large funds assess pricing and do forecasts on a State basis but that this is less common for the medium/small funds. By far the most common approach to pricing and forecasting is to use the liability valuation methods as a base combined with a separate analysis and projection of the membership and claim frequency. While the survey did not directly ask for input on the pricing and forecasting of the risk equalisation transfers (RET), explicit allowance for this was mentioned for two large funds and it is expected that all funds would need to make allowance for RET in their pricing and forecasting models.

## 5. Assumptions and parameters

This section examines the assumptions and parameters adopted in the actuarial models used in health insurance liability valuations, pricing and forecasting.

### *Rate of interest*

Item	Major funds (>=\$200 million in conts)	Major funds (>=\$200 million in conts)
<b>rate of interest for discounting</b>	figures in brackets are number of funds	figures in brackets are number of funds
- OSC valuations	risk-free rate (2), nil (4)	risk-free rate (3), nil (6)
- future claim valuations	implicit (2), nil (4)	implicit (2), nil (7)
- pricing and forecasts	earned rate (4), 6% (1), 0% (1)	as for OSC (8), 6% (1)

Two-thirds of health insurers surveyed do not discount their outstanding claim (OSC) provisions or future claim liabilities, while the remaining third uses risk-free rates for discounting. Given the short weighted mean term of the OSC liabilities, the discount amount is not likely to be material in the current interest rate environment. The discount could be material for the future claim liabilities particularly once the constructive obligation contributions are considered.

As expected when it comes to pricing and forecast work, rates of interest are more often applied at either risk-free plus a loading or the rate implied by the asset mix or the rate expected to be earned by the assets.

### *Rate of inflation*

Item	Major funds (>=\$200 million in conts)	Major funds (>=\$200 million in conts)
<b>inflation rate assumed</b>		
- OSC valuations	Nil (5), 3.5% (1)	3.5% (1), 3% to 16% (1), 7 Nil
- future claim valuations	implicit (2), rate review (2), nil (2)	implicit (3), rate review (1), variable (5)
- pricing and forecasts	current level (4), 4% (1), 0% (1)	as for OSC (8), 4% (1)

The summary survey table shows that most health insurers do not allow for inflation in OSC valuations but that inflation is increasingly allowed for in future claim valuations and in pricing and forecast work. The fund which allows 3% to 16% inflation in the OSC valuations derives the rate from the observed claims experience with the higher end being superimposed inflation ie cost inflation in excess of normal (CPI or AWE) inflation.

*Rate of superimposed inflation*

Item	Major funds (>=\$200 million in conts)	Major funds (>=\$200 million in conts)
<b>superimposed inflation</b>		
- <b>OSC valuations</b>	Nil (5), 2.0% on 2 valn groups (1)	1.5% to 4% (1), 8 funds nil
- <b>future claim valuations</b>	implicit (2), rate review (2), nil (2)	implicit (3), rate review (1), variable (5)
- <b>pricing and forecasts</b>	current level rate (4), by source (1), 0% (1)	as for OSC (8), by source (1)

The recognition of superimposed inflation in the actuarial methods is similar to that of normal inflation. Some methods allow implicitly for superimposed inflation and may require adjustment when claim experience changes significantly, as it has several times over the past decade. Other methods allow an explicit superimposed rate to be adopted and projected forward with flexibility as to rate and duration.

*Claim and policy expenses*

Item	Major funds (>=\$200 million in conts)	Major funds (>=\$200 million in conts)
<b>claims handling expenses</b>		
<b>Hospital and ancillary</b>		
- <b>OSC valuations</b>	2% to 3% (5), 8% (1)	3.5% + RE (1), 8% to 12% (8)
- <b>future claim valuations</b>	OSC (2), all exps (3), OSC% x 1.15 (1)	OSC (2), all exps (2), variable (5)
- <b>pricing and forecasts</b>	all exps (5), 3% (1)	all exps (9)
<b>policy administration expenses</b>		
<b>Hospital and ancillary</b>		
- <b>OSC valuations</b>	Nil (6)	Nil (9)
- <b>future claim valuations</b>	all exps (1), conservative (2), non-acqn (3)	OSC (1), all (1), variable (5), non-acqn (2)
- <b>pricing and forecasts</b>	all exps (5), conservative (1)	total mgt expenses (9)

Not unexpectedly, here we see a distinct difference between the expense assumptions for large and medium/small health insurers. For OSC valuations most large funds use expense loadings of 2% to 3% with one large fund at 8%. The medium/small funds expense loadings are much higher at 8% to 12% of the central estimate of the liabilities.

For future claim liabilities the practice is more diverse with half the large funds taking in all expenses and a third of the medium/small funds. Most funds take up more expenses than on the OSC reserves as future contributions require policy and collection administration in addition to just claims handling expenses. In many cases all expenses or all non-acquisition expense are taken into account. Interestingly the newly released general insurance actuarial standard draws this distinction. When doing future claims reserves several funds reflect an expense apportionment which has a higher level of expenses for ancillary than hospital claims per dollar of claim payment.

As expected, all but one health insurer take in all expenses when doing pricing and forecast work.

*Risk margin and levels of sufficiency*

Item	Major funds (>=\$200 million in conts)	Major funds (>=\$200 million in conts)
<b>risk margin %</b>		
- <b>OSC valuations</b>	4% to 7% (3), 8% to 14% (3)	variable (5), 6.2%(2), 7.5%, 10% (IFRS)
- <b>future claim valuations</b>	varies from 50% to 125% of OSC RM (6)	variable(5), 120%/125% OSC(3), 19%IFRS(1)
- <b>pricing and forecasts</b>	OSC RM (5), central estimate (1)	variable(5), OSC RM (3), central estimate (1)
<b>probability of adequacy %</b>		
- <b>OSC valuations</b>	80% to 95%(3) , 95%(3)	75%(5), 80%(2), 95%, 75%
- <b>future claim valuations</b>	75% to 95% (6)	75% to 80% (8), 95% over 21 months (1)
- <b>pricing and forecasts</b>	OSC sufficiency (5), 50% (1)	variable(5), OSC sufficiency (3), 50% (1)

Not unexpectedly, as for expenses, here we see a distinct difference between the risk margins adopted for large and medium/small health insurers. For OSC valuations half the large funds have risk margins between 4% and 7% with the other half in a much higher range of 8% to 14% which is higher even than the 6% to 10% medium/small fund range. Clearly some differences in view and approach exist here.

Another area where there is a difference of view is the risk margin for future claims. Is the future claims level of uncertainty higher or lower than that of outstanding claims ? There are strong arguments both ways. The table above shows the future claims risk margins to vary from a low of 50% to 125% of the OSC risk margins.

Somewhat surprisingly the risk margins used for pricing and forecasting are generally the outstanding claim risk margins as opposed to the future claim risk margins. This may be due to the risk margins attaching to the OSC reserves in this work. One funds reverts to using the central estimate in its pricing and forecast models.

## 6. Summary

The paper explores the methods available and currently in use for health insurance actuarial advice on provisioning, pricing and forecasting. The topics covered are the methods, models, assumptions and parameters for outstanding claim valuations, future claim valuations, contribution rate reviews and forward forecasts.

For *outstanding claim valuations* the chain ladder method is in most general use, but in an adjusted form to deal with the limitations of the method and variable development claim patterns for the one to three most recent months of service. Most funds surveyed use three valuation groups ie hospital, medical and ancillary. The use of two valuation benefit categories is also quite common ie hospital and ancillary.

A number of other methods are described, some of which may add value to actuarial valuations in health insurance. The most likely being the PCE (projected case estimates) and PPCI and PPCR (payments per claim incurred and reported, respectively).

*Future claim liabilities* are valued using recent claim experience to form a view of the likely future claim ratio. In some cases this is done retrospectively and in others, it is done prospectively by applying the claim ratio to a forward projection over the term of the future claims. There is a fairly even balance between these two approaches. All fund surveyed use both contributions in advance and unpaid contributions to the next April rate review as the base for the future claim liability and most funds assess this liability separately for hospital and ancillary benefits. In the event of a shortfall between the contribution base and the future claim liability, an unexpired risk liability (URL) needs to be raised. AASB1023 requires the write back of deferred acquisition costs (DAC) when this occurs. A number of funds do not use DAC in this assessment, presumably since there is no URL required.

*Pricing and forecast* work is largely done by State for the large funds and nationally for medium to small funds. The methods used combine the valuation methods with projections of participation rates and membership growth.

*Assumptions and parameters* for the methods and models are described and investigated. Outstanding claim provisions are generally not *discounted for interest earnings*. Where they are, a risk free rate is adopted. For future claim valuations, the discounting is generally implicit and the longer weighted mean term of these liabilities suggests this may be material enough to consider discounting. Most funds use a realistic rate of investment earnings when doing pricing and forecast projections. The application of an *allowance for inflation* and superimposed inflation closely follows the discounting for investment earnings approach. *Superimposed inflation* is generally adopted as needed in pricing and forecast projections at levels observed in the current claim trends but is not universally adopted for outstanding and future claim valuations..

The *claim management expense allowances* for outstanding and future claim assessments are distinctly lower for large funds than medium/small funds. This is to be expected. For pricing and forecast projections is it common practice for all expenses or all non-acquisition expenses to be taken into account. It would appear that some funds are using the same expense loadings for outstanding claim and future claim valuations. This approach is unlikely to be supportable in the medium to long term as the future claim liabilities involve policy and contribution administration and hence a somewhat higher allowance may need to be made.

The *risk margin analysis* is the area where actuarial practice in health insurance is perhaps the most formative. A diversity of practice exists in relation to the risk margins adopted and whether the future claim risk is higher or lower than the outstanding claim risk. In a stable claim environment the future claim risk is most likely lower but if future potential risk variations are taken into consideration, this view is less plausible (refer lifetime health cover and prostheses superimposed inflation). The risk margins on outstanding claim liabilities for large funds lie in two independent ranges ie 4% to 7% and 8% to 14%. Interestingly, the medium/small funds risk margins lie in the range 6% to 10% which is lower than that of large funds. I could not think of any sound reason for this apparent anomaly. The probability of adequacy is generally between 75% and 95% for large funds with a concentration around the higher end of this range. Medium/small funds reserve and price predominantly at 75% to 80% probability of adequacy.

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## 7. References

Lurie P, 2005, *The Evolving Role of the Actuary in Health Insurance*, Biennial Convention 2005, Institute of Actuaries of Australia

Hart DG, Buchanan RA, 1996 (5<sup>th</sup> Edition), Howe BA, *Actuarial Practice of General Insurance*, Institute of Actuaries of Australia

Private Health Insurance Administration Council, *Operations of the Registered Health Benefits Organisations Annual Report 2005-06*

GN650: *Actuarial Reports and advice on outstanding claims in health insurance*, Institute of Actuaries of Australia, June 1999

GN660: *Financial Projections for health insurers*, Institute of Actuaries of Australia, December 2002

GN670: *Financial condition reports for health insurers*, Institute of Actuaries of Australia, July 2004

AASB1023 : *Financial Reporting of General Insurance Activities*

AASB137 : *Provisions, Contingent Liabilities and Contingent Assets*