US Medical Malpractice Insurance

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Summary

This paper seeks to explain aspects of US medical malpractice insurance. Part 1 considers the recent history, current position and trends of the insurance market. In Part 2 we explain the terminology and definitions which may not be familiar to those not dealing with this class of insurance. Part 3 looks at the different types of rating commonly used by US actuaries and briefly consider reserving. Typical reinsurance programmes that are bought in the London Market are examined in Part 4. We analyse a fictional example of an actuarial submission that a London market actuary would expect to see from a cedant in Part 5.

1. U.S. Medical Malpractice Insurance Market

1.1 Market Size

A.M. Best data show that 142 companies or groups wrote at least $1 million of direct medical malpractice premiums in 1992. Total direct premiums totalled approximately $5.3 billion. This figure substantially understates the size of the market in that it fails to account for premiums written directly by non-US insurers and does not include the premiums for the many medical industry captives or trusts which are not required to file statutory statements.

For the portion of the industry captured by Best, actual direct earned premiums have grown as shown below:

Year	Earned Premium ($m)	Annual Growth
1992	5,233	3.3%
1991	5,067	-2.6%
1990	5,201	-3.9%
1989	5,414	1.6%
1988	5,328	0.6%
1987	5,295	18.5%
1986	4,469	39.0%
1985	3,215	29.3%
1984	2,487	22.7%
1983	2,027	

According to the Best data, ceded reinsurance premiums totalled $877 million in 1992. Fifteen companies accounted for $554 million or 63% of the total ceded premium. Seventy eight companies ceded in excess of $1 million.

1.2 Reasons for Market Growth

A major factor for the growth in premiums is social inflation in malpractice awards. The publicity of large awards is often cited as attracting more claimants.

Patient expectations are constantly being raised by reports of advances in medical technologies, lowering tolerances for less than perfect outcomes.

Juries are increasingly assigning liability in cases involving failure to diagnose claims. This is especially true with cancer which will ultimately affect a sizeable portion of the population.

There is a probable link between medical insurance claims and spiralling healthcare costs.

1.3 Key Regulatory Trends

The malpractice market is expected to be heavily affected by health care reform efforts. Major initiatives are underway to reduce the growth of healthcare costs and improve access to healthcare for the uninsured.

Legislators seek to minimise or eliminate many of the entrepreneurial aspects of the medical profession as a means toward controlling costs. Recent efforts include attempts to ban fees for physical referrals, and attacks against physician ownership or financial interest in out patient imaging centres.

Regulatory and legislative actions are hastening the current health industry trend to managed care. This trend is resulting in mergers and alliances between combinations of healthcare providers who previously represented separate economic interests. Many of these combined entities will be of a size that they are managed by professional risk managers who will be making the insurance purchase decision. This will remove the decision from individual physicians.

There is an increasing trend on the part of regulators to ensure the quality of care provided by individual physicians. The introduction of the national practitioner data bank requiring disclosure to prospective employers of past malpractice claims payments is one example of these efforts. It presents revised implications for hiring and peer review decisions and the liability which can accrue if not complied with.

Risk based capital is severely penalising the specialist medical liability companies in that the capital requirements established for medical liability are the the highest of any line of business.

Furthermore these companies have no spread of risk to mitigate potential bad experience in medical liability.

1.4 Determinants of Market Size

The size of the primary market for medical and related insurance coverage is likely to be determined by the success or failure of state and federal tort reform initiatives as part of the overall effort to stem the rate of increase in healthcare costs.

Whatever form of healthcare initiative is ultimately passed, it will have implications on the structure of the healthcare delivery system and on the structure of the primary insurance market. Any change in the primary market will have a direct impact on the size of the reinsurance market.

The size of the reinsurance market will be affected by any change in the perceived need for new products such as managed care liability and coverage for medical waste disposal.

Another critical factor which will determine the size of the medical reinsurance market will be the degree to which the medical community desires to remain actively involved in the mitigation of their liability exposures. The medical community has played a very active role in the handling of their insurance needs. They remember having been deserted once by the traditional insurance carriers and should not, therefore, be expected to easily concede their market.

1.5 Industry Structure

The medical liability market is highly fragmented. The legal climate and laws governing the liability of medical practitioners differ substantively by state and even geographical territories within states. As a result, the marketplace is highly fragmented, with a large number of single state or purpose, medical practitioner owned insurance entities.

Speciality Divisions of large multiline insurers such as St. Paul, CNA, AIG and the Farmers Group wrote slightly more than 25% of direct premiums reported by A.M. Best for the 1992 year.

Medical speciality companies, primarily physician or hospital owned or sponsored, accounted for nearly all of the balance of premiums written. Most of the medical specialty companies were formed during the 1970's, a period of crisis with respect to availability and affordability of coverage within the traditional insurance market.

Many of these companies have been single state or single specialty writers, although some of the companies have expanded in recent years to adjacent states or more broadly in an attempt to continue growing.

1.6 Customer Needs, Segmentation, and Market Trends

Purchasing Behaviour

Reinsurance purchasing behaviour differs greatly between the insurance entities involved with medical malpractice. These differences are more easily understood in the context of the company's market segment, capitalisation and limits sold.

Many of the companies have developed long term relationships with their reinsurers, especially in the London Market. However this may be affected by increasing competition.

In general the malpractice companies have generated substantial increases in their capitalisation as a result of highly profitable results during the late 80's and early 90's. As a result, nearly all the companies have increased their retentions in the past couple of years.

Customer Needs and Priorities

Medical malpractice is a line of business with a history of wide swings in profitability.

Most of the buyers of reinsurance are heavily dependent upon their reinsurers and must therefore place the reinsurer consistency and commitment near the top of their list of priorities.

Capital protection would be at the head of the list for lightly capitalised companies. Such companies will want to issue higher limits in order to compete with better capitalised competitors.

Reinsurers will need to increase their flexibility to help address changes resulting from changes in the medical delivery system and to support their cedants' new products.

Cedant companies will increasingly look for relief from the financial effects of Risk Based Capital.

Segmentation Schemes

The market for reinsurance companies is currently segmented four ways.

Large highly capitalised commercial insurance companies writing all forms of medical and related coverage on a multi-state, multi-speciality basis.

"Single" state, multi-speciality, physician controlled companies. These would also include companies which started out as a single state companies, but have subsequently expanded to other states.

Hospital owned or sponsored companies.

National single speciality companies.

Segment Size and Evolution

Traditional, large insurance companies now make up roughly 25% of the total malpractice premiums. Prior to the 1970's these companies dominated the market, but were unable to keep up with 20% annualised growth in loss costs. Many companies abandoned the market entirely and others pulled out of states in which they determined they could no longer make a profit. This opened the door to physician and hospital owned entities. Today, they write approximately 75% of all premiums. Moreover they enjoy a special loyalty among their customer group which has made it difficult for the traditional companies to compete on a equal footing.

Product Evolution

Medical malpractice was originally written exclusively on an occurrence basis. However, spiralling lost costs and the long tail on the reporting of claims in the mid 1980's forced insurers to find an alternative. The choice was claims made policies, which have become the market standard for physician and surgeons liability. Some companies do continue to use the occurrence form for doctors, but today, it is primarily used for hospitals.

Relative Segment Economics

Product and Customer Economics

The profitability of medical malpractice insurance became extremely favourable in the late 1980's when twenty years of annual claim frequency increases in excess of 8% annually was followed by a period of significant decrease over the next few years. This change resulted from a combination of factors including state tort reform efforts, better risk management practices, improved health care practices, and

heightened public awareness that unrestrained increases in professional liability costs were beginning to affect the availability of healthcare.

In more recent years, there has again been higher claims frequency combined with slow but steady severity growth to increase claims costs.

Profitability is also being reduced by quicker settlement of claims and a substantial decline in interest rates.

Impact of Different Purchasing Behaviour

The trend among doctor and hospital companies to raise their retentions will cause these companies to bear the brunt of increased losses stemming from the increase in frequency. This could force some companies to reconsider the decision to raise retentions.

2. Terminology and Definitions

As most medical malpractice insurance and reinsurance business is transacted on a claims made basis the definition of this is given below, together with the more familiar occurrence definition and also risks attaching to complete the picture of the three standard bases.

Claims Made Basis:

The insurer covers all claims reported during the period of insurance irrespective of when they occurred.

Occurrence Basis.

The insurer covers all claims occurring during the policy period, irrespective of when they are reported.

Risks Attaching Basis.

For reinsurance, the reinsurer covers losses arising under policies written by the reinsured attaching during the period of cover.

The bulk of medical malpractice insurance and reinsurance used to be on an occurrence basis. Due to the crisis in the industry in the mid-eighties, with very high claims severity and frequency inflation, much of the industry changed to claims made around 1986. Insureds and reinsureds changing to claims made in, say, 1986 were already covered for losses occurring in 1985 and previously but not reported pre-1986. Thus full cover on a claims made basis would not be required. A variety of different types of claims-made policies are therefore required to allow for different periods of occurrence and the terminology used for these is as follows:

Retroactive Date (or Retro Date).

The insurer covers all claims reported during the period of insurance subject to occurrence being on or after the Retro Date this date being set out in the policy details.

1st Year Claims Made

The insurer covers all claims reported during the policy year subject to occurrence also being during the policy year. I.e., the retro date is the same as the policy inception date.

2nd (3rd, 4th etc.) Year Claims Made

The insurer covers all claims reported during the policy year subject to occurrence being during the policy year or preceding year (preceding 2 years, 3 years etc.)

The following table shows the theoretical derivation of 1st year, 2nd year etc. claims made rates, all the rates being effectively percentages of the equivalent occurrence price, on an undiscounted pure premium basis. The calculations are based on the assumption of a standard reporting pattern for an occurrence year (as per the Pol Yr 0 Row: with Pol Yr being Policy Year) and the assumption of a fixed combined severity and frequency inflation rate (here 10% per annum assumed). Note that with development of reported claims here being for 9 years, the claims made price as a percentage of occurrence will remain unchanged at 86% from the 9th Claims Made Year.

Mature Claims Made

This is the highest claims made year. Quotations will be given for 1st, 2nd, 3rd etc. claims made years up to the Mature Claims Made Year. However:

a. There will still be a Retro Date (e.g. the date when the insurer changed from occurrence to claims made.

b. In order not to quote too many rates the insurer may use a value less than the probable maximum, here 9 years, e.g. 6 years with appropriate adjustments to rates. In the example, the theoretical 6th year claims made pure premium would be 84.2% of occurrence as against 86.0% for mature claims made.

One problem with claims made is that if the insured retires, is disabled or dies then a claim arising from an occurrence before the date of retirement, disablement or death but reported after the expiry of the last claims made policy purchased will not be covered unless some action is taken. Such cover may be purchased on retirement or disablement but is unlikely to be purchased on death! Therefore it is more likely to be purchased with the standard claims made policies for an additional premium, or possibly included in the premium as a pre-paid loading. The terminology for these are:

Tail Cover

The insurer covers claims reported after the expiry of any claims made policies for claims occurring on or after the retro date. The table shows pure premiums for tail cover for 1st year to 5th year and mature claims made. Note that the figures are percentages of the equivalent occurrence price. They might more normally be quoted as percentages of mature claims made which would here be done by multiplying by 100/86.

Prior Acts

This is cover for occurrences before the claims made period, i.e. before the retro date. This is required in particular cases, e.g. if higher limits of cover are required than were purchased under the preceding occurrence or claims made policies, missing periods of cover, etc. Prices for this are given in the following table associated with the current claims made year and the number of prior years of cover required.

Note that the values in the table of claims made factors are pure premium values on an undiscounted basis. Other factors need to be considered before quoting actual rates:

a. If investment income is taken into account the differential between claims made and occurrence is reduced. E.g. if, as a first approximation, it is considered that claims development will be the same for any tranche of claims once reported, and that there will be no other differences in payment patterns due to different bases of insurance, then the discount factor for occurrence will be equal to the discount factor for claims made times (for the example):

CLAIMS MADE FACTORS

Development:

										Revenue Year							
Pol Yr	*-9*	*-8*	*-7*	*-6*	*-5*	*-4*	*-3*	*-2*	*-1*	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
-9	10.60	12.72	8.48	5.09	2.5	1.5	0.8	0.4	0.2									
-8		11.66	14.00	9.33	5.6	2.8	1.6	0.9	0.5	0.2								
-7			12.83	15.39	10.3	6.2	3.1	1.8	1.0	0.5	0.3							
-6				14.11	16.9	11.3	6.8	3.4	2.0	1.1	0.6	0.3						
-5					15.5	18.6	12.4	7.5	3.7	2.2	1.2	0.6	0.3					
-4						17.1	20.5	13.7	8.2	4.1	2.4	1.4	0.7	0.3				
-3							18.8	22.5	15.0	9.0	4.5	2.6	1.5	0.8	0.4			
-2								20.7	24.8	16.5	9.9	5.0	2.9	1.7	0.8	0.4		
-1									22.7	27.3	18.2	10.9	5.5	3.2	1.8	0.9	0.5	
0										25.0	30.0	20.0	12.0	6.0	3.5	2.0	1.0	0.5

Factors:

	Prior Acts: Years					*Claims Made Price*	*Tail Cover*
	All	*4*	*3*	*2*	*1*		
1st Year	61.0	56.9	52.8	43.8	27.3	25.0	75.0
2nd Year	33.7	31.8	29.6	25.5	16.5	52.3	115.9
3rd Year	17.2	16.4	15.3	13.1	9.0	68.8	136.6
4th Year	8.1	7.9	7.4	6.3	4.1	77.8	146.3
5th Year	4.0	4.0	3.8	3.3	2.2	81.9	151.1
Mature						86.0	154.4

$$.25 + .3v + 2v^2 + 12v^3 + .06v^4 + .35v^5 + .02v^6 + .01v^7 + .005v^8$$

For an interest rate of 6% p.a. this would be a factor of 0.9093, i.e. the factor for mature claims made as a percentage of occurrence would change from 86.0% to 86.0/0.9093 or 94.5%.

b. Claims made is more predictable than occurrence and therefore a higher loading factor for contingencies might well be used in obtaining an occurrence rate. This would therefore have the opposite effect to that in a. tending to increase the differential between occurrence and claims made prices.

To complete the definitions the following describes coverage which lies somewhere between occurrence and claims made:

Sunset Clause

This is a clause in an occurrence policy whereby the insurer covers all claims reported during the period provided they are reported within a fixed period e.g. seven years after expiry of the coverage period for a seven-year sunset clause.

3. Rating and Reserving

3.1 Rating Methods

Projected pure premium method

The paid or incurred claims usually including allocated loss adjustment expenses (ALAE) are projected by the chain-ladder method to ultimate and are divided by the exposures to give pure premiums based on the experience of each historical year. These are then trended to the new exposure period to allow for the effect of inflation/trends. Based on these, the pure premium is selected e.g. by taking the average trended pure premium weighted by the exposures.

The trend factors used are selected by curve fitting to the historical pure premiums or based on industry data or judgment of future trends.

Projected pure premium method using report/accident year lag

The paid or incurred claims are split both by report year and the accident year to which they relate. For each relative accident year lag a chain-ladder projection of the claims is made. (Normally all lags greater than a certain number of years are combined.) The projected claims are divided by the corresponding exposures to give the pure premium based on the experience of each report year/ accident year cell.

These are then trended to the new exposure period. Based on these, a pure premium is selected for each relative accident year lag e.g. by taking the average of those for each report year. The total pure premium is found by summing those for all the relative accident year lags.

Frequency/severity method

This method involves the trending of historical frequencies and severities to the new exposure period. The trend factors selected are based on curve fitting to the historical data or based on industry data or judgment of future trends. There may be separate projections made of claims closed with expense only and

the indemnity and expense parts of claims closed with indemnity.

Loss simulation models (Monte Carlo method)

The loss process is modelled with assumptions being made for all the relevant factors involved e.g. the distributions of the number of claims and claim severities. A large number of simulated cases are run with the outcome of each case depending randomly on the assumptions made. As well as giving estimates of the expected losses this method gives the estimated losses at any required confidence level.

Credibility method

This involves producing pure premiums based on the company's own experience using a method such as those above and also based on industry experience. A weighted average is taken of these, the weights depending on the credibility given to the company's experience according to the volume of business, its maturity and volatility.

3.2 Components of Premium Basis

Projection of Paid claims / Incurred claims / ALAE at 'basic limits' by one or more of the above methods to produce the 'basic limits' pure premium. There are then several adjustments made to this pure premium to produce the office premiums at various limits :-

Other expenses

Fixed expenses	-	general administration
Variable expenses	-	Unallocated Loss Adjustment Expenses (ULAE)
		Commission and other acquisition costs
		Taxes - premium tax
		federal income tax
		Death, Disability and Retirement (DD&R) loading
		Reinsurance loading
		Management fee

Profit/contingency margin - this will often be taken as a percentage of the gross premium.

Rate of return required on capital - this involves a more sophisticated model taking into account the amount of capital required to finance the business and all the cash flows resulting from the business. The premium is set to give the required rate of return on the capital allowing for the time value of money.

Class Relativities - these are rating factors according to the class of business covered. They will normally be based on industry data or the experience of the scheme if it is sufficiently large. If changes are made to the class relativities this will alter the average relativity weighted by the exposures. The base premium therefore needs to be adjusted to allow for this.

Territory Relativities - these are rating factors based on the location of the insured. As above an adjustment will be made to the base premium when these are altered.

Claims-made factors - these factors are used to convert the mature claims-made pure premium to pure premiums for policies at shorter claims-made durations.

Rating Modification - this is the average premium reduction due to discounts and credits in a programme. The premium is divided by this factor to allow for these reductions.

Experience adjustment factor - for a small scheme or one with insufficient historical experience the rates may be based on industry data or that of a larger scheme. An experience adjustment factor may be applied to allow for the scheme's experience to date compared to the larger data.

Investment income

For rating purposes the claims are normally discounted to allow for investment income. (This is less common when reserving as the reserves will often implicitly contain this margin.)

In order to discount, assumptions are required for the claims payment pattern and interest rates. The payment pattern is usually based on the historical experience of the scheme or on industry data if the scheme is not sufficiently large or has not been in operation for enough years.

However, naturally this has to be adjusted for any expected changes in the future pattern from that experienced in the past e.g the general change from claims-occurrence to claims-made has reduced reporting times while there has been a general speeding up in settlement times in recent years.

Generally a single interest rate is applied for discounting intended to reflect the average rate earned over the period in which payments will be made. However, it is also possible to use a variable rate. As long term rates are currently higher than short term rates both in the UK and US, a variable rate would tend to increase with the length of time to payment.

Increased Limits Factors (ILFs)

Because of the scarcity of the larger claims in any one scheme's experience it is normal to project the claims truncated at a certain limit. The premiums at higher limits are found by multiplying the 'basic limits' premium by factors known as ILFs.

These ILFs are normally based on industry experience in order to provide a much larger sample than the scheme's own experience. However, there is the danger that this industry data may not be fully appropriate to the scheme's experience.

The ILFs can be calculated as the ratios of the projected claims at the higher limits to those at the basic limit. Other ways of calculating ILFs are as follows:

Curve-fitting

Curves are fitted to the historical claims data and from these the estimated future claim distribution curve is produced. The ILFs can then be calculated based on this curve.

For example, the Log-normal curve has two parameters, SIGMA and MU. One method of obtaining SIGMA is by a chain-ladder projection of the fitted historical SIGMAs. MU can then be found by a chain-ladder projection and then trending of the mean claim severities.

The other curve commonly applied is the Pareto distribution. Due to its thicker tail this will tend to produce higher ILFs than the Log-normal.

Chain-ladder projection

Triangles of the paid or incurred claims capped at the higher limits and the basic limits are formed. The triangle of claims capped at the higher limits is divided by the triangle of claims capped at the basic limits to give a triangle of ratios. This triangle is then projected by standard chain ladder techniques to obtain an ultimate ILF in respect of each past report year. These are then trended to produce the ILF for the new exposure period. This method implicitly assumes that the ratio of claims capped at higher and basic limits remains constant for all report years. It therefore makes no allowance for claims inflation.

3.3 Reserving

Standard methods such as chain-ladder on incurred claims can be used, but allowance has to be made:

a. For the move from occurrence to claims made around 1986, with much shorter claim development tails.

b. For policies with large aggregate deductibles and capped limits: one may need to individually assess and also reserve for a full exposure loss if necessary.

c. Automatic rated layers: Can be projected using overall projections of incurred claims, subject to a.

and b. . but one should use feedback to give future premium development (with a split of policies between those exceeding the maximum, those likely to remain below the maximum, and those currently below the maximum but likely to exceed the maximum).

d. Often there is a very long claim payment pattern even with claims-made: it would therefore seem logical to discount.

4. Reinsurance Programmes:

4.1. Working Layer plus Excess Cession Layers.

A fairly standard programme would comprise:

a. Working Layer:

This would usually be for the primary coverage of the insureds for primary limits, possibly up to $1M. If the upper limit is above $1M then the coverage above $1M is for clash (two or more physicians or surgeons involved in the same claim) and possibly for ECO (extra-contractual obligations) although ECO may be covered under a separate policy.

This may be on a standard swing-rated basis (otherwise known as automatic rated, a burner, or even a banker), i.e. the rate being equal to a Minimum + Claims x (1 + loading) subject to a Minimum and Maximum (with provisional premium paid over four quarters, and provision for adjustment annually based on claims).

The layer may have an aggregate deductible with the reinsured paying the first few claims, to reduce the ceded premium.

b. Excess Cession Layers:

The insured can buy cover above the primary level in layers of e.g. $1M xs 1M, $3M xs $2M and $5M xs $5M. The rate charged to the insured is expressed as a percentage of the primary rate by doctor or physician category. Reinsurance is usually by Excess Cession, i.e. the rate being that charged to the insured plus an over-riding commission of perhaps 30%. This is proportional cover of non-proportional business and may be classed as proportional business which may upset development statistics if not considered separately from true proportional business.

Example:

A large Physicians Programme placed in the London Market:

Working layer: 1 year incepting 1st July 1994, covering risks attaching:

A. $500,000 excess of $500,000 (UNL, each and every loss, each and every insured)

B. $2,000,000 excess of $500,000 (UNL, each and every Loss Event).

(UNL is Ultimate Net Loss)

Recoveries under A. deducted in determining UNL for B. Aggregate deductible 12% of GNEPI (estimated at $200M) Maximum loss 250% of Reinsurer's premium.

Deposit premium $215M payable quarterly in advance, provisionally adjusted to 12.5 % of GNEPI at expiry. Three years from inception and annually thereafter rate calculated as:

4.75% of GNEPI + 110% of incurred loss cost,

subject to a maximum of 25%, where:

Incurred loss cost = reinsurers' loss & loss expenses + 120% of statutory reserves

Brokerage: 10% of the Provisional Premium, i.e. 1.25% of GNEPI.

Graphs of results for different claims to the layer are shown below.

Excess Cession:

1st Layer:

$1M xs $1M (Brokerage 10%; Commission 10%)

2nd Layer:

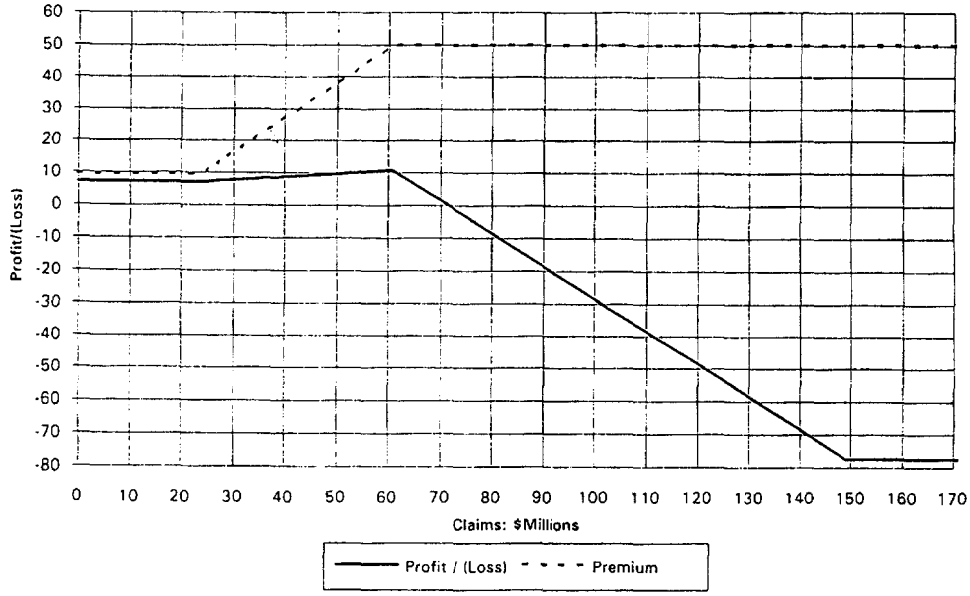
$3M xs $2M

2. Aggregate Structure.

Some programmes, particularly for groups of hospitals, work on an aggregate excess of loss basis. The following is one example:

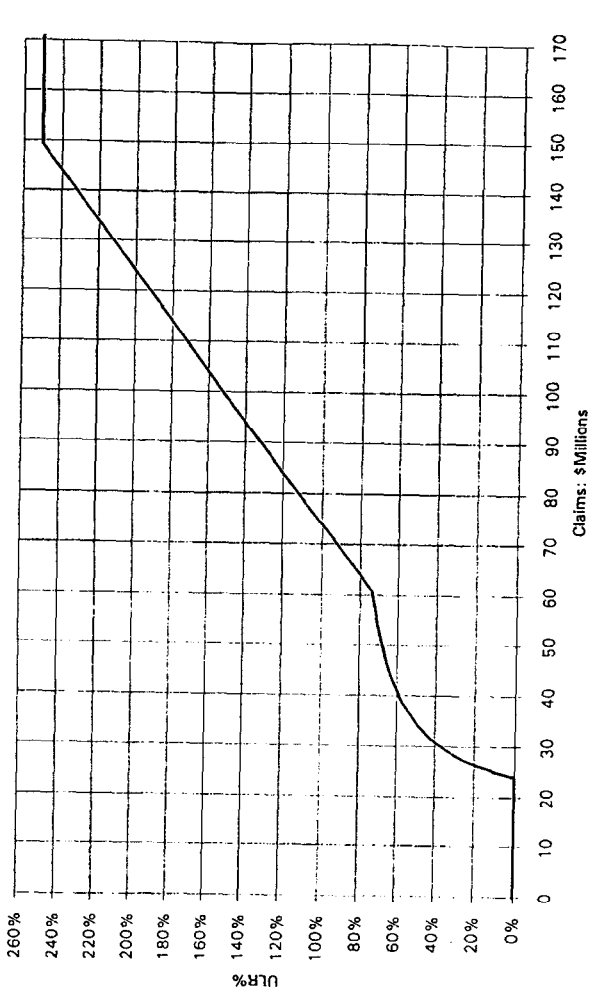
PHYSICIANS SWING-RATED LAYER

Premium & Profit / (Loss)



PHYSICIANS SWING-RATED LAYER

Loss Ratios



Example: Hospital Programme.

Seven hospitals are covered by this programme. The layers are listed in the following table with some layers not coming into the London Market (e.g. layers 1 and 2, layer 3B, which is self-insured and layers 8 to 10). The table is simplified from that in the placing documents where it is given in a format referred to as a Christmas tree structure as that is what it resembles. Each layer, in aggregate terms, is above the layers below it in the table. The following graph attempts to show the horizontal and vertical structure of the programme but it should be noted that, for example, layers 2, 8, 9 and 10 could vary from equal amounts to each hospital of one-seventh of the aggregate amount to the whole amount for one hospital (as shown). The table of layer descriptions gives the effective aggregate limits but this assumes that the value of the 3B $100,000 per claim layer is equivalent to $20,000,000 aggregate, a number supplied by the placing broker. Also shown is the incurred claims position for selected years on a what-if the current layers applied basis, at a particular date, showing how the claims have progressed through the layers (note that it is assumed here that there is a limit of $20M on the 3B layer).

AGGREGATE HOSPITALS PROGRAMME

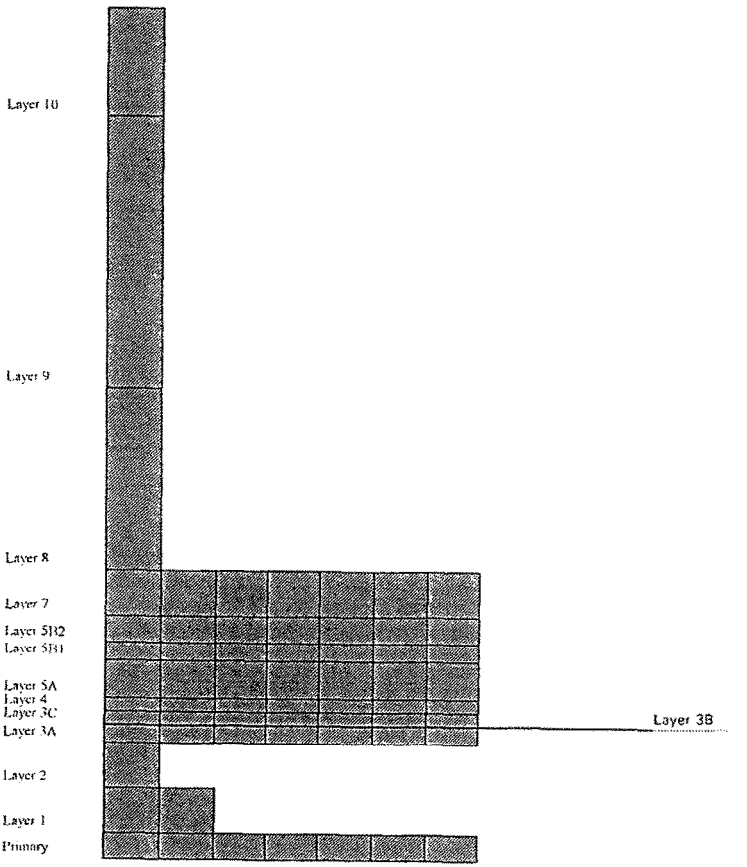
STRUCTURE

$ Millions

Layer	*Description*	*Aggregate*	*From*	*To*	*Premium*	*ROL*
Layer 10	$12M Joint; All Hospitals	12	239	251		
Layer 9	$30M Joint; All Hospitals	30	209	239		
Layer 8	$20M Joint; All Hospitals	20	189	209		
Layer 7	$5M Aggregate per Hospital	35	154	189	0.45	1.3%
Layer 5B2	$3M Aggregate per Hospital	21	133	154	0.42	2.0%
Layer 5B1	$2M Aggregate per Hospital	14	119	133	1.15	8.2%
Layer 5A	$4M Aggregate per Hospital	28	91	119	3.85	13.8%
Layer 4	$1.5M Aggregate per Hospital	10.5	80.5	91	2.60	24.8%
Layer 3C	$1.5M Aggregate per Hospital	10.5	70	80.5	3.70	35.2%
Layer 3B	$100,000 per Claim SIR	20	50	70		
Layer 3A	$2M Aggregate per Hospital	14	36	50	6.30	45.0%
Layer 2	$5M Joint; All Hospitals	5	31	36		
Layer 1	$5M Joint All Hospitals ($5M Sub-Limit per Hospital)	10	21	31		
Primary	$1.5M per Loss; $3M Aggregate Limit per Hospital	21	0	21		

AGGREGATE HOSPITALS PROGRAMME

STRUCTURE

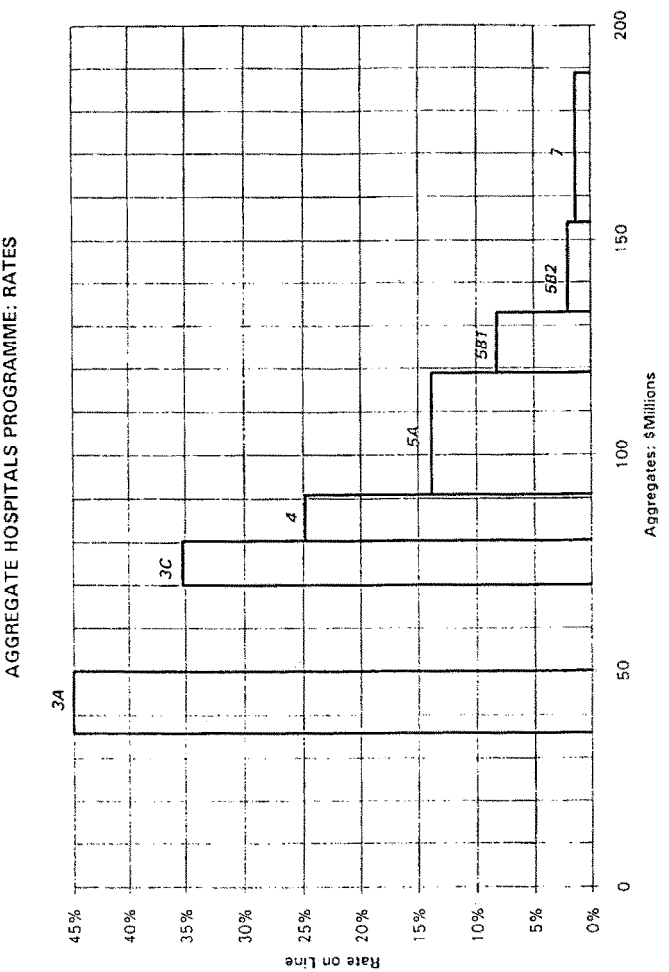


AGGREGATE HOSPITALS PROGRAMME

Examples of Incurred Losses: What-if Basis

$ 000's

Year	*Hospital*	*Excess of Primary*	*Layer 1*	*Layer 2*	*Layer 3A*	*Layer 3B*	*Layer 3C*	*Layer 4*	*Layer 5A*
1983									
	1	*13,941*	1,946	1,023	2,000	5,756	1,500	1,500	216
	2	*4,259*	842	393	2,000	657	367	0	0
	3	*5,984*	2,285	924	2,000	497	278	0	0
	4	*4,137*	167	183	2,000	1,146	641	0	0
	5	*8,302*	1,976	885	2,000	2,208	1,233	0	0
	6	*13,628*	691	611	2,000	6,625	1,500	1,500	701
	7	*9,924*	2,093	981	2,000	3,111	1,500	239	0
	Total	*60,175*	10,000	5,000	14,000	20,000	7,019	3,239	917
1984									
	1	*16,604*	4,131	1,564	2,000	8,193	716		
	2	*1,641*	374	159	1,108	0	0		
	3	*3,808*	423	425	2,000	883	77		
	4	*2,974*	377	326	2,000	249	22		
	5	*9,807*	2,698	892	2,000	3,878	339		
	6	*6,675*	782	739	2,000	2,900	254		
	7	*8,348*	1,215	895	2,000	3,897	341		
	Total	*49,857*	10,000	5,000	13,108	20,000	1,749		
1986									
	1	*10,133*	2,481	1,240	2,000	4,412			
	2	*1,766*	432	216	1,118	0			
	3	*2,109*	516	258	1,335	0			
	4	*3,894*	953	477	2,000	464			
	5	*10,618*	2,599	1,300	2,000	4,719			
	6	*4,606*	1,128	564	2,000	914			
	7	*7,723*	1,891	945	2,000	2,887			
	Total	*40,849*	10,000	5,000	12,453	13,396			
1990									
	1	*0*	0	0					
	2	*0*	0	0					
	3	*0*	0	0					
	4	*2,576*	2,576	0					
	5	*0*	0	0					
	6	*0*	0	0					
	7	*5,206*	5,000	206					
	Total	*7,782*	7,576	206					


AGGREGATE HOSPITALS PROGRAMME: RATES
Rate on Line
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
0
50
100
150
200
Aggregates: $Millions
3A
3C
4
5A
5B1
5B2
7

5. US Medical malpractice - an example

Note: The data included in this example was based on a US hospital programme but has been multiplied by a constant to preserve its anonymity. All names/characters in this example are totally fictitious and are used for illustrative purposes only

5.1 Background:

You are the actuary for the Eurostate Insurance company in London which specialises in writing US Casualty business. You have been asked by your Hospital Liability underwriter, Quinten Prudent, to assess a new risk which has been submitted by one of his less favoured brokers, Victor Slick (who works in the London office of a large multinational broker, Churn & Stashit).

The risk consists of a group of three hospitals (The "Healthy Hospital Group" [HHG]), who are seeking aggregate excess of loss cover for $20 million excess of $100 million for the 1994/5 underwriting year. The group wants to buy cover on an occurrence basis with a sunset clause to limit the exposure to late reported claims (Vic Slick suggests quoting for a 4 year and 7 year sunset period). The hospital group has a captive which provides cover up to $100 million, and has previously bought excess of loss cover in the US domestic market for $50 million excess of $100 million, to which no losses have so far been advised.

Quinten is concerned about quoting on this programme because the vast majority of his HPL book is written on a claims made basis (with limited extended reporting in some cases), and the company has suffered adverse loss ratios on US HPL business written on an occurrence basis prior to 1986 when most polices transferred to claims made. He has asked for actuarial help in reviewing a risk management report provided as part of the underwriting submission, which suggests there is minimal exposure to any layer above $100 million.

5.2 Projection Report and Underwriting Information

The underwriting submission includes a report by Getrich & Quick (a small US risk management consultancy which mainly acts for insureds and is a

wholly owned subsidiary of Churn & Stashit). The report was commissioned by HHG in order to assess the funding of their self insurance arrangements for the previous policy year (1993/94) and to indicate what excess of loss cover they may require.

Victor has also provided some exposure data which suggests that the number of occupied beds over the three hospitals has fallen progressively since 84/85. He believes that last years's rate of $5 million charged by Eurostate's US competitors for the $50 million excess $100 million gave no credit for this reducing exposure, and his client is only prepared to pay $2 million for cover excess of $100 million this year. Churn & Stashit will take 15% of any premium quoted as brokerage.

Getrich & Quick Risk Consultants

HEALTHY HOSPITAL GROUP

Analysis of Professional Liability Funding

1. PURPOSE

1.1 Healthy Hospital Group (HHG) requested Getrich & Quick, to develop estimated ultimate claims reserves for the insured's professional liability exposure based on the latest claim data available, with the specific aim of estimating the funding requirements for the latest policy year (1993/94)

1.2 This report is of a summary nature only. The methods used are the same as the report we prepared last year.

2. DISTRIBUTION

2.1 This report summarises our findings. It was requested by senior management of HHG, but we understand it may be shown to prospective excess carriers or reinsurers. Although our report may provide useful data to such parties, it was not intended for the purpose of rating prospective insurance cover. Any other use or further distribution is not authorised without our consent.

3. LIMITATIONS

3.1 We have relied on the accuracy of the data provided by HHG, which was not audited externally, but was reviewed for reasonableness by ourselves.

3.2 Industry data was used for the present value calculations (the paid claim data provided by HHG did not appear sufficient for this purpose).

4. CONCLUSIONS:

4.1 We recommend a funding level of $63.6 million (see Exhibit 5) for the 93-94 year based on a 90% confidence interval funding level, discounted for investment income.

Exhibit_1

HHG - Summary of Projections

Year	Number of Claims	Average Cost	Projected Ultimate Losses
		$	$
84-85	913	106,771	97,498,475
85-86	530	154,874	82,159,095
86-87	535	158,906	84,942,773
87-88	590	143,308	84,491,524
88-89	543	143,761	78,116,114
89-90	630	115,214	72,630,057
90-91	610	128,617	78,421,081
91-92	560	127,144	71,190,778
92-93	184	149,596	27,466,571
Average (Exc. 92-93)	614	134,824	81,181,237

Exhibit_2a

HEALTHY HOSPITAL GROUP (HHG)

Derivation of Claim Development Factors

Average Cost per Claim
(Based on HHG Data)

Year	12 mths	24 mths	36 mths	48 mths	60 mths	72 mths	84 mths	96 mths	108 mths	Projected Ultimate
84-85		32,429	70,634	121,299	115,006	117,566	107,830	106,312	106,771	106,771
85-86	48,444	96,042	152,787	169,586	166,895	163,523	160,036	154,210		154,874
86-87	71,143	143,360	127,022	156,614	141,676	154,292	163,020			158,906
87-88	190,416	108,969	126,661	132,867	132,380	148,746				143,308
88-89	77,212	87,050	95,123	114,124	140,220					143,761
89-90	51,426	80,047	86,173	107,721						115,214
90-91	29,186	50,042	95,452							128,617
91-92	22,388	66,758								127,144
92-93	37,684									149,596

Link Ratios — Average Cost per Claim — Exhibit_2b

Year	12-24	24-36	36-48	48-60	60-72	72-84	84-96	96-108	108-ult
84-85		2.178	1.717	0.948	1.022	0.917	0.986	1.004	
85-86	1.983	1.591	1.110	0.984	0.980	0.979	0.964		
86-87	2.015	0.886	1.233	0.905	1.089	1.057			
87-88	0.572	1.162	1.049	0.996	1.124				
88-89	1.127	1.093	1.200	1.229					
89-90	1.557	1.077	1.250						
90-91	1.715	1.907							
92-93	2.982								
Average	1.707	1.413	1.260	1.012	1.054	0.984	0.975	1.004	
Avg. Exc Hi-Lo	1.679	1.366	1.198	0.976	1.056	0.979			
Avg. Last 3	2.084	1.359	1.166	1.043	1.064	0.984	0.975	1.004	
Selected	2.084	1.413	1.260	1.043	1.064	0.984	0.975	1.004	1.000

Claim Development Factors

12-ult	24-ult	36-ult	48-ult	60-ult	72-ult	84-ult	96-ult	108-ult
3.970	1.905	1.347	1.070	1.025	0.963	0.979	1.004	1.000

HEALTHY HOSPITAL GROUP (HHG)

Derivation of Claim Development Factors

Number of Claims
(Based on HHG Data)

Year	12 mths	24 mths	36 mths	48 mths	60 mths	72 mths	84 mths	96 mths	108 mth	Ult
84-85		431	615	692	781	776	806	819	830	913
85-86	86	246	354	455	474	503	518	523		530
86-87	76	191	413	475	498	505	528			535
87-88	28	205	404	491	543	569				590
88-89	58	226	414	492	522					543
89-90	132	321	511	588						630
90-91	123	284	515							610
91-92	146	321								560
92-93	79									184

Exhibit_3b

Link Ratios — Number of Claims

Year	12-24	24-36	36-48	48-60	60-72	72-84	84-96	96-108
84-85		1.426	1.124	1.129	0.995	1.038	1.016	1.014
85-86	2.852	1.437	1.288	1.040	1.063	1.028	1.011	
86-87	2.500	2.163	1.151	1.048	1.014	1.045		
87-88	7.250	1.972	1.213	1.107	1.047			
88-89	3.902	1.831	1.188	1.060				
89-90	2.441	1.590	1.152					
90-91	2.310	1.811						
92-93	2.204							

Selected Average of Link Ratios (avg. last 3 years)

12-24	24-36	36-48	48-60	60-72	72-84	84-96	96-108	108-ult**
2.318	1.744	1.184	1.072	1.041	1.037	1.013	1.014	1.100

**Assumed Tail Factor

Claim Development Factors

12-ult	24-ult	36-ult	48-ult	60-ult	72-ult	84-ult	96-ult	108-ult
6.263	2.701	1.549	1.308	1.220	1.172	1.130	1.115	1.100

Exhibit_4

HEALTHY HOSPITAL GROUP (HHG)

Present Value Calculations

Interest Rate = 7.00%
(Based on Industry Data)

Period mths	Percent Paid in Period	Percent Unpaid at beginning of period	Present Value of Payments in Period	Average discount Factor for Remaining Payments at Beginning of Period
00-12	1.5%	100.0%	1.5%	72.9%
12-24	8.5%	98.5%	7.7%	77.7%
24-36	11.5%	90.0%	9.7%	81.2%
36-48	15.0%	78.5%	11.8%	84.4%
48-60	20.0%	63.5%	14.8%	87.2%
60-72	15.0%	43.5%	10.3%	88.7%
72-84	12.5%	28.5%	8.1%	90.4%
84-96	8.0%	16.0%	4.8%	91.5%
96-108	4.0%	8.0%	2.3%	92.4%
108-120	2.5%	4.0%	1.3%	94.3%
120-132	1.5%	1.5%	0.7%	96.7%

Simulation of Aggregate Claims in a one year period

Model Assumptions

1.Average Claim Cost = US$ 134,824
2. Average Number of claims = 614 p.a.
3. Claim Frequency has Poisson distribution, mean 614.
4. Claim size has lognormal distribution, based on mean and standard deviation of average claim costs 84-92 per Exhibit_1.

Results:

The results of 500 trials suggested the following confidence intervals for aggregate claims:

Mean = $ 82,682,516

Confidence Level:	Aggregate Claims:
70%	84,538,981
80%	85,742,339
90%	87,282,854
95%	88,438,638

Suggested Captive Funding Level for 93/94:

At 90% confidence level, discounted at 7% p.a. per Exhibit 4:

87,282,854 x 0.729 = US$ 63,629,000

HHG -
Analysis of Proposed Cover and Risk Consultants' Report

1). Consider Purpose and Use of Report:

Most supporting reports for US HPL (including the example shown) are commissioned by the insured hospital group to assess its own insurance needs. They are often aimed at assessing reserve levels for self insured retentions (for past and future years) taking full credit for investment income. This may be totally satisfactory from the insured's perspective, as any funding deficit can be smoothed over time.

For an excess insurer the assumptions used in such a report may be inappropriate in pricing prospective cover. In the attached example this is mentioned in section 2.1 of Getrich & Quick's report. The detailed procedures which may differ for the pricing of Eurostate's proposed layer are discussed below.

2). Consider Reputation and Ownership of the Report's Author:

In this case the report has been done by risk consultants who are owned by the broker. A report performed by a reputable independent firm of consulting actuaries would clearly be more desirable, but given it would still have been commissioned by the insured any assumptions made must be carefully scrutinised.

3). How up to date is the report?

The attached report appears to be somewhat out of date as the most developed years seems to equate to mid 1993. Clearly the most up to date information possible should be used. The report is also not dated - it would be desirable to know when it was prepared.

4). Level of detail of the report:

The attached report is of a very brief summarial nature, containing no explanation of the methods used, or a discussion of the assumptions made. Section 1.2 refers to a previous more detailed report, a copy of which should be obtained.

5). Key Assumptions:

i) Incurred Loss Development Pattern

The incurred development model selected by he consultants was tested against the actual data by comparing the actual incurred as a percentage of the projected ultimate claims against the model. The results for numbers of claims and average claim amounts are shown in the attached Exhibits A-D. The graphs suggest that the development models used by Getrich and Quick are reasonable, and could even be slightly conservative compared with the average of the historical development patterns.

It should be noted that this analysis assumes that the tail factors used by G&Q are reasonable. Industry or other data for similar hospitals should be investigated to check these factors are acceptable. A sensitivity analysis could include altering the tail factors to some extent.

ii). Claims Inflation

The G&Q report was not performed for the purpose of rating the 94/95 cover. An allowance for inflation needs to be made to adjust historic claims to their "equivalent" values if they occurred during the period of the 94/95 cover.

Exhibit G indicates the effect of indexing the projected ultimate average claims at 7.5% p.a. This substantially increases the average claim cost (the average of policy years incepting in 84 to 91 increasing by 63% from $134,824 to $219,392).

Various rates of inflation should be investigated in a sensitivity analysis (e.g 5%, 10%, 12.5%) as it is difficult to estimate an accurate historic rate of inflation for any given hospital group.

Industry · medical cost inflation factors are available, and suggest that 7.5-10% is not unreasonable over the period concerned.

iii) Exposure Trend

Exhibits E and F indicate the trend in historic exposures (usually measured in occupied bed equivalents). For this hospital group, the situation is unusual in that the effective exposure has decreased historically. Factoring this into the premium rates for 94/95 offsets the inflation effects (as shown in Exhibit G).

For many programmes, the exposure tends to increase systematically over time. This is often ignored by underwriters in setting rates, potentially leading to underpricing.

It should also be noted that other exposure factors (such as number/duration of visits by visiting attending physicians) are often converted to occupied bed equivalents by various rules of thumb. This may not be material if the exposure due to such factors is relatively small, but care is needed if the hospital group is non-standard (e.g. has a large emergency room or blood bank).

iv). Discount Rate/Payout Pattern

The present value calculations shown in G&Q Exhibit 4 are based on an industry pattern. If paid development data is available this should be used to assess the appropriateness of this pattern. Sunset clause restrictions (discussed below) are likely to reduce the effective payout term resulting in a reduction of potential investment income.

The interest rate used in G&Q's report of 7% may not be a reasonable "risk free" rate of return, and a sensitivity analysis should incorporate the effect of different interest rate assumptions (although these should be related to the inflation rate used).

Many underwriters do not like incorporating an investment discount into their rates, but it is important to assess the magnitude of the likely investment income in assessing profit margins and target loss ratios.

v. Effect of Sunset Clause

The calculations in Exhibit G include adjustments for a 4 year or 7 year sunset clause. The adjustments assumed that the occurrence patterns for claim numbers developed by G&Q could simply be capped at 4 years or 7 years to allow for a sunset clause. In practice, the existence of such a clause may alter reporting patterns, as the insured will have an incentive to report all claims before any coverage limitation takes effect.

vi) Confidence Intervals

The "confidence" intervals shown in G&Q Exhibit 5 arguably do not reflect the true variance in the system, as the parameters themselves are estimates which are subject to a large element of uncertainty. In this example, a rating assessment of the proposed cover can be made by looking at expected costs in conjunction with a sensitivity analysis.

If simulation methods are used it may be appropriate to vary the parameter assumptions used in the selected distributions, thus giving a more realistic impression of the potential variability in loss costs.

6). Conclusions

The calculations in Exhibit G suggest an average claim cost of $11.8 million (with a 7 year sunset), or $4.3 million (with a 4 year sunset). Given the insured is only prepared to pay $2 million (less brokerage) it appears unlikely that a deal can be struck. However, the projections in Exhibit G suggest that the losses to the proposed cover may be reducing over the more recent years' (the average of the "4 year" sunset projections over the past 5 years is zero!)

After performing a sensitivity analysis and looking at the more recent years' experience it may be possible to offer terms on the 4 year sunset basis approaching those required by the insured.

EPILOGUE:

Before further work was completed, Quinten phoned the actuarial department and told them to stop any further work on HHG. Vic had phoned in to say that cover of $50 million excess $100 million had been placed 100% for $1 million premium with the Allrisk Insurance Company (a large and rapidly expanding competitor).

HEALTHY HOSPITAL GROUP (HHG)

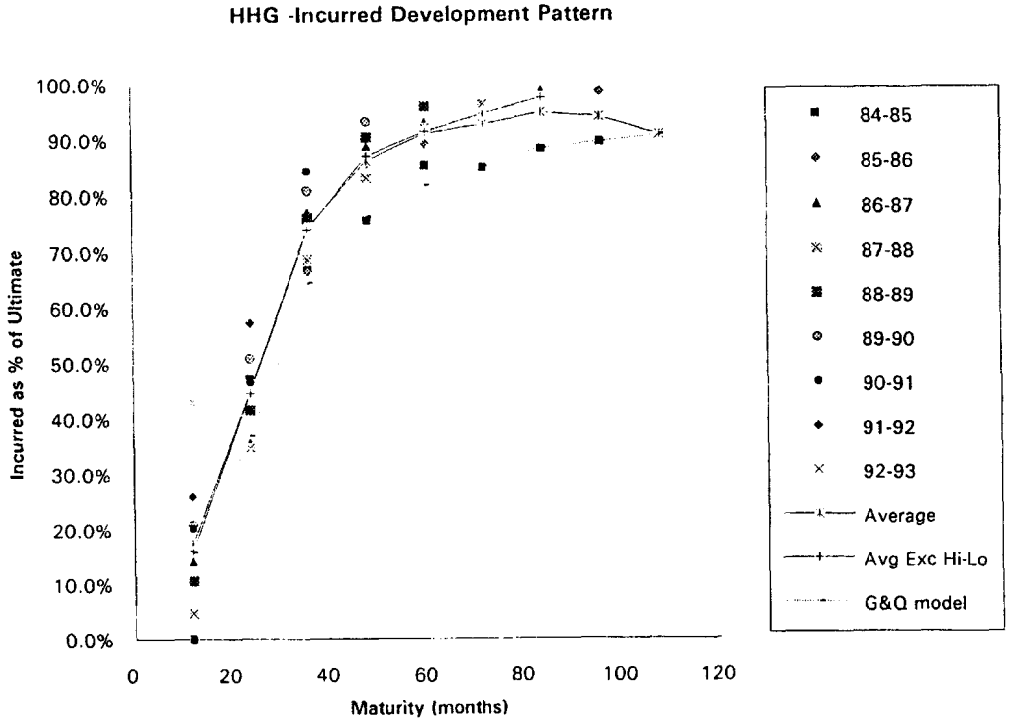
Exhibit_A

Derivation of Claim Development Factors

Number of Claims
(Incurred as % of Ultimate)

Year	12	24	36	48	60	72	84	96	108
84-85	0.0%	47.2%	67.4%	75.7%	85.5%	85.0%	88.3%	89.7%	90.9%
85-86	16.3%	46.4%	66.6%	85.8%	89.3%	94.9%	97.6%	98.6%	
86-87	14.3%	35.7%	77.3%	88.9%	93.1%	94.4%	98.7%		
87-88	4.8%	34.8%	68.6%	83.2%	92.1%	96.4%			
88-89	10.7%	41.6%	76.3%	90.6%	96.0%				
89-90	20.9%	50.9%	81.0%	93.3%					
90-91	20.2%	46.6%	84.4%						
91-92	26.0%	57.3%							
92-93	43.1%								
Average	17.4%	45.1%	74.5%	86.3%	91.2%	92.7%	94.8%	94.2%	90.9%
Avg Exc Hi-Lo	16.2%	44.8%	74.1%	87.1%	91.5%	94.7%	97.6%		
G&Q model	16.0%	37.0%	64.6%	76.5%	81.9%	85.3%	88.5%	89.7%	90.9%

Exhibit B


HHG -Incurred Development Pattern
Incurred as % of Ultimate
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0
20
40
60
80
100
120
Maturity (months)
84-85
85-86
86-87
87-88
88-89
89-90
90-91
91-92
92-93
Average
Avg Exc Hi-Lo
G&Q model

HEALTHY HOSPITAL GROUP (HHG)

Exhibit_C

Derivation of Claim Development Factors

Average Cost per Claim
(Incurred % of Ultimate)

Year	12	24	36	48	60	72	84	96	108
84-85		30.4%	66.2%	113.6%	107.7%	110.1%	101.0%	99.6%	100.0%
85-86	31.3%	62.0%	98.7%	109.5%	107.8%	105.6%	103.3%	99.6%	
86-87	44.8%	90.2%	79.9%	98.6%	89.2%	97.1%	102.6%		
87-88	132.9%	76.0%	88.4%	92.7%	92.4%	103.8%			
88-89	53.7%	60.6%	66.2%	79.4%	97.5%				
89-90	44.6%	69.5%	74.8%	93.5%					
90-91	22.7%	38.9%	74.2%						
91-92	17.6%	52.5%							
92-93	25.2%								
Average	46.6%	60.0%	78.3%	97.9%	98.9%	104.1%	102.3%	99.6%	100.0%
Avg Exc Hi-Lo	37.0%	59.9%	76.7%	98.6%	99.2%	104.7%	102.6%		
G & Q Model	34.9%	63.5%	81.0%	90.7%	95.6%	98.0%	99.1%	99.6%	99.8%

Exhibit_D

HHG - Average Cost Per Claim Development

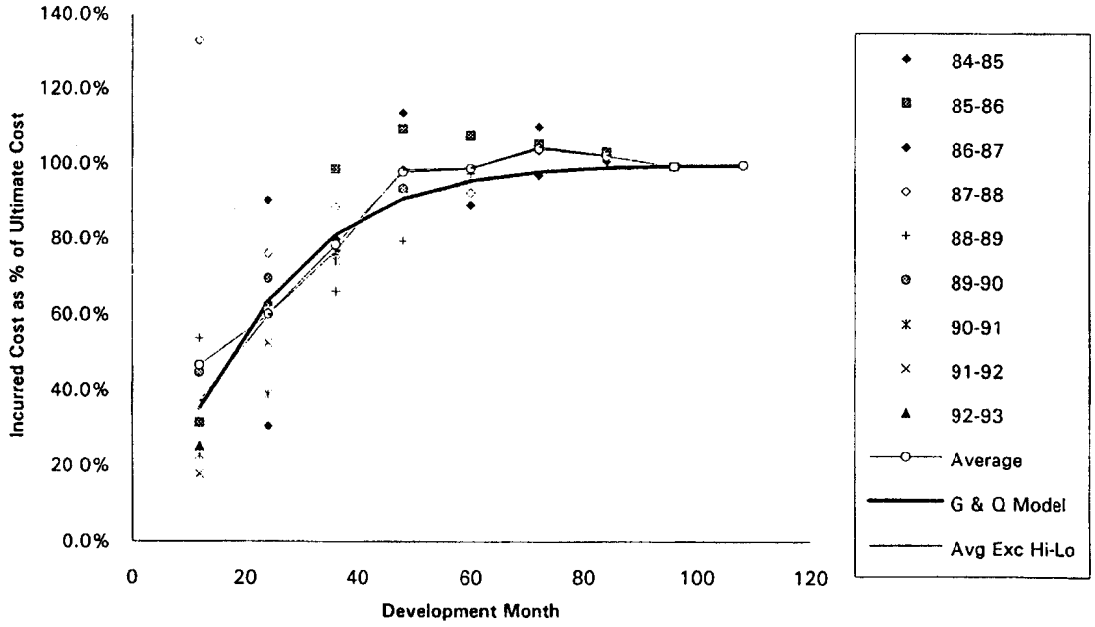


Exhibit E

HEALTHY HOSPITAL GROUP (HHG)

Exposure Data

Year		Occupied Beds		Fitted Trend
84-85	84	1,812		1,814
85-86	85	1,775		1,775
86-87	86	1,746		1,736
87-88	87	1,697		1,697
88-89	88	1,644		1,658
89-90	89	1,623		1,619
90-91	90	1,575		1,580
91-92	91	1,544		1,541
92-93	92	1,504		1,502
93-94	93	1,500	Estimate	1,463
94-95	94	1,500	Estimate	1,424

Average 84-92 1,658

Linear Fit for data 84/85 to 92/93: Intercept 5,091.24
Slope (39.02)

Exhibit F

HHG - Fitted Exposure Trend

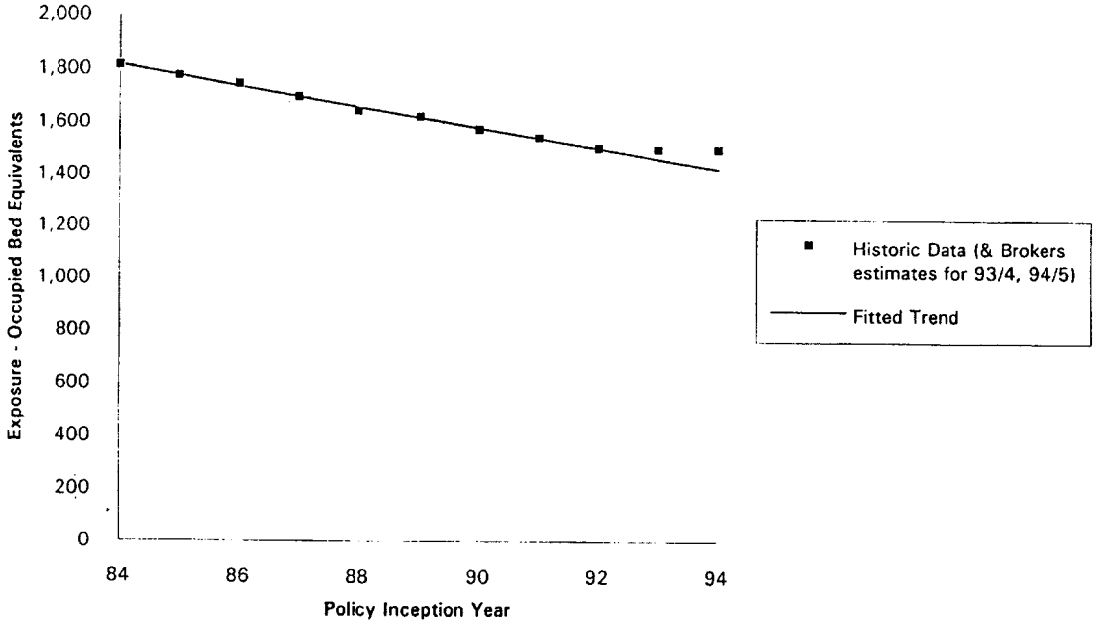


Exhibit G

HHG - Analysis of Projections

Year	Uninflated Average Cost $	Inflation Index	Inflated Average Cost	Exposure: Occupied Beds (Fitted Trend)	Inflated Average Cost per 94/5 Exposure	Projected Number of Claims 7 Year Sunset	Projected Number of Claims 4 Year Sunset	Projected Ultimate Claims 7 Year Sunset	Projected Ultimate Claims 4 Year Sunset	Losses to $20m xs $100m 7 Year Sunset	Losses to $20m xs $100m 4 Year Sunset
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
84-85	106,771	2.061	220,058	1,814	172,722	806	692	139,231,724	119,446,163	20,000,000	19,446,163
85-86	154,874	1.917	296,931	1,775	238,183	518	455	123,284,120	108,463,078	20,000,000	8,463,078
86-87	158,906	1.783	283,405	1,736	232,443	528	475	122,613,974	110,451,194	20,000,000	10,451,194
87-88	143,308	1.659	237,755	1,697	199,486	590	491	117,612,874	97,894,278	17,612,874	0
88-89	143,761	1.543	221,867	1,658	190,537	564	492	107,368,722	93,771,839	7,368,722	0
89-90	115,214	1.436	165,404	1,619	145,470	681	588	99,025,236	85,582,118	0	0
90-91	128,617	1.335	171,764	1,580	154,795	705	610	109,207,988	94,382,517	9,207,988	0
91-92	127,144	1.242	157,950	1,541	145,951	767	663	111,999,239	96,794,843	11,999,239	0
92-93	149,596	1.156	172,877	1,502	163,894	439	379	71,930,838	62,165,906	0	0
93-94				1,463							
94-95				1,424							
Average (Exc. 92-93)	134,824		219,392					116,292,985	100,848,254	11,798,758	4,262,271

Column (1) From G&Q Exhibit 2
Column (2) = Compounded inflation factors of 7.5% p.a. to 94/95 values
Column (3) = (1) * (2)
Column (4) From Exhibit E
Column (5) = Column (3) / Column (4) * 94-95 Exposure
Column (6) From G&Q Exhibit 3a/b , limiting devlopment to 84 months
Column (7) From G&Q Exhibit 3a/b , limiting devlopment to 48 months
Column (8) = (5) * (6)
Column (9) = (5) * (7)
Column (10) = $20m xs $100m applied to losses in Column 8
Column (11) = $20m xs $100m applied to losses in Column 9