Some Thoughts on Strategies for the Management of the Monthly Medical Insurance Valuation Process

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Introduction

In a world of perfect data and perfect models, actuarial liability calculations would not be subject to restatements.

In a 2009 Society of Actuaries' monograph by Chadick, Campbell and Knox-Seith (Chadick), a detailed comparison of various medical liability (IBNR) calculation methods is made. Chadick shows that, based on their statistical analysis, there will almost always be some restatement. Chadick states: "Finally, it is important to note that ultimately the best method or combination of methods to use in a particular situation may be dependent upon factors and actuarial judgment that cannot be tested through a scientific model (Chadick, page 6). While management may continually inquire about the level of restatement, the actuary is aware that restatements will not go away. This paper's focus is on the management of the IBNR process.

This paper is organized as follows:

- The problem of IBNR restatement is discussed;
- An outline of a management process of IBNR is shown;
- The issue of how many models to use in an IBNR calculation is analyzed;
- An example showing how recent market changes need to be incorporated into monthly IBNR calculations is presented.

Discussion of the problem

Chadick shows the following results for some of the models he tested (Chadick, pages 47,49):

Exhibit I
Sample Results – Major Medical
Mean Error

IBNR Methods	Base Scenario	Excessive Trend	Varying Trend & Single Rate Increase	Varying Trend & Rolling Rate Increase	Steady Member Loss	WorkDay Seasonality	Seasonality of beginning CY loss	Seasonality of ending CY loss
LossRatio	0.2%	0.4%	16.8%	9.2%	-0.2%	-16.2%	-13.9%	52.5%
PMPM	-6.5%	-10.9%	13.3%	13.3%	-10.6%	-22.6%	-26.1%	49.3%
Paid PMPM	3.7%	3.4%	10.6%	10.6%	4.7%	0.9%	9.7%	-0.4%
Benktander	6.2%	6.0%	6.3%	6.5%	6.7%	5.7%	7.9%	5.5%
Bornhuetter	4.4%	4.3%	5.5%	6.0%	4.6%	2.4%	12.2%	2.9%
Credibility Weighted	5.5%	6.1%	5.4%	6.3%	6.7%	3.9%	10.5%	4.2%
Hybrid Loss Ratio	1.8%	1.6%	2.0%	2.7%	2.3%	-0.3%	9.5%	0.2%
Lag - 12 Mo Avg	6.1%	6.0%	6.1%	6.1%	6.5%	6.1%	6.4%	6.2%
Lag - 9 Mo Avg	6.6%	6.4%	6.6%	6.6%	7.0%	6.6%	6.8%	6.6%
Lag - 6 Mo Avg	6.7%	6.5%	6.8%	6.8%	7.4%	6.8%	7.0%	6.8%
Lag - 3 Mo Avg	7.8%	7.5%	7.8%	7.8%	8.8%	7.8%	8.1%	7.8%
Lag - Cross Incurral	-0.1%	-5.3%	0.7%	0.7%	14.8%	-0.1%	0.3%	-0.2%
Lag - Dollar Weighted	4.2%	4.1%	4.2%	4.2%	4.5%	4.2%	4.5%	4.2%
Lag - Drop Extremes	2.0%	1.8%	2.0%	2.0%	2.5%	2.1%	2.4%	2.0%
Lag - Geometric Avg	5.6%	5.5%	5.7%	5.7%	6.1%	5.7%	5.9%	5.7%
Lag - Harmonic Avg	4.7%	4.6%	4.7%	4.7%	5.2%	4.7%	5.0%	4.7%
Stochastic Method	2.0%	2.0%	3.6%	3.6%	1.5%	-0.2%	9.6%	-1.3%

Exhibit II
Sample Results – Major Medical
Standard Deviation

IBNR Methods	Base Scenario	Excessive Trend	Varying Trend & Single Rate Increase	Varying Trend & Rolling Rate Increase	Steady Member Loss	WorkDay Seasonality	Seasonality of beginning CY loss	Seasonality of ending CY loss
LossRatio	10.9%	10.5%	12.3%	11.7%	12.1%	9.8%	10.5%	16.3%
PMPM	13.9%	13.4%	14.5%	14.5%	15.0%	13.7%	15.1%	16.7%
Paid PMPM	19.0%	18.4%	19.9%	19.9%	20.6%	14.2%	17.9%	16.2%
Benktander	21.2%	21.0%	21.3%	21.3%	21.9%	21.0%	21.8%	21.3%
Bornhuetter	18.5%	18.2%	18.7%	18.8%	19.5%	18.0%	20.1%	18.4%
Credibility Weighted	18.8%	21.1%	18.4%	18.6%	21.8%	18.8%	20.9%	19.8%
Hybrid Loss Ratio	18.5%	18.3%	18.6%	18.7%	19.3%	18.0%	20.0%	18.4%
Lag - 12 Mo Avg	22.2%	22.1%	22.3%	22.3%	22.7%	22.2%	22.6%	22.5%
Lag - 9 Mo Avg	22.3%	22.2%	22.3%	22.3%	22.9%	22.3%	22.6%	22.5%
Lag - 6 Mo Avg	23.4%	23.2%	23.5%	23.5%	24.2%	23.4%	23.8%	23.6%
Lag - 3 Mo Avg	26.5%	26.3%	26.6%	26.6%	27.4%	26.4%	26.9%	26.7%
Lag - Cross Incurral	19.9%	18.7%	20.1%	20.1%	24.1%	19.9%	20.3%	20.2%
Lag - Dollar Weighted	21.9%	21.7%	21.9%	21.9%	22.5%	21.8%	22.2%	22.2%
Lag - Drop Extremes	21.7%	21.6%	21.7%	21.7%	22.2%	21.6%	22.0%	21.9%
Lag - Geometric Avg	22.1%	22.0%	22.1%	22.1%	22.7%	22.1%	22.4%	22.3%
Lag - Harmonic Avg	21.9%	21.8%	21.9%	21.9%	22.5%	21.9%	22.2%	22.1%
Stochastic Method	16.5%	16.3%	16.9%	16.9%	17.1%	16.1%	18.0%	16.1%

The best results shown are a 0.2% mean error with a 10.9% standard deviation. Thus, if IBNR is estimated as $1,000,000 in the Base Scenario, we are approximately 95% confident that our IBNR will fall between $782,000[1]and $1,218,000[2].

We cannot say in a balance sheet that IBNR is between $782,000 and $1,218,000. We need to put one number in the balance sheet. We most probably would put in the $1 million best estimate plus margin. To summarize the problem – "You can't put a confidence interval in a balance sheet."

[1] $782,000=$1,000,000*(1-2*10.9%)
[2] $1,218,000=$1,000,000*(1+2*10.9%)

Management of IBNR process

In a recent article titled "The Actuarial Profession and Complex Models: Knowing the Limits of Our Knowledge", Kurt Wrobel discusses how the following three issues are affecting the actuary's work:

- Easy Access to Data and Software Tools
- Increasing Expectation of the Usefulness of Data
- Environmental Change

We discuss these issues and how they apply to the valuation actuary.

Easy Access to Data and Software Tools

Wrobel states: "With the remarkable progress in software and access to data, companies have effectively democratized data analysis across large organizations giving access to a significant number of individuals with less intensive statistical training and without the same degree of professionalism applied to impartial data analysis" (Wrobel, page 5).

Some models developed to check the models used by the valuation actuary may have specific objectives of either lowering or increasing IBNR. We learned from Jim Mange, FSA, MAAA, that "All [actuarial] models are wrong, some models are useful." The inherent approximation in actuarial models makes it more difficult to determine if non-actuarial models lack predictive value. In addition, these models may be presented to the actuary in the short timeframe (sometimes 3 to 5 business days) in which the actuary need to calculate monthly IBNR. For the actuary, two key management strategies to deal with this phenomenon are the following:

- Better documentation of the actuarial IBNR model. The key is that the actuaria models and IBNR calculations are explained to the proper audience. For instance, if a competitive non-actuarial model is built on the bases that the actuarial IBNR model does not adequately explain recent changes in claim payment patterns, it is up to the actuary to show how the actuarial model (or actuarial judgment) accounts for this. A key for the explanation is for the actuary to explain uncertainty in non-technical terms.
- Usually, in the days where the actuary is not calculating month-end IBNR, the actuary has some more time to review alternative models. The actuary should use these days to review these alternative models.

Increasing Expectation of the Usefulness of Data

With increased data availability, the argument goes, the actuary should be able to keep reducing the amount of restatement. As we are discussing, this is often not the case due to factors outside the actuarial models.

Environmental Change

Environmental change in a medical insurance setting can fall into four broad categories: claim costs, claim processing membership, and financial.

- Claim trend changes – In the past, the most common assumption was that claim costs increase over time. With some products, claim costs are actually staying constant, or in some instances decreasing, over time. An example of claim costs decreasing is when the government mandates fee reductions to government sponsored programs, such as with Medicaid or Medicare in the United States. Note that, for IBNR calculation purposes, the change in trend could cause more IBNR calculation issues than actual trend. Thus, a 0.5% constantly increasing monthly medical cost is easier to use in a valuation model than trend that is changing.

- Claim payment fluctuations – With the introduction of new systems or new claim forms, there could be changes in the speed at which claims are paid. What often happens is that claims at first are paid slower with the new system, and when the new system is fully operational, claims are paid quicker with the new system than they were paid with the old system. A valuation model which assumes constant claim payments might not pick up these changes.

- Membership changes – Often IBNR models assume a constant demographic mix in blocks in which IBNR is calculated. As members move in and out of blocks on which IBNR is based, the monthly claims costs change. If it is gradual, it may be hidden in the underlying trend. However, a rapid shift from one month to the subsequent month may not be picked up without the actuary having the market knowledge that the shift is occurring.

- Financial – Financial issues include capital requirements and asset-liability matching. These issues are not developed in this paper.

Wrobel concludes his article by stating: "…I … think [that] our profession has an obligation to clearly articulate the limits and potential variation in our predictions of complex systems" (Wrobel, page 8).

Improvements to IBNR Calculations

We as actuaries have the goal of improving our IBNR calculations. We first discuss some key points on this topic and then have a larger discussion on how to divide data.

Key points to consider when working on change are the following:

- The first area to improve on is data weaknesses that can be relatively easily upgraded. For instance, if your membership data that you use is three weeks old when you are developing monthly IBNR, you may inquire to see if you can get more current membership data. As another example, additional inquiries to claims management may increase knowledge on catastrophic claims.
- If you are currently using one model, you may want to add one or more additional models to get a range of IBNR values. Some keys to consider in choosing additional models are the following:
    - No model is perfect; thus more models may make IBNR more uncertain.
    - Additional models should hopefully add insight to areas of uncertainty. For instance, if the uncertainty is concentrated in the current months (which is often the case), adding a model to go from 3 years of trend to 5 years of trend will most probably not add much to your IBNR calculations.

Changes need to be documented and have to be proven to have better predictive value. Time and resource planning need to be done to effectively manage material changes.

Note that, for an introduction to statistical methods underlying IBNR calculations, one may reference the work by Gamage and others.

How fine do you divide your data?

If, for every time a new product is introduced, at least one IBNR model is introduced, the risk is that there would be numerous models with data that is sparse or non-credible. In this section, we discuss strategies for determining the appropriate number of divisions in a business for monthly IBNR calculations. Let's discuss the following example: You have medical business with 4 different benefit plans for which you have to report monthly results by 5 types of service (inpatient, outpatient, physician, prescription drug, and dental). As a first way for calculating IBNR, you can have 20 different full models (4 regions x 5 different benefits). However, this may not be the optimal way, both from a time and predictability perspective, to calculate IBNR.

If prescription drugs are paid at point-of-service (automatically billed when the member is in the pharmacy or when the prescription is dispensed through mail-order service), then all claims are paid in the current month. If IBNR is set at the end of the month, then IBNR should be zero or close to zero. One would not need a complete pharmacy model for IBNR. In fact, since prescription drug claims complete differently than for the other types of service, it may be most appropriate to have a real simple model for prescription

drugs, where the IBNR would be for claim anomalies and the relatively few paper claims. Thus, from 20 models, we are now down to 17 (one prescription drug model for all regions).

We are assuming that if we do not calculate IBNR for one of the 20 items listed, we would calculate IBNR for a group of these 20 and then allocate by membership.

For the other types of service, the key items to review in combining lags are the following:

- Size
- Similarity in Completion Factors
- Market Knowledge

Size

An IBNR calculation that is too small may be affected too much by changes in claim payments or large claims. For IBNR calculations that are at least a certain size, they may be too big to be aggregated. For instance, two IBNR calculations that each represent 0.1% of the total IBNR, with similar completion factor patterns, could most probably have their IBNR calculated together and then allocated to the two blocks of business. On the other side of the spectrum, the risk of losing market knowledge would most probably be greater that the computational efficiency if you combine to models that represent 30% and 40%, respectively, of your business.

Similarity in Completion Factors

If completion factors are similar, we can get better predictability. The more divergent the completion factors, the less beneficial it would be to combine models. Two factors that lead to different sets of completion factors are different types of service and claims processed on different claim platforms.

Let's look at the following example:

Exhibit III
Example of Combining Blocks of Business
Different Completion Factors - Blocks Separated

Block 1

Incurred Month	Members	Paid through Feb 2012	Completion Factor	IBNR
Feb-12	5,000	$100,000	10%	$900,000
Jan-12	5,000	600,000	60%	400,000
Dec-11	5,000	800,000	80%	200,000
Nov-11	5,000	900,000	90%	100,000
Oct-11	5,000	950,000	95%	50,000
Sep-11	5,000	1,000,000	100%	-
Total		**4,350,000**		**1,650,000**
	(1)	(2)	(3)	(4)=(2)/(3)-(2)

Block 2

Incurred Month	Members	Paid through Feb 2012	Completion Factor	IBNR
		$		$
Feb-12	20,000	200,000	20%	800,000
Jan-12	20,000	1,200,000	80%	300,000
Dec-11	20,000	1,600,000	90%	177,778
Nov-11	20,000	1,800,000	95%	94,737
Oct-11	20,000	1,900,000	98%	38,776
Sep-11	20,000	2,000,000	100%	-
Total		**8,700,000**		**1,411,290**

Exhibit IV
Example of Combining Blocks of Business
Different Completion Factors
Blocks Combined

Combined

Incurred Month	Members	Paid through Feb 2012	Completion Factor (Weighted Average)	IBNR	Comparison with the sum of individual models Dollar	%
Feb-12	25,000	$ 300,000	18%	$ 1,366,667	$ (333,333)	-24%
Jan-12	25,000	1,800,000	76%	568,421	(131,579)	-23%
Dec-11	25,000	2,400,000	88%	327,273	(50,505)	-15%
Nov-11	25,000	2,700,000	94%	172,340	(22,396)	-13%
Oct-11	25,000	2,850,000	97%	76,078	(12,697)	-17%
Sep-11	25,000	3,000,000	100%	-	-	
Total		**13,050,000**		**2,510,779**	**$ (550,511)**	***-22%***

We have Block 1 and Block 2, which could represent any of the non-pharmacy blocks in our example. Block 1 has lower completion factors than Block 2. We decide to combine these 2 blocks. We assume that the completion factors for the combined block is the weighted average (by membership) of the 2 blocks. With these models combined, overall IBNR is reduced by 22%. One needs to realize, that, when combining blocks that are not similar, you may not be dealing with calculations that can be easily added or subject to simple weighted averages.

Market Knowledge

When combining models, we may be able to see overall trend more clearly. However, one has to be careful not to lose market knowledge. For instance, catastrophic cases are almost always in inpatient claims. By combining inpatient and outpatient claims, we have the additional issue of catastrophic claims influencing outpatient IBNR, in addition to inpatient IBNR.

Trend and benefit changes often do not affect inpatient, outpatient, and physician costs evenly. For instance, an increase in physician deductible does not affect inpatient costs directly (although an increase in deductible can affect overall utilization, including inpatient utilization). Thus if we combine inpatient and physician costs in this example, we have less insight into this increase in deductible.

When combining blocks, one has to be certain that it makes sense from a business point of view. For instance, it may be advisable to keep the IBNR calculations separate for each state or country, even if the actuarial metrics suggest that they could be combined.

In summary, one may be able to improve both efficiency and predictability in IBNR calculations by combining blocks of business and types of service. However, market and product factors limit this reduction in IBNR models.

IBNR and Recent Market Changes

In addition to restatements, sometimes actuarial judgment may seem unnecessary and arbitrary to the non-actuary. Often the changes that we need to model are in recent months, where actuarial models have the least predictability. Therefore, in markets with significant change, actuarial judgment is a key component to increasing IBNR predictability and reducing future restatements.

Let's discuss the following. Let's assume that ABC Insurance Company had the exact payments shown below in all months of 2011. As shown, the total IBNR is calculated as $1,650,000. In addition, let's assume that ABC uses a trend model to predict the most recent two months and completion factors for subsequent months.

Exhibit V
Recent Month Example
2011 Paid Claims

Lag	Paid Every Month in 2011	Paid to date	Completion Factor	IBNR
0	$ 100,000	$ 100,000	10%	$ 900,000
1	500,000	600,000	60%	400,000
2	200,000	800,000	80%	200,000
3	100,000	900,000	90%	100,000
4	50,000	950,000	95%	50,000
5	50,000	1,000,000	100%	-
Total	**1,000,000**			**1,650,000**

If the payment for January and February 2012 is changed as highlighted/bold, what should IBNR be?

Exhibit VI
Recent Month Example
Claim Payment Changes in 2012

Lag	Paid Every Month in 2011	Paid in Jan 2012	Paid in Feb 2012
0	$ 100,000	$ 100,000	***$ 50,000***
1	500,000	***450,000***	***400,000***
2	200,000	200,000	200,000
3	100,000	100,000	***50,000***
4	50,000	50,000	50,000
5	50,000	50,000	50,000
Total	**1,000,000**	**950,000**	**800,000**

To answer the question, we need to look into what cause the reduction of payments. Below are 3 scenarios:

Scenario 1: Based on historical trend

By using our historical trend and completion factors, we assume that the lower paid claims in November and December are to factors causing lower utilization such as reduced influenza incidence. Thus we keep our January and February trend assumptions constants and have our lower incurred claims estimates for November and December, resulting in an IBNR of $1,781,944.

Exhibit VII
Recent Month Example
IBNR Based on Historical Experience

Lag	Month	Paid to Feb 2012	Completion Factor	Incurred Claims	IBNR
0	Feb-12	$ 50,000	trend override	$ 1,000,000	$ 950,000
1	Jan-12	500,000	trend override	1,000,000	500,000
2	Dec-11	750,000	80%	937,500	187,500
3	Nov-11	850,000	90%	944,444	94,444
4	Oct-11	950,000	95%	1,000,000	50,000
5	Sep-11	1,000,000	100%	1,000,000	-
Total					**1,781,944**

Scenario 2: 5% Claim Cost Decrease

If we knew that the reduced paid claims were caused by a 5% claim cost decrease effective November 1, then we would reduce our incurred claim estimates for January and February by $50,000 each. The total IBNR becomes $100,000 less than the IBNR in Scenario 1, or $1,681,944. We show this calculation as follows:

Exhibit VIII
Recent Month Example
Including Claim Cost Decrease in IBNR

Lag	Month	Paid to Feb 2012	Completion Factor	Incurred Claims	IBNR
0	Feb-12	$ 50,000	trend override	$950,000	$ 900,000
1	Jan-12	500,000	trend override	950,000	450,000
2	Dec-11	750,000	80%	937,500	187,500
3	Nov-11	850,000	90%	944,444	94,444
4	Oct-11	950,000	95%	1,000,000	50,000
5	Sep-11	1,000,000	100%	1,000,000	-
Total					**1,681,944**

Factors that can cause claim cost decreases include contracting, benefit, and morbidity changes.

Scenario 3: $50,000 in claim payment not processed for each month, November 2011 to February 2012

If the payment is down because of missing claims, we need to add them back as special adjustments. IBNR should be increased by $50,000 for both November and December 2011.

Exhibit IX
Recent Month Example
Fewer Claims Processed

Lag	Month	Paid to Feb 2012	Completion Factor	Special adj - missing claims	Incurred Claims	IBNR
0	Feb-12	$ 50,000	trend override	$ 50,000	$ 1,000,000	$ 950,000
1	Jan-12	500,000	trend override	50,000	1,000,000	500,000
2	Dec-11	750,000	80%	50,000	987,500	237,500
3	Nov-11	850,000	90%	50,000	994,444	144,444
4	Oct-11	950,000	95%		1,000,000	50,000
5	Sep-11	1,000,000	100%		1,000,000	-
Total						**1,881,944**

In our example, we see that recent market changes are precluding us from getting our target IBNR from historical models, without using actuarial judgment.

Conclusion

The key points that we discussed are the following:

- Calculating IBNR is more than just picking the best model that worked in the past;
- Choosing how to divide data can increase both the predictability and efficiency of IBNR calculations;
- Actuarial models based on historical claim payment patterns can be ineffective in estimating the effect of recent market changes.

While this paper did not introduce new actuarial models, it hopefully assists the practicing valuation actuary in the management of the IBNR process.

Finally, we need to remember that the following 2 phrases apply simultaneously when calculating IBNR:

> "All models are wrong, some models are useful."
>
> "You can't put a confidence interval into a balance sheet."

This is the challenge of monthly IBNR calculations.

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