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Calculation of IBNR Reserves with Low Variance

by Robert G. Lynch

The most common and persistent bugaboo for Chief Financial Officers of managed care and health insurance organizations is the month-to-month variation in calculated reserves for "Incurred But Not Yet Paid" (IBNP) claims. While a certain degree of real variation in these reserves is to be expected, it is the duty of the financial actuary to calculate as accurately as possible the amount to be expected. The achievement of this goal necessitates an understanding of the difference between the process variance, measured by the "standard deviation" of the underlying claim incurral and payment process, and the method variance, or "standard error", which is a characteristic of the measurement method.

Due to the heuristic nature of most of the calculation methods used by actuaries, a certain amount of method variance is to be expected. However, a critical evaluation of the most common methods used by actuaries practicing in health care finance shows that these methods yield, for the most part, a much higher error due to methodology than is necessary.

A re-examination of one of the basic properties of variance will reveal why the usual reserve calculation methods result in a high variance, and what will lower that variance. That key property is that variances are additive under additions, but increase polynomially under multiplication. That is, the variance of the sum of a collection of random variables is, in general, the sum of the variances of the individual variables, while multiplication of random variables increases variance in proportion to the square of the multiplying factor. (For ease of presentation here, I will assume that covariances are negligible.)

So, to keep the error variance to a minimum, one should seek to use methods that rely on the summation of data, and avoid methods which use or result in multiplicative factors. A prime example of this principle in statistics is the "Best (i.e., lowest variance) Linear Unbiased Estimator" of regression, which is derived by minimizing the sum of the squared errors.

As an aside here, I would point out that there are really two different flavors of multiplication. The first, "counting" multiplication, is actually shorthand for the addition of large numbers of identical quantities. Because it is really just puffed-up addition and keeps one argument firmly planted in the domain of the Integers, it is quite well-behaved. The second avatar of multiplication, the true algebraic operator, is often expressed as an application of ratios or percentages. It is this latter "evil twin" operator which can nefariously lead the unwary into a statistical quagmire.

If you have trouble with the concept of two different kinds of multiplication, I offer the allegory that, when walking in the jungle, there are two kinds of tigers, "Nice" and "Not-nice". The "Nice" kind of tiger is cute, cuddly, and pretty, as well as having a big belly and purring a lot because it just ate a nice fat pig. The "Not-nice" tiger hasn't eaten in several days, and you never see them because, by the time you do, you are already lunch. The two kinds of tiger may appear similar, but the circumstances of the encounter make a great deal of difference in the quality of the results.

The "textbook" method used by most actuaries to calculate IBNP reserves is the Completion Factor method, which is mathematically equivalent to the "Chain Ladder" and "Lag" methods. As anyone who has studied for SOA Exam 5 (or its predecessors) knows, this method is based on the calculation of the historical proportion of claims incurred in a given incurral period (usually the incurral month) and paid in that and any given succeeding period (usually the paid month), to the total incurred claims in the incurral period. This

ratio is the "completion factor". For a recent month, the incurred and paid claims are then multiplied by the reciprocal of the completion factor to give an estimate of the actual incurred claims in the incurral month. The total incurred claims are estimated by simply adding together the amounts calculated for each month up to the valuation date.

Since this process involves multiplying real data by a statistical parameter which is calculated using the subversive operator of multiplication (and is therefore itself a random variable), it is no surprise that the standard error of the result is quite high. Even though the SOA-approved text ("Group Insurance") on this topic recognizes that "Generally, months with completion factors lower than a [subjective] percentage are seen as non-credible estimates . . . " without identifying the root cause of the problem, this method remains the favored method by most actuaries.

Many CFOs, frustrated by the wild fluctuations in reserves produced by the Completion Factor method, have sought refuge and stability by turning to a different approach, which I will refer to as the Incurred Claims Per Member Per Month (Incurred PMPM) method. In this method, the average total incurred claims PMPM from historical (and supposedly complete) data is calculated, and trend is applied to project those amounts to recent months. Then this projected PMPM amount is multiplied by the number of member-months in the valuation period to yield the estimate of total incurred claim costs to be entered in the financials. (The "Loss Ratio" method is just a variant of this one.) The IBNP reserve is "backed-into" as an afterthought by subtracting the total incurred and paid claims amounts from this estimate of the total incurred claims amount.

This method gives a nice, stable projection of total incurred (or accrued) claims expenses, which is great comfort to CFOs, most of whom crave stability. However, for purposes of estimating incurred claims it totally ignores data on claims incurred and paid in recent months. Moreover, it inherently assumes a negative correlation between claims incurred and paid and claims incurred and not yet paid.

It is worthwhile scrutinizing the sources of variability in the process of claims incurral and payment to better understand what we are attempting to measure. People get sick, more-or-less at random, and, if they judge themselves to be sufficiently sick, seek out medical care by going to their doctor, or in some cases, the hospital emergency room. At that point they enter the complex world of the health care system, which provides them a selection of services or products which, hopefully, gets them well and back into their normal, healthy routine again. The amount and cost of this health care treatment can vary greatly in each case, depending on the presenting condition.

On the face of it, then, the actuary is concerned with dealing with these two largely random events: who gets sick how often, and how much does it cost?

However, between the point when the person (now a patient) enters the health care system, and the time when the paying party (e.g., the health insurer or HMO) actually cuts a check to the providers in the system to reimburse them for the expense of their services, a lot of things happen. And those things (let's call them "claims reporting and processing") usually take time (the "claim lag"). During the claim lag period, the value of those healthcare services (or at least the part for which the payer is liable) floats in the limbo of IBNP.

People get sick, more-or-less at random, and, if they judge themselves to be sufficiently sick, seek out medical care by going to their doctor, or in some cases, the hospital emergency room.

The problem from the actuary's point of view is that the amount of time involved in claims reporting and processing can vary a lot in a seemingly random manner, and may or may not relate to how many claims are floating around in the IBNP limbo, or how big they are.

Enter the IBNP calculation. The health care actuary applies the textbook Completion Factor method, because that is what he has learned and using it saves the bother of having to think too much ("If it's good enough for everybody else, then it's good enough for me!") Unfortunately, the Completion Factor method has an implicit, hidden assumption in it. That assumption is this:

The only source of variability in actual claims incurral is in the frequency and intensity of health care services (morbidity), and there is no variability in the rate of claims reporting and processing.

The actuary dutifully sends off his IBNP reserve report to the CFO every month, on the same day. The CFO, however, is incredulous of the actuary's reported reserve estimates, because from month to month they bounce around like a gerbil snacking on espresso beans. She knows this can't

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be right. She also knows that if her financial reports to the CEO and the board of directors don't resemble something approaching reality, she will be out on the pavement peddling pencils pretty promptly.

So the CFO thinks, "The health plan has a lot of members, and they don't all get sick at once. I will just project forward our past incurred PMPM claims using the trend rate I got from actuarial department (maybe they got that right, at least!), and book the difference as the IBNP reserve." She has unwittingly stumbled onto the "Incurred PMPM" method. Unfortunately, the Incurred PMPM method also has an implicit, hidden assumption in it. That assumption is this:

The only source of variability in how much is paid in claims each month is due to the claims reporting and processing, and there is no variability in actual member morbidity.

So which one is using the best IBNP estimator? The answer is neither!

As a result, when incurred and paid claim amounts exceed the expected incurred claims, the IBNP is truncated at zero.

The score is now tied: Actuaries minus 1 vs. Accountants minus 1.

The actuary can derive a much better (i.e., lower error variance) estimator by reviewing and using the information from his first actuarial exam (the one on mathematics and statistics). Rather than calculating a factor by which to multiply monthly incurred and paid claims, project a collection of several values, which can be summed together to give an unbiased estimator of the IBNP reserves.

I propose the "Projected Paid Lag PMPM" method. It goes something like this: For each incurral month i with j months of lag, project from historical data the average dollar amount per member incurred in month i, but not paid until j months later. After adjusting those amounts for trend, add them all together for all the corresponding i's and j's in the IBNP limbo, and add all those together for every member m in every month i. For ease of calculation in this last step, one can also just multiply by M_i, the number of members covered in month i, and then add all the M_i's together. (Note that this is the "Nice" kind of multiplication.)

In order to illustrate the differences in results between these three methods, I have prepared a comparison of IBNP estimates calculated using each, together with realized "look-back" IBNP amounts. These calculations are made on real data, which has been transformed to preserve confidentiality. The data has also been adjusted in volume to represent a constant exposure of 100,000 members. The data is divided into three sets. One set of data represents claims incurred and paid under coverage of a closed-panel, integrated health care delivery system (IDS) or managed care organization (MCO). The second data set represents claims for health care services from providers in a non-network setting, who have no connection to the payer organization, as would be the case with an indemnity or fee-for-service (FFS) health insurance plan. The third data set represents an open-panel, loosely held managed care plan, such as a point-of-service (POS) or preferred provider organization (PPO).

I show the calculated results for estimates of IBNP amounts for periods with zero claims payment run-out, 1 month, 2 months, and 3 months of run-out, respectively. Table 1 shows the results for the IDS/MCO model, Table 2 shows results for the FFS-type coverage, and Table 3 the results for the POS/PPO payer organization. Scattergram plots of estimated IBNP values versus actual IBNP values are shown in Figures 1, 2 and 3.

One item which becomes apparent in examining the estimated values of IBNP amounts using the Incurred PMPM method is that it is biased towards over-stating the actual IBNP. This tendency is most noticeable in the examples with some period of claims payment run-out. This estimator bias results from the fact that negative values of IBNP are not allowed for individual months. As a result, when incurred and paid claim amounts exceed the expected incurred claims, the IBNP is truncated at zero. Since this truncation does not occur when incurred claims are less than the projected estimate, the method produces a biased estimator.

Figures 4, 5 and 6 present a comparison of the standard error of estimation for each of the three methods, together with the sample standard deviation of the actual IBNP. It is apparent from these figures that the Paid PMPM method yields substantially lower error with no run-out of claims payment. As the claims payment run-out payment gets longer, the standard error of estimate for the Completion Factor and Paid PMPM methods converge, although the Paid PMPM method contin-

ues to have a smaller standard error at all lengths of claims run-out.

I summarize the characteristics of each these three methods in Table 4.

A logical next step might be to ask if a hybrid of these three methods might yield better results by moderating the inaccuracies of the assumptions implicit to each. I applied such mixed methods to the sample data, using the Paid PMPM and Incurred PMPM methods, respectively, for the final three months of claims incurral leading up to the valuation date, and using the Completion Factor method for periods more than three months prior to the valuation date. The results are summarized in Tables 1, 2, and 3, and are listed immediately below the results for the "Pure" Paid PMPM and Incurred PMPM methods, respectively.

In this example, the hybrid methods appear to generally give improved results over any of the three pure method estimators. In particular, the hybrid 3-Month Paid Claims PMPM method appears to consistently yield better results than any other estimation method. This is somewhat surprising in light of the fact that, even with 3 months of claims run-out, the pure Paid Claims PMPM method appears to out-perform the Completion Factor method. Rather than speculate here on the reasons for this apparent paradox (see my earlier disclaimer on covariance), I would invite anyone who cares to repeat this analysis on separate data to check for the reproducibility of this result.

I have also experimented with refining the Paid PMPM method further by regressing claims incurred and paid in specific lag months against cumulative claims incurred and paid in prior lag months. This process appears to generally yield better results than those obtained using a simple average of claims incurred and paid by lag month, since it at least partly takes into account the relation between claims incurred and paid and those not yet paid. Not too surprisingly, however, I have found that the degree of improvement depends on the quality of the data.

In conclusion, it is apparent that it is time to discard the Completion Factor method for estimating IBNP reserves as fundamentally flawed. While an approach such as the Completion Factor method may have been a practical necessity in the age of slide-rules and adding machines, its lack of mathematical soundness condemns it in the age of computers. It is not sufficient to resolutely memorize cookbook methods in much the same manner as 16th-century scholars clung to Aristotle and Galen as Holy Writ. "If it's good enough for everyone else, . . ." is the logical equivalent of ". . . because that's the way we've always done it!", which should raise the hackles of any true professional.

We must critically revisit and re-examine our basic methods for sound thought and sound mathematics, discarding out-dated and unsound methods when necessary, and replacing them with newer, well-founded analyses. Otherwise, we are bound to become merely an association of complacent, over-paid technicians, doomed to the same destiny as the Dodo and the dinosaurs.

There is always a better way, it is up to us to find it.

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Table 1
IBNP Estimates for Tighly-Held managed Care Organization or Integrated Healthcare Delivery System

	Zero Runout IBNP						1-Month Runout IBNP					
	Average Estimated IBNP			Standard Error of Estimate			Average Estimated IBNP			Standard Error of Estimate		
Method	Average Total IBNP $ (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	S.E. of Esxtimated IBNP * (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	Average Total IBNP $ (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	S.E. of Estimated IBNP * (x 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims
Actual IBNP	$7,991	100.0%	130.8%	$840	10.5%	13.7%	$3,563	100.0%	58.3%	$603	16.9%	9.9%
Completion Factor	$7,621	95.4%	124.7%	$1,515	19.0%	24.8%	$3,217	90.3%	52.7%	$790	22.2%	12.9%
Pure Paid PMPM	$7,745	96.9%	126.8%	$962	12.0%	15.7%	$3,293	92.4%	53.9%	$759	21.3%	12.4%
3-Month Paid PMPM	$7,652	95.8%	125.2%	$791	9.9%	12.9%	$3,142	88.2%	51.4%	$625	17.6%	10.2%
Pure Incurred PMPM	$8,818	$110.3%	144.3%	$1,111	13.9%	18.2%	$4,607	129.3%	75.4%	$1,271	35.7%	20.8%
3-Month Incurred PMPM	$7,707	96.4%	126.1%	$1,137	14.2%	18.6%	$3,348	94.0%	54.8%	$938	26.3%	15.3%

	2-Month Runout IBNP						3-Month Runout IBNP					
	Average Estimated IBNP			Standard Error of Estimate			Average Estimated IBNP			Standard Error of Estimate		
Method	Average Total IBNP $ (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	S.E. of Esxtimated IBNP * (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	Average Total IBNP $ (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	S.E. of Estimated IBNP * (x 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims
Actual IBNP	$2,076	100.0%	34.0%	$483	23.3%	7.9%	$1,339	100.0%	21.9%	$308	23.0%	5.0%
Completion Factor	$1,809	87.2%	29.6%	$603	29.0%	9.9%	$1,113	83.2%	18.2%	$398	29.7%	6.5%
Pure Paid PMPM	$1,808	87.1%	29.6%	$615	29.6%	10.1%	$1,134	84.7%	18.6%	$408	30.5%	6.7%
3-Month Paid PMPM	$1,724	83.0%	28.2%	$488	23.5%	8.0%	$1,064	79.5%	17.4%	$342	25.6%	5.6%
Pure Incurred PMPM	$3,332	160.5%	54.5%	$1,420	68.4%	23.2%	$2,804	209.5%	45.9%	$1,584	118.3%	25.9%
3-Month Incurred PMPM	$2,030	97.8%	33.2%	$870	41.9%	14.2%	$1,462	109.2%	23.9%	$723	54.0%	11.8%

* Sample standard deviation is shown for actual IBNP, rather than standard error.

Table 2
IBNP Estimates for Open Indemnity Type Health Insurance Carrier

	Zero Runout IBNP						1-Month Runout IBNP					
	Average Estimated IBNP			Standard Error of Estimate			Average Estimated IBNP			Standard Error of Estimate		
Method	Average Total IBNP $ (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	S.E. of Esxtimated IBNP * (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	Average Total IBNP $ (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	S.E. of Estimated IBNP * (x 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims
Actual IBNP	$11,084	100.0%	181.4%	$957	8.6%	15.7%	$5,930	100.0%	97.1%	$800	13.5%	13.1%
Completion Factor	$10,462	94.4%	171.2%	$2,910	26.3%	47.6%	$5,817	98.1%	95.2%	$1,170	19.7%	19.1%
Pure Paid PMPM	$11,219	101.2%	183.6%	$1,005	9.1%	16.5%	$5,935	100.1%	97.1%	$860	14.5%	14.1%
3-Month Paid PMPM	$11,137	100.5%	182.3%	$976	8.8%	16.0%	$5,822	98.2%	95.3%	$801	13.5%	13.1%
Pure Incurred PMPM	$13,463	$121.5%	220.3%	$3,000	27.1%	49.1%	$8,612	145.2%	141.0%	$3,140	53.0%	51.4%
3-Month Incurred PMPM	$11,232	101.3%	183.8%	$1,109	10.0%	18.2%	$6,145	103.6%	100.6%	$991	16.7%	16.2%

	2-Month Runout IBNP						3-Month Runout IBNP					
	Average Estimated IBNP			Standard Error of Estimate			Average Estimated IBNP			Standard Error of Estimate		
Method	Average Total IBNP $ (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	S.E. of Esxtimated IBNP * (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	Average Total IBNP $ (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	S.E. of Estimated IBNP * (x 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims
Actual IBNP	$3,728	100.0%	63.8%	$514	13.8%	8.8%	$2,634	100.0%	45.1%	$402	15.3%	6.9%
Completion Factor	$3,510	94.1%	60.1%	$692	18.6%	11.8%	$2,422	91.9%	41.5%	$517	19.6%	8.8%
Pure Paid PMPM	$3,821	102.5%	65.4%	$580	15.6%	9.9%	$2,651	100.6%	45.4%	$424	16.1%	7.3%
3-Month Paid PMPM	$3,525	94.6%	60.4%	$461	12.4%	7.9%	$2,427	92.1%	41.6%	$359	13.6%	6.2%
Pure Incurred PMPM	$6,670	178.9%	114.2%	$3,292	88.3%	56.4%	$5,785	219.6%	99.1%	$3,433	130.3%	58.8%
3-Month Incurred PMPM	$4,087	109.6%	70.0%	$933	25.0%	16.0%	$3,153	119.7%	54.0%	$997	37.8%	17.1%

* Sample standard deviation is shown for actual IBNP, rather than standard error.

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Table 3
IBNP Estimates for Open-Access POS or PPO Type of Health Plan

	Zero Runout IBNP						1-Month Runout IBNP					
	Average Estimated IBNP			Standard Error of Estimate			Average Estimated IBNP			Standard Error of Estimate		
Method	Average Total IBNP $ (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	S.E. of Esxtimated IBNP * (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	Average Total IBNP $ (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	S.E. of Estimated IBNP * (x 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims
Actual IBNP	$9,538	100.0%	159.6%	$801	8.4%	13.4%	$4,746	100.0%	79.4%	$641	13.5%	10.7%
Completion Factor	$9,196	96.4%	153.9%	$1,727	18.1%	28.9%	$4,542	95.7%	76.0%	$860	18.1%	14.4%
Pure Paid PMPM	$9,474	99.3%	158.6%	$841	8.8%	14.1%	$4,612	97.2%	77.2%	$713	15.0%	11.9%
3-Month Paid PMPM	$9,399	98.5%	157.3%	$679	7.1%	11.4%	$4,486	94.5%	75.1%	$598	12.6%	10.0%
Pure Incurred PMPM	$10,695	$112.1%	179.0%	$1,787	18.7%	29.9%	$6,144	129.5%	102.8%	$1,900	40.0%	31.8%
3-Month Incurred PMPM	$9,468	99.3%	158.4%	$872	9.1%	14.6%	$4,720	99.4%	79.0%	$779	16.4%	13.0%

	2-Month Runout IBNP						3-Month Runout IBNP					
	Average Estimated IBNP			Standard Error of Estimate			Average Estimated IBNP			Standard Error of Estimate		
Method	Average Total IBNP $ (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	S.E. of Esxtimated IBNP * (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	Average Total IBNP $ (X 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims	S.E. of Estimated IBNP * (x 1,000)	Percent of Actual IBNP	% of Avg Monthly Incurred Claims
Actual IBNP	$2,902	100.0%	48.6%	$412	14.2%	6.9%	$1,987	100.0%	33.2%	$292	14.7%	4.9%
Completion Factor	$2,678	92.3%	44.8%	$545	18.8%	9.1%	$1,782	89.7%	29.8%	$388	19.5%	6.5%
Pure Paid PMPM	$2,806	96.7%	47.0%	$462	15.9%	7.7%	$2,886	95.0%	31.6%	$319	16.0%	5.3%
3-Month Paid PMPM	$2,628	90.6%	44.0%	$371	12.8%	6.2%	$1,749	88.0%	29.3%	$278	14.0%	4.7%
Pure Incurred PMPM	$4,552	155.8%	75.7%	$2,021	69.6%	33.8%	$3,793	190.9%	63.5%	$2,140	107.7%	35.8%
3-Month Incurred PMPM	$3,000	103.4%	50.2%	$739	25.5%	12.4%	$2,239	112.7%	37.5%	$720	36.3%	12.1%

* Sample standard deviation is shown for actual IBNP, rather than standard error.

Table 4
Important Characteristics of the Completion Factor, Incurred Claims PMPM, and Paid Claims PMPM Estimators of IBNP and Incurred Claims

Characteristics of IBNP Reserve/Incurred Claims Estimation Method	IBNP Reserve/Incurred Claims Estimation Method		
	Completion Factor/ Chain Ladder	**Incurred Claims PMPM**	**Paid Claims PMPM**
Assumptions which are Implicit to the Respective Methods	Variation in paid claim amounts are dependent only on variations in morbidity and total incurred claim costs. Conversely, total incurred claim costs are dependent only on claim amounts incurred and already paid. Rates of claims reporting and processing are stable and constant.	Morbidity and total incurred claim costs are fully predictable solely from past claim costs, adjusted for trend, etc. Total incurred claim amounts for recent months are independent of claims incurred for the same period and already paid (except when the latter is the greater).	Claim dollar amount incurred, but not yet paid are equal to past average PMPM paid amounts with similar lags, adjusted for trend, etc. Claim amounts are incurred, but not yet paid are independent of claim amounts incurred and already paid.
Error variance of IBNP estimate associated with respective methods	Very High	Moderate	Low
Error variance of Incrred Claim estimate associated with respective methods	Very High	Low	Low
Bias of IBNP and Incurred Claim estimator	Unbiased	Produces estimates biased towards the high side. Relative bias increases with longer claims run-out.	Unbiased
Correlation between IBNP estimates vs. claim amounts	Strongly positive correlation.	Strongly negative correlation.	Not related, 0% correlation.
Correlation between total incurred claim estimates vs. claim amounts incurred and already paid	100% positive correlation by ratio.	No correlation (except when Incurred and paid is greater than average total incurred).	Strong positive “additive” correlation.
Sensitivity of IBNP estimator to seasonility of morbidity (claims incurral)	Not sensitive, seasonaility is implicitly accounted for in method.	Very sensitive, but inversely. Without adjustment, any seasonility may contribute significant error to IBNP estimates.	Not sensitive. Adjustments may be made for known seasonal variations in morbidity.
Sensitivity of IBNP estimator to calendar seasonality (e.g., number of days in month)	Minimal sensitivity, primarily due to length of run-out period with paid-through end-of-month data.	Very sensitive, adjustments necessary.	Somewhat sensitive, adjustments necessary.
Sensitivity of IBNP estimator to benefit design seasonality (e.g., calendar-year deductibles, benefit limits)	May be slightly sensitive, depending on benefit design, adjustments may be necessary.	Very sensitive, adjustments necessary.	May be sensitive, adjustments necessary depending on benefit design.

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Table 4 (continued)

Characteristics of IBNP Reserve/Incurred Claims Estimation Method	IBNP Reserve/Incurred Claims Estimation Method		
	Completion Factor/ Chain Ladder/Lag	**Incurred Claims PMPM/ Loss Ratio Method**	**Paid Claims PMPM**
Sensitivity of IBNP and Incurred Claims estimates to trend effects.	Not sensitive to trend	Sensitive to trend, inaccuracy of trend assumptions may lead to significant error in IBNP estimates.	Slightly sensitive to trend, but potential for error significantly less than Incurred PMPM method.
Sensitivity of IBNP estimates to changes in morbidity or utilization patterns of covered population.	Very sensitive, but due to high variance of results, it may be difficult to identify changes immediately.	Very sensitive, but in the wrong direction. Change in morbidity may result in significant error of IBNP estimate.	Not sensitive. Method inherently assumes that remaining IBNP is constant after other adjustments.
Sensitivity of Incurred Claims estimates to changes in morbidity or utilization patterns of covered population.	Very sensitive, but due to high variance of results, it may be difficult to identify changes immediately.	Not sensitive. Method inherently assumes that morbidity does not change.	Somewhat sensitive. More sensitive in situations with rapid claims reporting and processing, less sensitive in slow or inefficient systems.
Sensitivity of IBNP estimates to variation in rate of claims reporting and processing.	Very sensitive, but in the wrong direction, any variation may result in significant error of IBNP estimate.	Very sensitive.	Somewhat sensitive, speeding up process causes over-estimation of IBNP, and vice-versa.
Sensitivity of Incurred Claims estimates to variation in rate of claims reporting and processing.	Very sensitive, any variation may result in significant error of Incurred claims estimates.	Not sensitive.	Somewhat sensitive, similar to IBNP estimator.

Figure 1 - Error in Total IBNR Estimates - Zero Run-Out
Closed Panel Integrated Delivery System or HMO

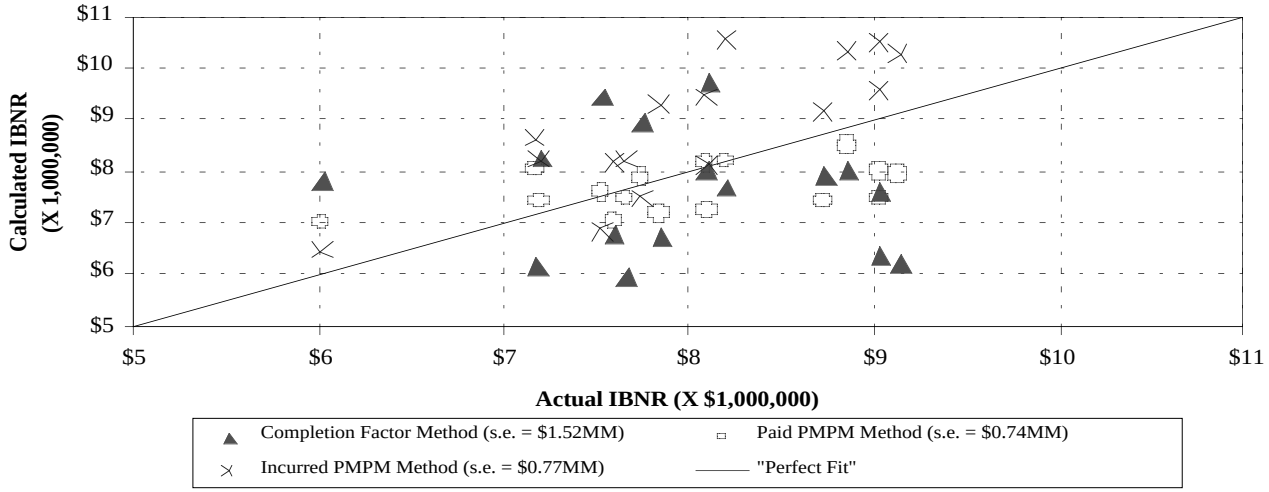


Figure 2 - Error in Total IBNR Estimates - Zero Run-Out
Open-Access Indemnity Health Plan

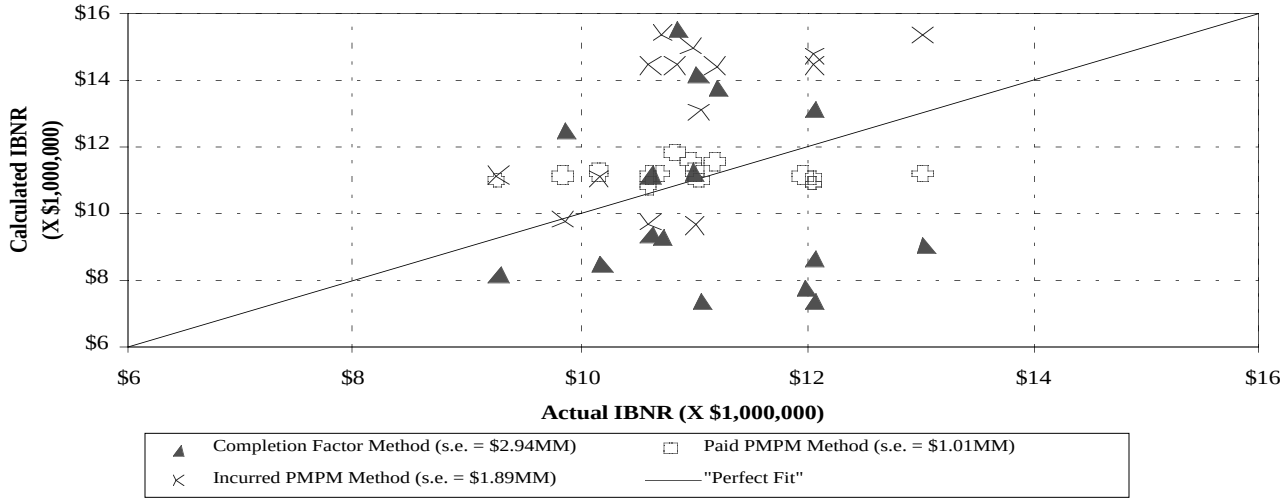
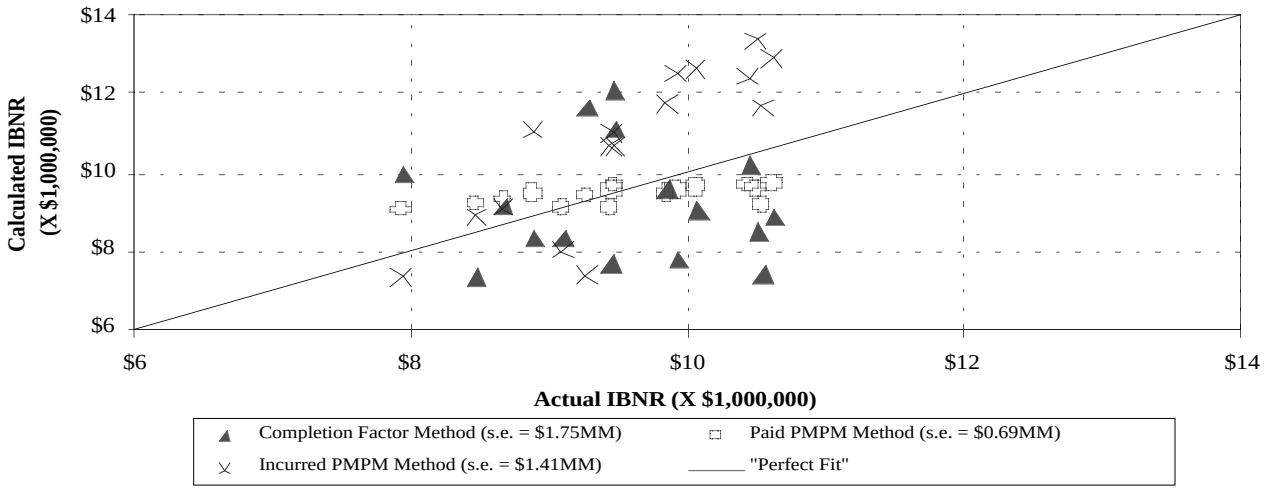


Figure 3 - Error in Total IBNR Estimates - Zero Run-Out
Open-Access POS or PPO Managed-Care Health Plan



(continued on page 30)

Figure 4 - Standard Error of IBNR Estimates
Tightly-Held HMO or IDS: by Length of Claims Run-Out Period

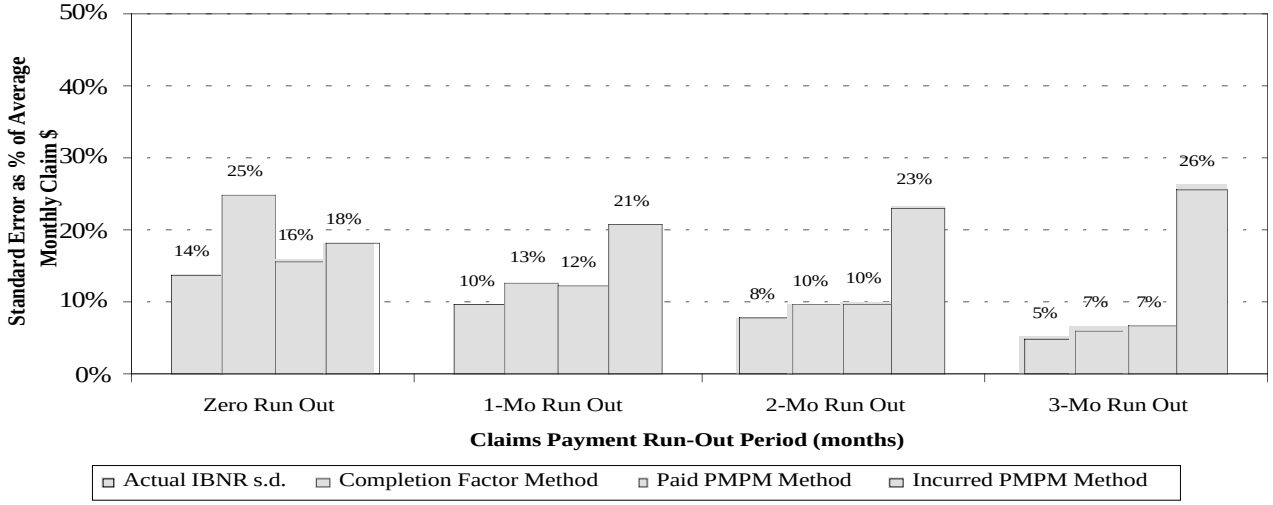


Figure 5 - Standard Error of IBNR Estimates
Open Indemnity / FFS Plan: by Length of Claims Run-Out Period

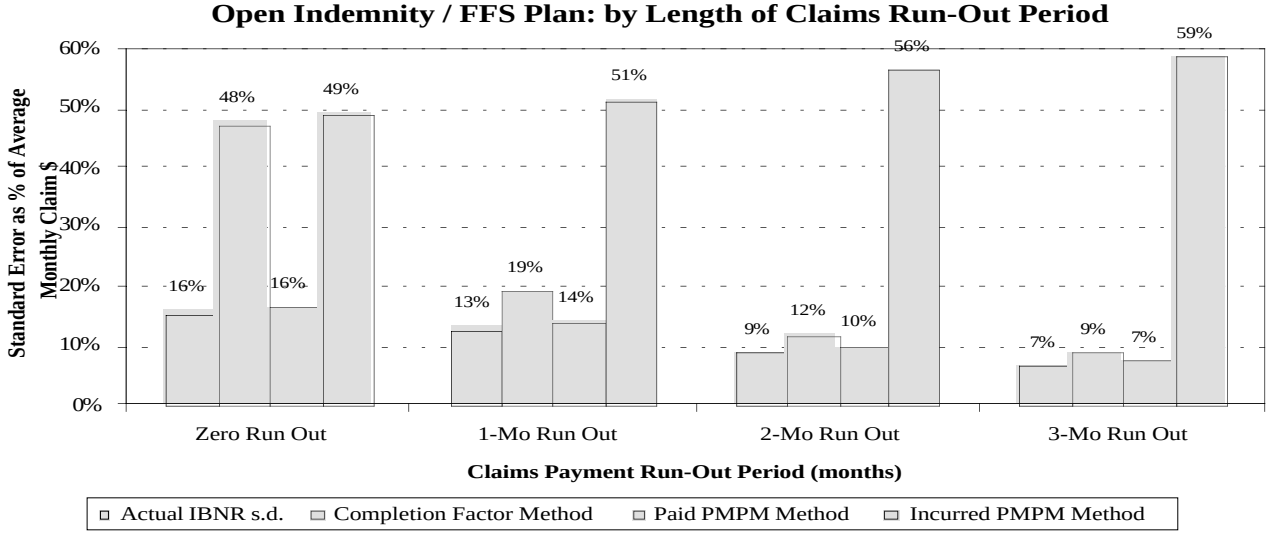
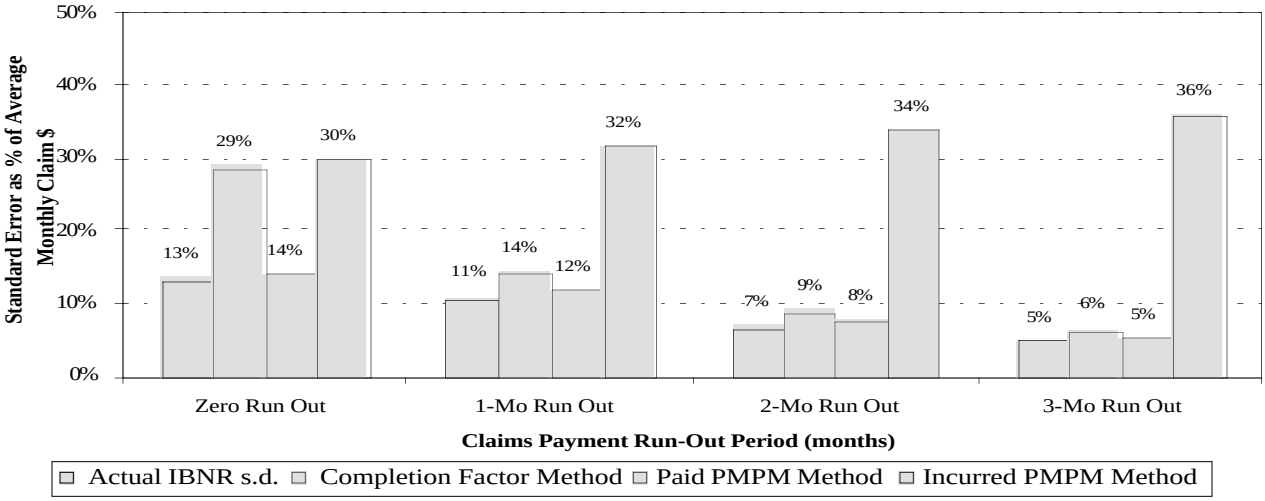


Figure 6 - Standard Error of IBNR Estimates
Open-Access POS or PPO Plan: by Length of Claims Run-Out Period



Health Care System in Crisis

The SOA's Health Benefit Systems Practice Area and Health Section Council have pledged their support for a new SOA project designed to shed some light on the current pressures within the U.S. healthcare system. This initiative was prompted by perceptions that cost increases are spiraling out of control and beyond levels of affordability, and that the actuarial profession is not adequately contributing to understanding and solving these problems.

The first phase of the Healthcare System in Crisis project is to develop a descriptive model that articulates the dynamics of the healthcare system and the interrelationships of the system stakeholders. The primary goal is provide the public with an actuarial perspective on competing interests in the healthcare system. A secondary goal is to increase the actuarial community's knowledge base of healthcare system dynamics in order to promote increased involvement by actuaries in health policy discussions and research in the future.

The working group has drafted a timeline for its work and identified interim deliverables to align with the Spring and Annual SOA Meetings. The first phase of the project is scheduled from April through June, and includes:

- Defining what is meant by "cost" for the purposes of the model.
- Identifying the major stakeholders in the health care system and grouping them for purposes of the model.
- Defining a template for collecting information on each stakeholder.
- Identifying underlying cost levers for each stakeholder, and evaluating ways that each stakeholder can affect (positively or negatively) the costs of other stakeholders. Both the cost and the revenue side of each stakeholder will be considered.
- Researching descriptive model types.
- Searching for other research that has been conducted on this issue. The SOA model should not duplicate work that has already been done, but rather should build on other research or take it into a new direction.

The next conference call of the working group will take place in early May. For more information on this project, please contact Jeff Allen, the working group chair, at jgallen@hewitt.com, or Kara Clark, SOA Health Staff Fellow, at kclark@soa.org.