Calculation of Medical Liability
- Combination of Statistical Methods, Actuarial Judgment, and Communication

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Context

We use the completion factor method for most months and a regression method for the most current two months for our calculation of IBNR
Outline of Completion Factor Method

• Given: Claims Paid-to-date
• Claims Paid-to-Date / Completion factor = Incurred Claims
• IBNR = Incurred Claims minus claims paid-to-date
• Completion factor method uses history of claim payment patterns to determine completion factors
IBNR Methodology
Completion Factor Method

• Still commonly used
• Also called chain ladder or development method
• Often produces poor estimates for most recent months
• Deterministic
  – Produces point estimates of completion factors
  – Since underlying distribution not determined, unable to quantify confidence in ranges of reserve values
Regression Models

• Regression models chosen are representative of models that might be a good fit for IBNR data
• No guarantee that any of chosen regression models would be a good fit
Parameters in Software

• Distributions: Simple, Quadratic, Exponential
• Weekday/weekend factor – can be adjusted by
  – Percent a weekend day cost to weekday
  – Weekend days/holidays per month
Parameters in Software

• User Defined Variable
• One value per month in regression model
• Variable used as
  – Benefit change (e.g. 5% reduction in benefits on January 1, 2006 and January 1, 2007)
    • Factor would be, 1.00 for 2007, 1.05 for 2006, and 1.1025 for 2005)
Actuarial Judgment Guidelines

• Based on actuary’s experience
• Well documented
• Reasonable based on data
• Reject models that clearly do not make sense
  – For instance, if the average per member per month (PMPM) values from January 2005 through October 2005 is $200, we would most probably reject a model that calculates a PMPM value of $125 for November 2005 even if the statistical values, such as adjusted R-square, are relatively high.
Method With No Actuarial Judgment

- Automated Actuary – taking the IBNR produced by the computer model and using it as your estimate
Areas of Actuarial Judgment

• Internal Information
  – Prediction Levels vs. Percent Margin
  – Outliers
Prediction Intervals vs. Margin

• Prediction Intervals – Statistical Basis

• Margin – Easier for non-actuary to understand
Prediction Interval Guidelines

• Prediction intervals need to be derived from a statistical distribution.
  – The completion factor method gives a point estimate – therefore, unable to derive prediction intervals from this method
  – Regression models produce prediction intervals
Actuarial Judgment in Determining Prediction Intervals

- Size of prediction intervals is dependent on company’s risk profile.

- Often prediction interval may be too large for practical business purposes (e.g., if we add 50% to our best estimate of IBNR, we will be 99% sure that our margin is sufficient.)

- In business terms, what does 99% confidence mean?
Identifying Outliers

- Effect on IBNR
- An outlier in one model may not be an outlier in another model
- A $200,000 unpaid claim may be an outlier in lag 20 but not in lag 2.
Outliers

• Unless you have a good reason, such as an outlier, you do not delete data points
  – Particularly true in a monthly regression model with relatively few points (e.g., 36)
  – We would not take out a whole month’s data just because the pmpm calculated for that month is 10% lower than that of other months unless we have some external knowledge to justify its removal
Outliers
Catastrophic Cases

Let’s assume that catastrophic claims have a simple distribution

- 1/24 $750,000
- 23/24 0
- Claims paid 7 months after incurrence

Expected value = $750,000 * 7 / 24 = $218,750

If you reserved $218,750,
  Under-reserved if there was a claim,
  Over-reserved if there was not a claim.
Approaches to Handling Catastrophic Cases

• Document assumptions and risk
• Separate catastrophic reserve
• Reinsurance
## Coefficient of Variation

**Completion Factor Method**

**Calculation of the Coefficient of Variation**

<table>
<thead>
<tr>
<th>Lag</th>
<th>Mean of Individual Months</th>
<th>Standard Deviation</th>
<th>Coefficient of variation (Std. Dev./Mean)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.03215</td>
<td>0.02548</td>
<td>0.79237</td>
</tr>
<tr>
<td>1</td>
<td>0.58789</td>
<td>0.12032</td>
<td>0.20467</td>
</tr>
<tr>
<td>2</td>
<td>0.84632</td>
<td>0.06114</td>
<td>0.07225</td>
</tr>
<tr>
<td>3</td>
<td>0.92366</td>
<td>0.04414</td>
<td>0.04778</td>
</tr>
<tr>
<td>4</td>
<td>0.95917</td>
<td>0.02483</td>
<td>0.02588</td>
</tr>
<tr>
<td>5</td>
<td>0.97211</td>
<td>0.02271</td>
<td>0.02336</td>
</tr>
</tbody>
</table>
Number of Variables in Model

• More variables do not necessarily mean a better model.
  – May have minimal increased predictive value with new variable.
  – If multicolinearity exists, you have a worse, or unstable, model.
  – Need to communicate all variables in model.
External Information

- External information – Knowledge about the data that is not specifically shown in the data
- External information that might cause you to remove a month that has a pmpm value that is 10% lower than the other months
  - Benefit design
  - Economics
  - Legislative/regulatory
  - Claim disputes
Simulation

• Key Issues
  – Outliers – Both large claims and negative adjustment
  – Model will not be incorporating all external factors – trend changing over time
  – Number of iterations
    • Time to run
    • Communicating results
Research Paper and Software On-Line


• Currently, two spreadsheets
  – Regression
  – Simulation

• Two additional spreadsheets will be added in near future
Example of Case Presented to Reduce IBNR

• Automated Medical Records (AMR)
  – Faster claim payments – increase in completion factors
  – Historical completion factors would tend to over-estimate IBNR
  – Assume request is made today for adjustment in year-end December 2008 IBNR
## AMR in a Physician’s Office

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefit</th>
<th>Light AMR</th>
<th>Medium AMR</th>
<th>Full AMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online Patient Charts</td>
<td>Chart Pull Savings</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Transcription Savings</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Electronic Prescribing</td>
<td>Adverse Drug Event Prevention</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Alternative Drug Suggestions</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Laboratory Order Entry</td>
<td>Appropriate Testing Guidance</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Radiology Order Entry</td>
<td>Appropriate Testing Guidance</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Electronic Charge Capture</td>
<td>Increase Billing Capture</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Decrease Billing Errors</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

– The greater the number of AMR functions, the greater the savings

AMR in IBNR

- IBNR: 90% of IBNR for claims incurred in past 3 months
- AMR: Usually a longer term change in cost
  - From a pricing perspective, an individual’s, and group’s, short-term cost could increase due to AMR
- Most of effect of AMR already reflected in incurred claims triangles
- AMR more a pricing issue than a reserving issue
AMR in IBNR

• Speed of payment of claims
  – Would not effect our estimates for November and December 2008, since we do not rely on completion factors (CF) for the most current two months
  – May have an implied CF of 80% in November, highest physician factor you had in 2008 was 72%
  – May be advisable to adjust upward the CF for months prior to October 2008
Communication Issue

• You cannot put a confidence interval into a balance sheet.
## Restatement and Margin

**Incurred Date:** December 2008

<table>
<thead>
<tr>
<th>Estimation Date</th>
<th>Expected Claims</th>
<th>At Upper Bound of 95% Confidence Interval</th>
<th>Length of One-Sided Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>December 2008</td>
<td>$100</td>
<td>$110</td>
<td>$10</td>
</tr>
<tr>
<td>January 2009 (Recast)</td>
<td>101</td>
<td>109</td>
<td>8</td>
</tr>
<tr>
<td>Change</td>
<td>1</td>
<td>(1)</td>
<td>(2)</td>
</tr>
</tbody>
</table>
Conclusion

• Even with the best statistical methods, actuarial judgment and effective communication needs to be used in the calculation of IBNR.

• In the second half of this workshop, we will be applying the above conclusion.