

How to Use Predictive Modeling to Investigate Claims

CAS Predictive Modeling Seminar
Roosevelt C. Mosley, Jr., FCAS, MAAA
October 5-6, 2008
San Diego, CA



Discussion Topics

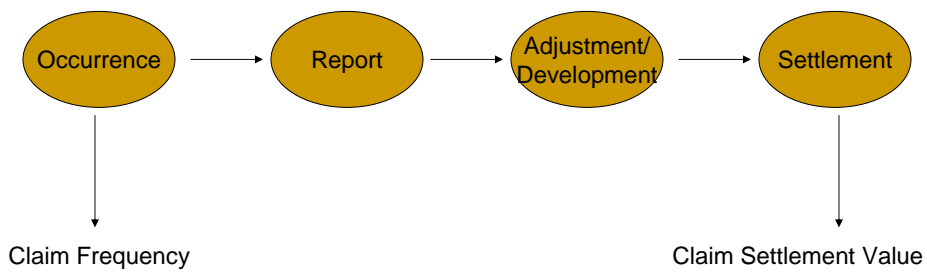
- Background
- Claims Applications of Predictive Modeling
 - Occurrence
 - Report
 - Adjustment/Development
 - Settlement
- Settlement Lags
- Loss Adjustment Expenses
- Opportunities & Challenges



Background



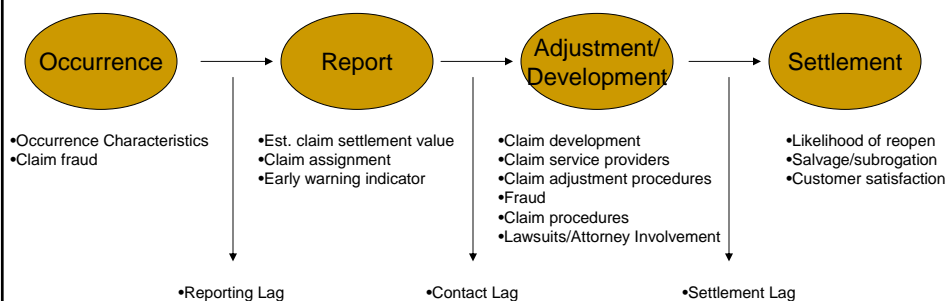
Claims Process



Date Mining & Predictive Modeling

- **Data mining:** analysis of (often large) observational data sets to find unsuspected relationships and to summarize the data in novel ways that are both understandable and useful to the data owner
- **Predictive modeling** is the development of models generally based on historical data for the purposes of making decisions regarding future events

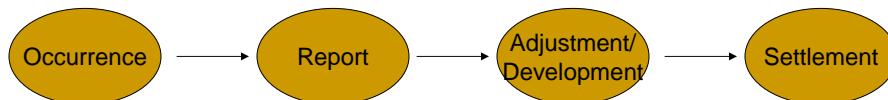
Predictive Modeling Opportunities for Claims



Claims Applications of Predictive Modeling

Claims Applications of Predictive Modeling

- Occurrence
- Report
- Adjustment/Development
- Settlement
- Lags



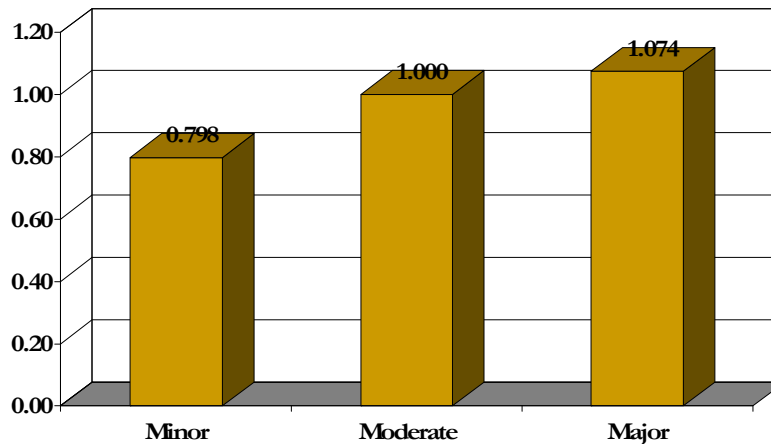
Occurrence

Occurrence

- Auto
 - Time of accident
 - Day of the week
 - Location (rural/suburban/urban)
 - Number of vehicles involved in accident
 - Police report
 - Severity of impact
- Homeowners
 - Time of loss
 - Day of the week
 - Storm involved?
 - Seasonality
- Worker's Compensation
 - Circumstances surrounding accident
 - Policy state, benefit states

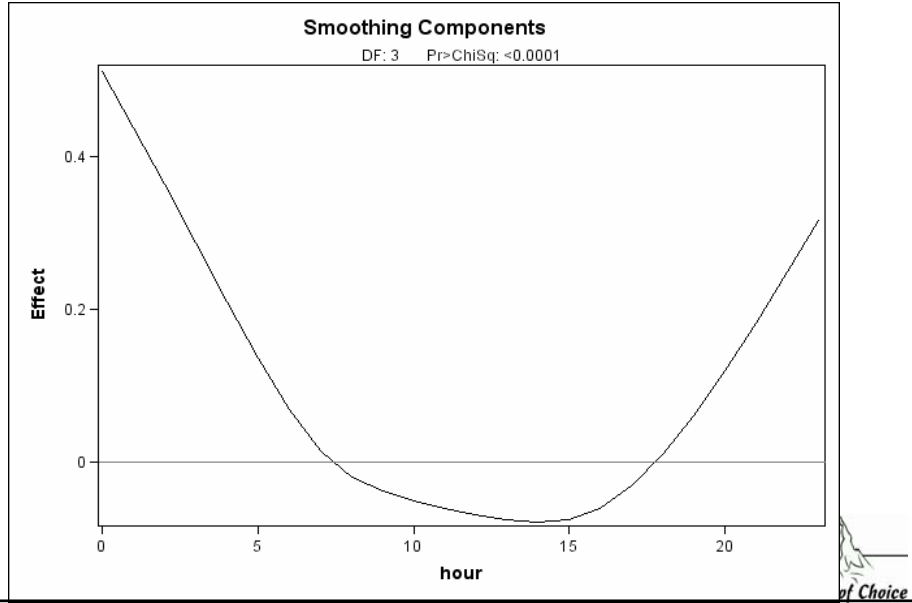
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Impact Severity

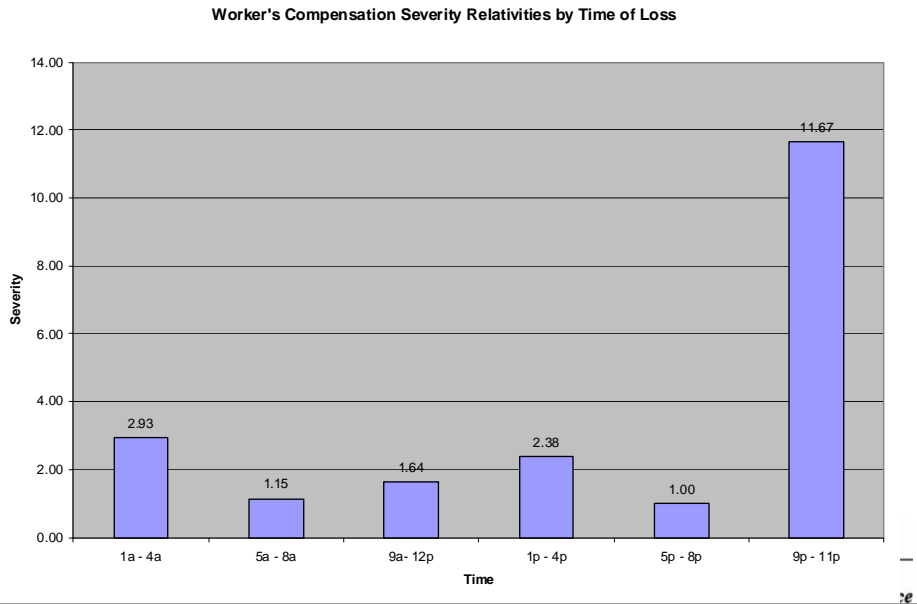


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Hour of the Accident



Time of Workers Compensation Loss



Application of Occurrence Characteristic Analysis

- Policyholder education
- Loss control services
- Rating (for situations which make important characteristics more likely)
- Work with government to address issues (for example, dangerous intersections)



Applications of Modeling at Time of Report

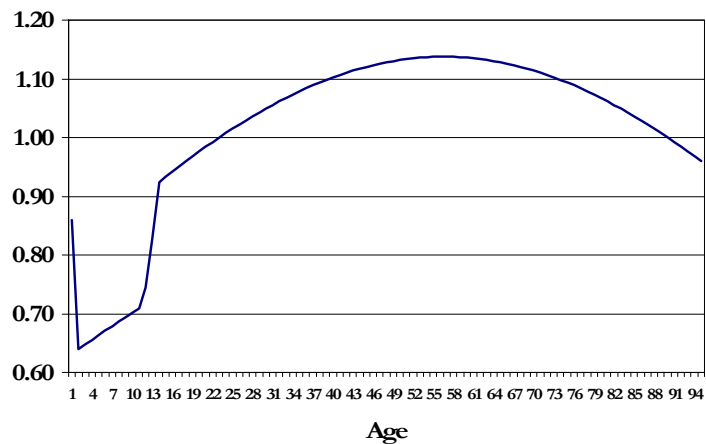
- Assignment of claim to adjuster
- Claim settlement value based on characteristics at time of report
- Early warning indicator
- Estimated duration



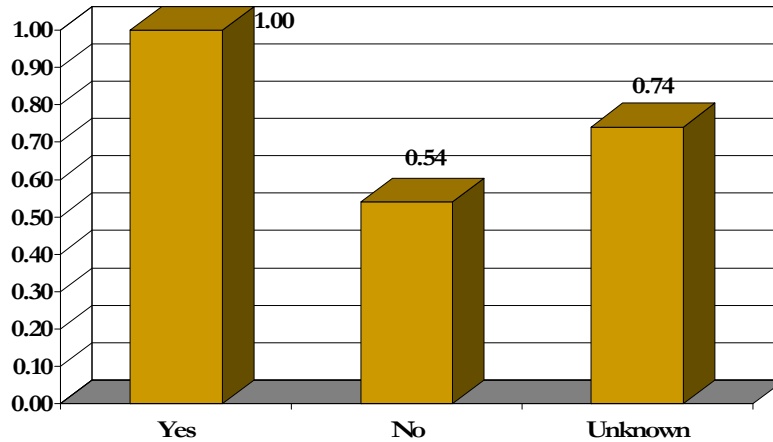
Claims Settlement Value Modeling

- Claim settlement value based on characteristics at time of report
 - Attorney involvement
 - “In-Network” Medical or Auto Repair
 - Extent of property damage
 - Coverages involved
 - Injuries
 - Claimant characteristics

Claim Settlement Value by Age of Claimant – Bodily Injury Coverage



Limited Claim Settlement Value Modeling – Attorney Involvement



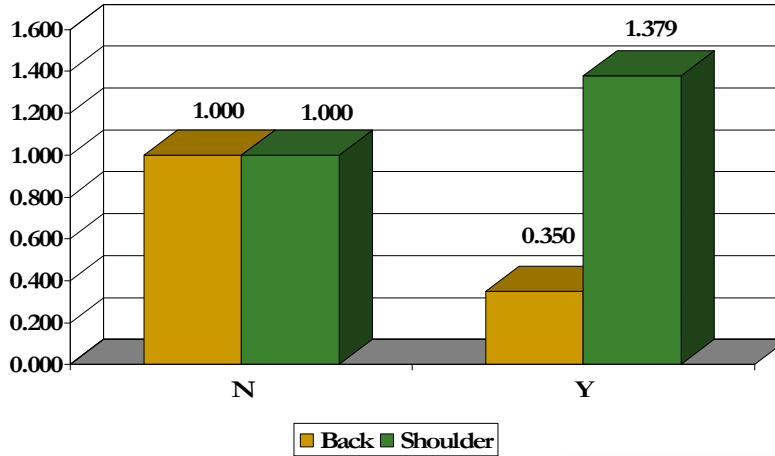
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Early Warning Signs

- Large claims
- Exceptional claims
- Delayed recovery
- Exceptional number of medical treatments
- Lawsuit development
- Coverage development
- Types of treatments

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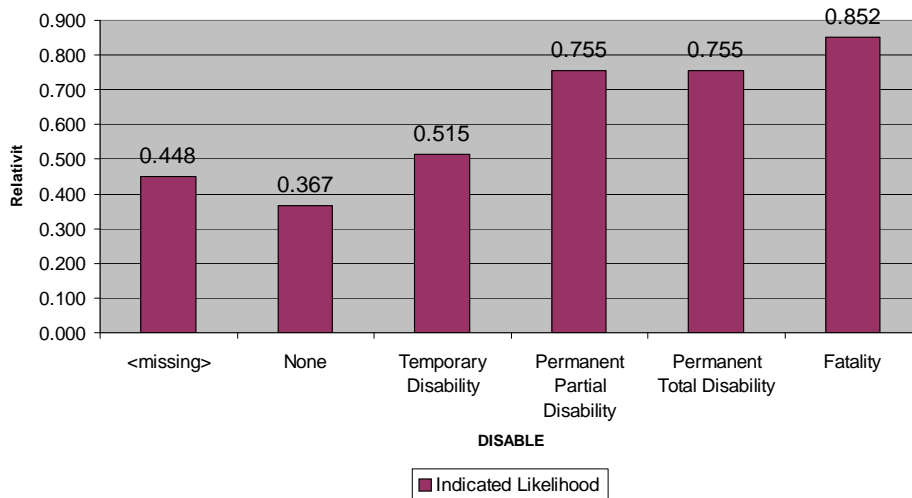
Large Loss Likelihood – Type of Injury



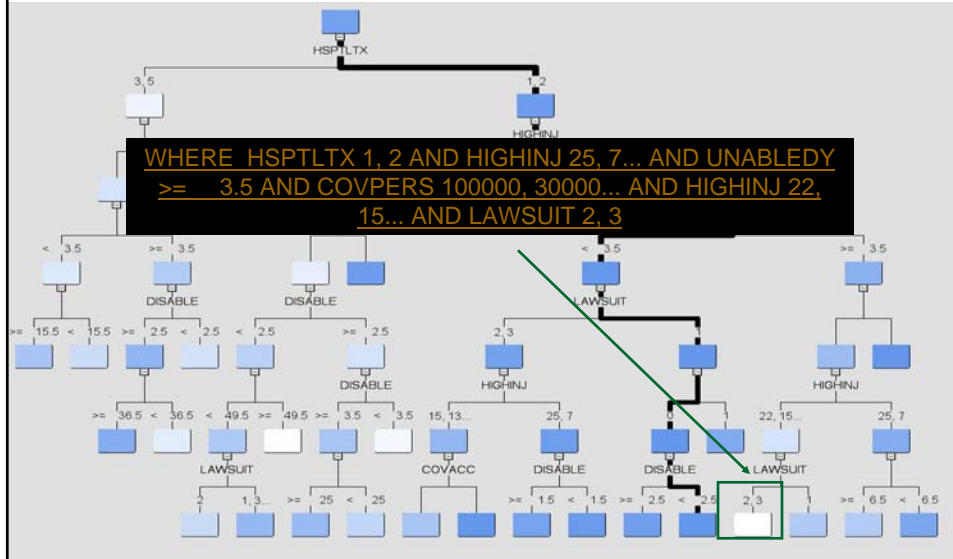
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Likelihood of Development of BI Claims

Florida PIP Analysis with Loss



Likelihood of Large Loss Decision Tree – Rules Based Approach



Variable Importance

Variable Name	Label	Number of Splitting Rules	Importance	Validation Importance	Ratio of Validation to Training Importance
HSPPLTX		1	1.000	1.000	1.000
COVPERS		3	0.869	0.832	0.957
HIGHINJ		3	0.645	0.614	0.952
UNABLEDY		3	0.525	0.565	1.077
DISABLE		5	0.382	0.316	0.828
LAWSUIT		3	0.269	0.291	1.081
DAYSLOST		2	0.216	0.148	0.686
BIDRIVER		2	0.156	0.086	0.549
COVACC		1	0.139	0.136	0.977
LACERATI		1	0.085	0.081	0.954
CITYCODE		0	0	0	
CLMSTATE		0	0	0	
CLRCKLSI		0	0	0	
STCODE		0	0	0	
BRAININJ		0	0	0	
acc_time		0	0	0	

Model Comparison Statistics

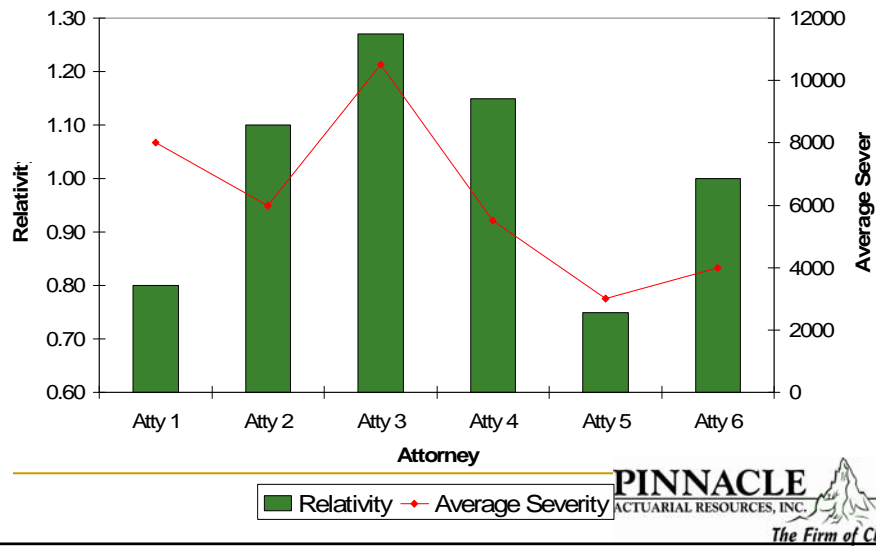
Model	Train: Average Squared Error		Valid: Average Squared Error		Valid: Train: Roc Index	Train: Gini Coefficient	Train: Kolmogorov-Smirnov Statistic
	Misclassification Rate	Misclassification Rate	Misclassification Rate	Misclassification Rate			
Decision Tree (2)	0.0272	0.0362	0.0277	0.0358	0.9396	0.8792	0.7758
Ensemble (Maximum)	0.0280	0.0366	0.0295	0.0380	0.9395	0.8790	0.7896
Ensemble (Average)	0.0306	0.0435	0.0314	0.0435	0.9545	0.9039	0.8026
Regression	0.0346	0.0418	0.0355	0.0424	0.8925	0.7850	0.6215
Neural Network	0.0455	0.0490	0.0464	0.0498	0.6134	0.2269	0.1360

Adjustment/Development

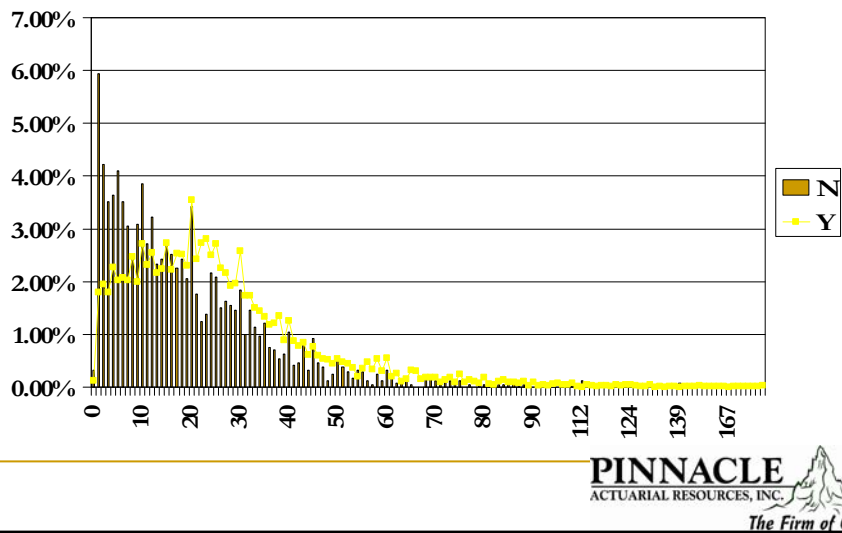
Adjustment/
Development

- Claim development – amounts and characteristics
- Claim service providers – value added/detracted
- Claim settlement procedures – injury treatments, repair procedures, etc.
- Fraud – soft fraud, claim padding
- Claim handling procedures: reviews, updates, additional investigation, estimates, inspections, etc.
- Lawsuits/Attorney Involvement – potential for development of lawsuits

Attorney Relativities



Frequency of Chiropractor Visits by Presence of Back Injury



Settlement

Settlement

- Likelihood of reopen
- Salvage/subrogation potential
- Customer satisfaction

Customer Satisfaction

- JD Power: 75% of the customers shop because they are unsatisfied with insurer switch
- By tying together claims and retention, can identify customers more likely to leave as a result of claims process

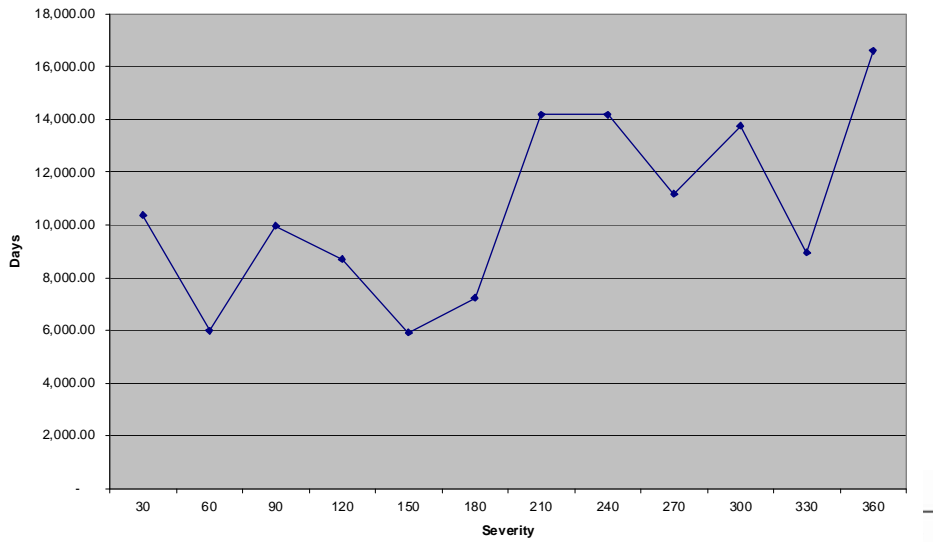
Delays in the Claims Settlement Process

Lags

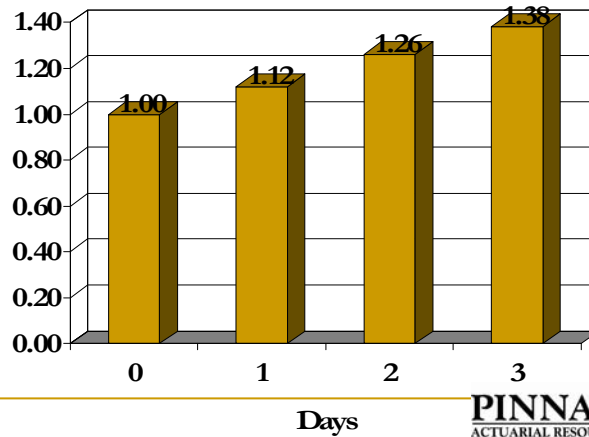
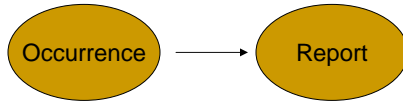
- Delays in stages of the claim settlement process
- Can occur in several stages
 - Occurrence
 - Report
 - Contact
 - Settlement
- In general, delays are costly

Occurrence Lag

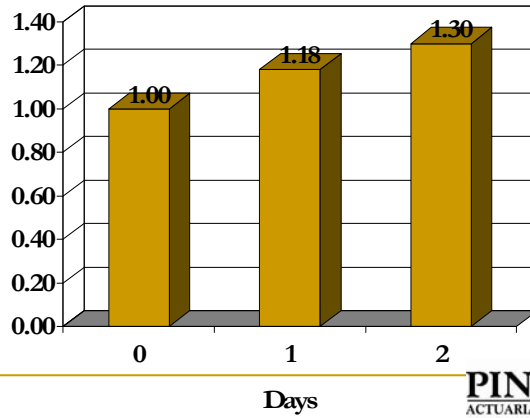
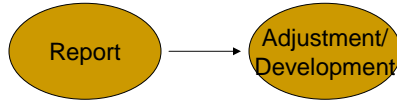
Time Since Policy In Effect



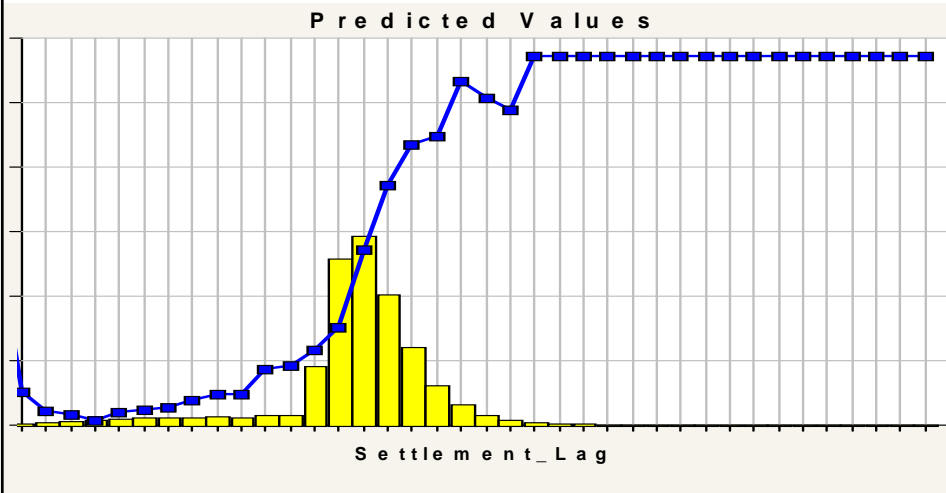
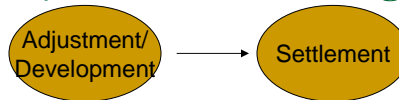
Report Lag



Contact Lag



Severities by Settlement Lag



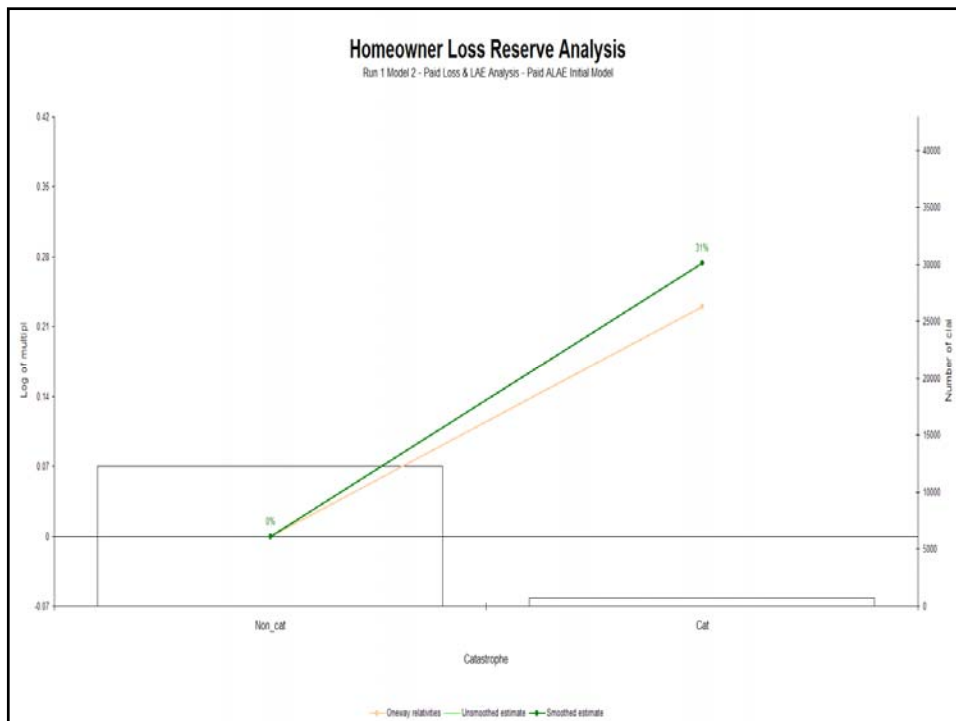
Applications

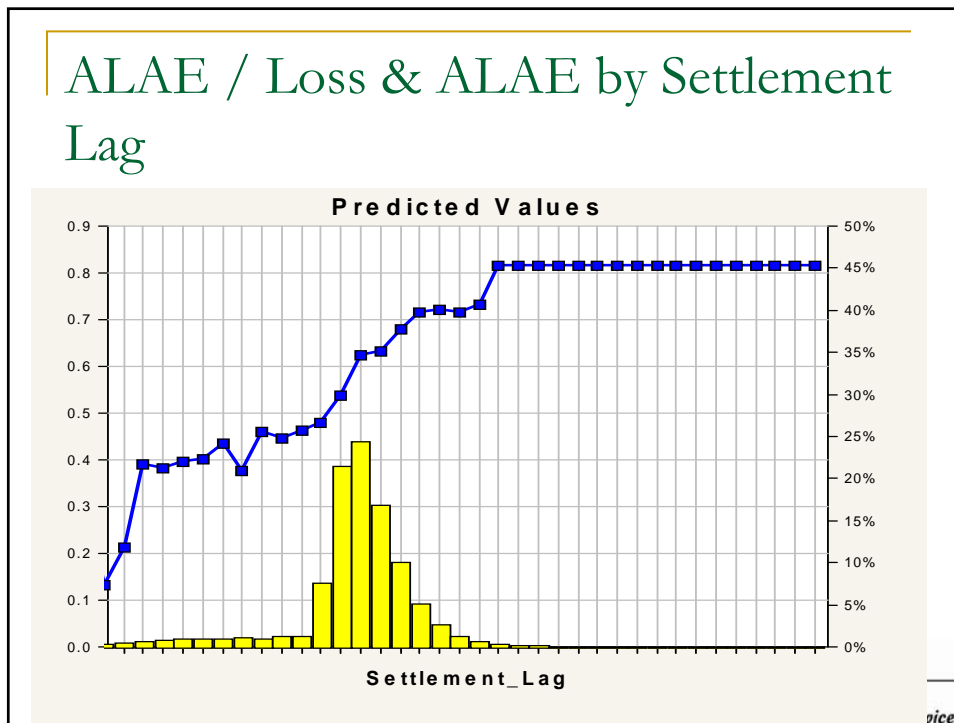
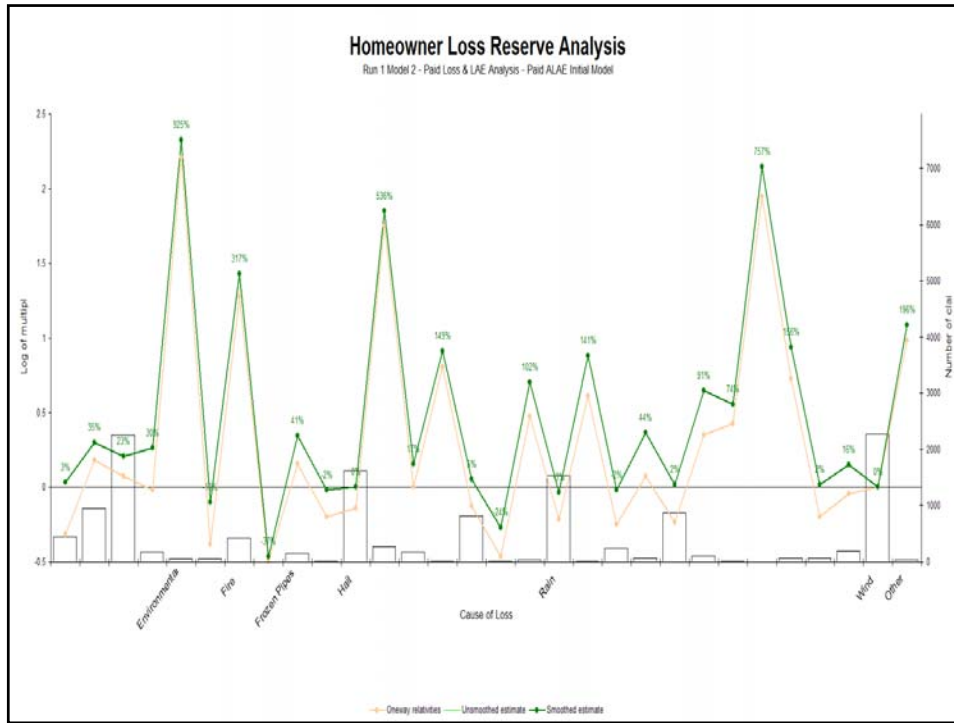
- Report Lag
 - Accident report incentives
 - Ease of claim reporting
- Contact Lag
 - Contact plans (maximum time, accident scene)
 - Multiple modes of contact
 - Staffing?
- Settlement Lag
 - Assignment of claims
 - More focused/active management of older claims
 - Claim staffing/cost allocations
 - More communication during claims process

Loss Adjustment Expenses

Loss Adjustment Expenses

- Just as there are differences in claim cost based on characteristics, there are also differences in loss adjustment expenses
- May be opportunities for early identification, adjustment in claims handling process





Opportunities & Opportunities in Disguise

- Opportunities
 - Enhanced estimate of needed case reserves
 - Improved assignment of claim to claim handlers
 - Cross training adjusters with superior skills in a given claim
 - Better assignment of claims to service providers
 - Large/exceptional claim early warning system
 - Early warning of significant claim “development”
 - Real dollar savings
 - Better fraud detection
- Opportunities in disguise
 - Data
 - Expertise – partnering vs. taking over
 - Existing products