Predictive Modeling and Claims Analytics to Incorporate Leakage Analyses

2012 RPM

March 21 2012

ERNST & YOUNG
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Agenda

What drives the adverse development of claims?

- Fact-based predictors
- Leakage predictors

Analysis methodology

- Claims predictive modeling
- Claims triaging and mitigation strategies
- Operational and financial claim leakage assessment
- Process improvement
  - Claims process
  - Underwriting process

What drives claims adverse development?

- Adverse development is disproportionately driven by specific types of claims.
- The drivers of claims development are those not identified or fully understood early in the process.
- It can be extremely difficult (or impossible) to quantify the preponderance of factors that drive claims development.
- Early identification of these claims allows for proactive claims handling and real cost savings.

Current claims handling practice

- Early recognition of claims which may develop adversely is largely dependent on adjuster judgment, training and supporting vendors.
- Adjusters are under more pressure due to complex case loads and increased administrative tasks.
- Severe claim types will be triaged when reported and experienced handlers will be assigned.
- Claims that do not initially appear costly may be difficult to differentiate.
- These claims represent 60% on average of the claims population.

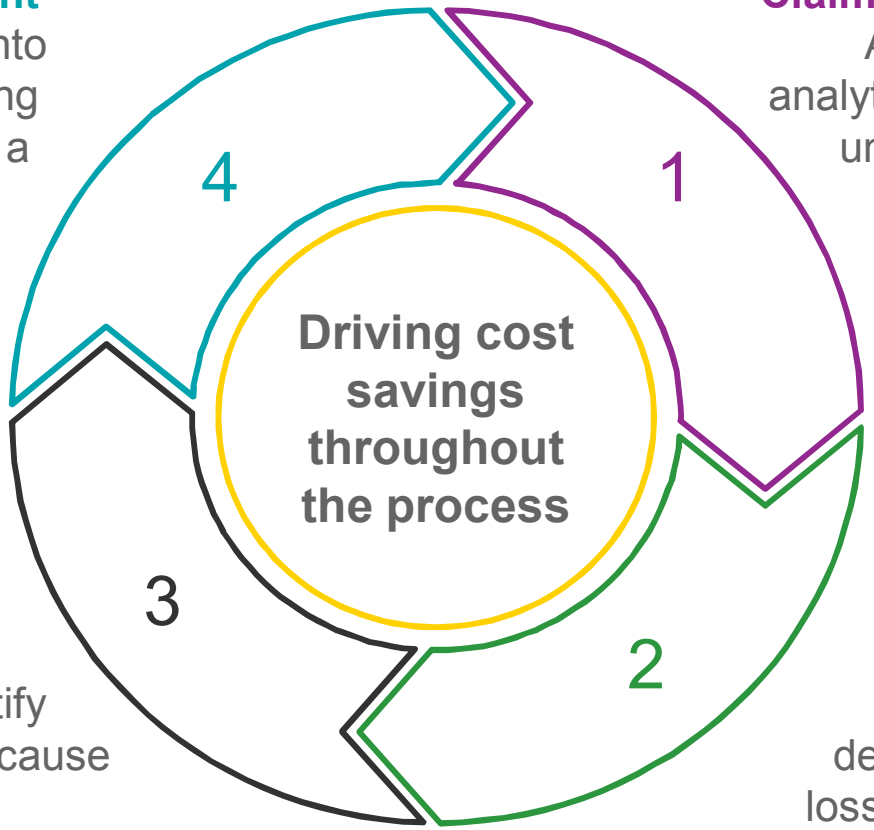
Potential cost savings

- The key is early detection of the characteristics of the claims within a loss portfolio that drive adverse development of those claims.
- Once potentially severe claims are identified, actions can be taken
  - Prompt assignment of senior claims handler
  - Prompt assignment of nurse case manager or rehab specialist, where appropriate
  - Early enrollment in vocational rehabilitation, where appropriate
  - Continued proactive follow-up with injured party and employer
  - Claims management committee review
  - Proactive early settlement efforts
  - Application of return to work initiatives
  - Modify claim service instructions
- Early application of mitigation strategies could reasonably allow for capture and recover of 25%-50% of adverse development that would have occurred.

Claims process improvement cycle

Process improvement
Incorporate findings into claims and underwriting processes to develop a leading practice environment

Claims predictive modeling
Application of advanced analytics to identify drivers of unexpected development



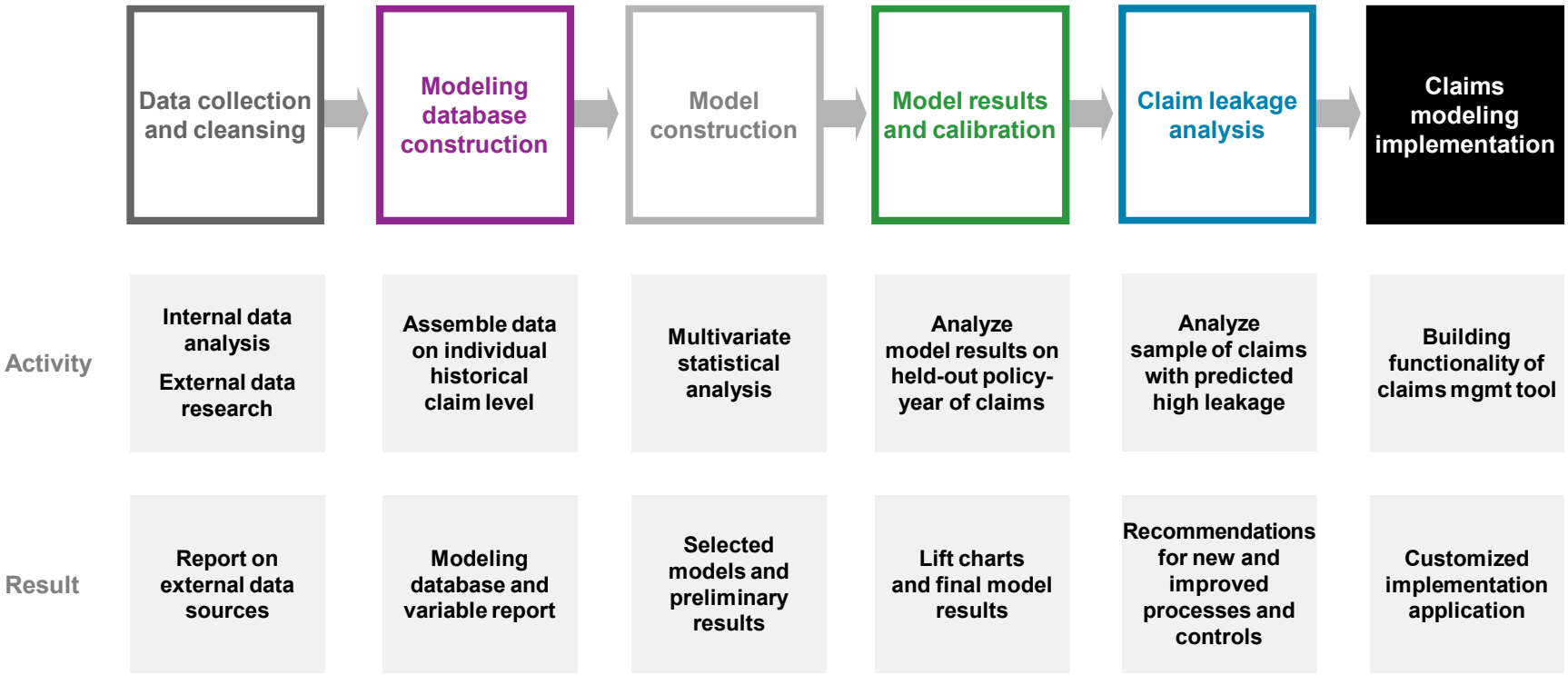
Claims leakage analysis
Analyze unexpected development to identify inefficient claim root cause practices

Claims triage and mitigation
Implementation of model to predict development and apply loss mitigation strategies

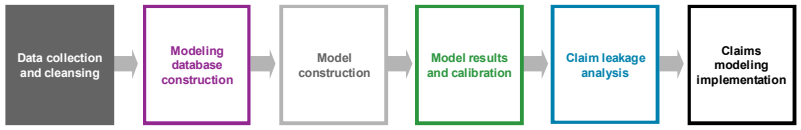
Predictive modeling process

- Predictive models are now being successfully applied in insurers' claims operations.
- The models are used to identify which claims have the potential to develop adversely based on information known when the claim is first reported.
- Analytics and early detection of potential claim leakage provide a potential edge and cost savings in the current competitive and economic environment.
- A predictive model identifies the main quantifiable drivers of individual claim leakage at the point of first report.

Claims model development process



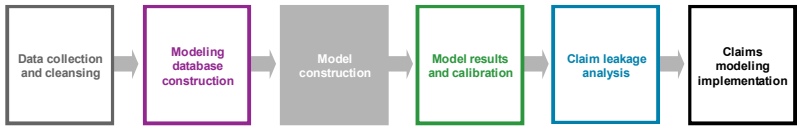
Internal data collection and cleansing



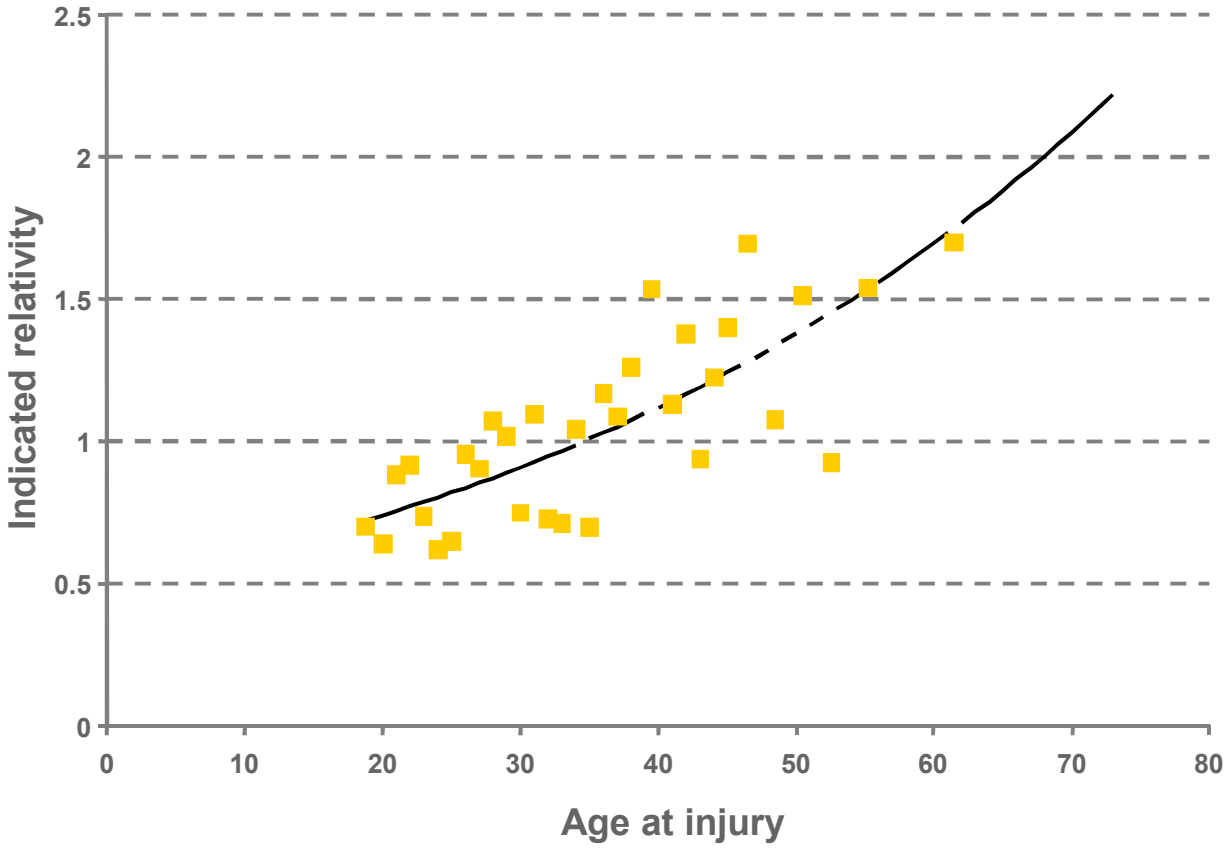
- The first phase of the predictive modeling process is to construct the internal claims database file.
- Internal claims data is assembled at the claim level to include claim identifiers, potential predictor variables and response information.
- This internal data is then tested and modeled before external data is appended.

Claim identifiers			Predictor variables					Response		
Policy number	Claim number	Accident year	Occupation code	Injured body part	Days until notice	Age at injury	State	Indemnity losses at reporting	Indemnity losses at 24 months	Development
0000012	7568871	2003	Constr	Back	0	59	CT	$36,434	$18,932	$(17,502)
0000018	8404981	2004	Constr	Upper ext	1	47	NY	$93,106	$146,728	$53,622
0000138	7359087	2003	Manu	Upper ext	0	41	NY	$21,316	$30,284	$8,968
0000146	8347860	2004	Constr	Lower ext	0	25	NY	$4,604	$6,820	$2,216
0000157	7350092	2003	Manufac	Back	8	56	ME	$27,893	$48,861	$20,968
0000160	8343256	2004	Office	Back	2	34	RI	$34,212	$40,985	$6,773
0000239	7738291	2003	Constr	Head	0	51	MA	$42,695	$45,891	$3,196
0000401	8760921	2004	Manu	Neck	0	25	NY	$33,785	$34,874	$1,089
0001439	7598823	2003	Constr	Lower ext	1	28	NY	$6,947	$721	$(6,226)

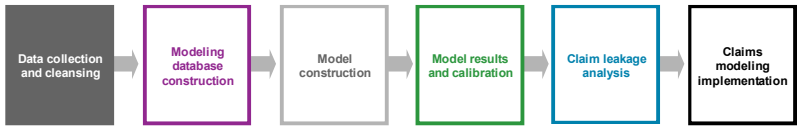
Internal data modeling – age at injury



Hypothesis: The age of the claimant affects the ultimate cost of the claim.
Finding: Older claimants have significantly larger claims on average.



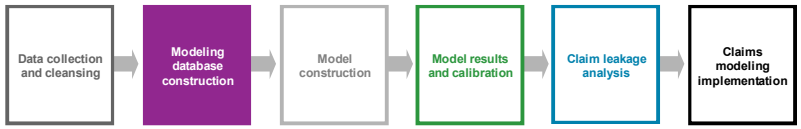
Incorporating external data sources



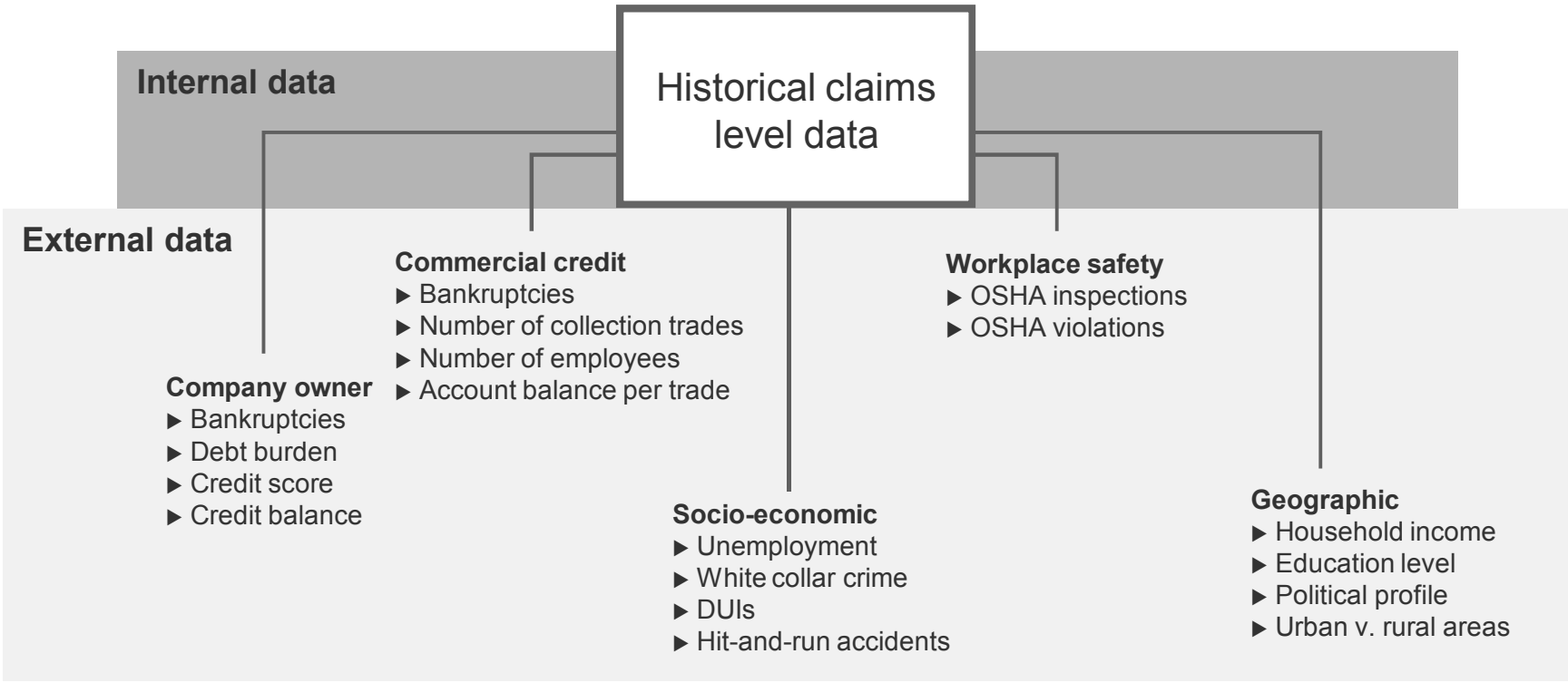
- Much of the power in a predictive model comes from the incorporation of additional external data.
- There are numerous vendors that can provide various types of potentially valuable external data.
- Examples of some of these sources are shown below:

Data source name	Type	Value	Cost
Data source 1	Business	High	Low
Data source 2	Business	High	Med
Data source 3	Business	High	Med
Commercial credit vendor	Credit	High	High
Personal credit vendor	Credit	High	High
Crime index	Demographic	Med	Low
Litigiousness index	Demographic	Med	Low
Hospital index	Hospital	Med	Low
Data source 9	Business	Med	Med
Data source 10	Business	Med	High
Voting patterns	Demographic	Low	Low
Traffic safety index	Demographic	Low	Low
Data source 16	Business	Low	Low

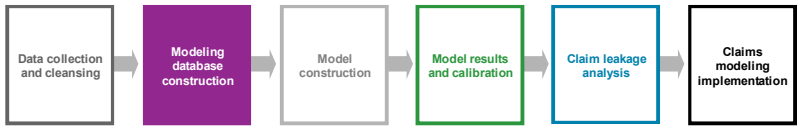
Combining internal and external data



- External data is matched to internal claims data to capture many potential predictor variables.



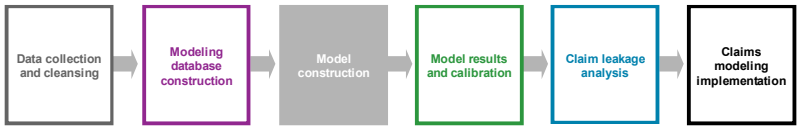
Modeling database



- Modeling database will contain all internal and external risk factors.

Claim identifiers			Predictor variables					External predictor variables						Response		
Policy number	Claim number	Accident year	Occupation code	Injured body part	Days until notice	Age at injury	State	Average household income	Credit score	Prior claims	% w/ bachelor degree	% in legal profession	Unemploy-ment rate	Indemnity losses at reporting	Indemnity losses at 24 months	Development
0000012	7568871	2003	Constr	Back	0	59	CT	64,064	632	No	33%	1%	3.5%	$36,434	$18,932	$(17,502)
0000018	8404981	2004	Constr	Upper Ext	1	47	NY	57,218	540	No	39%	2%	3.5%	$93,106	$146,728	$53,622
0000138	7359087	2003	Manufac	Upper Ext	0	41	NY	28,311	796	No	4%	3%	3.5%	$21,316	$30,284	$8,968
0000146	8347860	2004	Constr	Lower Ext	0	25	NY	39,251	742	No	27%	2%	3.5%	$4,604	$6,820	$2,216
0000157	7350092	2003	Manufac	Back	8	56	ME	28,381	581	No	19%	2%	3.5%	$27,893	$48,861	$20,968
0000160	8343256	2004	Office	Back	2	34	RI	59,136	719	No	33%	2%	4.2%	$34,212	$40,985	$6,773
0000239	7738291	2003	Constr	Head	0	51	MA	68,711	603	No	17%	1%	4.2%	$42,695	$45,891	$3,196
0000401	8760921	2004	Manufac	Neck	0	25	NY	28,117	578	No	35%	0%	4.2%	$33,785	$34,874	$1,089
0001439	7598823	2003	Constr	Lower Ext	1	28	NY	47,159	571	No	38%	4%	4.2%	$6,947	$721	$(6,226)
0001892	8673492	2004	Constr	Back	0	37	NY	16,758	747	No	21%	2%	4.2%	$74,685	$81,988	$7,303
0001930	2843490	1997	Constr	Head	1	35	MA	45,600	746	No	42%	1%	5.9%	$97,685	$179,909	$82,224
0003888	3901123	1998	Constr	Upper Ext	0	32	CT	42,750	521	No	51%	1%	5.9%	$60,172	$59,346	$(826)
0003888	7862234	2003	Constr	Upper Ext	2	50	CT	47,316	776	Yes	37%	2%	5.0%	$19,837	$34,218	$14,381
0004233	2789065	1997	Constr	Upper Ext	0	64	RI	45,600	540	No	29%	4%	5.9%	$41,384	$45,522	$4,138
0004233	6789456	2002	Constr	Lower Ext	0	30	RI	47,316	511	Yes	3%	1%	5.0%	$62,542	$75,650	$13,108
0004982	2887011	1997	Office	Multiple	0	33	MA	45,600	785	No	19%	1%	5.9%	$39,793	$68,975	$29,182
0005893	3609981	1998	Manufac	Back	1	30	MA	42,750	767	No	12%	4%	5.9%	$88,357	$168,877	$80,520
0006980	3452981	1998	Constr	Back	0	36	MA	46,989	582	No	19%	3%	6.0%	$15,146	$11,957	$(3,189)
0006980	8593404	2004	Constr	Upper Ext	0	66	NY	42,750	749	Yes	7%	1%	4.5%	$62,508	$107,825	$45,317
0007012	4459321	1999	Manufac	Back	0	31	NY	47,316	510	No	35%	4%	4.5%	$19,187	$19,953	$766
0007012	6398703	2002	Manufac	Upper Ext	4	54	CT	47,316	741	Yes	33%	4%	5.0%	$64,838	$85,838	$21,000
0007792	2398050	1997	Constr	Head	0	60	CT	32,750	613	No	34%	4%	6.3%	$26,434	$8,433	$(18,001)
0007792	7574410	2003	Constr	Neck	0	37	NY	32,750	702	Yes	38%	2%	5.0%	$79,680	$88,661	$8,981

Examples of tested hypotheses



Do socio-economic conditions impact claims?

Measured by:

- Unemployment in geographic location of injury
- Average household income in area of injury

Does the lack of consistency in the claim management process increase claim leakage?

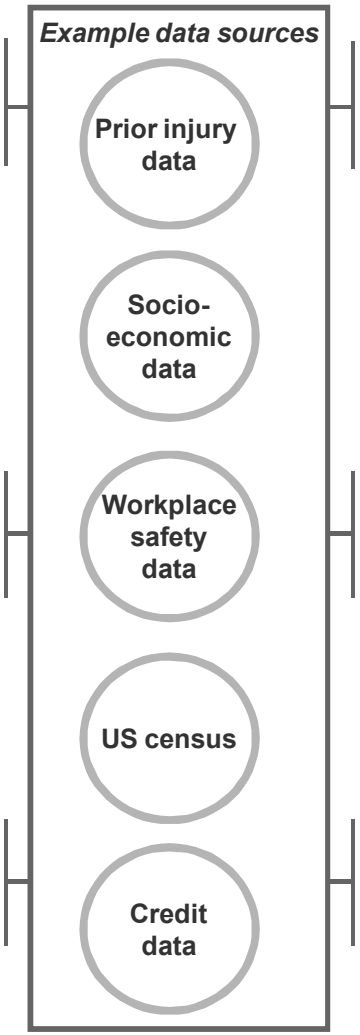
Measured by:

- Repeated re-assignment of claim handlers
- Lack of case continuity

Are geo-demographic characteristics significant?

Measured by:

- Demographic data
- Census data
- Venue data



Is the claimant's prior claim history significant?

Measured by:

- Number of past claims
- Severity of past claims
- Claim settlement
- Litigated vs. non-litigated

Is abidance by contract rules significant?

Measured by:

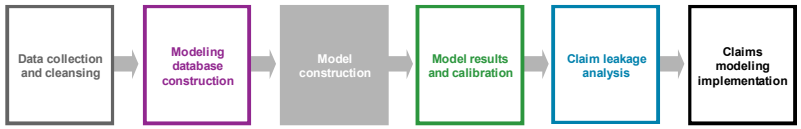
- Failure to pay according to contract or fee arrangement
- Failure to recognize third-party risk transfer protection – indemnity/hold harmless/ additional insured provisions

Is financial condition of claimant predictive of ultimate settlement value?

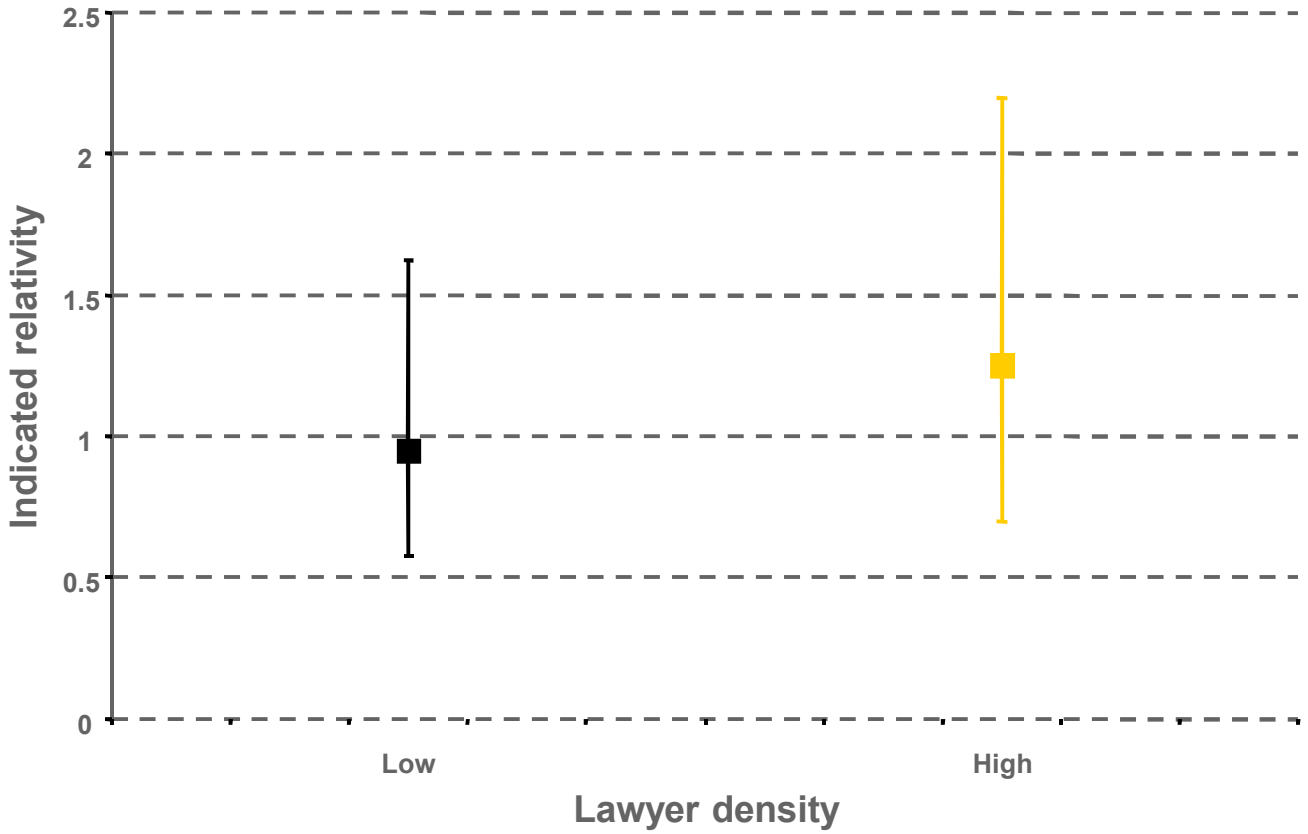
Measured by:

- Personal credit data of claimant
- Individual credit attributes of claimant

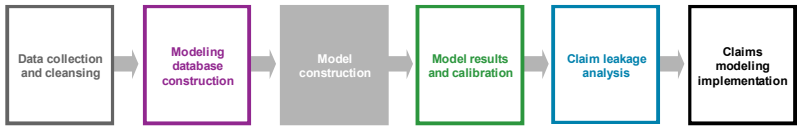
Multivariate modeling results – lawyer density



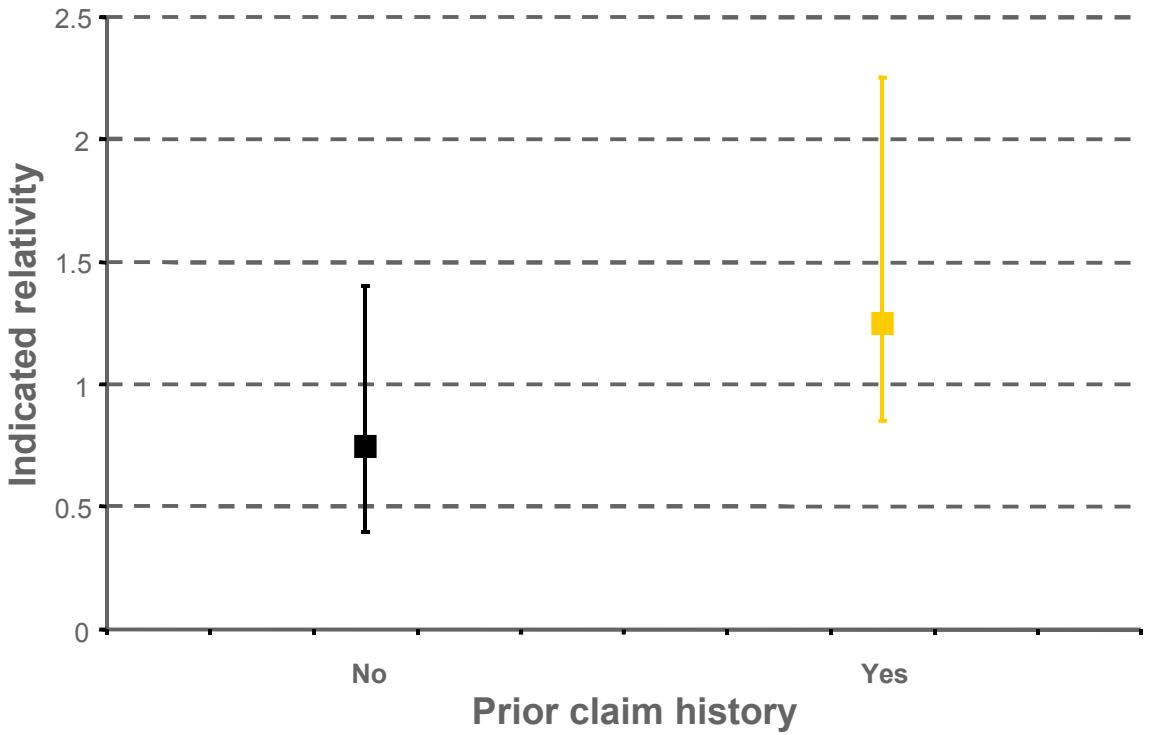
Hypothesis: The density of lawyers in a geographic area increases claim amounts.
Finding: Lawyer density in a geographic area leads to higher ultimate claim values.



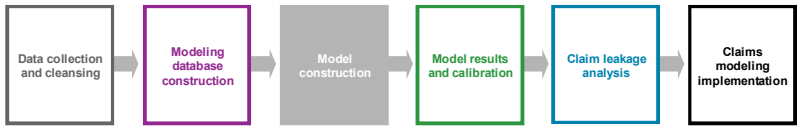
Multivariate modeling results – prior claims history



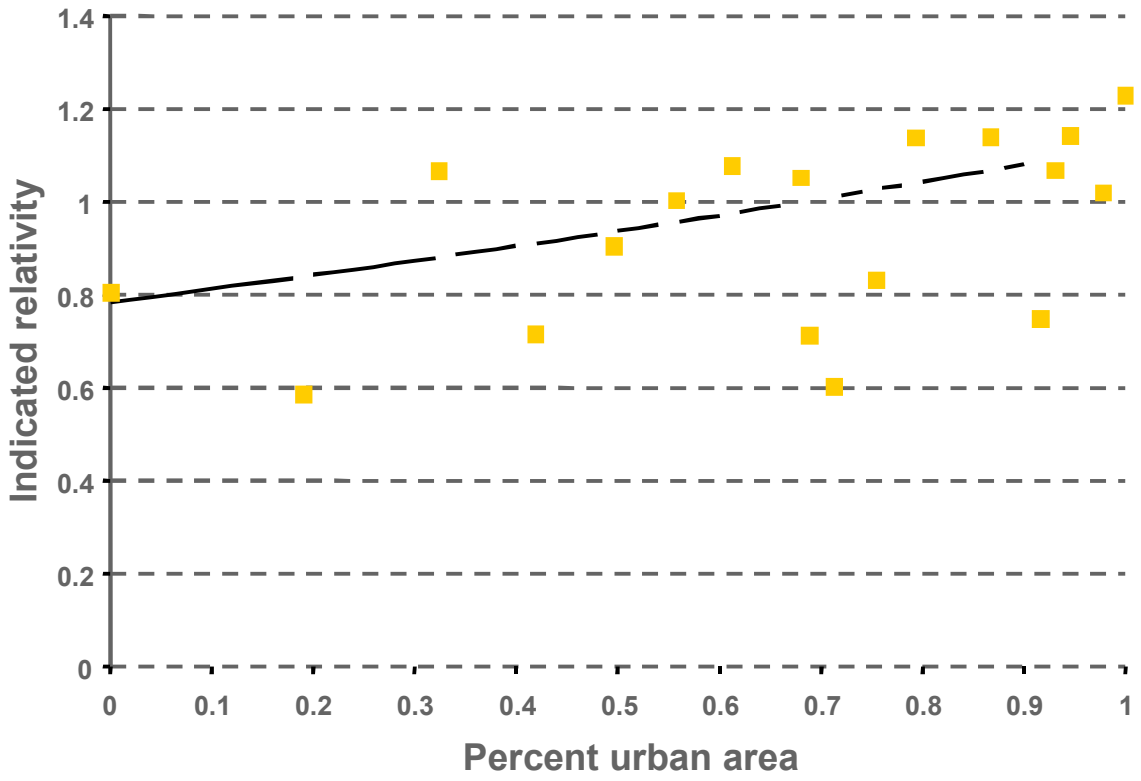
Hypothesis: An individual's claim history is predictive of current claim value.
Finding: Prior claims history is highly predictive of the amount required to settle a current claim.



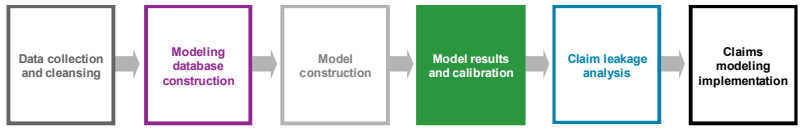
Multivariate modeling results – urban areas

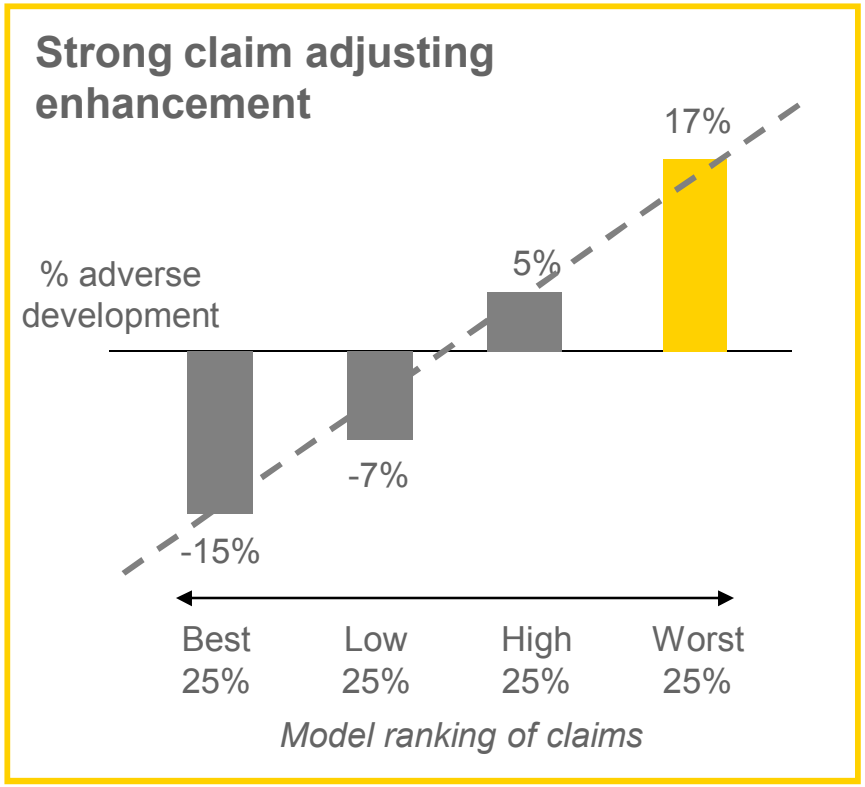


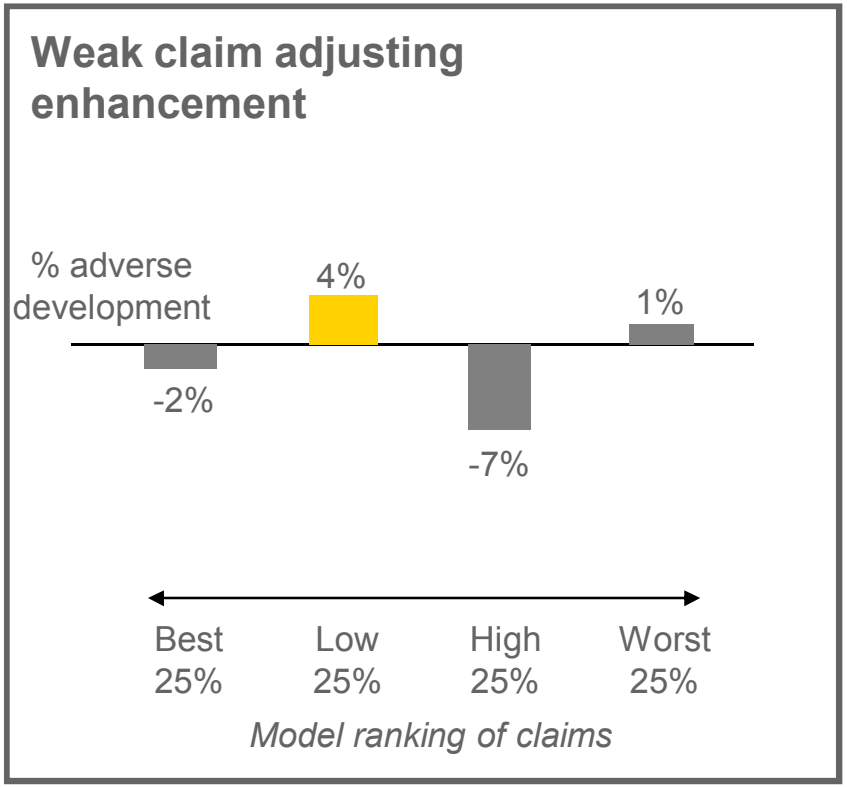
Hypothesis: Claims that occur in urban areas tend to be more expensive.
Finding: Claims in urban areas are 50% more expensive than claims in rural areas, on average.



Results – potential savings with model

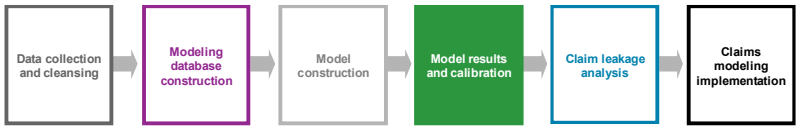




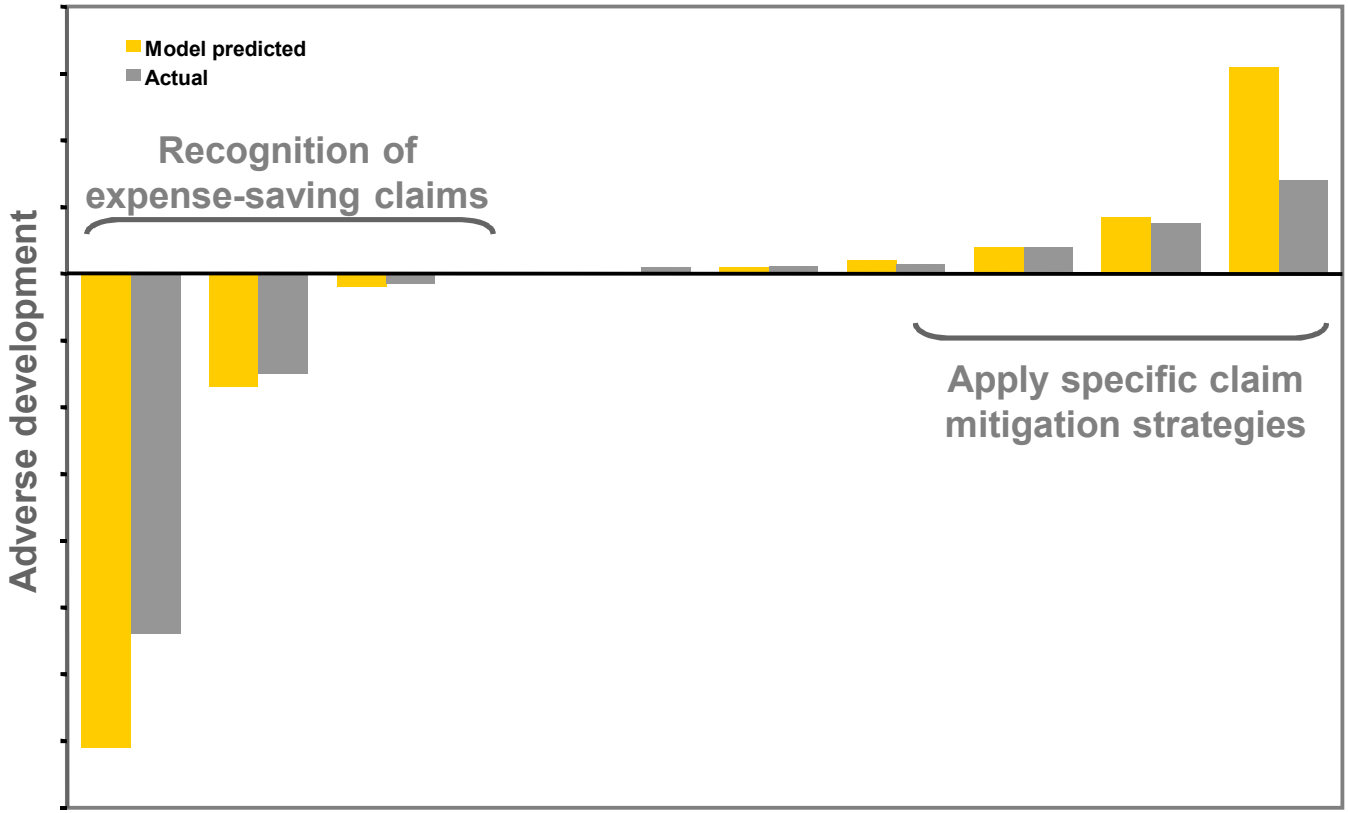


1. Construct a database, including internal and external data.
2. Build a predictive model that supplements existing claim management procedures.
3. Score recent month's claims by expected adverse development.
4. Divide the ranked claims into equal bins (quartiles, deciles, etc.).
5. Measure the experienced adverse development within each bin.

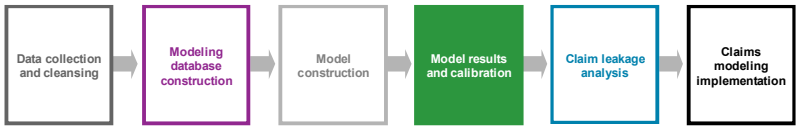
Illustrating improvement in predictability



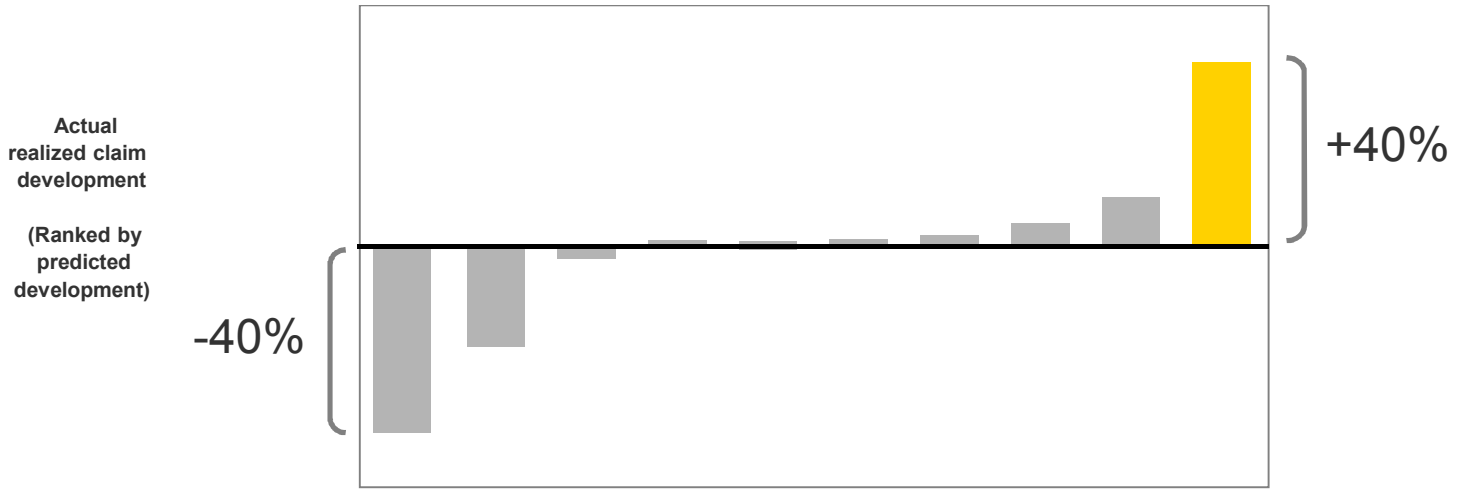
Testing is performed on claims that are outside of the modeling data set.



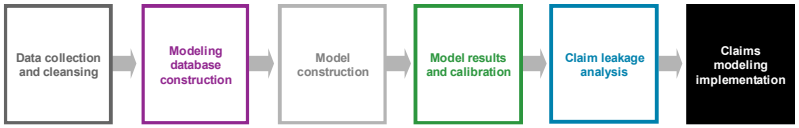
Demonstration of value



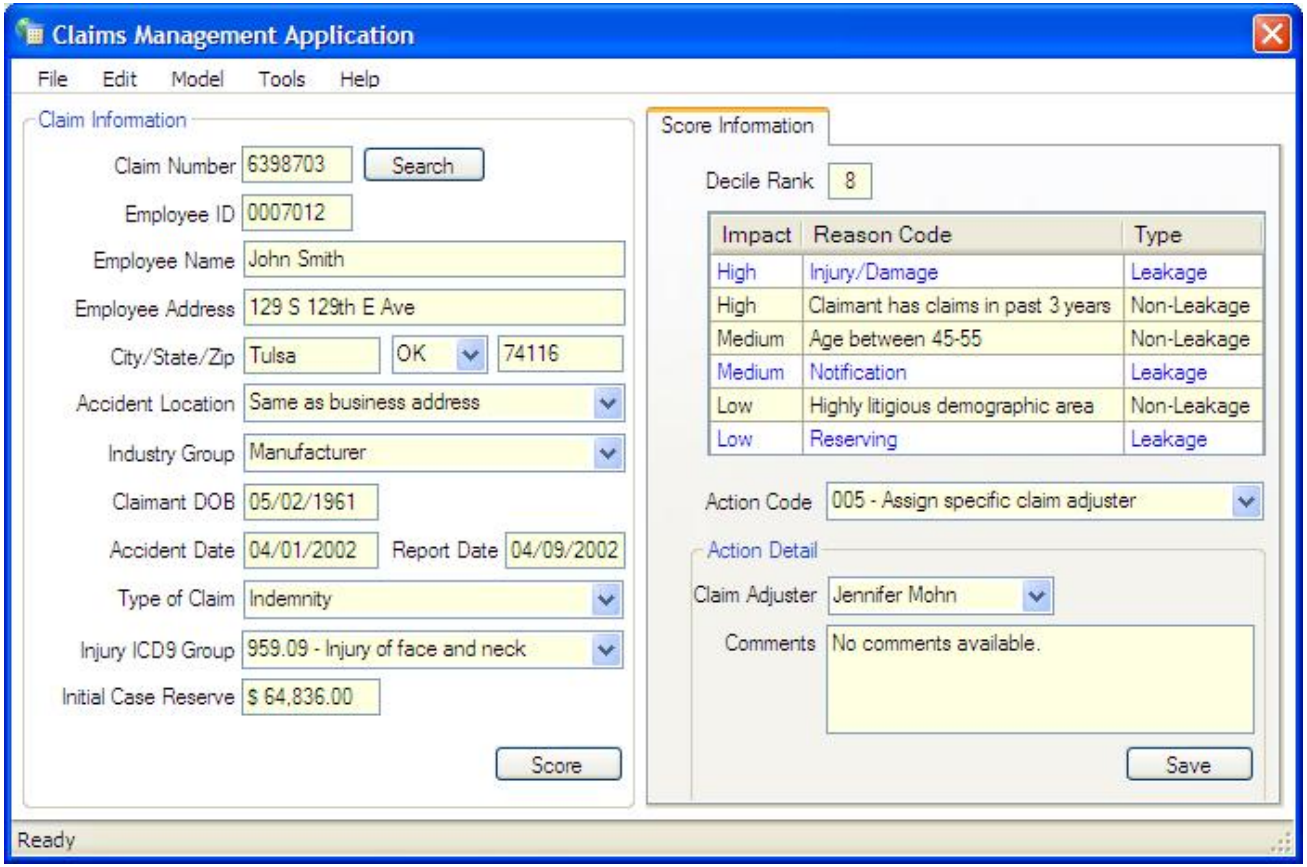
- Predictive modeling can lead to an improvement of approximately +/- 40% in the prediction of actual ultimate incurred claim amounts.
- Action can be taken on those claims with expected adverse development.
- While it may not be possible to completely eliminate that adverse development, it is realistic to capture a significant portion.



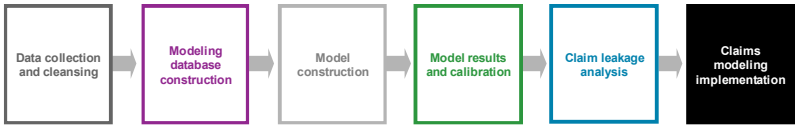
Claims triaging tool



- Can be deployed to claims personnel through a desktop interface

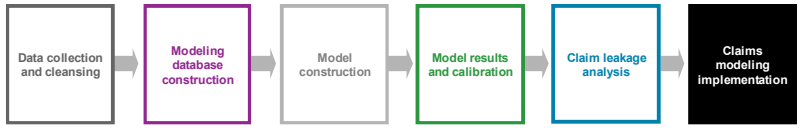


Claims triaging tool

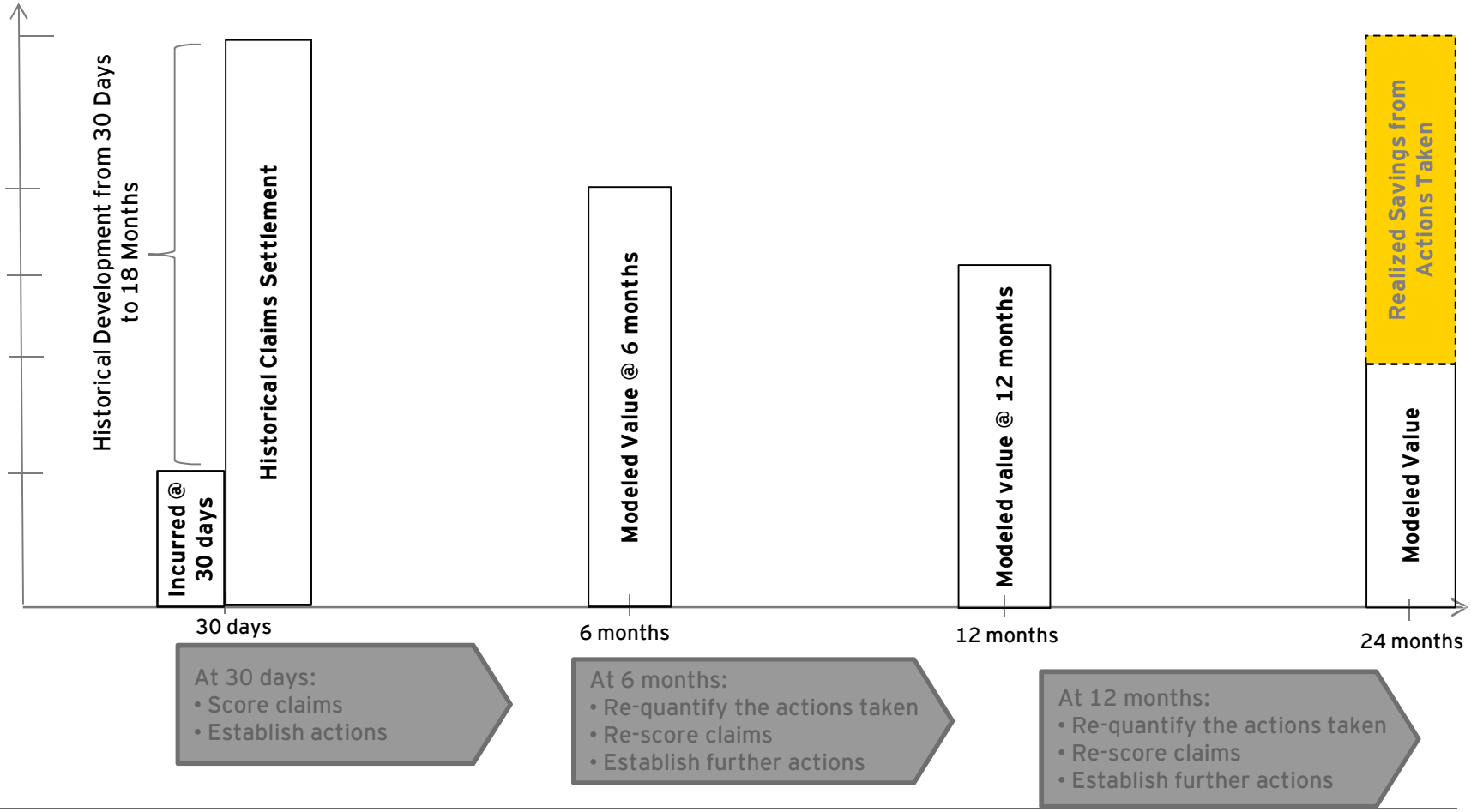


Claim scorecard (two sample prior claims)				
	Claim ID			
Claim characteristics	**24819**		**39854**	
Date of accident	3/5/2006		3/28/2007	
Date of claim reporting	3/9/2006		3/29/2007	
Initial incurred loss at 30 days	$5,000		$22,000	
State claim	NY		MA	
…	…		…	
Predictor variable	**Value**	**Model effect**	**Value**	**Model effect**
…	…	…	…	…
Injury type	Category 3	Negative	Category 1	Positive
Driver prior loss experience	3+	Negative	1-2	Positive
# days reporting lag	4	Negative	1	Neutral
Weather conditions	0.65	Neutral	0.45	Neutral
…	…	…	…	…
Model output				
Predicted incurred loss at 24 mos	$150,000		$10,000	
Decile ranking (based on expected development)	9		2	
Rule set:				
Suggested action 1	1. Assignment to senior adjuster		1. Deprioritize claim in case log	
Suggested action 2	2. Proactive settlement efforts			
Actual outcome				
Actual incurred losses at 24 mos	$250,000		$6,000	
Current incurred losses at present day	$265,000		$6,000	

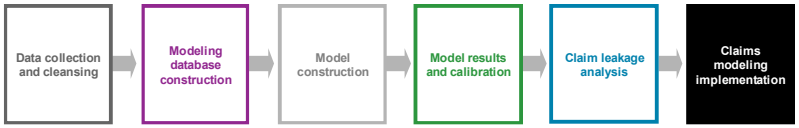
Claims development lifecycle



- **The claim development lifecycle starts at 30 days with a claims modeling score and leakage assessment with associated action plans.**
- **Subsequent to the scoring of the claims along with the associated action plans invoked, a re-evaluation is required through a re-scoring process.**

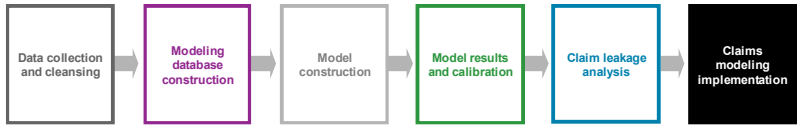


Potential loss mitigation strategies



- Identify specific loss mitigation strategies to be applied to claims with potential claim leakage.
- Possible loss mitigation strategies are as follows:
  - Prompt assignment of senior claims handler
  - Prompt assignment where appropriate of nurse case manager or rehab specialist
  - Early enrollment in vocational rehabilitation
  - Continued proactive follow-up with injured party
  - Claims management committee review
  - Proactive early settlement efforts
  - Application of return-to-work initiatives
  - Modify claim service instructions
- The loss mitigation strategies identified and implemented will vary based on the client and data available.
- Develop “rule set” (“guiding principles”)to guide the application of the strategies.

Loss mitigation rule set



Potentially severe claim identified:

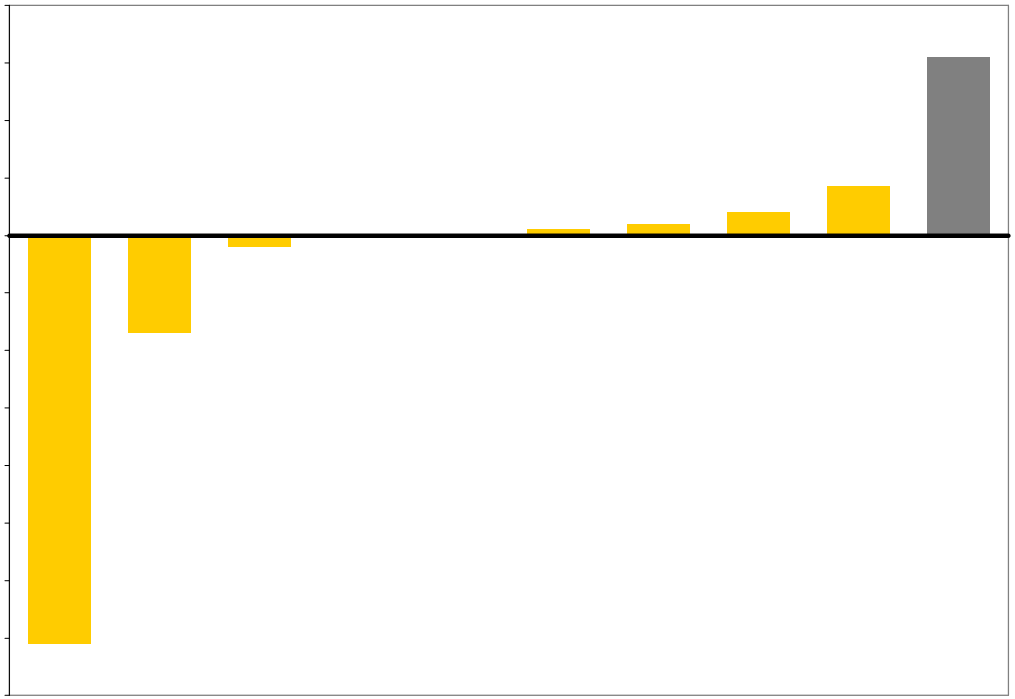
- Nerve damage
- Significant pre-existing conditions:
  - Overweight
  - Diabetes
- Extensive claims history

Model prediction:

- Adverse development of $1m

Given facts, rule set indicates:

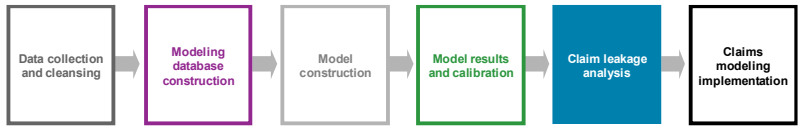
1. Promptly assign senior adjuster
2. Promptly assign nurse case manager
3. Proactive medical management
4. Order independent medical exam
5. Seek early return to work (light duty)

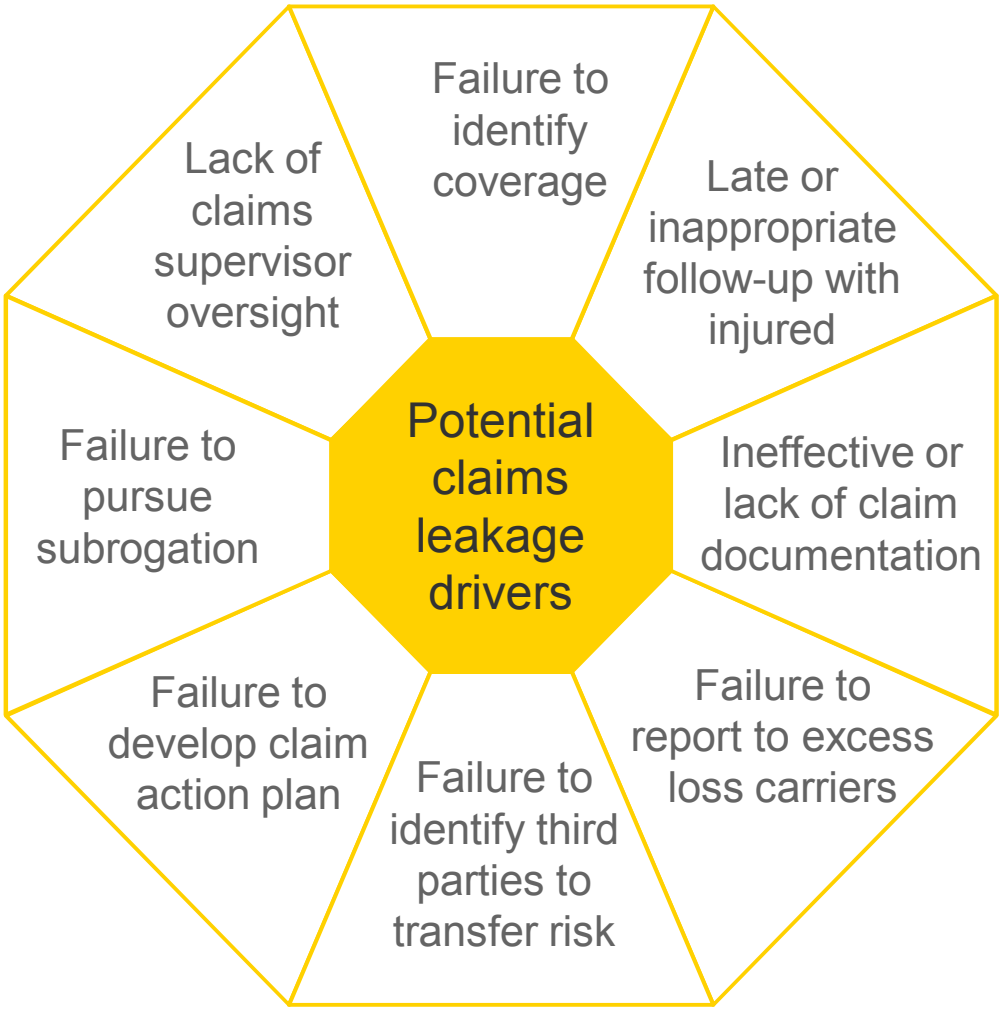


Outcome:

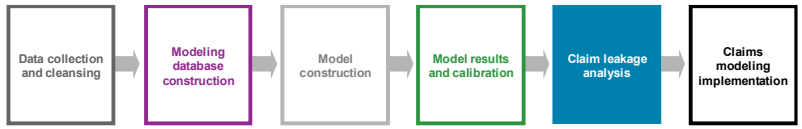
Reduced claim leakage (lower indemnity: permanent impairment + on-going medical) resulting in reduction in total incurred loss

Claim leakage analysis



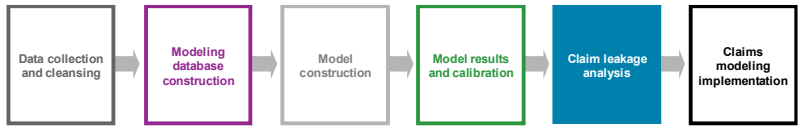


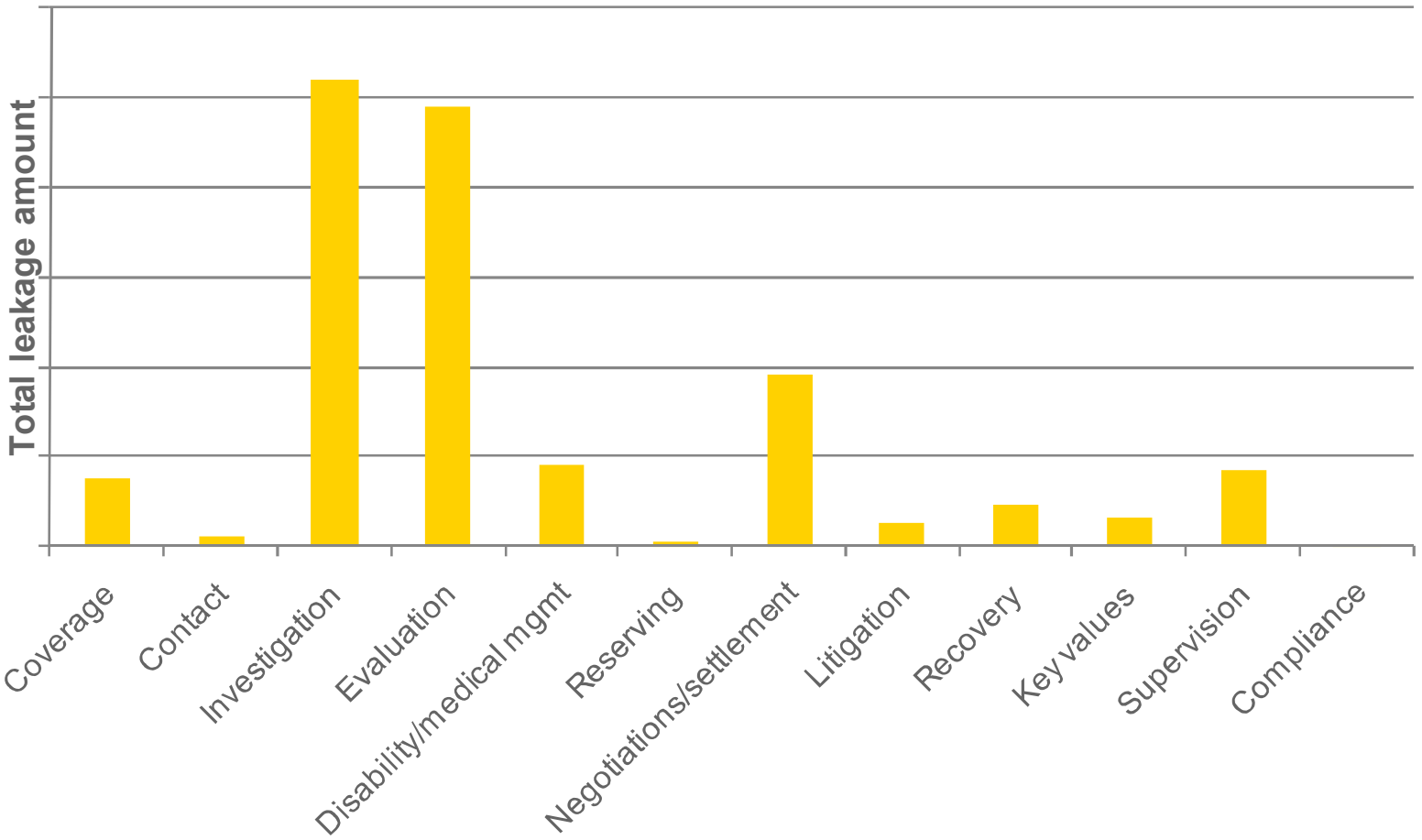
Potential benefits of the claim leakage process



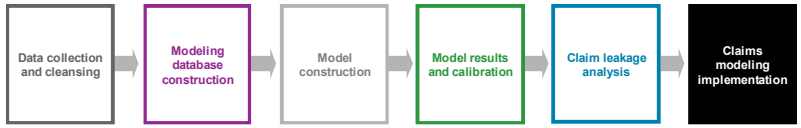
- Certain factors that contribute to increased claim leakage are not available at first report and therefore are not included as factors in the predictive model.
- Claim leakage analysis aims at reviewing a sample of historical claims with high leakage that cannot be attributed to the predictors identified during the model development.
- Claim leakage predictors are part of analysis to identify trends and opportunities for process improvement.
- The analysis includes building an historical claim database and identifying common themes and characteristics among the sample of claims reviewed that are the main drivers of high claim leakage.
- The claim leakage analysis results in a recommendation report for each leakage process that has been identified.

Leakage impact analysis by process



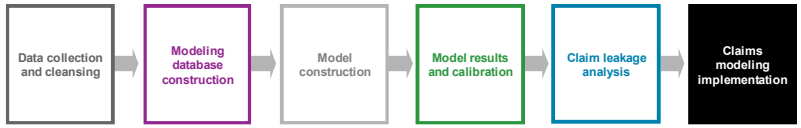


Development of leakage rule set – 19 dimensions to consider



Self-critical analysis questionnaire	
Overall self-critical analysis assessment Self-critical analysis scoring results	Exceeded expectations 98%
1. Initial claims triage and assignment process 2. Identification of coverage issues 3. Three point contact elements 4. Elements of the compensability evaluation 5. Appropriate subsequent contact made with all applicable parties 6. Effectiveness of the action plan 7. Completion of the proper facts surrounding the investigation 8. Effectiveness of subrogation efforts 9. Elements of the medical treatment plan 10. Elements of lost time claim characteristics	11. Reserve accuracy 12. Aspects of reserve accuracy 13. Aspects of the settlement process 14. Special fund process 15. Elements of the recovery process 16. Aspects of claim adjuster file completeness 17. Aspects of vendor management 18. Aspects of supervisor involvement in claim process 19. Claims handling compliance with state statutory requirements

Process improvement



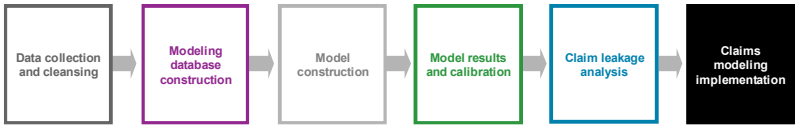
Claims process
- Better claim triaging and mitigation
- Improved efficiency of claims department

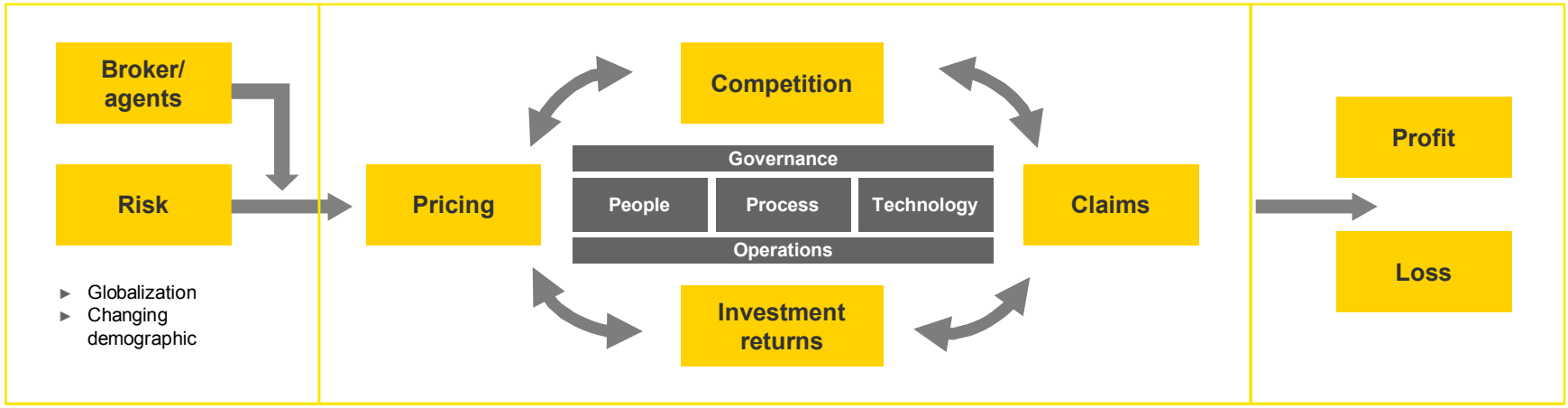
Underwriting process
- Improved understanding of claims drivers
- Application of criteria to underwriting

Overall improvement to operations

1% to 2.5% combined ratio savings

Process improvement





Competition	Customers	Service	Regulatory	Financial markets
► Challenging financial results ► Focused inward fixing issues ► Not as close to their customers ► Fewer new products ► New competitors ► Emerging tools and technology ► Turnover at all levels ► Dynamic, flexible operating model by strong core values and leadership	► Exert pressure on pricing ► Require global, end-to-end solutions ► More willing to move for price and service reasons ► Demanding innovation ► Complexity increasing related to lack of knowledge of local, political and geographic laws and customs	► Challenging financial results ► Focused inward fixing issues ► Not as close to their customers ► Fewer new products ► New competitors ► Emerging tools and technology ► Turnover at all levels ► Dynamic, flexible operating model by strong core values and leadership	► Rating agency pressure ► Increased regulatory action due to government interventions ► Increased foreign regulation ► Consolidation of banking and insurance environment	► Debt and equity market issues ► Increasing government intervention ► Increased foreign exchange pressure ► Increased desire by corporations to utilize financial markets in lieu of insurance to manage risk (e.g., cat bonds)

Summary

- There is significant opportunity for potential savings by applying claims predictive modeling and leakage analysis to a company's claims operations.
- Companies that leverage the knowledge from the above combined process all the way back to underwriting will benefit the most.
- Claim leakage processes and controls and loss mitigation strategies can be applied proactively.

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