



# Mitigating claim development through predictive modeling

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CAS Casualty Loss Reserve Seminar  
21 September 2010

# Agenda

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- ▶ What drives the adverse development of claims?
  - ▶ Fact-based predictors
  - ▶ Leakage predictors
- ▶ Analysis methodology
  - ▶ Predictive modeling
  - ▶ Operational and financial claim leakage assessment
- ▶ Implementation
- ▶ Next steps

# What is claim leakage?

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- ▶ Claim leakage capture is the process of identifying, analyzing and measuring the adjudication process and resulting claims payments/recoveries or lack of, against established standards to identify opportunities for improvement.
- ▶ Claim leakage is defined as the difference between the actual claim payment made and the amount that would have been paid if more effective claim payment controls were in place (operational and financial).
- ▶ Leakage is caused by deviations from established industry or company standards and/or leading practices.
- ▶ Leakage is also calculated against the probability that a company utilizing leading practices with the same claim fact pattern would have identified and avoided the result.
- ▶ Leakage = (actual payout – appropriate payout) X probability.

# Typical causes of claim leakage

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- ▶ Assignment of claim to inappropriate adjuster by skill level resulting in poor recognition of critical issues
- ▶ Repeated re-assignment of files across various claim handlers causing delay and lack of case continuity
- ▶ Improper determination of coverage or risk transfer obligation
- ▶ Failure to perform and document meaningful investigations, as well as infrequent communication with relevant parties
- ▶ Inadequate management or inappropriate use of vendors, including legal and medical professionals
- ▶ Lack of proactive claim handling and resolution planning
- ▶ Failure to pay according to a contractual agreement or fee arrangement
- ▶ Missed subrogation, recovery or offset opportunities

# Potential cost savings

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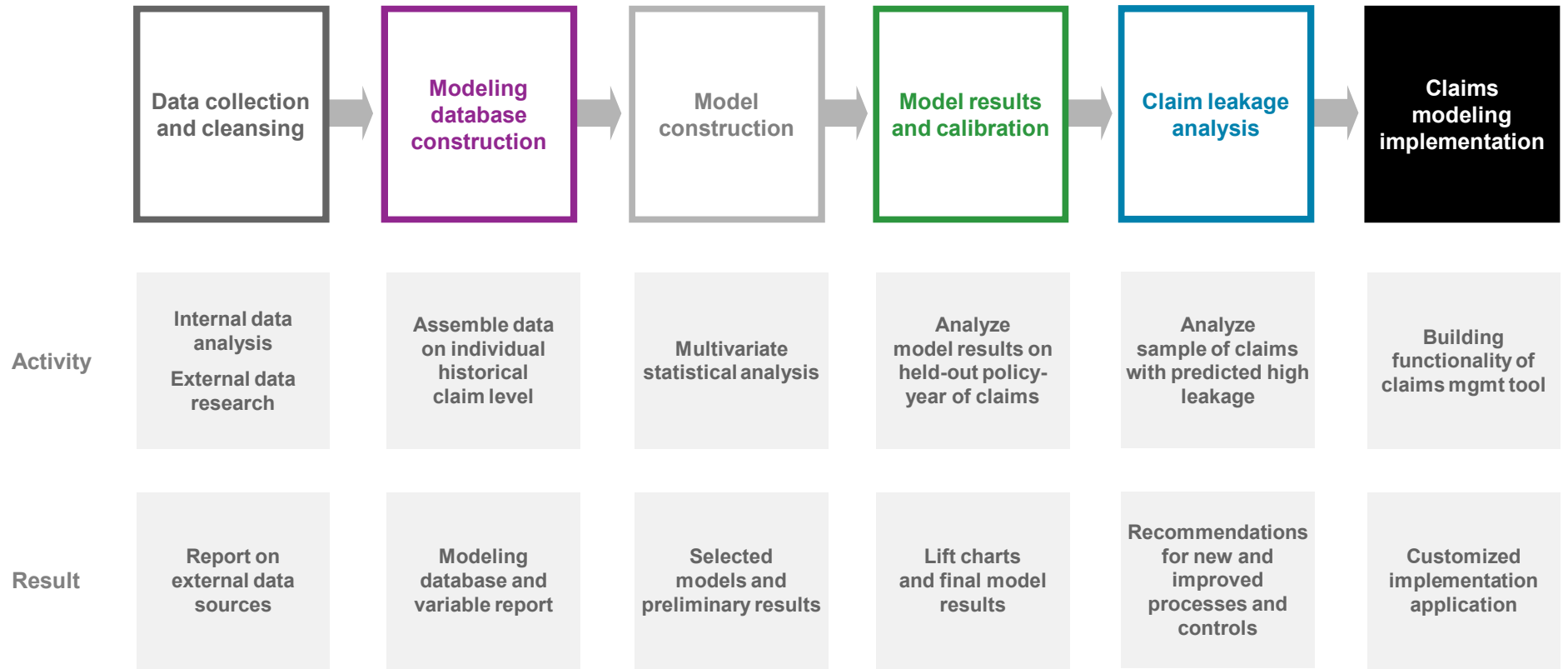
- ▶ The analysis of historical claim development via predictive modeling allows for the quantification of the root-cause cost drivers of adverse claims development.
- ▶ Once potentially severe claims are identified, actions can be taken:
  - ▶ Prompt assignment of senior claims handler
  - ▶ Prompt assignment of nurse case manager or rehab specialist
  - ▶ Early enrollment in vocational rehabilitation
  - ▶ Early application of return-to-work strategies/initiatives
  - ▶ Continued proactive communication with injured party and employer
  - ▶ Claims management committee review
  - ▶ Proactive early settlement efforts
- ▶ Early application of mitigation strategies could reasonably allow for capture of a significant portion of adverse development that would have occurred.

# Predictive modeling process

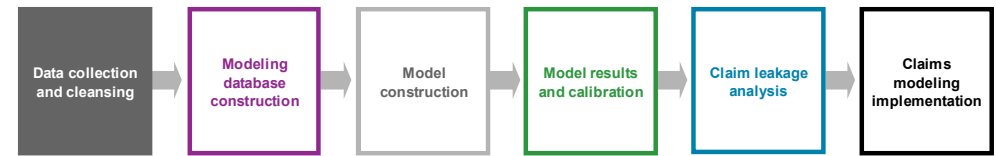
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- ▶ Predictive models are now being successfully applied in insurers' claims operations.
- ▶ The models are used to identify which claims have the potential to develop adversely based on information known when the claim is first reported.
- ▶ Analytics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

# Claims model development process



# Internal data collection and cleansing

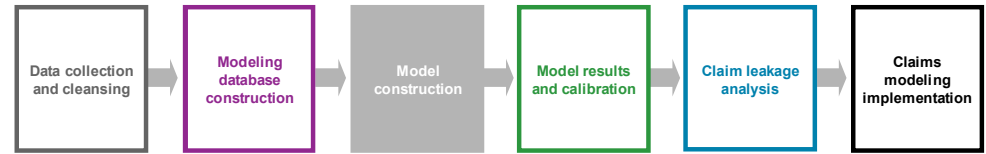


- ▶ The first phase of the predictive modeling process is to construct the internal claims database file.
- ▶ Internal claims data is assembled at the claim level to include claim identifiers, potential predictor variables and response information.
- ▶ This internal data is then tested and modeled before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

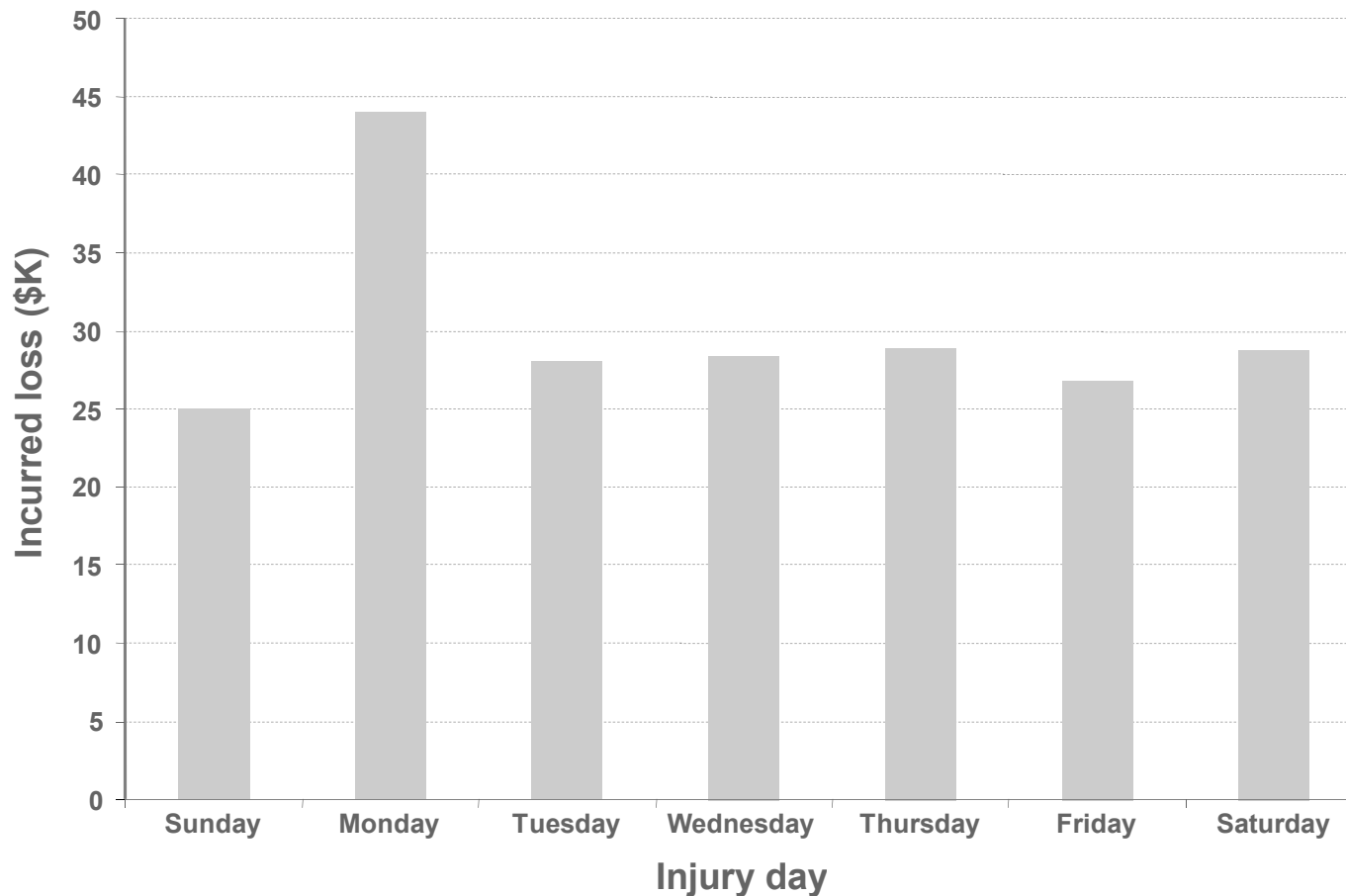


# Internal data review – injury day

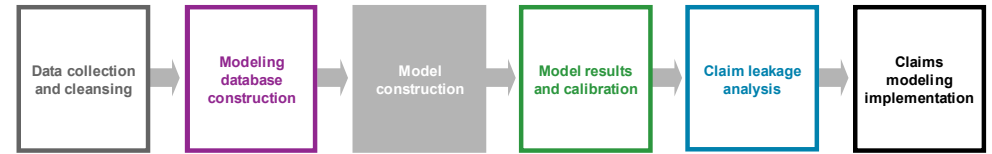


**Hypothesis:** The day that an indemnity claim occurs could be a fraud indicator.

**Finding:** Claims that occur on Monday tend to develop into significantly larger claims.

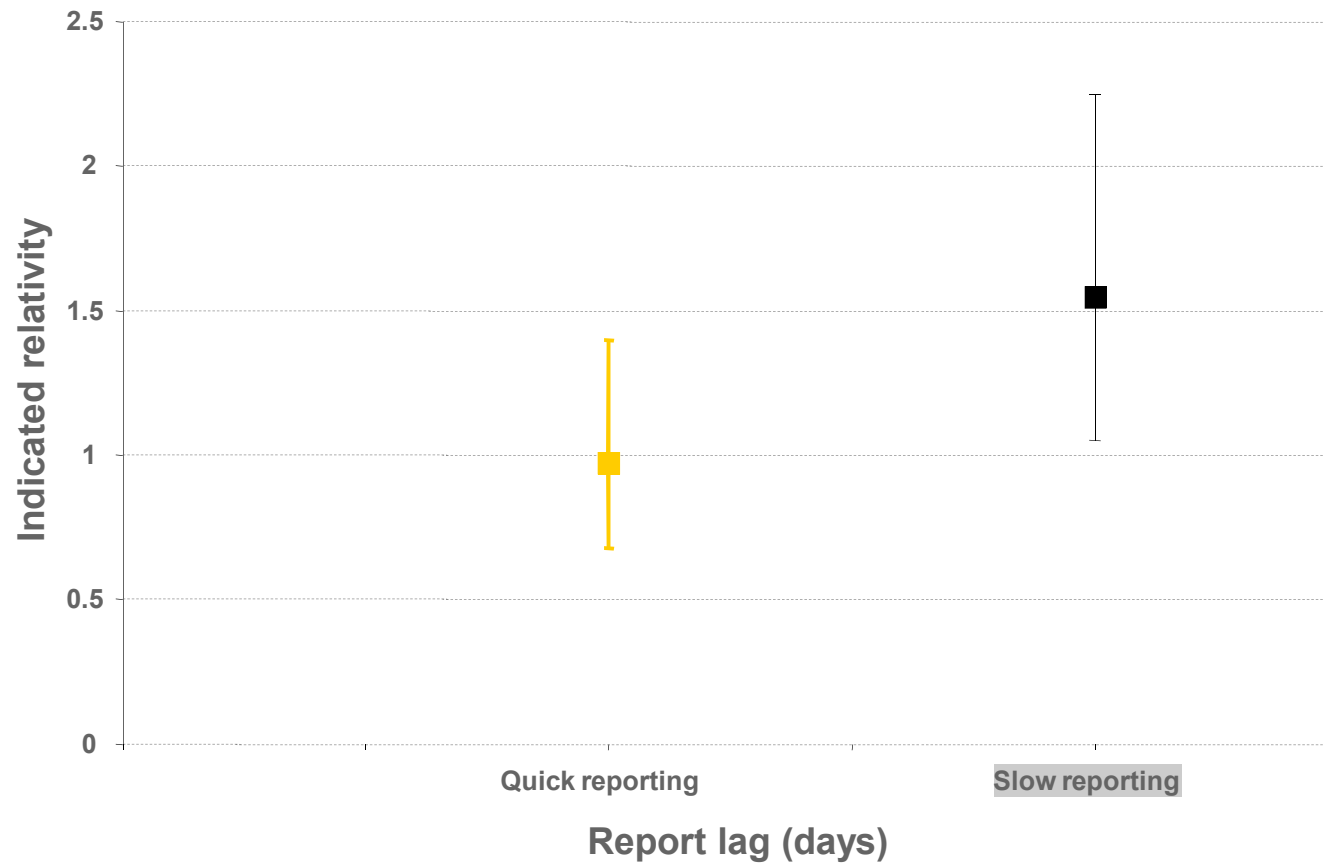


# Internal data modeling – reporting lag

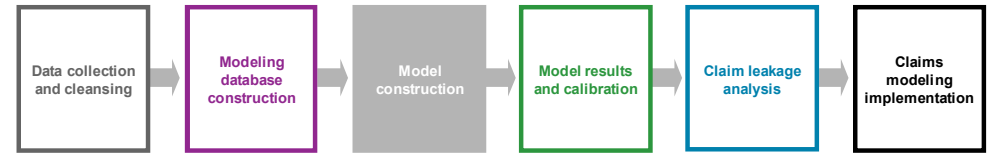


**Hypothesis:** The reporting lag of a claim affects the ultimate settlement amount.

**Finding:** Claims that take longer to report tend to be significantly more expensive.

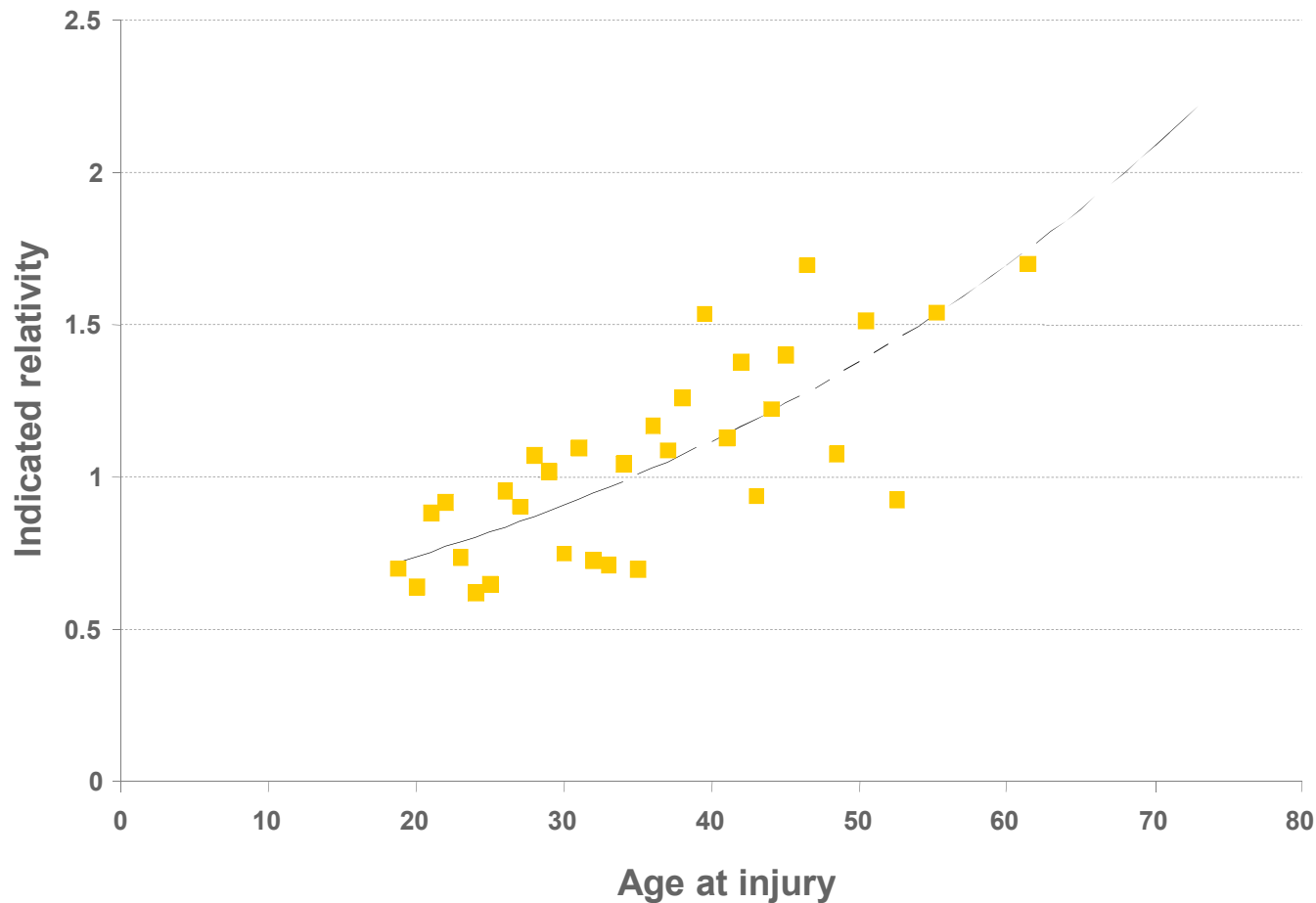


# Internal data modeling – age at injury

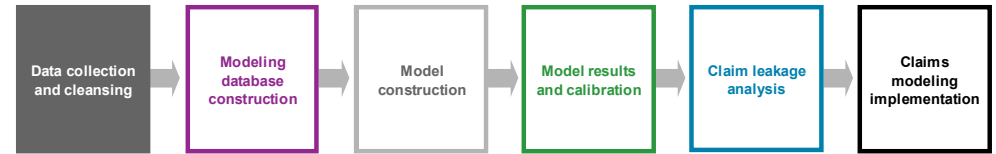


**Hypothesis:** The age of the claimant affects the ultimate cost of the claim.

**Finding:** Older claimants have significantly larger claims on average.



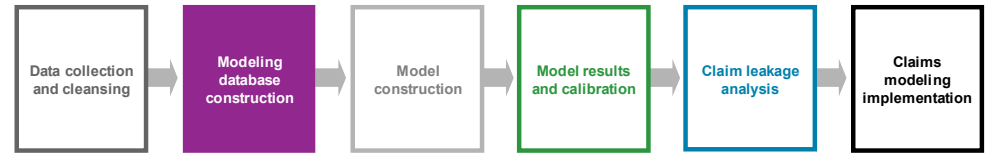
# Incorporating external data sources



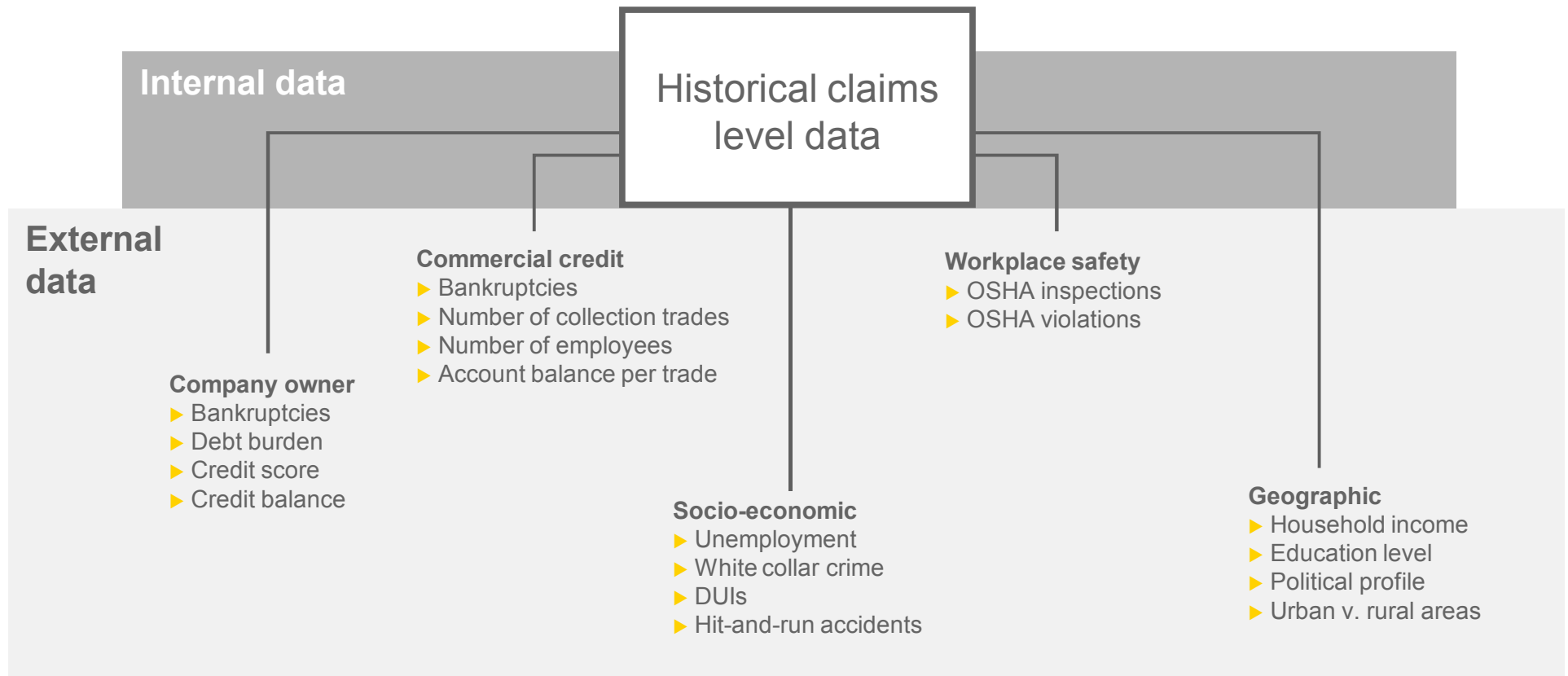
- ▶ Much of the power in a predictive model comes from the incorporation of additional external data.
- ▶ There are numerous vendors that can provide various types of potentially valuable external data.
- ▶ Examples of some of these sources are shown below:

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

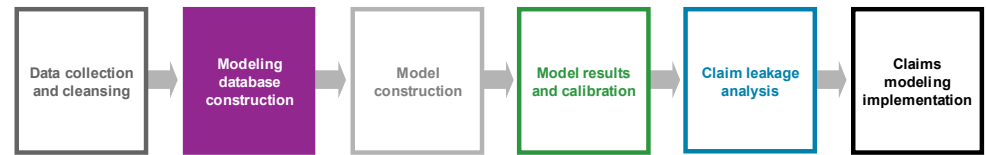
# Combining internal and external data



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



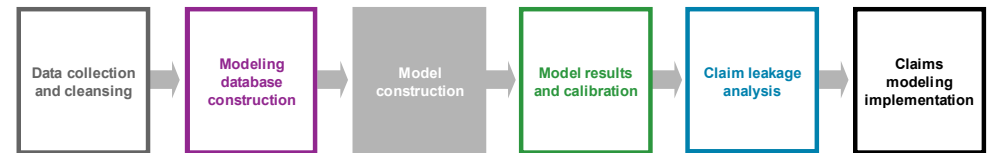
# Modeling database



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	Unemployment 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	Manu	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	Manu	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	\$8,891

► Modeling database will contain all internal and external risk factors

# 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

## Example data sources

Prior injury data

Socio-economic data

Workplace safety data

US census

Credit 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:*

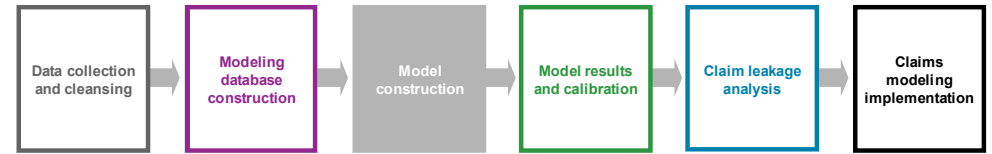
- ▶ Failure to pay according to contract or fee arrangement
- ▶ Failure to recognize third-party risk transfer protection – indemnity/hold harmless/additional insured provisions

Is financial condition of claimant predictive of ultimate settlement value?

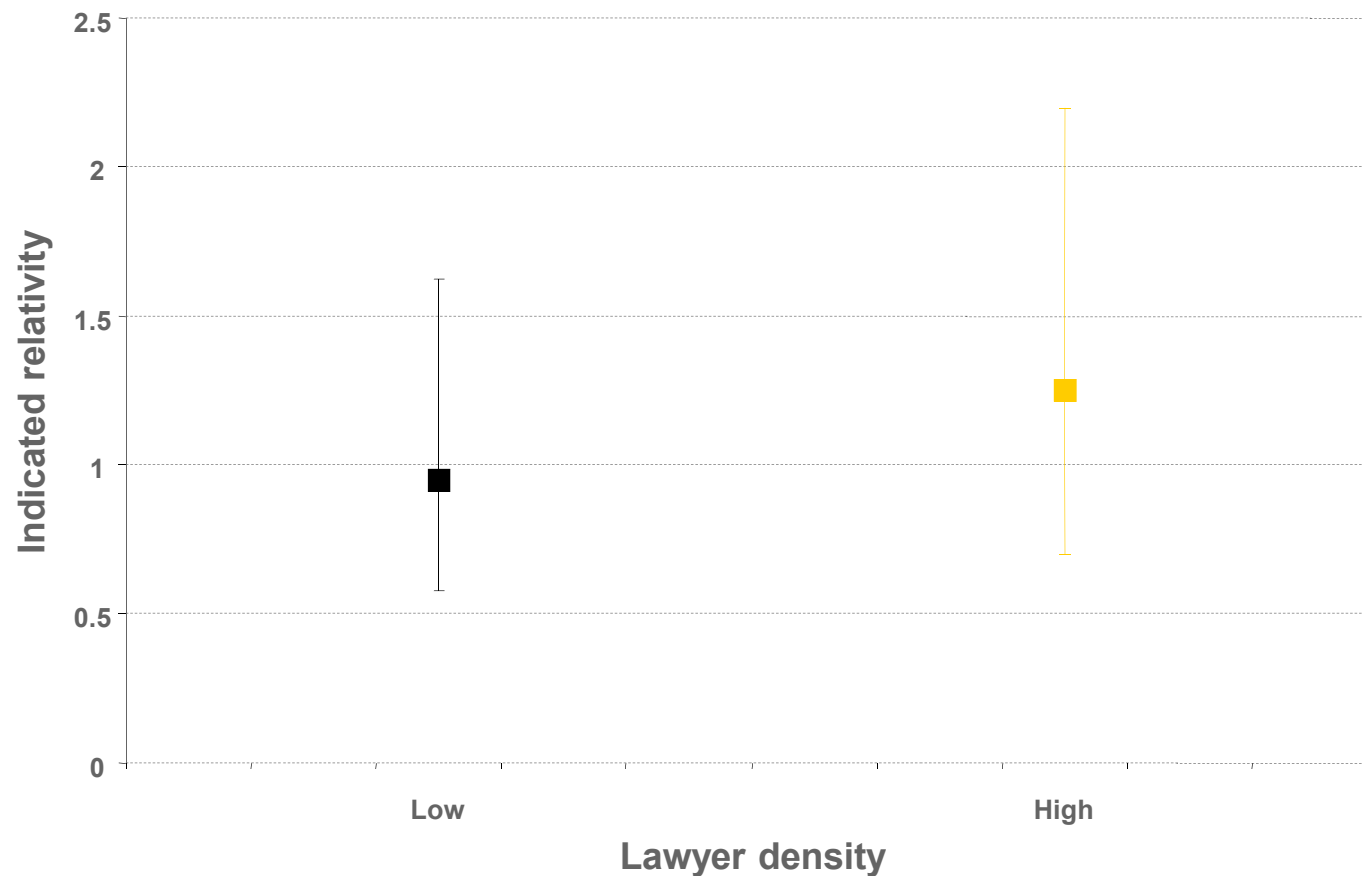
*Measured by:*

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

# Multivariate modeling results – lawyer density

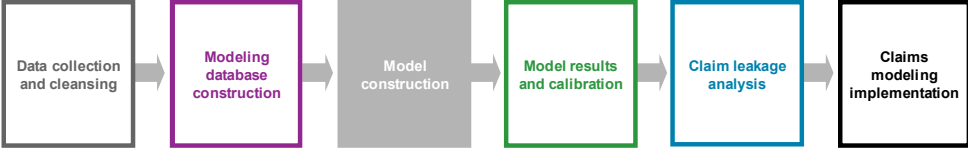


**Hypothesis:** The density of lawyers in a geographic area increases claim amounts.  
**Finding:** Lawyer density in a geographic area leads to higher ultimate claim values.



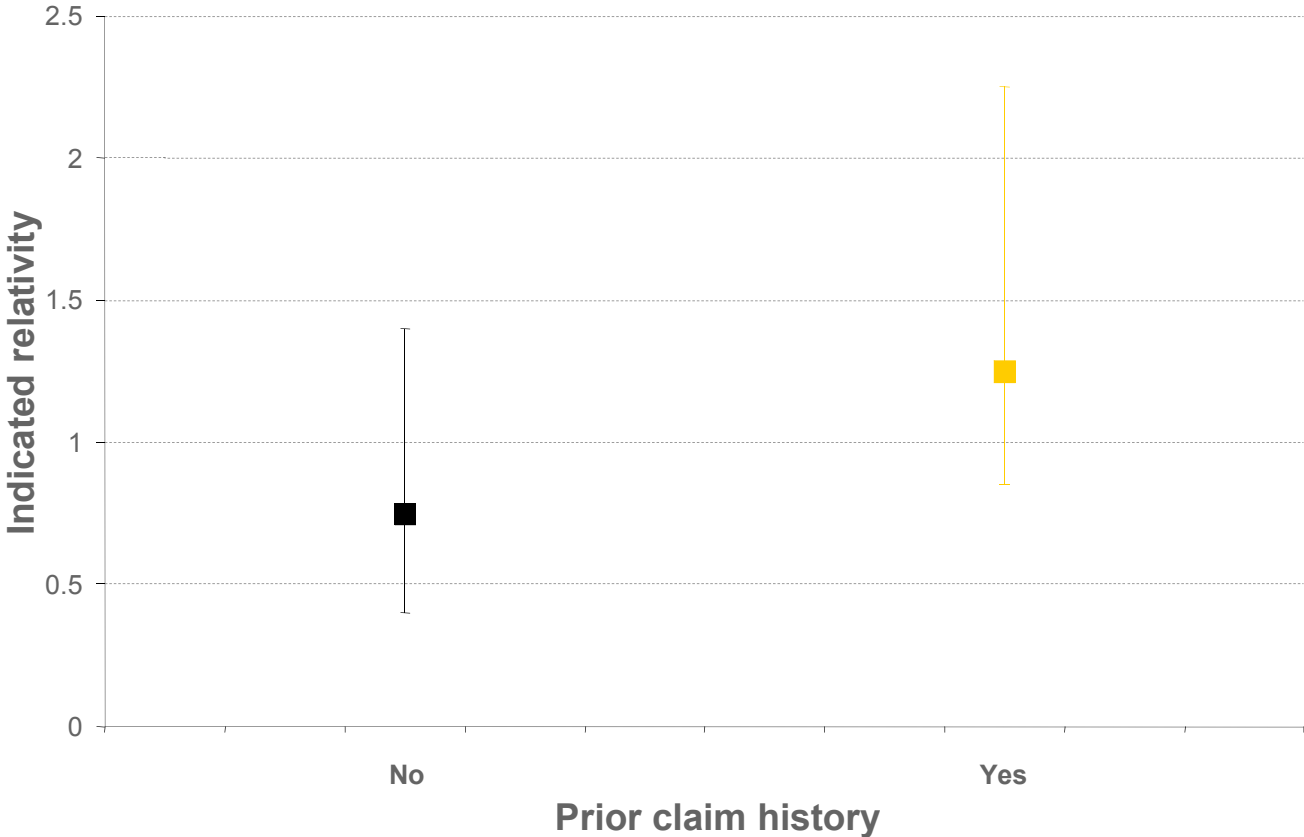


# Multivariate modeling results – prior claims history

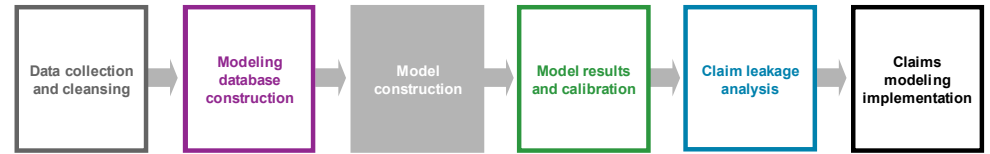


**Hypothesis:** An individual’s claim history is predictive of current claim value.

**Finding:** Prior claims history is highly predictive of the amount required to settle a current claim.

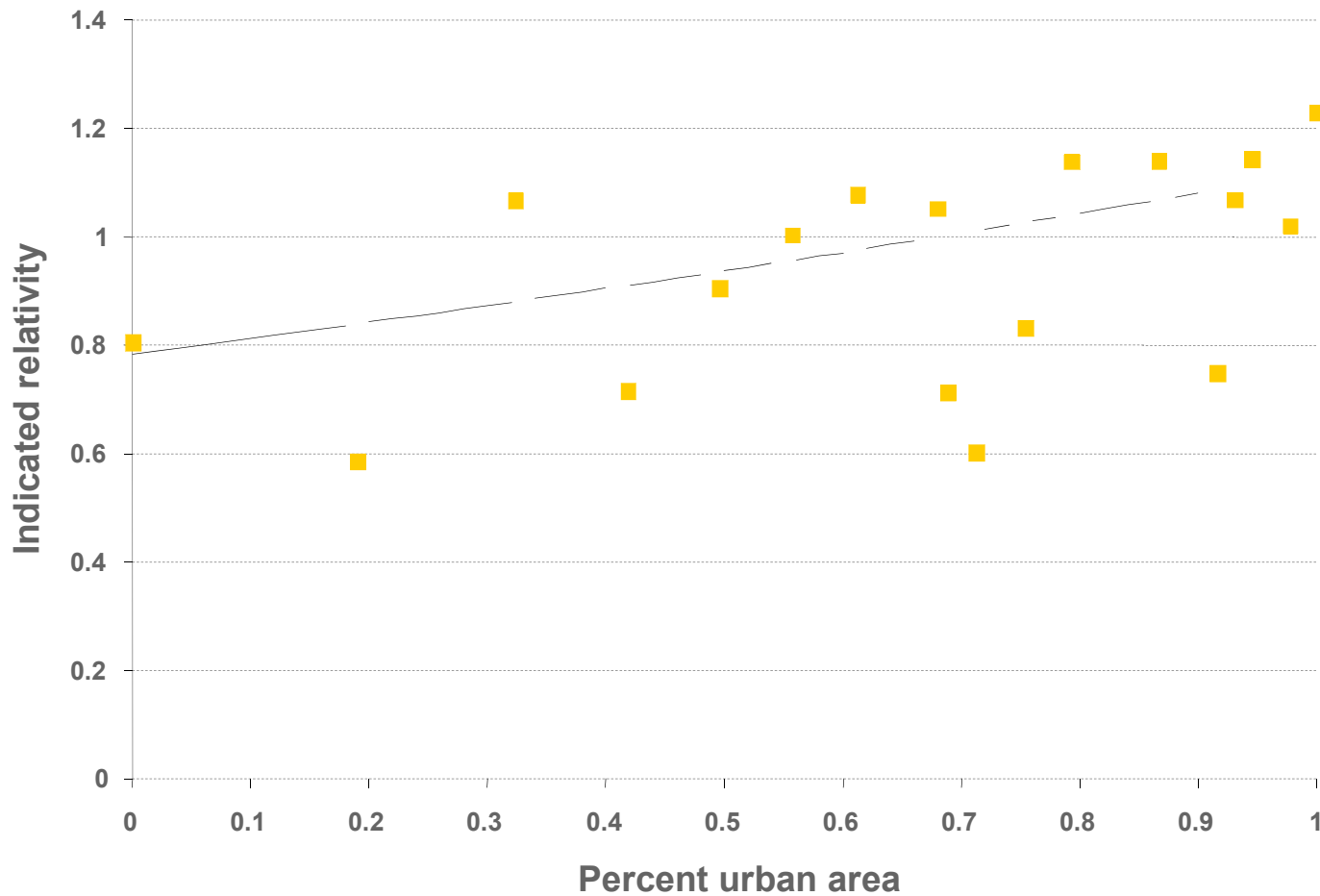


# Multivariate modeling results –urban areas

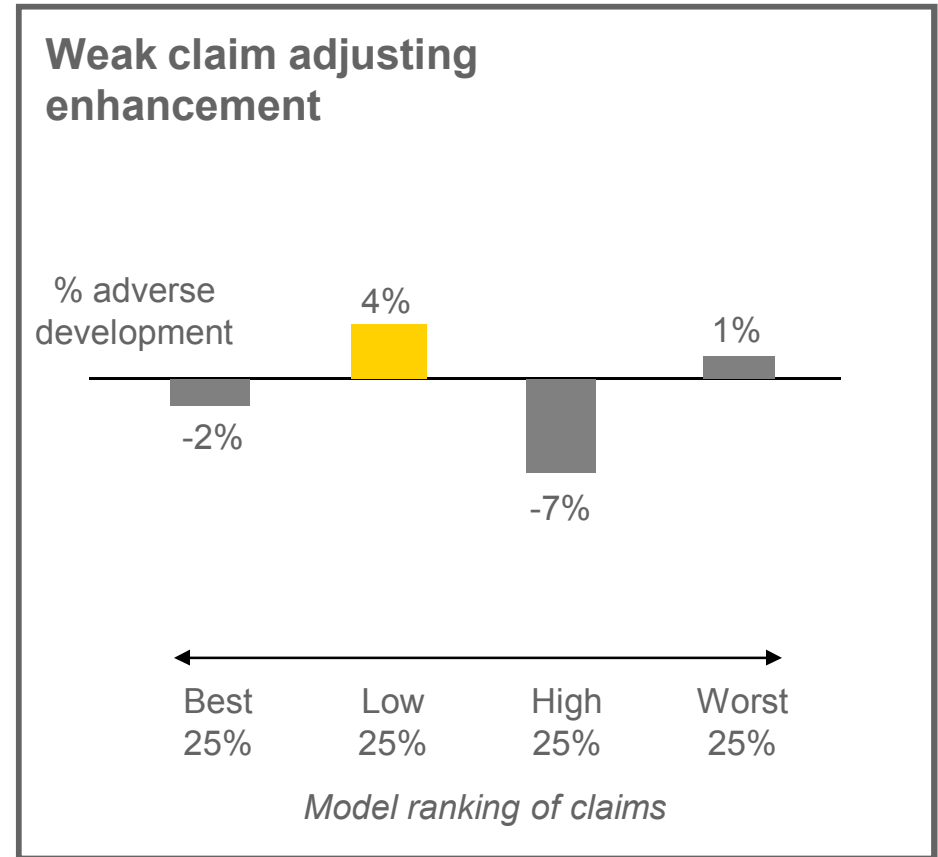
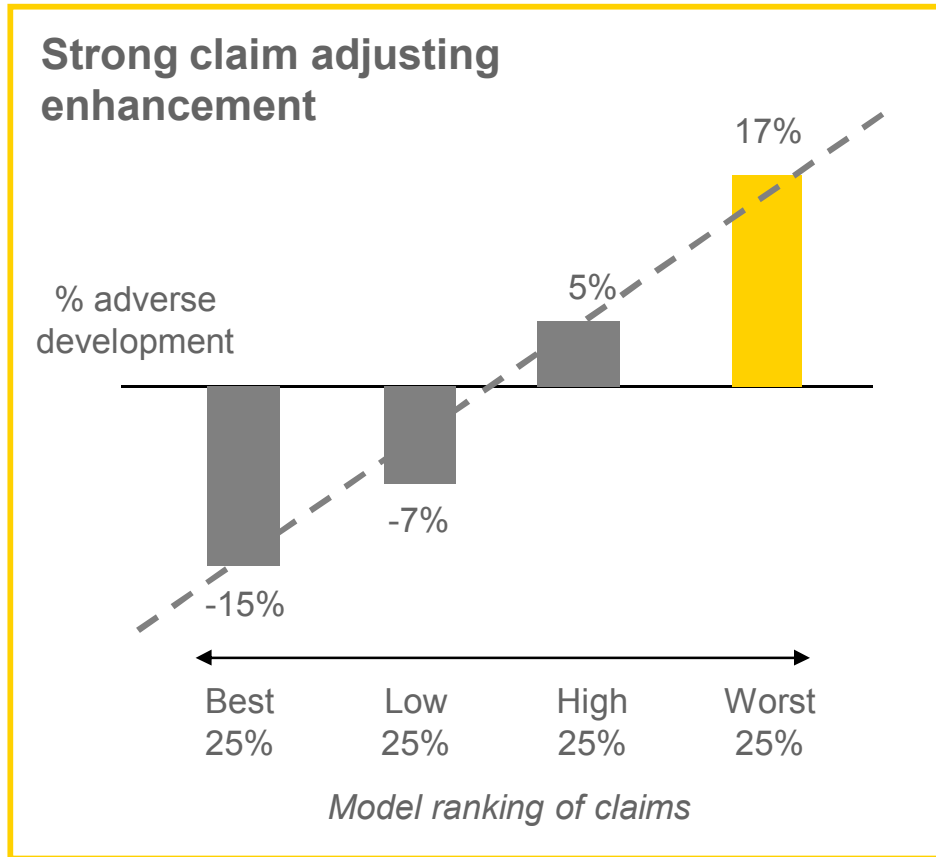
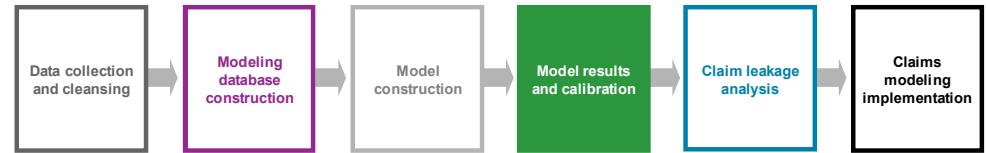


**Hypothesis:** Claims that occur in urban areas tend to be more expensive.

**Finding:** Claims in urban areas are 50% more expensive than claims in rural areas, on average.

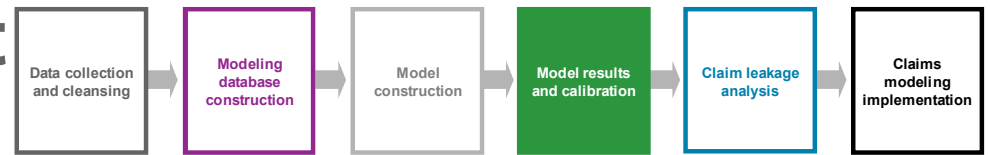


# Results – potential savings with model

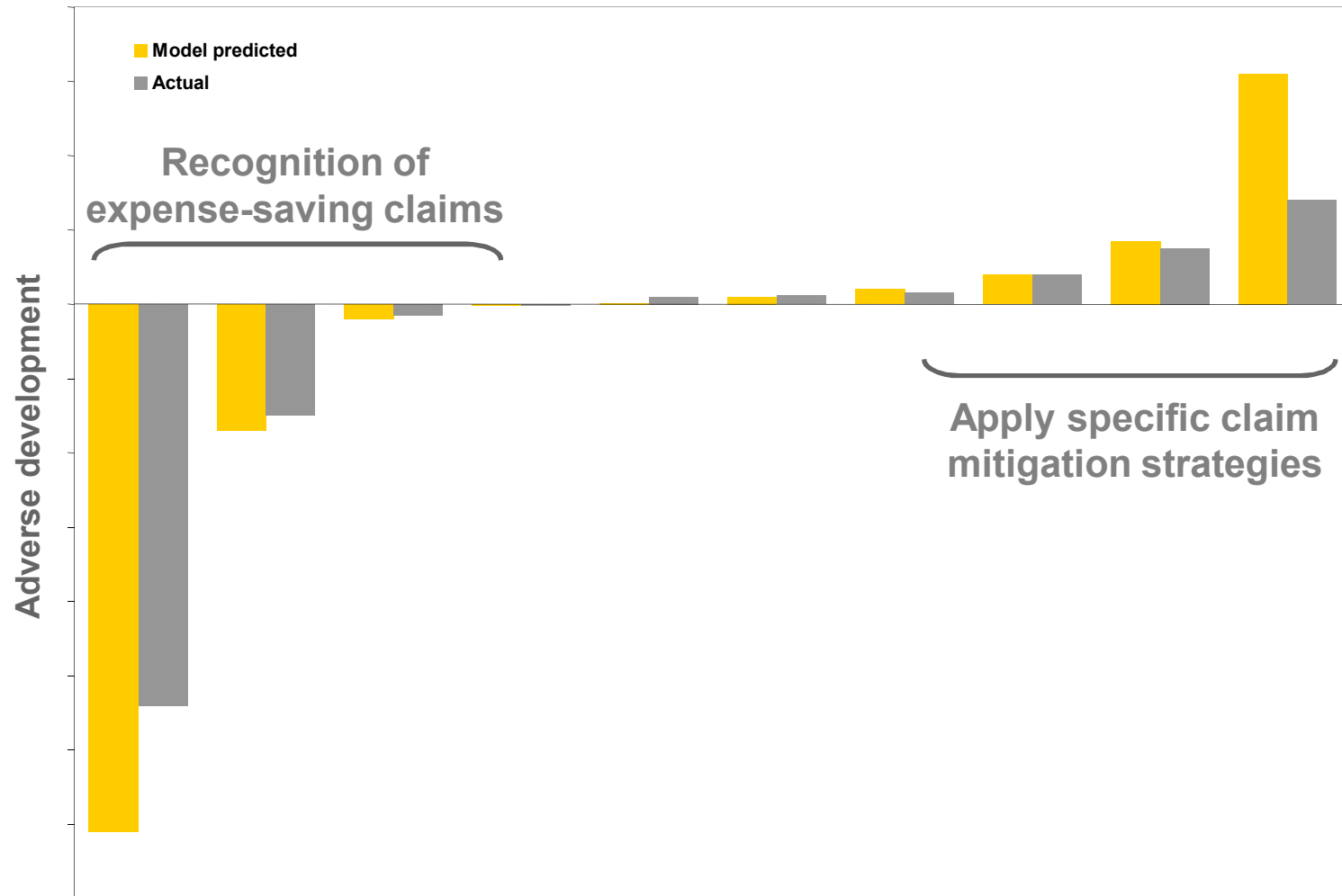


1. Construct a database, including internal and external data.
2. Build a predictive model that supplements existing claim management procedures.
3. Score recent month's claims by expected adverse development.
4. Divide the ranked claims into equal bins (quartiles, deciles, etc.).
5. Measure the experienced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

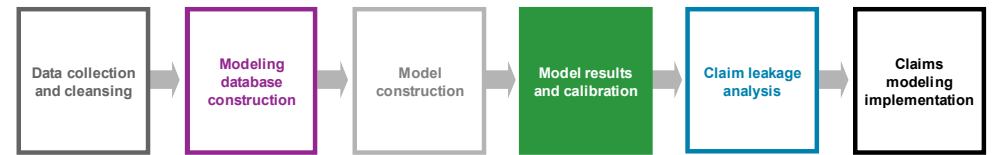
# Illustrating improvement in predictability



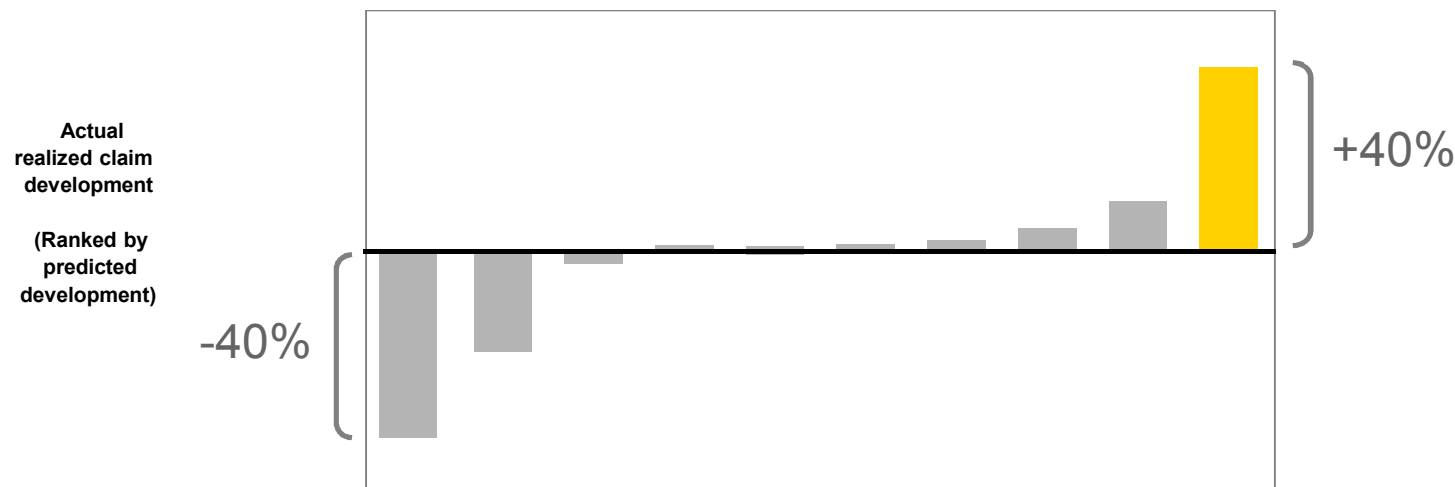
- ▶ Testing is performed on claims that are outside of the modeling data set.



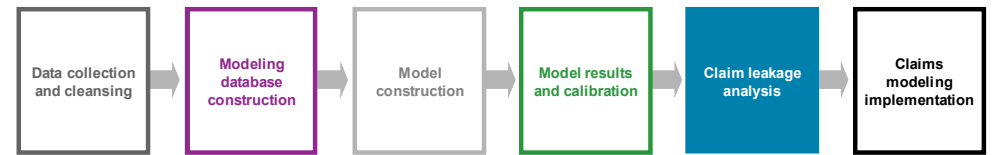
# Demonstration of value



- ▶ 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.



# Claim leakage analysis



- ▶ 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 a 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.

# Potential benefits of the claim leakage process

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- ▶ Flexibility
  - ▶ This process can be customized and adjusted for various lines of business.
- ▶ Performance improvement
  - ▶ The claim leakage process utilizes data which provides a basis for a consistent measure of claims performance.
  - ▶ The information is used to develop actionable performance improvement procedures.
- ▶ Potential recoverables
  - ▶ The claims review process can help identify opportunities to recover paid dollars.
- ▶ Management prioritization
  - ▶ The results help to focus management attention and resources on the areas of greatest impact and to specifically target individual and group improvement initiatives where needed.

# Workers compensation leakage study example

A claim specialist was assigned a new loss for a worker who alleged a back injury first thing on a Monday morning. The adjuster contacted the employer who confirmed that there were no witnesses and the employee was referred to the panel physician. The adjuster then contacted the treating physician who confirmed that the injured employee was treated and placed on TTD for four weeks. No further investigation was completed. Compensability was accepted and TTD payments were issued after the appropriate wait period and medical bills were paid when received and processed by bill review provider. The injured worker treated for 11 months and collected TTD for the same period before being released back to work. Total payments incurred:

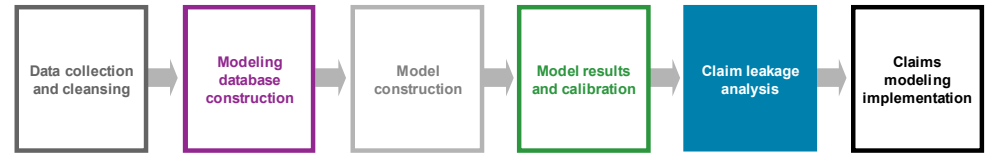
\$ 25,200 for 48wks of TTD @ \$525/wk  
\$ 20,100 for medical  
 \$ 45,300 Total paid

The claim was reviewed as part of the claim leakage study and the analyst determined that claim leakage occurred due to the adjuster's failure to timely follow up with the employer to seek and execute a modified duty for return to work (RTW) and lack of proactive medical management.

Analysis	Leakage	X	Probability	=	Result
	<ul style="list-style-type: none"> <li>▶ Adjuster did not obtain timely or actively seek modified duty or RTW; also adjuster didn't medically manage claim to mitigate loss.</li> <li>▶ Payment(s) of \$45,300 is gross leakage.</li> </ul>		<ul style="list-style-type: none"> <li>▶ 30-40% of the time, these payments could have been impacted by utilizing leading practice.</li> </ul>		<ul style="list-style-type: none"> <li>▶ Discount to probability applied due to unknown availability of modified duty during the disability period. In addition, there is a limited time to direct care in the loss state.</li> <li>▶ Applying discount factor provides realistic estimates.</li> </ul>
	<b>\$45,300</b>	X	<b>30%–40%</b>	=	<b>\$13,590–\$18,120 Leakage</b>



# Claim leakage database



Indemnity Calc	Medical Calc	Cost Containment	Second Injury/Subrogation	Litigation/Arbitration	Settlement	Supervision/Evaluation
Existing Info	Notification/Compliance	Coverage Analysis	Contact/Investigation	Injury/Damage (Medical)	Injury/Damage (Indemnity)	Reserving

**Existing Info**

Audit Type:  TPA/Auditing Site:  Reviewer:

Adjuster:  Review Date:  Handling Office:

Supervisor:

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Claimant:  Employer Name:  Open/Closed:

Claim No:  Loss State:  Med Only/Lost Time:

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Indemnity Paid:  Claimant Age:  DOL:

Medical Paid:  Claimant DOB:  Date of Notice to Insured:

Expense Paid:  Average Weekly Wage:  Date of Notice to TPA:

Total Paid:  Comp Rate:

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Policy Number:  Part of Body:

Policy Effective Date:  Nature of Injury:

Deductible/SIR:  Cause of Injury:

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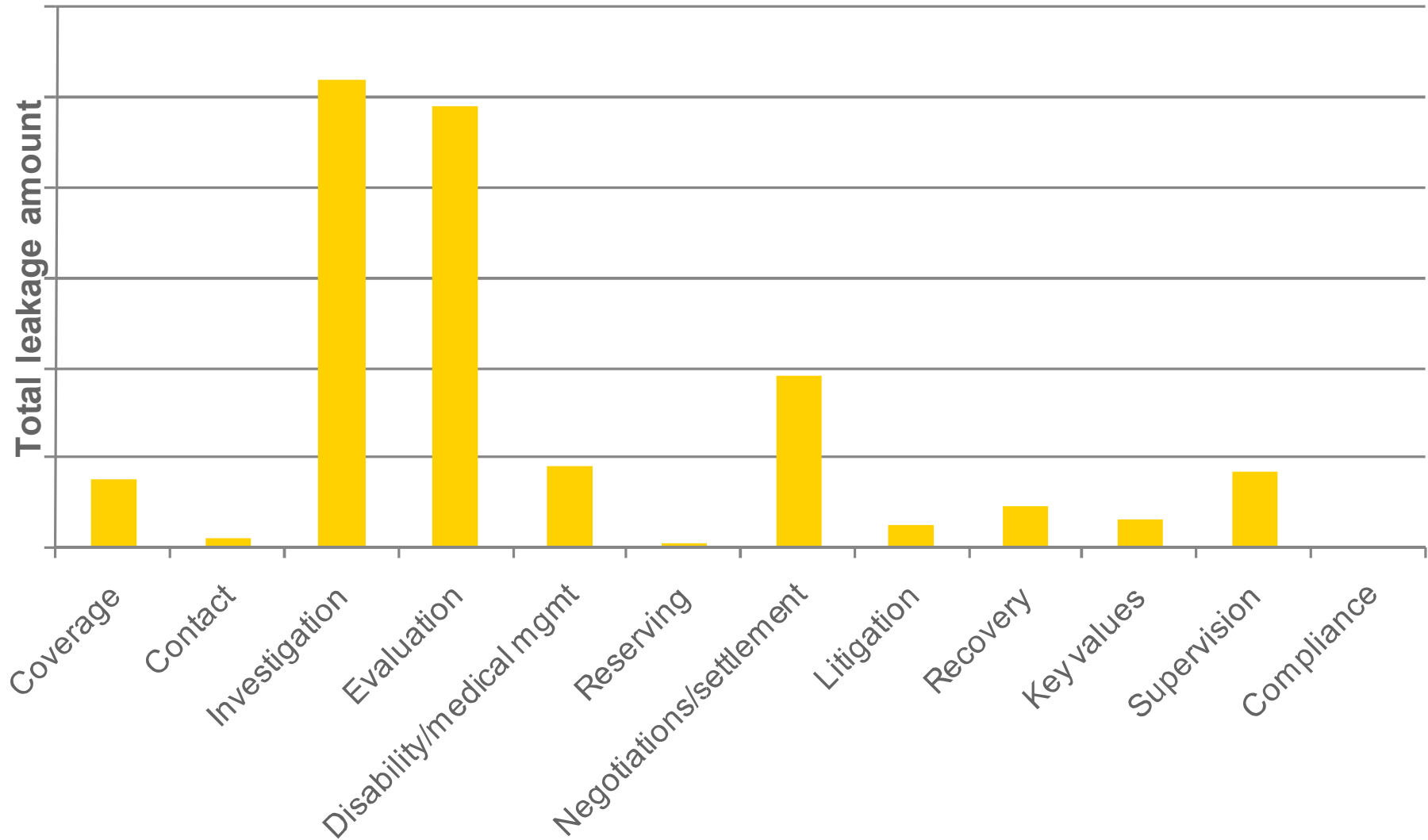
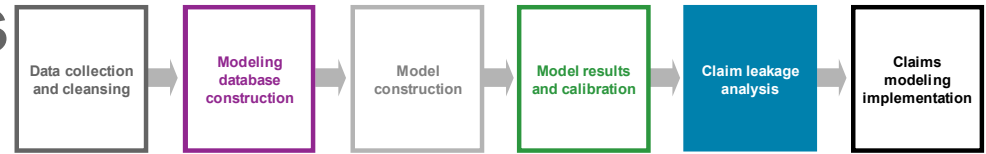
Accident Description:

Comments:

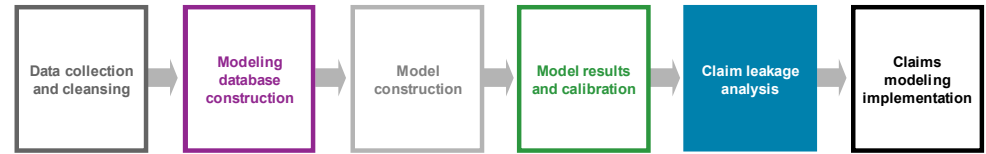
**Overall Leakage Totals**

	Dollars	Percent
Notification	\$0.00	0.0%
Compliance	\$0.00	0.0%
Coverage Analysis	\$0.00	0.0%
Contact & Investigation	\$0.00	0.0%
Injury/Damage (Med)	\$0.00	0.0%
Injury/Damage (Ind)	\$0.00	0.0%
Reserving	\$0.00	0.0%
Medical Bill Review	\$0.00	0.0%
Fraud Recognition	\$0.00	0.0%
Second Injury	\$0.00	0.0%
Subrogation	\$0.00	0.0%
Litigation/Arbitration	\$0.00	0.0%
Settlement	\$0.00	0.0%
Supervision	\$0.00	0.0%
<b>Total</b>	<b>\$0.00</b>	<b>0.0%</b>

# Leakage impact analysis by process



# Sample recommendation report



## Vendor management

### Description

- ▶ Rationalize the number of claims vendors utilized across LOBs
- ▶ Eliminate duplication of internal and external claim services (i.e., appraisal tools, software)
- ▶ Develop formal vendor management program to govern the usage of key vendors, identification, selection, contracting and performance measurement
- ▶ Optimize organizational scale to drive more favorable pricing

### Initiative

Initiative	Estimated benefit	Estimated cost	Total
▶ Vendor rationalization		(\$0.4)	
▶ Reduce duplication of services		(\$0.2)	
▶ Vendor management program		(\$0.6)	
▶ <b>Net benefit:</b> <i>All values in millions</i>	\$12.75	(\$1.2)	\$11.55

### Implementation assessment

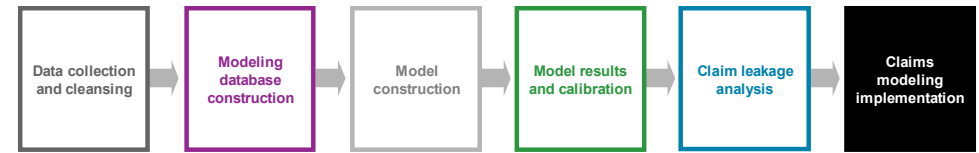
	Vendor rationalization	Reduce duplication of services	Vendor mgmt program
▶ Effort	M	L	M
▶ Cost	L	L	L
▶ Duration	M	M	M
▶ Risk	M	L	M

### Assumptions

- ▶ Target benefit estimates include a combination of reduced leakage (\$5.25m) as well as cost reduction (\$7.5m) achieved through vendor management program implementation and vendor rationalization
- ▶ Cost reduction estimate includes 10% savings of 2008/2009 average ALAE (\$75m)
- ▶ Estimated internal resource cost includes 2.5 FTEs and supporting tools and technologies
- ▶ External vendor cost estimate is a one-time charge

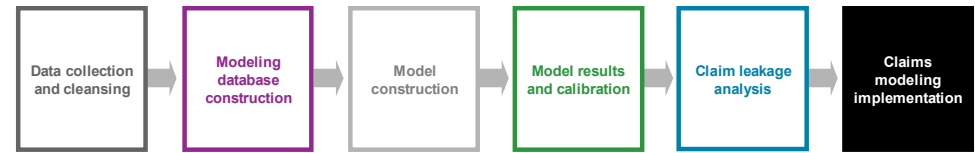
Legend	
Effort	<b>Team size</b> L <3 M 3–10 H 10+
Cost	<b>Spend</b> L <\$1m M \$1m–\$2m H \$2m+
Duration	<b>Months</b> L <3 M 3–6 H 6+

# Implementation of predictive model



- ▶ Implementation needs to be customized and flexible
- ▶ Several implementation options available:
  - ▶ Stand-alone desktop claims management tool
  - ▶ Integration of model scoring algorithm to claims system
  - ▶ Claims scorecard for use in branches or field
  - ▶ Monthly scoring of claims
- ▶ Objective of implementation is the efficient and effective realization of model benefits
- ▶ Example of stand-alone desktop application on following slide

# Claims management tool – user interface



- ▶ Can be deployed to claims personnel through a desktop interface

**Claim Information**

Claim Number: 6398703 [Search]

Employee ID: 0007012

Employee Name: John Smith

Employee Address: 129 S 129th E Ave

City/State/Zip: Tulsa OK 74116

Accident Location: Same as business address

Industry Group: Manufacturer

Claimant DOB: 05/02/1961

Accident Date: 04/01/2002 Report Date: 04/09/2002

Type of Claim: Indemnity

Injury ICD9 Group: 959.09 - Injury of face and neck

Initial Case Reserve: \$ 64,836.00

[Score]

**Score Information**

Decile Rank: 8

Impact	Reason Code	Type
High	Injury/Damage	Leakage
High	Claimant has claims in past 3 years	Non-Leakage
Medium	Age between 45-55	Non-Leakage
Medium	Notification	Leakage
Low	Highly litigious demographic area	Non-Leakage
Low	Reserving	Leakage

Action Code: 005 - Assign specific claim adjuster

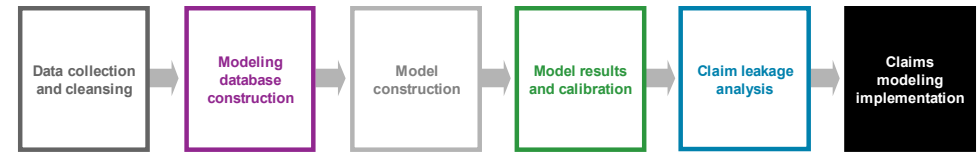
Action Detail

Claim Adjuster: Jennifer Mohn

Comments: No comments available.

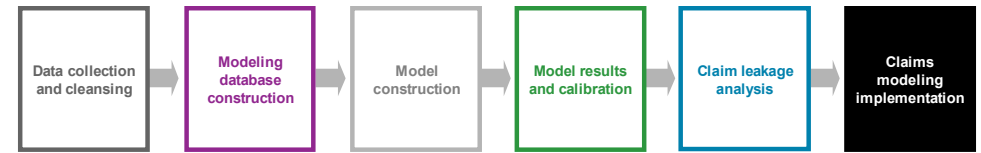
[Save]

# 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 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
- ▶ The loss mitigation strategies identified and implemented will vary based on the client and data available.
- ▶ “Rule set” would be developed to guide the application of the strategies.

# Loss mitigation rule set – example 1



## Potentially severe claim identified:

- ▶ Moderate back strain/sprain
- ▶ Expected recovery time of 2-4 months
- ▶ Geographic area of high unemployment

## Model prediction:

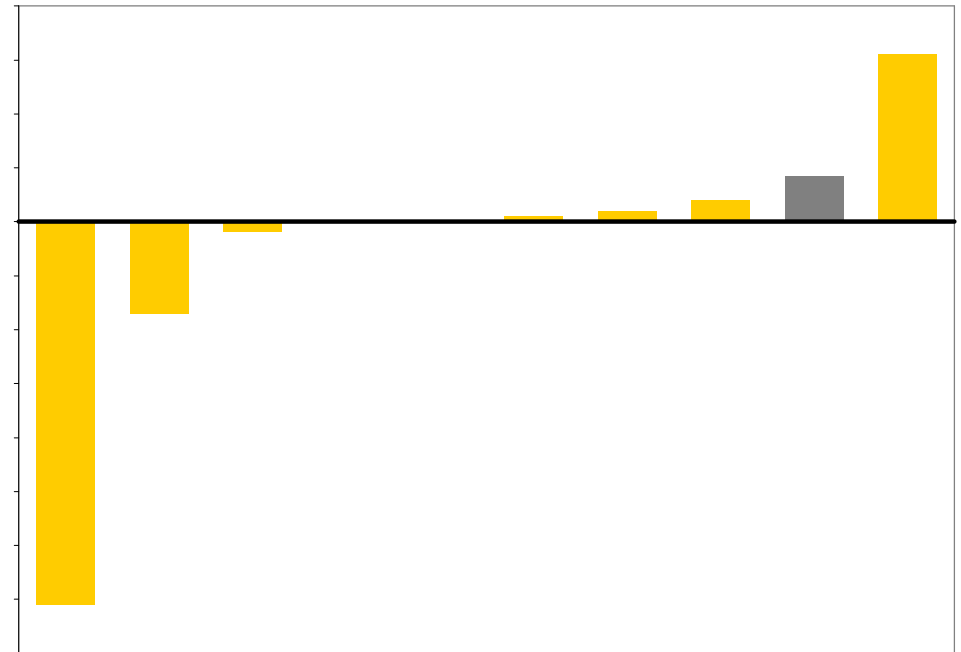
- ▶ Adverse development of \$500k

## Given facts, rule set indicates:

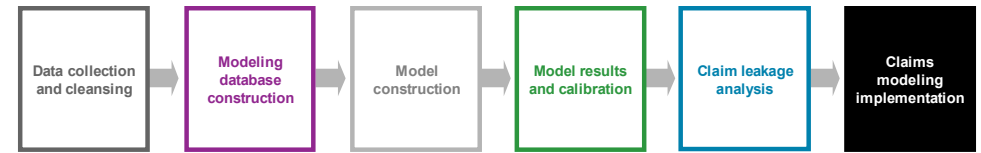
1. Assignment to more senior adjuster
2. Case added to supervisor diary
3. Assignment of nurse case manager
4. Aggressive return-to-work program
5. Vocational rehabilitation

## Outcome:

No claim leakage, resulting in overall reduction in loss cost



# Loss mitigation rule set – example 2



## Potentially severe claim identified:

- ▶ Lower back injury
- ▶ Highly litigious jurisdiction
- ▶ High-wage skilled trade

## Model prediction:

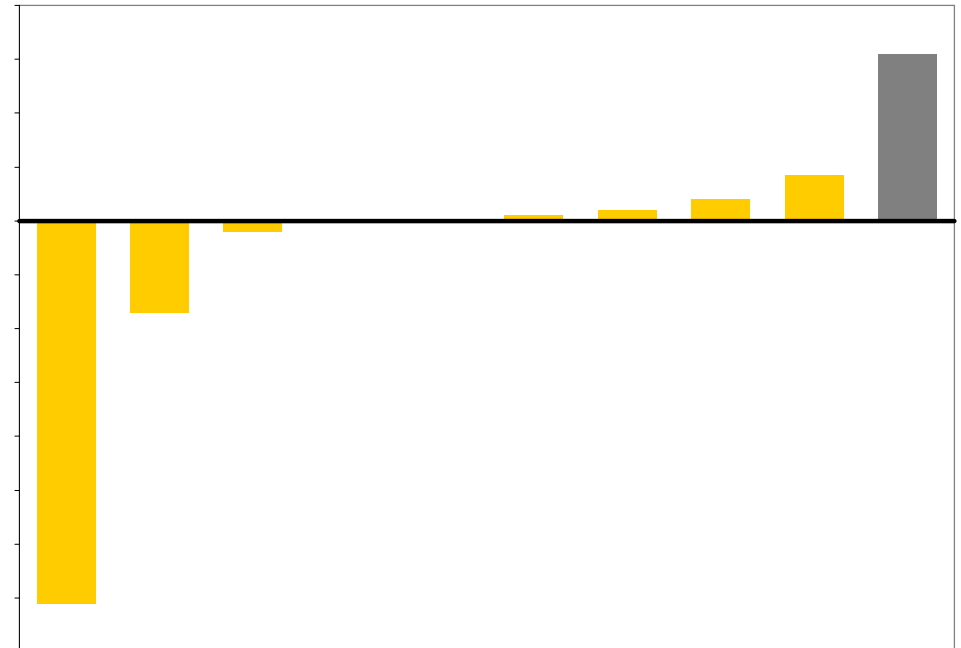
- ▶ Adverse development of \$850k

## Given facts, rule set indicates:

1. Assignment of senior claims adjuster
2. Case added to supervisor diary
3. Early intervention by nurse case manager
4. Early independent medical exam
5. Proactive early settlement efforts

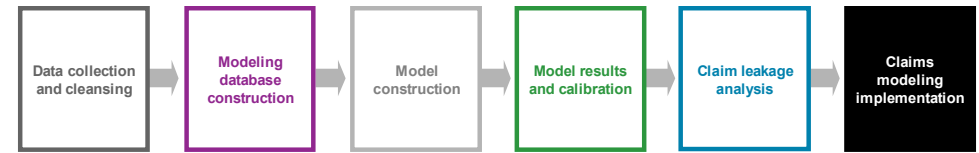
## Outcome:

Limited claim leakage, with ability to impact overall results





# Loss mitigation rule set – example 3



## Potentially severe claim identified:

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

## Model prediction:

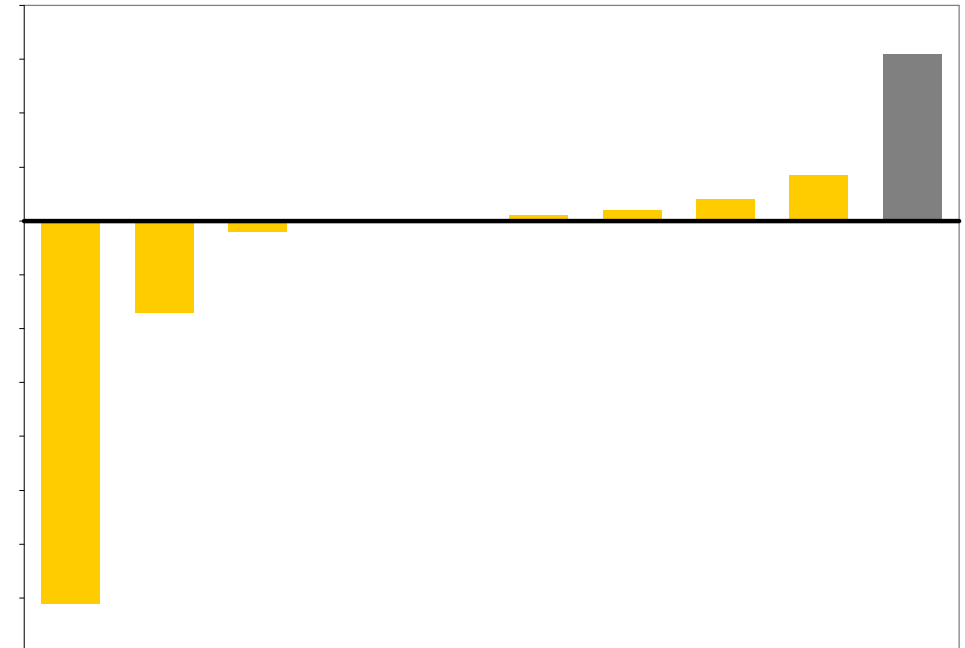
- ▶ Adverse development of \$1m

## 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:

Limited claim leakage with mitigation of loss cost



# Summary

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- ▶ Systematic claim leakage presents considerable costs.
- ▶ These costs can be limited if general processes and controls can be implemented to curb claim leakage and if individual claims with high potential for claim leakage are identified early.
- ▶ Claim leakage processes and controls and loss mitigation strategies can be applied proactively.
- ▶ When claim leakage processes and controls are implemented successfully, there is a possibility to capture 11%–15% of claim leakage.