

PREDICTIVE ANALYTICS FOR WORKERS COMPENSATION CLAIMS

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Overview

- Focus: Workers Compensation Claims
- Special Considerations
 - Interplay between medical and indemnity
 - Statutory considerations
 - Confounding factors
 - Choice of statistical methodology
- Types of Analyses
 - Descriptive
 - Multivariate
 - Complex multivariate
- Examples
 - Preauthorization of medical care
 - Use of medical treatment guidelines
 - Claims segmentation

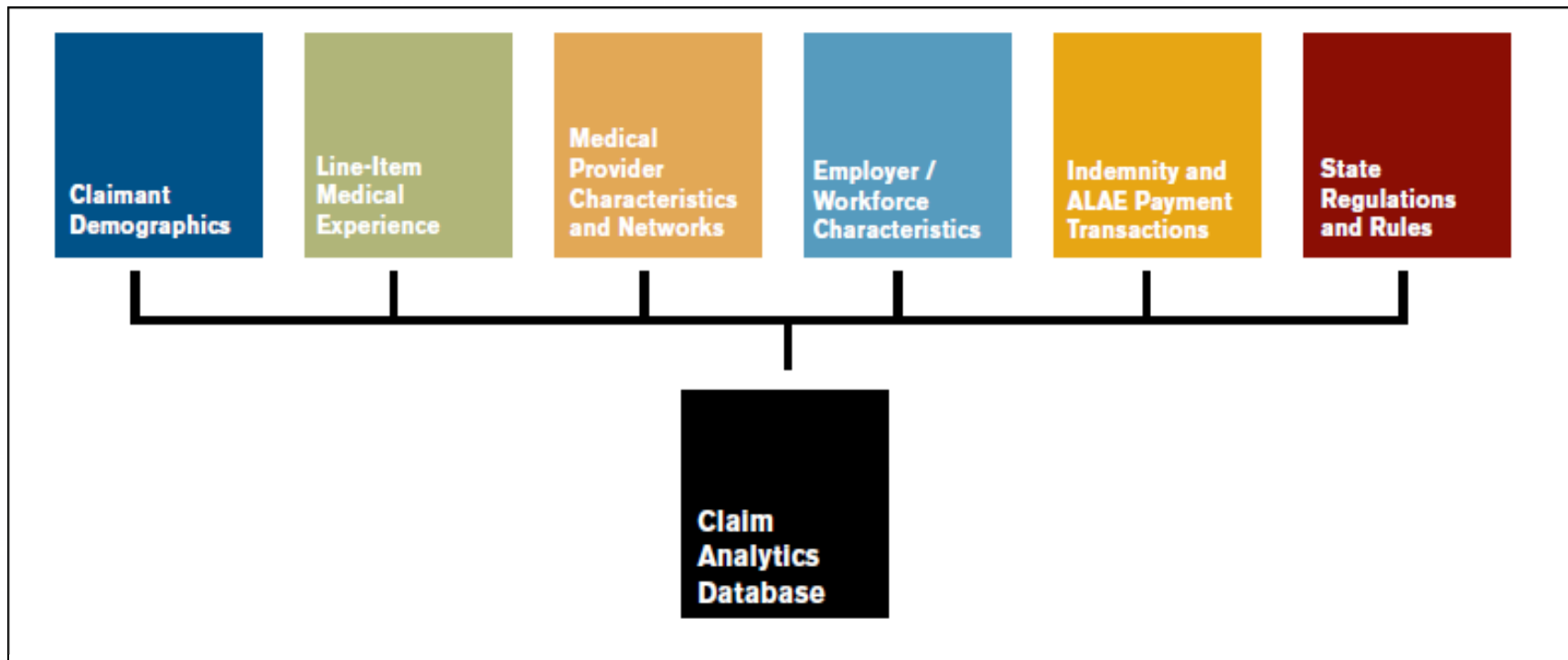
Focus: Workers Compensation

- Long-tail line
- Significant variations in state statutes and regulations
- Interplay between medical and indemnity benefits
- Return to work may be limited by treating physicians
- Return to work may be limited by job conditions

- Types of indemnity benefits
 - Temporary total
 - Permanent partial
 - Permanent total
 - Fatal
- Medical care considerations
 - Different providers
 - Different services (office visits, lab tests, therapy, hospital)
 - Other (DME, Rx, implants)

Workers Compensation Analytics

- A multitude of data sources for WC claims



Three Studies: Objectives

- Preauthorization for Physical Medicine (PM)
 - Measure the impact of Preauthorization of Physical Medicine on medical care
 - “Impact of Preauthorization on Medical Care in Texas,” Cambridge, MA: Workers Compensation Research Institute, WC-11-34, June 2011.
- Treatment Guidelines for 4 Types of Injuries
 - Measure the impact of Treatment Guidelines on medical care
 - “Impact of Treatment Guidelines in Texas,” Cambridge, MA: Workers Compensation Research Institute, WC-12-23, September 2012.
- Market Segmentation
 - Stratification of claims into market segments for various claim groups and outcome measures

Starting Considerations

- Objective of the studies
 - Measure the impact of the PA regulations on the utilization of physical medicine, work hardening, and spinal surgeries
 - Measure the impact of Treatment Guidelines on the cost of medical care

- Value to actuaries
 - Using results from the completed studies
 - Benchmarks for evaluating an insurer's claims for claim triage, operations initiatives, and reserve review

 - Implications for future work
 - Template for evaluating an insurer's book of claims for a given operations initiative (does not need to be limited to preauthorization or treatment guidelines)

Major Findings of Studies

- Preauthorization for Physical Medicine (PM)
 - Fewer workers receiving PM
 - Fewer PM services per visit
 - No significant change in temporary disability duration
- Treatment Guidelines for 4 Types of Injuries
 - Reduced likelihood of surgery
 - Fewer services for low back injuries
 - Mixed results for neck and upper back, shoulder, knee injuries
- Market Segmentation
 - Demonstrated ability to classify claims into clusters (even when data are incomplete for some claims)

Preauthorization for Medical Treatments

Preauthorization – Starting Considerations

- Statutory/regulatory
 - Late 1990s-early 2000s: claim costs high in Texas
 - September 1, 2005: major reform passed
 - **December 1, 2005: physical medicine added to “preauthorization” regulations**

- Interest:
 - Did allowing employers/insurers opportunity to preauthorize physical medicine reduce medical costs?
 - If so, was there an impact on worker outcomes?

- Confounding considerations:
 - Need to control for medical inflation
 - Need to design analyses to limit influence of other reforms (e.g., treatment guidelines)

- Study design considerations
 - Matched-claim sample not available: impractical to find exact matches post-effective date
 - Contemporaneous samples not available: regulations applied to all covered workers / no claim stratifications
 - Inter-period samples: required controlling for period differences

Preauthorization – Starting Considerations

- Physical medicine, regardless of type of injury

Body Part	Surgery	Office Visits	Physical Medicine	Chiro Manip.	Radiology	Injections	Rx
Head							
Neck and Upper Back							
Upper Extremities							
Shoulder							
Low Back							
Knee							
Lower Extremities							

- Physical medicine can be rendered by different types of providers

Billing Provider Type	Surgery	Office Visits	Physical Medicine	Chiro Manip.	Radiology	Injections	Rx
MD/ DO							
Physical Therapist							
Chiropractor							
Hospital							
Unidentified							

Defining Pre-Reform and Post-Reform Claims

- Objective: gather 12 months of post-injury medical experience
- Injury periods: 3 months (pre-reform and post-reform)
- Pre-reform period:
 - Injuries with medical experience prior to reform effective date
 - End of period: 12 months (9/30/2005) prior to reform effective date
- Post-reform period:
 - Beginning 5 months after reform effective
 - End of period: 12 months (9/30/2006) prior to subsequent reforms

	Pre-Reform Injury Dates	Reform Effective Date	Post-Reform Injury Dates
Physical Therapy	7/1/2004 - 9/30/2004	12/1/2005	4/1/2006 - 6/30/2006

Research Methodology – Analytical Questions

- Did PA change the likelihood an injured worker received physical medicine?

- Did PA change the amount of medical care received by an injured worker?
 - Rationale for focus on number of services, not medical costs
 - Breakdown number of services per claim into (a) visits per claim and (b) services per visit)
 - Did PA change the number of visits for physical medicine?
 - Did PA change the number of services for physical medicine?

- Did PA change the outcome for the injured worker?
 - Did PA change the duration of lost worktime?

Research Methodology – Data and Estimation

- Data
 - WCRI Detailed Medical Database
 - TX claims: representation from fully-insured and self-insured employers
 - Line-item medical information for each medical service
 - Weights applied so claim samples were representative of TX WC market
- Multivariate analyses
 - Likelihood of receiving physical medicine: logit model
 - Number of visits per claim: multiple regression
 - Number of services per visit: multiple regression
 - Duration of temporary disability: multiple regression

Preauthorization Study – Descriptive Statistics

- Explanatory variables
 - Demographic characteristics
 - age, marital status, gender
 - Tenure
 - Industry groups (7)
 - Construction, manufacturing, clerical and professional, et. al.
 - Injury groups (12)
 - Knee derangements, fractures-lower extremity, hand lacerations, et. al.
 - Days of temporary disability duration (control for injury severity)
- Billing provider type
 - MD/Physical Therapist
 - Chiropractor
 - Hospital
 - Unidentified

Under Texas Preauthorization Reform

- Impact on likelihood of receiving physical medicine services
 - Reduced likelihood of workers receiving physical medicine services
 - Reduced likelihood of workers receiving physical medicine for each billing provider type

	Billing Provider Type			
	All Providers	MD / PT	Chiropractor	Hospital
Percent of pre-reform group receiving physical medicine services	72.0%	51.6%	24.5%	9.5%
Estimated percentage-point change	-4.7 ppt**	-4.9 ppt**	-5.0 ppt**	-0.6 ppt
Percent change in the number of injured workers receiving physical medicine services after reform	-7%	-9%	-20%	-6%

Under Texas Preauthorization Reform

- Impact on the number of visits for physical medicine services
 - Fewer number of visits across all billing provider types
 - Fewer number of visits billed by MD / PT and Chiropractors
 - More visits billed by hospitals (pre-reform was lower than other billing types)

	Billing Provider Type			
	All Providers	MD / PT	Chiropractor	Hospital
Average number of physical medicine visits -- pre-reform group	19.0	12.9	25.0	6.4
Estimated change in the number of visits	-7.4**	-3.7**	-9.9**	1.4**
Percent change in the number of visits	-39%**	-29%**	-40%**	22%**

Under Texas Preauthorization Reform

- Number of services per visit consistent across billing provider types
- Fewer services per visit for physical medicine across all billing types
 - Fewer services per visit for MD / PT

	Billing Provider Type			
	All Providers	MD / PT	Chiropractor	Hospital
Average number of physical medicine services per visit -- pre-reform group	3.84	3.83	3.84	3.43
Estimated change in the number of services per visit	-0.32**	-0.40**	-0.18	-0.29
Percent change in the number of services per visit	-8%**	-10%**	-4%	-8%

Under Texas Preauthorization Reform

- Pre-reform: 34% of injured workers received more than 15 PM visits
- With reform: Significant decreases in number of workers receiving large number of PM visits at 15-, 25-, 40-, and 60-visit thresholds

	All Claims	Number of Visits for Physical Medicine Services -- More Than			
		15 visits	25 visits	40 visits	60 visits
Percent of injured workers in pre-reform period with a visit for physical medicine services	72.0%	34.0%	20.1%	8.0%	3.2%
Estimated percentage-point change	-4.7 ppt**	-14.8 ppt**	-10.9 ppt**	-4.9 ppt**	-2.0 ppt**
Percent change in number with a visit for physical medicine service after reform	-7%**	-44%**	-54%**	-61%**	-63%**

Under Texas Preauthorization Reform

- No change in TTD for injured workers receiving PM services
- Implication: fewer medical services did not cause longer TD spells (which would have been an adverse outcome)

	All Types of Injuries	Type of Injury		
		Back Sprain/Strain	Other Sprain/Strain	Neuro Spine
Average number of days of TD payment for injured workers in the pre-reform group	114.1 days	88.2 days	95.6 days	171.8 days
Estimated percent change in the number of TD days	-0.4%	5.2%	-4.7%	3.4%
Estimated change in the number of TD days	-0.5 days	4.6 days	-4.5 days	5.8 days

Major Findings – Physical Medicine

- In Texas, preauthorization for physical medicine:
 - Number of workers receiving PM reduced by 7%,
higher for high users of PM services
 - Number of PM visits per claim reduced by 39%
 - Number of PM services per PM visit reduced by 8%
 - Little impact on length of the temporary disability period
- Implications for Policy
 - Reduction in the amount of PM services
 - No significant change in temporary disability duration (which also implies that reduced PM services did not have an adverse impact on the medical outcome)

Preauthorization – Starting Considerations (reprise)

- Confounding considerations:
 - Need to control for medical inflation
 - **Used incidence and treatment counts as surrogates for costs**
 - **Analyzed likelihood of receiving PM**
 - **Decomposed number of treatments into (a) visits and (b) services per visit**
 - **Analyzed number of visits**
 - **Analyzed number of services per visit**
 - Need to design analyses to limit influence of other reforms (e.g., treatment guidelines)
 - **Careful attention to periods for pre-reform and post-reform samples**
- Study design considerations
 - Matched-claim sample not available: impractical to find exact matches post-effective date
 - Contemporaneous samples not available: regulations applied to all covered workers / no claim stratifications
 - Inter-period samples: required controlling for period differences
 - **Used inter-period samples: (a) injured workers from similar employer groups, (b) characteristics consistent**

Treatment Guidelines for Medical Care

Treatment Guidelines for Medical Care

- Project Objective:
 - Treatment Guidelines
 - Quantify Impact of Treatment Guidelines on the Rendering of Medical Care

- Statutory Background in Texas

- Project Design
 - Timelines for Preauthorization and Treatment Guidelines in Texas
 - Data
 - Statistical methodology

- Empirical Results
 - Descriptive statistics
 - Multivariate analyses

Treatment Guidelines – Statutory Background

- Statutory and regulation actions created confounding effects for trying to measure impacts of PA and Treatment Guidelines
- Employers using a certified network did not need to use ODG-TWC guidelines

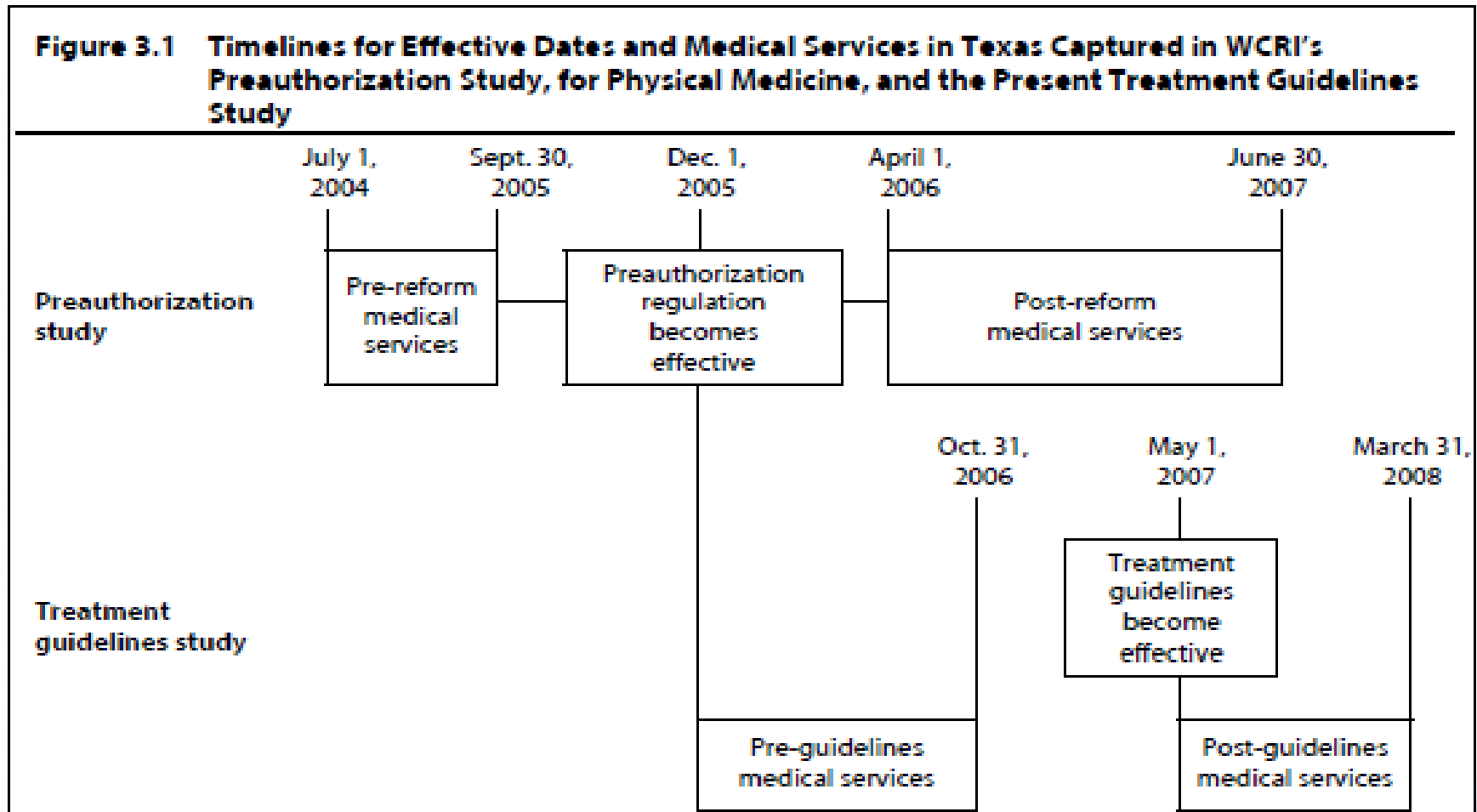
Date	Statutory / Regulatory Action
January 1, 2002	Preauthorization for a list of services became effective
September 1, 2005	HB 7 passed – TDI can mandate evidence-based treatment guidelines
December 1, 2005	Physical/occupational therapy added to covered preauthorization guidelines
March 2006	TDI certified first health care network
August 1, 2006	TDI began to certify other health care networks
December 29, 2006	ODG-TWC treatment guidelines chosen to be the evidence-based treatment guidelines for non-certified network care
May 1, 2007	ODG-TWC treatment guidelines became effective

Treatment Guidelines – Starting Considerations

- ODG-TDI treatment guidelines
 - Arranged in chapters by body part
 - Each chapter (body part) provides guidelines for the amount and timing for a type of medical service
 - Guidelines are evidence-based
 - Guidelines do not cover Rx or return-to-work (covered by different guidelines)

Body Part	Surgery	Office Visits	Physical Medicine	Chiro Manip.	Radiology	Injections	Rx
Head							
Neck and Upper Back							
Upper Extremities							
Shoulder							
Low Back							
Knee							
Lower Extremities							

Timelines for PA and Treatment Guidelines Studies



Research Methodology – Data and Statistical Methodology

- Data (compared to PA study: same database, different claims)
- Treatment Guidelines study (each chapter in ODG-TWC guidelines is for a specific type of injury)
 - Low back
 - Neck and upper back
 - Shoulder
 - Knee
- Different perspective on injured workers' experience
 - PA study: for a particular medical services, all types of injuries
 - Treatment Guidelines study: for each injury, analyses for different types of medical services
- Multivariate analyses (for each injury type)
 - Likelihood of receiving a type of medical service: logit model
 - Number of visits per claim for a type of medical service: multiple regression
 - Number of services per visit for a type of medical service : multiple regression
 - Duration of temporary disability: multiple regression

Treatment Guidelines – Descriptive Statistics

- Characteristics of the samples: age, tenure, wage, gender, marital status, industry
- Percentage receiving a medical service, number of visits, number of services
- Other services in analysis, not in table: MRI/CT, other radiology, injections

	Pre-Treatment Guidelines Sample	Treatment Guidelines Sample	Difference
Low back injury			
Percentage receiving a medical service			
Surgery	5.8%	4.0%	-1.8 ppt
Physical medicine	88.9%	84.7%	-4.2 ppt
Chiro manipulation	26.1%	19.1%	-7.0 ppt
More than 12 physical medicine visits	48.7%	39.8%	-8.9 ppt
Average number of visits			
Physical medicine	17.51	13.10	-4.41
Chiro manipulation	13.38	9.94	-3.44
Average number of services per visit			
Physical medicine	3.68	3.88	0.20
Chiro manipulation	1.23	1.06	-0.17

Treatment Guidelines – Descriptive Statistics

- Percentiles for number of visits (phys med, chiro) and number of days
- Lower average for number of visits due to shorter tail in distribution
- Slightly longer tail for distribution of indemnity payments

	Average	25th Percentile	50th Percentile	75th Percentile	90th Percentile
Low back injuries					
Number of visits, physical medicine					
Pre-treatment guidelines sample	17.5	6.0	12.0	23.0	38.0
Post-treatment guidelines sample	13.1	6.0	10.0	17.0	27.5
Number of visits, chiro manipulation					
Pre-treatment guidelines sample	13.4	5.0	11.0	17.0	28.0
Post-treatment guidelines sample	9.9	3.0	5.0	11.0	22.0
Number of days of indemnity payments					
Pre-treatment guidelines sample	88.0	13.0	49.1	142.0	245.2
Post-treatment guidelines sample	90.4	12.0	49.7	153.1	252.0

Treatment Guidelines – Logit/Multiple Regr Results

	Low Back		Neck and Upper Back		Knee		Shoulder	
Low back injuries								
Surgery								
Estimated percentage point change for receiving surgery	-3.7	***	-3.0		-2.7		-9.3	***
Physical medicine								
Estimated percentage point change for receiving treatment	-2.9	**	9.7	***	3.1		3.3	*
Estimated change in number of visits	-4.07	***	-5.61	***	0.25		-5.01	***
Estimated change in number of services per visit	0.19	*	-0.06		-0.02		0.01	
Chiro manipulation								
Estimated percentage point change for receiving treatment	-7.4	***	1.4		n/a		n/a	
Estimated change in number of visits	-3.89	***	-3.23		n/a		n/a	
Estimated change in number of services per visit	-0.19	**	-0.38	**	n/a		n/a	
More than 12 physical medicine visits								
Estimated percentage point change	-10.9	***	-11.7	***	4.4		-9.2	***

Recap the Subject-Matter Considerations

- Statutory considerations
 - Treatment Guidelines followed Preauthorization
 - Other reforms became effective after Treatment Guidelines
- Nature of the Treatment Guidelines
 - Focus is on type of injury
 - Employers using a certified network not required to use ODG-TWC
- Descriptive statistics can help interpret results from multi-variate analyses

Generalizing and Interpreting Results

- Findings measure the incremental change in utilization after preauthorization
 - Over and above other utilization management practices in place before reform
 - Applying results to other states requires understanding of what was in place prior to proposed reform
- Generalizing findings to other states
 - Pre-reform Texas had high utilization of physical medicine and chiropractic care

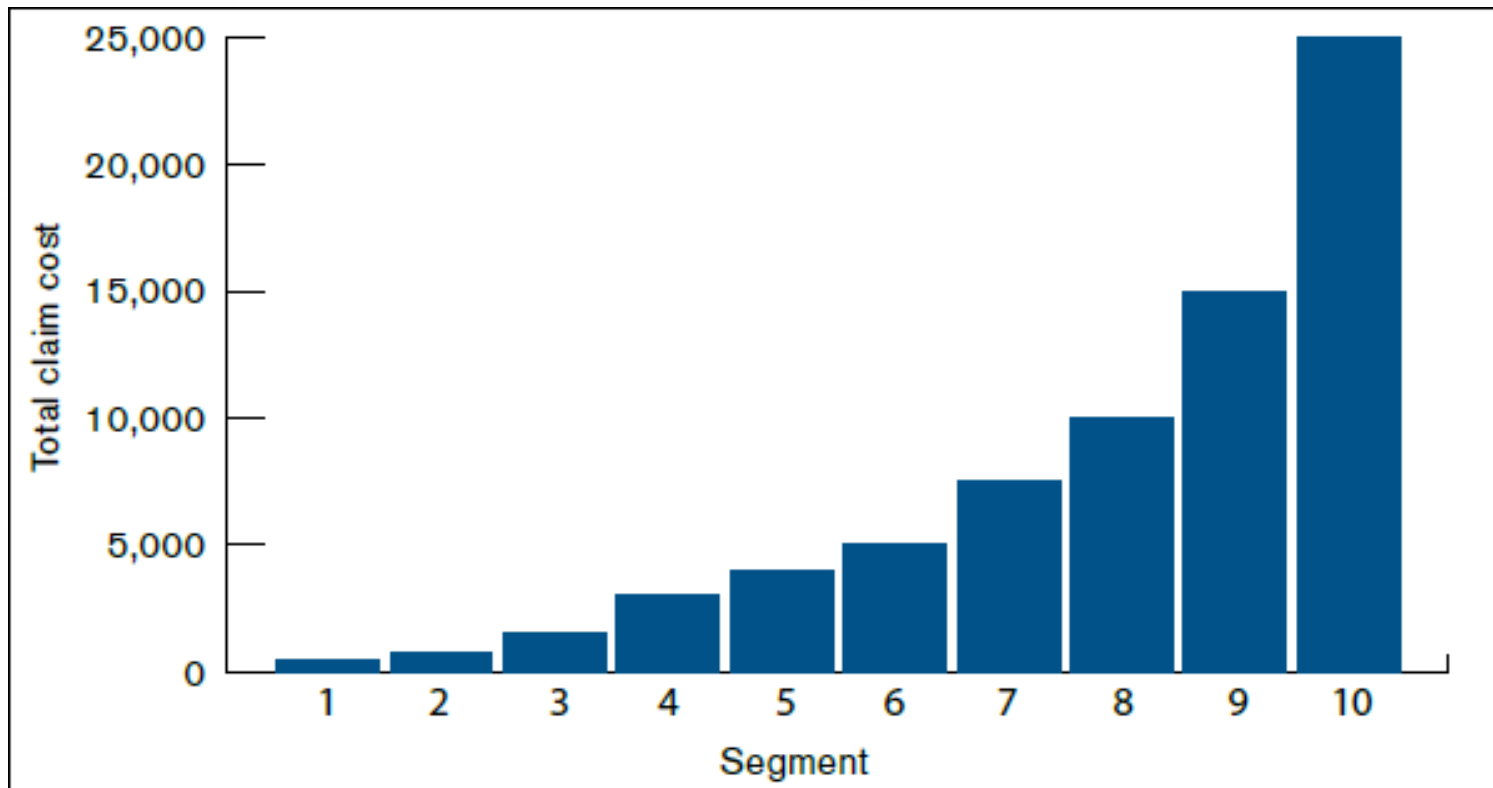
Claim Segmentation

Overview

- Opportunity: use of conventional information on claimant characteristics and inclusion of detailed medical experience in a process that does not require pre-determined statistical models or complete data for all factors and claims in the analysis
- Segmenting Claims
- Evaluation Period
- Uses for the Results
- Cost Factors in Analyses
- Variations – Outcome Measures and Claim Groups

Segmenting Claims

- Claim characteristics and medical experience can be used to segment claims into groups with similar total claim costs



Segments

- Claim segments can be defined by the claimant characteristics, payment history, and medical experience
 - Opportunity to include detailed medical experience in claim analytics
 - Opportunity to view claim costs from different timing perspectives
- Claims could be arranged into any manageable number of segments (eg, 4-12)
- Segments may not use the same factors or the same number of factors
 - Worker age or industry group may/may not be a consideration for each segment
 - Number of office visits or physical therapy treatments may/may not be a consideration
 - High-cost segments may include surgery
- Information does not need to be complete for all factors for a claim to be included in the analyses and assigned to a segment
- Information does not need to be complete for all claims for a factor to be included in the analysis and such as a segmenting factor

Segments – Factors in an Illustrative Example

- 10 segments
- Not every factor used in each segment
- Claims assigned to segment best fitting segment definition
- Illustration uses claimant characteristics, payment history, and detailed medical experience

Factor	Segment									
	1	2	3	4	5	6	7	8	9	10
Body Part	not multiple not back	not multiple			back knee shoulder	back knee shoulder			multiple	multiple
Age	under 40	40+			-----	-----			-----	
Medical	<= 3 med visits	> 3 med visits			13-24 phys ther visits no surgery	> 24 phys ther visits no surgery			> 12 med visits no surgery opioids	> 12 med visits surgery
Industry	not mfg not construct	mfg construction			-----	-----			-----	-----
Disability Status	med only	med only			temporary	temporary			permanent	permanent
Region	-----	-----			-----	-----			high urban	-----
Claim Reporting	-----	-----			-----	-----			> 2 wks after injury	-----
Claimant attorney	-----	-----			-----	-----			-----	Yes

Evaluation Period

- Two approaches, reflecting different timing for accumulating experience on a claim and different opportunities for managing costs
- “Accident year” analysis: claim costs as of a year-end for claims with injury dates during the preceding 12 months
 - AY 2011: claim costs as of 12/31/2011 for claims with injury dates during 2011 (average = 6 months)
 - AY 2010: claim costs as of 12/31/2011 for claims with injury dates during 2010 (average = 18 months)
- “Injury period” analysis: claim costs as of 30, 60, 180, or 360 days from injury date
 - Indemnity benefits and medical expenses capture outlays for days-from-injury
 - Example: number and cost of physical therapy during first 30 days from injury
 - Analysis captures comparable experience on claims (in contrast to AY analysis)

Uses for the Results

- “Accident year” analysis
 - Cost drivers: Identify characteristics and medical experience for cost drivers in AY claim costs
 - High-cost cohorts: Identify characteristics for high-cost claim subpopulations
 - Outliers: Identify anomalies for similarly-situated claims (that is, outliers within a segment)
- “Injury period” analysis
 - Prediction: Results can be used in successive periods to predict which claims will be low- or high-cost claims
 - Claim triage: assign the most experienced or specialty claim adjusters to high-cost claims
 - Business strategies: develop strategies for controlling costs of high-cost claims
 - Having identified characteristics of high-cost claims (Segments G-H), strategies can be developed to control the costs of these claims
- Both analyses
 - Scorecard for comparing experiences across offices
 - Scorecard for comparing experiences for different geographic regions
 - Scorecard for comparing experiences for different industry groups

Cost Factors in Analyses

- Cost factors
 - Cost factors in analyses depends on availability from insurer and medical bill review vendors
 - Three general types:
 - Claim characteristics
 - Payment history
 - Detailed medical experience
 - Nonwork-related factors can be added to the analyses (eg, smoking, weight, job absenteeism)
 - Data do not need to be complete for all claims for a factor to be included in the analysis
- Claim characteristics that can be included in the analysis:
 - Body part / nature of injury
 - Age at time of injury
 - Gender / marital status
 - Industry group
 - Size of employer
 - Geographic location
 - Delay in reporting the claim
 - Method for reporting the claim
 - Presence of an attorney
 - Seriousness of disability (med-only, temporary, permanent)

Cost Factors in Analyses

- Payment history
 - Payments by type of benefit (indemnity, medical)
 - Payments by subtype (eg, payments to MD/DO, hospital)
- Medical experience :
 - Number of visits for different types of services
 - Surgery (timing of surgery, type of surgery, seriousness of procedures)
 - Use of clinic v. hospital-based services
 - Pharmaceuticals
 - Durable medical products
 - Concentration of services in network
 - Use of high-cost providers
- Alternative measures: number of visits, number of services per visit, number of providers, average cost per visit
- Measures compiled by type of provider and/or type of service (eg. office visit, radiology test)

Variations – Outcome Measures and Claim Groups

- Outcome measures:
 - Starting point: total claim costs
 - Alternatives measures
 - Paid indemnity benefits
 - Paid medical expenses
 - Incurred indemnity benefits
 - Incurred medical expenses
- Claim groups
 - Starting point: all claims
 - Alternatives groups (subgroups):
 - Lost-time claims: removes large number of low-cost claims
 - Claims limited to a particular type of injury (eg, low back injuries)
 - Claims limited to a particular industry (eg, manufacturing)
 - Claims limited to a particular demographic (eg, workers 40 years and over)

Presentation Summary

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