Determinants of Escalating Costs in Low Risk Workers' Compensation Claims

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Objective: *To identify and quantify attributes that lead to unanticipated cost escalation in workers' compensation claims.* ***Methods:*** *We constructed four claim categories: low initial reserve/low cost, migrated catastrophic (low initial reserve/high cost), high initial reserve/low cost, and catastrophic (high initial reserve/high cost). To assess the attributes associated with the increased cost of migrated catastrophic claims, we analyzed 36,329 Louisiana workers' compensation claims in the four categories over a 5-year period.* ***Results:*** *In the 729 claims initially thought to be low-cost claims (migrated catastrophic), the most significant predictors for cost escalation were attorney involvement and claim duration, followed by low back disorder, married/single/divorced status, male gender, small company size, high premium, reporting delays, and older age. These injuries accounted for 2% of all claims but 32.3% of the costs. Accelerated escalation of costs occurred late in the claim cycle (2 years).* ***Conclusion:*** *Certain attributes, particularly attorney involvement and claim duration, are associated with unanticipated cost escalation in a small number of claims that drastically affect overall losses. The results of this study suggest that these cases may be identified and addressed before rapid escalation occurs.* (J Occup Environ Med. *2007;49:780–790*)

The primary strategy used to reduce workers' compensation costs is the control of workplace accidents and illnesses.[1–15] A secondary strategy is the effective management of the duration of post-accident medical care and disability.[15–30] The success of the first strategy is exemplified by a decade-long reduction in losses per $100 of payroll for virtually all US industrial classifications. In contrast, the failure of the second is illustrated by the continuing escalation of medical (7.4% per year) and indemnity (9.5% per year) losses for individual workers' compensation claims.[5,17,19,31,32]

A number of studies have addressed the risk factors known to increase workers' compensation claim costs and disability duration.[4,5,10,13,16,17,23,31,33–43] However, few investigators have tried to determine the characteristics of claims that are initially felt to be low-cost, but ultimately become costly (ie, migrated catastrophic or adverse surprise claims).[44] In contrast to claims whose incurred costs have been accurately assessed at the time of injury, these migrated catastrophic claims may possess or develop attributes that can lead to costs that are higher than expected. The purpose of this study was to identify attributes present at the time of the injury, or occurring later in the life of the claim, that account for a low-cost claim becoming costly, and to identify the point at which rapid cost escalation begins.

Materials and Methods

This investigation utilized data from the Louisiana Workers' Com-

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pensation Corporation (LWCC). LWCC is a private mutual insurance company writing workers' compensation insurance for approximately 33% of the fully insured market in the state of Louisiana. Information on all workers' compensation claims administered by the LWCC resides in the LWCC Claims Payment Database. Information recorded between January 1, 1998 and December 31, 2006 on claims filed between January 1, 1998 and December 31, 2002 was abstracted from this database, and a separate file was constructed. The data in this file were used to our analysis. All information and dates contained in the newly created file matched the information in the database, with the exception of the initial reserve, which we recorded as the quarter (not the date) in which the reserve was placed. All claimants were employed by policyholders in the state of Louisiana.

Information available from the file included the age, gender, and marital status of each claimant; premium size; payroll size of the employer; date of injury; date the claim was entered into the database; quarter the initial reserve was placed; nature of the accident or diagnosis; attorney representation; date of initial attorney involvement; date of claim closure; and medical, indemnity, and other claim payments (defense-related litigation, investigation expenses etc.).

At the LWCC, reserves are placed on workers' compensation claims to insure that sufficient funds have been allocated to pay all future claim expenses, as well as to determine the aggregate future liability for the LWCC.[45] The claim representative places the initial reserve on a claim within 14 days of the accident. If there are no complicating factors or the claim will involve only medical payments, the initial reserve may be assigned immediately on receipt of the claim. The vast majority of medical-only and uncomplicated lost time claims are reserved for under $15,000. Typically, there is nothing about the nature and extent of injuries with a reserve of <$15,000 that would involve costly medical expenses or an extended period of time from injury to full recovery. Adverse development (cost escalation above the norm) of these claims almost always takes place as the claim matures, rather than at the time of the injury or placement of the initial reserve. From the newly created file we identified four claim categories, utilizing an initial reserve cut-off point of $15,000 and a final cost cut-off point of $100,000: 1) Claims with an initial total reserve of <$15,000 and final costs <$100,000 were classified as low reserve/low cost claims. 2) Claims with reserves of <$15,000 that closed with a final total cost of ≥$100,000 or greater were defined as low reserve/high cost or migrated catastrophic claims. 3) Claims with reserves of ≥$15,000 that closed for <$100,000 were termed high reserve/low cost claims. 4) Claims with initial reserves of ≥$15,000 whose total cost at closure was ≥$100,000 were defined as high reserve/high cost or catastrophic claims.

We then assessed the distribution of attributes among all four claims categories and attempted to identify the characteristics that predicted two of the categories, migrated catastrophic claims and catastrophic claims. Migrated catastrophic claims were compared with low initial reserve/low cost claims, and catastrophic claims were compared with high initial reserve/high cost claims. In analyzing the characteristics of these claim categories, we utilized medical and indemnity costs of $50,000 and total costs of $100,000 as cut-off points.

Our rationale for utilizing the $15,000 cut-off point is that claims with initial reserves of ≥$15,000 at the LWCC have complexities associated with them that make it clear at intake that the associated medical and indemnity costs will be unusually serious. We chose the $100,000 cost cut-off point because this number was felt to represent the threshold for unusually high-cost or catastrophic claims; in our study, only 4% of the 36,379 claims equaled or exceeded $100,000 by the time of closure.

Statistical Methods

Data were analyzed using the SAS statistical software package, Version 8. The outcomes of interest in this study were the covariates that predicted medical, indemnity, and total costs in each claim category. The covariates analyzed were age, gender, marital status, company payroll, premium size, initial medical reserve, initial indemnity reserve, initial total reserve, reporting delay, low back disorders, accident year, and attorney involvement. Monetary outcomes (medical, indemnity, and combined losses) were not adjusted for inflation.

Results

There were 36,379 claims for injuries or illnesses filed by the LWCC between January 1, 1998 and December 31, 2002 (Table 1). Of these claims, 31,334 (86.1%) were low reserve/low cost claims (initial reserves <$15,000 and final cost <$100,000), and 729 (2.0%) were migrated catastrophic claims (initial reserve <$15,000 and final cost ≥$100,000). There were 3653 (10.0%) high reserve/low cost claims (claims reserved for ≥$15,000 and final cost <$100,000) and 663 (1.8%) catastrophic claims (claims reserved for ≥$15,000 and final cost ≥$100,000).

Migrated catastrophic claims and catastrophic claims represented <4% of the total claim volume but 64% of the total claim costs (Table 1). Migrated catastrophic claims accounted for only 2.0% of the total claims but had 32.3% ($154,379,267) of the total claim costs, and catastrophic claims accounted for 1.8% of the total claims but had 31.7% ($151,781,868) of the total claim costs. The claim categories with the highest percentage of claims, low reserve/low cost (86.1%)

TABLE 1
Claim Cost Distribution by Claim Category – LWCC 1998–2002

Claim Category				Final Costs					
Initial Reserve	Final Cost	Number	%	Type	Mean	Median	Total	% of Category	% Total
Low reserve/low cost									
<$15,000	<$100,000	31,334	86.1	Other	$279	$10	$8,756,059	8.5	2.0
				Indemnity	$1076	$0	$33,722,420	32.6	7.0
				Medical	$1942	$378	$60,864,881	58.9	12.7
Mean/median initial reserve = $1904/$384				Total	$3298	$426	$103,343,360	100.0	21.6
Migrated/catastrophic									
<$15,000	≥$100,000	729	2.0	Other	$9070	$6657	$7,379,080	4.8	1.4
				Indemnity	$111,717	$95,257	$81,441,795	52.8	17.0
				Medical	$89,929	$69,400	$65,558,392	42.5	13.7
Mean/median initial reserve = $4332/$700				Total	$211,769	$176,096	$154,379,267	100.0	32.3
High reserve/low cost									
≥$15,000	<$100,000	3653	10.0	Other	$1233	$195	$4,719,212	6.8	0.9
				Indemnity	$7683	$2799	$28,064,670	40.7	5.9
				Medical	$9909	$6088	$36,196,029	52.5	7.6
Mean/median initial reserve = $30,924/$23,300				Total	$18,883	$10,726	$68,979,910	100.0	14.4
Catastrophic									
≥$15,000	≥$100,000	663	1.8	Other	$8652	$6327	$6,338,247	4.2	1.2
				Indemnity	$116,279	$97,760	$77,092,692	50.8	16.1
				Medical	$103,093	$71,809	$68,350,928	45.0	14.3
Mean/median initial reserve = $87,232/$30,032				Total	$228,932	$178,299	$151,781,868	100.0	31.7
All categories									
		36,379	100.0	Other	$723	$13	$27,192,598	5.7	5.5
				Indemnity	$6056	$0	$220,321,577	46.0	46.0
				Medical	$6349	$485	$230,970,230	48.3	48.3
Mean/median initial reserves = $6422/$600				Total	$13,153	$574	$478,484,405	100.0	100.0

and high reserve/low cost claims (10.0%), had the lowest percentage of costs, 21.6% ($103,343,360) and 14.4% ($68,979,910), respectively.

The mean and median expenditures for low reserve/low cost claims ($3298 and $426, respectively) and for high reserve/low cost claims ($18,883 and $10,726) differed dramatically from those for migrated catastrophic claims ($211,769 and $176,096) and catastrophic claims ($228,932 and $178,299).

Table 1 indicates that medical costs accounted for 58.9% of low reserve/low cost claims, 42.5% of migrated catastrophic claims, 52.5% of high reserve/low cost claims, and 45.0% of catastrophic claims. The two categories with the highest proportion of medical costs, low reserve/low cost and high reserve/low cost claims, had the highest percentage of medical only claims (69.4% and 1.9%, respectively), which may account for the high proportion of medical expenditures (Table 2, discussed below). Indemnity costs made up 32.6% of low reserve/low claims, 52.8% of migrated catastrophic claims, 40.7% of high reserve/low cost claims, and 50.8% of catastrophic claims.

The mean and median final costs of all 36,379 claims were $13,153 and $574, respectively (Table 1). The mean and median initial reserves on these claims were $6422 and $600, indicating that adjusters were able to forecast ultimate claim costs quite accurately at the time of the initial reserve. While this forecasting ability was accurate for the universe of claims, it was not necessarily accurate for the individual claim categories. In particular, the reserves placed by the adjusters at the time of the injury quite closely approximated the ultimate losses for the high reserve/low cost claims, and especially for the low cost/low reserve claims. However, the initial reserves placed on catastrophic and migrated catastrophic claims were imperfect indicators of the ultimate costs, particularly for the latter. For migrated catastrophic claims, the median final cost of the claims ($176,096) was 252 times higher than the initial median reserve ($700). For catastrophic claims, the ultimate final cost ($178,299) was six times higher than the initial reserve ($30,032).

Initial reserves and final costs for lost time and medical only claims are presented in Tables 2 and 3 for the four claim categories. The median initial reserves for medical only claims and lost time claims were good indicators of the final claim medical and indemnity costs. For all lost time claims (Table 3), the overall initial median reserve placed was $9670, and the median final claim costs were $9117; however, the initial median reserve placed on migrated catastrophic claims and catastrophic claims significantly underestimated the final median claim costs ($724 versus $176,234 and $30,016 versus $178,559, re-

TABLE 2
Medical Only Claim Cost Distribution by Initial Reserve/Final Cost Category

Claim Category				Final Costs					
Initial Reserve	Final Cost	Number	% All Claims	Type	Mean	Median	Total	% MO Claims	% All Claims
Low reserve/low cost									
<$15,000	<$100,000	25,228	69.4	Other	$111	$8	$2,794,663	11.4	0.6
				Indemnity	$0	$0	$0	0.0	0.0
				Medical	$861	$298	$21,712,597	88.6	4.5
Mean/median initial reserve = $1203/$266				Total	$971	$316	$24,507,260	100.0	5.1
Migrated/catastrophic									
<$15,000	≥$100,000	12	<0.1	Other	$1,9394	$6895	$232,731	10.1	0.0
				Indemnity	$0	$0	$0	0.0	0.0
				Medical	$172,915	$1751	$2,074,978	89.9	0.4
Mean/median initial reserve = $1219/$0				Total	$192,309	$2897	$2,307,709	100.0	0.5
High reserve/low cost									
≥$15,000	<$100,000	488	1.3	Other	$1662	$96	$810,978	25.1	0.2
				Indemnity	$0	$0	$0	0.0	0.0
				Medical	$4956	$1751	$2,418,512	74.9	0.5
Mean/median initial reserve = $26.292/$20,445				Total	$6618	$2897	$3,229,490	100.0	0.7
Catastrophic									
≥$15,000	≥$100,000	7	<0.1	Other	$25,369	$7555	$177,584	13.9	0.0
				Indemnity	$0	$0	$0	0.0	0.0
				Medical	$156,518	$134,192	$1,095,625	86.1	0.2
Mean/median initial reserve = $$325,593/$37,500				Total	$181,887	$146,940	$!,273,209	100.0	0.3
All categories		25,735	70.7		$1217	$322	$31,317,668	100.0	6.5
Mean/median initial reserve = $1767/$281									

TABLE 3
Lost Time Claim Cost Distribution by Claim Category, LWCC 1998–2002

Claim Category				Final Costs					
Initial Reserve	Final Cost	Number	% All Claims	Type	Mean	Median	Total	% LT Claims	% All Claims
Low reserve/low cost									
<$15,000	<$100,000	6106	16.8	Other	$976	$87	$5,961,396	1.3	1.2
				Indemnity	$5523	$1234	$33,722,420	7.5	7.0
				Medical	$6412	$2376	$39,152,284	8.8	8.2
Mean/median initial reserve = $4800/2977				Total	$12,911	$4592	$78,836,100	17.6	16.5
Migrated/catastrophic									
<$15,000	≥$100,000	717	2.0	Other	$9094	$6690	$7,146,349	1.6	1.5
				Indemnity	$113,587	$96,838	$81,441,795	18.2	17.0
				Medical	$88,540	$68,773	$63,483,414	14.2	13.3
Mean/median initial reserve = $4385/$724				Total	$212,094	$176,234	$152,071,558	34.0	31.8
High reserve/low cost									
≥$15,000	<$100,000	3165	8.7	Other	$1294	$210	$3,908,233	0.9	0.8
				Indemnity	$8867	$3623	$28,064,670	6.3	5.9
				Medical	$10,672	$6849	$33,777,517	7.6	7.1
Mean/median initial reserve = $31,639/$23,764				Total	$20,774	$12,334	$65,750,420	14.7	13.7
Catastrophic									
≥$15,000	≥$100,000	656	1.8	Other	$8653	$6306	$6,160,663	1.4	1.3
				Indemnity	$117,519	$98,537	$77,092,692	17.2	16.1
				Medical	$102,523	$71,257	$67,255,303	15.0	14.1
Mean/median initial reserve = $84,689/$30,016				Total	$229,434	$178,559	$150,508,659	33.7	31.5
All categories		10,644	29.3		$42,011	$9117	$447,166,737	100.0	93.5
Mean/median initial reserve = $17,677/$9670									

spectively). For all medical-only claims (Table 2), initial median reserves placed on claims were $281, and the final claim costs, $322; there were too few claims in the migrated catastrophic and catastrophic categories for a meaningful comparison to be made.

Table 4 presents the final claim cost in relationship to claim duration for each initial claim reserve category (<$15,000, $15,000 to

TABLE 4
Mean and Median Cost by Initial Total Reserve and Claim Duration

Initial Total Reserve	Duration	N	% of Sub-Total	% of Total	Mean	Median
A. <$15,000	A. 0–30 d	6447	20.1		$418	$247
	B. 31–90 d	12,877	40.2		$752	$339
	C. 91–180 d	5097	15.9		$1917	$680
	D. 181–360 d	2799	8.7		$4145	$1495
	E. 361–720 d	2127	6.6		$9459	$2860
	F. >720 d	2716	8.5		$75,059	$32,291
Sub-total	*Mean: $1959					
	†Median: $385	32,063	100.0	88.1	$8038	$444
B. $15,000–<$30,000	A. 0–30 d	4	0.1		$1248	$1142
	B. 31–90 d	337	11.8		$3438	$2560
	C. 91–180 d	650	22.7		$6136	$5095
	D. 181–360 d	560	19.5		$11,104	$9146
	E. 361–720 d	461	16.1		$19,565	$12,830
	F. >720 d	855	29.8		$95,727	$65,168
Sub-total	*Mean: $20,901					
	†Median: $20,323	2867	100.0	7.9	$35,660	$9905
C. $30,000–<$40,00	A. 0–30 d	1	0.2		$86	$86
	B. 31–90 d	31	5.0		$5293	$2640
	C. 91–180 d	98	15.7		$8922	$6992
	D. 181–360 d	132	21.1		$15,182	$13,605
	E. 361–720 d	120	19.2		$25,881	$20,218
	F. >720 d	243	38.9		$121,177	$81,173
Sub-total	*Mean: $34,302					
	†Median: $34,000	625	100.0	1.7	$56,951	$18,983
D. $40,000–<$50,000	A. 0–30 d	0	0.0			
	B. 31–90 d	19	5.0		$5300	$4523
	C. 91–180 d	52	13.6		$10,350	$7712
	D. 181–360 d	67	17.6		$15,413	$14,976
	E. 361–720 d	77	20.2		$28,833	$24,214
	F. >720 d	166	43.6		$114,939	$64,759
Sub-total	*Mean: $44,904					
	†Median: $44,606	381	100.0	1.0	$60,293	$21,985
E. $50,000+	A. 0–30 d	0	0.0			
	B. 31–90 d	9	2.0		$5247	$4470
	C. 91–180 d	30	6.8		$20,546	$10,785
	D. 181–360 d	75	16.9		$32,846	$22,076
	E. 361–720 d	80	18.1		$48,217	$34,605
	F. >720 d	249	56.2		$212,750	$133,420
Sub-total	*Mean: $163,272					
	†Median: $75,433	443	100.0	1.2	$135,348	$54,529
Total	*Mean: $6422					
	†Median: $600	36,379		100.0	13,153	574

*Mean of initial reserves.
†Median of initial reserves.

<$30,000, $30,000 to <$40,000, $40,000 to <$50,000, and $50,000). For all four claim categories, the longer the claim was open, the higher was the ultimate cost of the claim. The cost of claims increased very slowly for claims open for ≤720 days (~2 years), then rose dramatically for claims open for >720 days. It is also noteworthy that the initial reserves placed on claims were rather predictive of claim costs for claims closing in ≤720 days, and in all initial reserve categories, adequate reserves were placed at the time of the initial reserve for claims open ≤720 days. Thus, it appears that duration is an important variable in predicting the ultimate cost of a claim.

Demographic and other claim information, stratified according to initial reserve and final total costs, is presented in Table 5. Claims were evenly distributed among accident years, ranging from 17.3% of claims occurring in 1999 to 23.2% of claims occurring in the 2001 accident year. Approximately 63% of migrated catastrophic claims were reported five or more days after the accident occurred, as compared with 45.7% of low reserve/low cost claims, 40.2% of high reserve/low cost claims, and 40.1% of catastrophic claims.

Women accounted for 30.4% of all claims and men for 69.6%. Men

TABLE 5
Distribution of Risk Factors – LWCC 1998–2002

	Initial Reserve <$15,000					Initial Reserve ≥$15,000						
	Final Cost <$100,000 (Low Reserve/ Low Cost)		Final Cost ≥$100,000 (Migrated/ Catastrophic)			Final Cost <$100,000 (High Reserve/ Low Cost)		Final ≥$100,000 (Catastrophic)			Total	
Variables	N	%	N	%	% ≥$100,000	N	%	N	%	% ≥$100,000	N	%
Sex												
F	9956	31.8	186	25.5	1.8	805	22.0	122	18.4	13.2	11,069	30.4
M	21,378	68.2	543	74.5	2.5	2848	78.0	541	81.6	16.0	25,310	69.6
Marital status												
Married	10,636	33.9	272	37.3	2.5	1372	37.6	277	41.8	16.8	12,557	34.5
Sep/dev/wid.	1652	5.3	67	9.2	3.9	206	5.6	46	6.9	18.3	1971	5.4
Single	8132	26.0	147	20.2	1.8	910	24.9	127	19.2	12.2	9316	25.6
Unknown	10,914	34.8	243	33.3	2.2	1165	31.9	213	32.1	15.5	12535	34.5
Reporting delay												
Within 5 days	17,027	54.3	267	36.6	1.5	2183	59.8	397	59.9	15.4	19,874	54.6
5 or more days	14,307	45.7	462	63.4	3.1	1470	40.2	266	40.1	15.3	16,505	45.4
Payroll size												
<$500,000	8148	26.0	231	31.7	2.8	1126	30.8	214	32.3	16.0	9719	26.7
$500,000–<$1,000,000	4149	13.2	109	15.0	2.6	534	14.6	95	14.3	15.1	4887	13.4
$1,000,000–>$2,500,000	6273	20.0	158	21.7	2.5	796	21.8	144	21.7	15.3	7371	20.3
$2,500,000+	12,764	40.7	231	31.7	1.8	1197	32.8	210	31.7	14.9	14,402	39.6
Premium size												
<$10,000	4565	14.6	127	17.4	2.7	545	14.9	97	14.6	15.1	5334	14.7
$10,000–<$100,000	11,693	37.3	264	36.2	2.2	1392	38.1	240	36.2	14.7	13,589	37.4
$100,000–>$500,000	9182	29.3	217	29.8	2.3	1127	30.9	213	32.1	15.9	10,739	29.5
$500,000+	5894	18.8	121	16.6	2.0	589	16.1	113	17.0	16.1	6717	18.5
Low back injuries												
All others	29,489	94.1	509	69.8	1.7	3247	88.9	501	75.6	13.4	33,746	92.8
Low back injures	1845	5.9	220	30.2	10.7	406	11.1	162	24.4	28.5	2633	7.2
Age group (year)												
20–29	7603	24.3	71	9.7	0.9	734	20.1	79	11.9	9.7	8487	23.3
30–39	7343	23.4	208	28.5	2.8	941	25.8	183	27.6	16.3	8675	23.8
40–49	6678	21.3	271	37.2	3.9	910	24.9	233	35.1	20.4	8092	22.2
50–59	3596	11.5	120	16.5	3.2	509	13.9	106	16.0	17.2	4331	11.9
60–69	1185	3.8	35	4.8	2.9	214	5.9	43	6.5	16.7	1477	4.1
Unknown	4929	15.7	24	3.3		345	9.4	19	2.9		5317	14.6
Accident year												
1998	6201	19.8	152	20.9	2.4	353	9.7	72	10.9	16.9	6778	18.6
1999	5458	17.4	145	19.9	2.6	588	16.1	107	16.1	15.4	6298	17.3
2000	6530	20.8	122	16.7	1.8	953	26.1	143	21.6	13.0	7748	21.3
2001	7157	22.8	162	22.2	2.2	947	25.9	160	24.1	14.5	8426	23.2
2002	5988	19.1	148	20.3	2.4	812	22.2	181	27.3	18.2	7129	19.6
Attorney involvement												
No	29,779	95.0	204	28.0	0.7	2893	79.2	188	28.4	6.1	33064	90.9
Yes	1555	5.0	525	72.0	25.2	760	20.8	475	71.6	36.5	3315	9.1
Total claims	31,334	100.0	729	100.0	2.3	3653	100.0	663	100.0	15.4	36,379	100.0

TABLE 6
Risk Estimates for Migrated Catastrophic Claims vs Low Reserve/Low Cost Claims

	Final Total Cost ≥$100,000			Final Indemnity Cost ≥$50,000			Final Medical Cost ≥$50,000		
Variables	**OR**	**95% CI**		**OR**	**95% CI**		**OR**	**95% CI**	
Claimant sex M vs F	1.45	1.19	1.77	1.69	1.38	2.07	1.15	0.94	1.41
Marital married vs single	1.20	0.95	1.51	1.24	0.98	1.57	0.93	0.72	1.19
Marital separated/divorced/widowed vs single	1.43	1.02	2.02	1.35	0.95	1.92	1.31	0.92	1.87
Marital unknown vs single	1.08	0.85	1.38	1.20	0.94	1.54	0.99	0.77	1.27
Reporting delay 5 or more days	1.27	1.07	1.52	1.39	1.17	1.66	1.32	1.09	1.60
Payroll size A. <$500,000 vs D. $2.5+	2.23	1.50	3.30	2.43	1.64	3.60	2.49	163	3.78
Payroll size B. $500,000–<$1.0 vs D. $2.5+	2.10	1.46	3.03	2.07	1.43	3.00	2.00	1.35	2.96
Payroll size C. $100,000–<$2.5 vs D. $2.5+	1.69	1.27	2.24	1.87	1.40	2.49	1.57	1.15	2.13
Premium size B. $10,000–<$100,000 vs A. <$10,000	1.02	0.77	1.36	1.09	0.82	1.45	0.98	0.72	1.32
Premium size C. $100,000–<$500,000 vs A. <$10,000	1.65	1.11	2.45	1.72	1.16	2.57	1.70	1.11	2.59
Premium size D. $500,000+ vs A. <$10,000	2.35	1.46	3.78	2.50	1.55	4.03	1.96	1.18	3.27
Lowback vs all other	3.63	2.96	4.46	3.57	2.90	4.39	3.96	3.20	4.89
Age group 30 vs 20	2.06	1.53	2.77	2.02	1.50	2.72	2.13	1.54	2.96
Age group 40 vs 20	3.04	2.27	4.07	2.84	2.12	3.81	3.42	2.48	4.70
Age group 50 vs 20	2.99	2.15	4.16	3.10	2.23	4.31	3.26	2.28	4.68
Age group 60 vs 20	3.03	1.92	4.79	2.95	1.86	4.67	2.73	1.63	4.57
Age group unknown vs 20	0.51	0.32	0.84	0.50	0.31	0.81	0.42	0.23	0.75
Accident year 1999 vs 1998	1.05	0.80	1.37	1.08	0.82	1.41	1.14	0.85	1.53
Accident year 2000 vs 1998	0.80	0.60	1.06	0.88	0.67	1.16	0.94	0.70	1.27
Accident year 2001 vs 1998	0.82	0.63	1.08	0.78	0.59	1.01	0.87	0.65	1.16
Accident year 2002 vs 1998	0.91	0.70	1.19	0.79	0.60	1.04	1.02	0.76	1.36
Attorney yes vs. no	36.74	30.71	43.95	35.66	29.78	42.69	28.56	23.58	34.59

OR indicates odds ratio; CI, confidence interval.

were over-represented in the migrated catastrophic claim and catastrophic categories (74.5% and 81.6%, respectively, of the total claims in these categories); conversely, women were under-represented in these categories.

Individuals under age 50 accounted for 69.3% of all claims; those aged 50–69 accounted for 16.0% of all claims, 15.3% of low reserve/low cost claims and 19.8% of high reserve/low cost claims, but 21.3% of migrated catastrophic claims and 22.5% of catastrophic claims. Those in the age 40 to 49 category accounted for 22.2% of the total claims, but a disproportionately high percentage of the migrated catastrophic (37.2%) and catastrophic (35.1%) claims. Those under age 30 made up a notably smaller proportion of the migrated catastrophic (9.7%) and catastrophic (11.9%) claim categories than either low cost claim category. Although low back injuries comprised only 7.2% of all claims, they accounted for 30.2% of the migrated catastrophic claims, 5.9% of the low reserve/low cost claims, 11.1% of the high reserve/low cost claims, and 24.4% of the catastrophic claims. Attorneys were involved in 5.0% of the low reserve/low cost claims and 20.8% of the high reserve/low cost claims, but a remarkably high 72.0% of the migrated catastrophic claims and 71.6% of the catastrophic claims, suggesting an association between attorney involvement and higher claims costs.

The multivariate logistic regression results obtained when we compared migrated catastrophic claims to low reserve/low cost claims (Table 6) and catastrophic claims to high initial reserve/low cost claims (Table 7) indicated that the most significant contributing risk factor predicting high final costs was attorney involvement, although this relationship was much stronger for migrated catastrophic claims than for catastrophic claims. For migrated catastrophic claims, the odds ratio (OR) for attorney involvement was 36.74 (confidence interval [CI], 30.71–43.95) and for catastrophic claims, 9.49 (CI, 7.82–11.53). Similar ORs were observed between migrated catastrophic and catastrophic claims for medical and indemnity costs exceeding $50,000 (Tables 6 and 7).

As seen in Table 6, with regard to total final cost, the OR of the cost migration to ≥$100,000 for low back injuries was 3.63 (CI, 2.96–4.46) for migrated catastrophic claims. Other risk factors that were associated with the migrated catastrophic claims (but to a lesser extent) were male gender (OR, 1.45; CI, 1.19–1.77), older age, smaller payroll size, and bigger premium size. Finally, married, separated, and divorced individuals had higher ORs than single individuals. Reporting delays had an OR of 1.27, compared with the reporting of claims within five working days. The ORs for accident year revealed little differences between years, indicating an absence of secular trends in claims costs. When the covariates were analyzed

TABLE 7
Risk Estimates for Catastrophic Claims vs High Initial Reserve/Low Cost Claims

	Final Total Cost ≥$100,000			Final Indemnity Cost ≥$50,000			Final Medical Cost ≥$50,000		
Variables	OR	95% CI		OR	95% CI		OR	95% CI	
Claimant sex M vs F	1.30	1.01	1.67	1.68	1.29	2.17	1.07	0.82	1.38
Marital married vs single	1.25	0.96	1.62	1.08	0.84	1.40	1.29	0.98	1.70
Marital separated/divorced/widowed vs single	1.25	0.82	1.92	1.07	0.70	1.65	1.16	0.74	1.84
Marital unknown vs single	1.14	0.87	1.49	0.90	0.68	1.18	1.00	0.75	1.34
Reporting delay 5 or more days	0.74	0.61	0.90	0.84	0.70	1.02	0.66	0.54	0.82
Payroll size A. <$500,000 vs D. $2.5+	1.34	0.88	2.05	1.22	0.79	1.87	1.30	0.83	2.04
Payroll size B. $500,000–<$1.0 vs D. $2.5+	1.23	0.83	1.83	1.20	0.80	1.80	1.29	0.85	1.97
Payroll size C. $100,000–<$2.5 vs D. $2.5+	1.13	0.83	1.54	1.18	0.87	1.62	1.01	0.72	1.41
Premium size B. $10,000–<$100,000 vs A. <$10,000	0.98	0.71	1.36	0.93	0.67	1.30	0.94	0.67	1.31
Premium size C. $100,000–<$500,000 vs A. <$10,000	1.31	0.85	2.04	1.27	0.81	1.99	1.19	0.75	1.90
Premium size D. $500,000+ vs A. <$10,000	1.60	0.95	2.71	1.70	1.00	2.90	1.08	0.61	1.90
Lowback vs all other	1.85	1.46	2.35	2.06	1.63	2.62	1.78	1.39	2.28
Age group 30 vs 20	1.71	1.26	2.34	1.74	1.27	2.37	1.29	0.93	1.79
Age group 40 vs 20	2.41	1.77	3.27	2.30	1.69	3.15	1.92	1.40	2.64
Age group 50 vs 20	2.27	1.60	3.24	2.59	1.82	3.70	1.73	1.19	2.50
Age group 60 vs 20	2.22	1.41	3.49	2.55	1.62	4.02	1.05	0.62	1.78
Age group unknown vs 20	0.65	0.38	1.13	0.52	0.29	0.96	0.54	0.29	1.00
Accident year 1999 vs 1998	0.83	0.57	1.20	0.89	0.61	1.30	0.88	0.59	1.32
Accident year 2000 vs 1998	0.71	0.50	1.01	0.71	0.50	1.02	0.74	0.51	1.09
Accident year 2001 vs 1998	0.77	0.54	1.09	0.73	0.52	1.05	0.93	0.64	1.36
Accident year 2002 vs 1998	1.10	0.78	1.57	0.99	0.69	1.41	1.37	0.94	1.98
Attorney yes vs no	9.49	7.82	11.53	9.54	7.84	11.62	7.65	6.21	9.42

OR indicates odds ratio; CI, confidence interval.

in relationship to final medical and indemnity costs of ≥$50,000, the ORs observed were similar to those for total costs of ≥$100,000.

The same covariates were used to predict final claim costs for catastrophic claims (Table 7). The ORs for each covariate paralleled the ORs for migrated catastrophic claims, but to a lesser degree. For example, the ORs for attorney involvement were three times greater in the migrated catastrophic than catastrophic claim categories (36.74 versus 9.49), and the OR for the group aged 50 to 59 was also higher (2.99 versus 2.22). When the ORs were analyzed to predict medical and indemnity costs, the patterns observed were similar to those obtained when the >$100,000 end-points were used. The ORs for the $50,000 indemnity cut-off point, however, more closely approximated the ORs for the $100,000 cut-off point than the medical cut-off point.

Discussion

In the present study, we have analyzed the characteristics of workers' compensation claims that were initially felt to be low-cost claims but developed into very costly claims (ie, migrated catastrophic claims). The median final cost of these claims was 250 times the sum initially reserved for them, whereas the median final cost of claims in the other three categories for the most part approximated the initial reserves set aside for them. The migrated catastrophic claims accounted for 2% (729 claims) of all claims processed by the LWCC during the 5-year study period, but they consumed 32.3% of the total claim costs. What were the unique characteristics of this claim category that had such a great impact on overall claim costs for the 5-year period?

Attorney involvement was, by far, the most important factor associated with high claim costs. Other important predictors were older age, higher premiums, small size of company (ie, small payroll), marital status (married/separated/divorced versus single), reporting delays, male gender, and low back disorders. Although this relationship was not formally tested by multivariate analysis, the data suggested that the longer it took to resolve a claim, the higher the ultimate cost of that claim. Therefore, it appears that a combination of these factors, especially low back pain, attorney involvement, and older age, coupled with a failure to resolve a claim within 24 months, make claims particularly vulnerable to cost escalation.

In performing our study, we discovered another smaller group of claims whose final costs were also inaccurately predicted, catastrophic claims. The magnitude of the discrepancy between what was initially reserved and what these claims ultimately cost was much less than for migrated catastrophic claims. The median final cost of these claims was six times what was initially reserved for them, as compared with the 250-fold difference for migrated catastrophic claims. When performing the risk estimates for catastrophic claims versus high reserve/low cost claims, attorney involvement contin-

ued to be the most important predictor of a claim becoming catastrophic. As for migrated catastrophic claims, the other predictors of high cost were older age, small payroll, married/separated/divorce versus single, reporting delays, male gender, and low back disorders, but the OR values were much lower than those for the migrated/catastrophic claims.

We observed that the longer the time a claim was open, the higher the probability that the claim would show adverse development. Our study unfortunately did not allow us to determine the inflection points in each category at which costs ceased to rise slowly and began to escalate rapidly. However, it appears from our data that costs for settled claims rise slowly for approximately 2 years, than begin to escalate rapidly. The mean and median differences between claims paid prior to the 2-year period and after that time were very large. For example, in each initial reserve category, the median cost of claims that were closed between 361 and 720 days was approximately one-fourth that of claims closed after 720 days. This finding indicates that time becomes an important factor in cost escalation. Thus, our results suggest that aggressive medical management be applied to achieve full recovery as soon as possible and settlement should be considered before the claim has reached 12 to 18 months without resolution.

Our findings confirm and extend the observations and resulting strategies that have previously been utilized to contain workers' compensation costs.[5,16,17,31,33,34,46] Medical case management, return to work programming, and vocational rehabilitation have been demonstrated to decrease medical and indemnity costs.[16,20,30,46,47] The results presented here suggest that these management techniques may be effective in reducing costs because they reduce the time that a claim is open; our study adds to the literature by providing information to allow the adjuster or case manager to apply these techniques to a smaller number of claims, thereby conserving resources.

Can the results of our work be applied to workers' compensation cases in other jurisdictions or insurers? In a study similar to ours, Victor examined medical cost migration in 12 states.[44] His work is consistent with our findings and suggests that our observations can potentially be extended beyond a single carrier or state. In his study, Victor defined an adverse surprise claim as a claim with seven or more days of lost time in which medical costs at 36 months exceeded the incurred medical expenses at 12 months. His results pointed to an association between medical cost migration and low back pain, older age, and being married, as did ours. He did, however, note large differences among the states with regard to the number and cost contribution of adverse surprise claims to the total number of claims. California and Texas had the highest frequencies of adverse surprise claims, 6.0% and 3.7% of the total claims, and related medical costs incurred, 31% and 24% of the total medical costs, respectively.[44] Louisiana ranked fourth among the 12 states, with 2.6% of the claims being significant adverse surprise claims that consumed 13% of the incurred medical costs.

Theoretically, migrated catastrophic claims should result in losses very similar to those expected for the low initial reserve/low cost category. If the migrated catastrophic claims in our study were managed in a way that approximated the outcome for the low initial reserve/low cost claims (average cost = \$3298), the risk bearer (the LWCC) could have saved approximately \$152 million (\$154,379,267 – [\$3298 × 729]), or 32% of \$478 million. Although it is unlikely that this whole amount would be realized, saving any portion of it as a result of a refined management of high-risk claims would be significant.

Similarly, catastrophic claims, if well managed, could approximate the high initial reserve/low cost category. If catastrophic claims in our study were managed in a way that approximated the outcome for high initial reserve/low cost claims (average, \$18,883), the LWCC could have saved approximately \$139 million (\$151,781,768 – [\$18,883 × 663]), or 29.1% of \$478 million. The likelihood of realizing this level of savings with regard to catastrophic claims is lower than that for migrated catastrophic claims because these claims represented the most severe cases. Again, any portion of the savings that could be realized by intense medical and claims management to prevent escalation could be significant as well.

There are other attributes of claimants and the provision of health care that can affect claim costs such as physician networks, obesity, smoking, substance abuse, and union membership.[4,5,10,13,16,17,23,31,33–43] The inclusion of these variables into our analysis would improve the precision of the individual ORs as predictors claims cost migration. Unfortunately, we could not obtain data on these factors to include in our model for the present study. We plan on repeating this research in this jurisdiction to ascertain the effect of physician networks on migrating catastrophic claims. We will conduct a similar study in another jurisdiction taking into account obesity and smoking history to improve predictive precision, as well as assessing the effect of differences in workers' compensation regulations on these attributes.

In conclusion, we have identified the attributes of a small group of high-cost workers' compensation claims that, based on the nature of the injuries involved, should have resulted in claims with low medical and indemnity expenses. Claims with the attributes identified in this study can be subject to intense case management or settlement if necessary, potentially providing a substantial

reduction in workers' compensation, medical case duration and associated costs without a drastic increase in resources. Further research is being planned to test the risk estimation models established in this paper.

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