Short Term Disability Claims Following Lumbar Spinal Stenosis Surgery: An Analysis of Employer Costs

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Commissioned by Paradigm Spine, LLC

April 2016

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EXECUTIVE SUMMARY

Symptomatic lumbar spinal stenosis (LSS) is one of the most frequent indications for spinal surgery which typically includes decompression alone (decompression) or decompression with lumbar fusion (fusion). Similar clinical benefits with respect to pain, disability or walking ability have been reported in studies comparing decompression with fusion in the treatment of symptomatic LSS[1] but higher rates of major complications, 30 day mortality and resource use have been reported for fusion compared to decompression.[2,3,4] The authors of this report published a previous study in 2015 comparing the medical cost for primary decompression versus fusion surgery for a commercially insured population using the Truven Health MarketScan® (MarketScan) medical claim databases.[5] We identified a significant cost difference between the two procedures: $12,749 versus $65,509 respectively for 2013 cases – costs included all facility and professional charges during the inpatient stay for the procedure or on the day of the procedure if performed outpatient.

In addition to medical claim costs, employers providing short term disability (STD) benefits will incur STD claim costs and other associated labor costs (discussed later in this paper) for their employees undergoing these surgeries. Data on STD claims associated with back surgery are limited. A significant portion of STD claims are for back related conditions. UNUM, a major STD insurer, reports that 7% of their customers' 2012 STD claims were for back disorders.[6] Cigna, another STD insurer, analyzed patterns in STD claims from 1993-2012 and reported a 45% increase in work absence for herniated discs with 60% of the absence due to surgery. The study also reported that in 2013, musculoskeletal related conditions and separately, back/neck strain, were responsible for 9.5% and 2.5% of STD claims.[7] A 2010 study examined return to work after lumbar spinal surgery and reported that 40% of the surgery patients that had been previously employed had returned either full time or part time to work by 6 weeks and that by 6 months, all employed workers had returned to baseline preoperative employment levels.[8]

Using the primary decompression and fusion cases from our original analysis, we analyzed the STD claim experience of those with disability eligibility in the MarketScan data to determine if there was a notable difference in STD initiation and duration between the decompression and fusion patients. Of the 3,050 primary decompressions and 2,167 primary fusions in our previous analysis, 660 primary decompressions and 422 primary fusion patients were eligible for STD benefits.

We identified a higher rate of fusion cases initiating STD compared to decompression cases as well as a longer duration of STD claim days for the fusion cases compared to the decompression cases. We converted the STD day difference between decompression and fusion cases to STD work days and STD days per surgery. STD work days includes all week days in a year (~261 work days per year). STD days *per surgery* accounts for the difference in fusions and decompressions initiating STD while STD days *per surgery initiating STD* only accounts for the STD day difference between decompressions and fusions. The findings are summarized in the table below.

	Primary Fusion	Primary Decompression	Difference between Fusion and Decompression	P-Value
% of Surgeries with a STD claim	67%	61%	6%	0.030
Average STD days per surgery with an STD claim	108.6	85.9	22.7	< .001
Average STD work days per surgery with an STD claim	77.6	61.4	16.2	< .001
Average STD days per surgery	72.8	52.1	20.7	< .001
Average STD work days per surgery	52.0	37.2	14.8	< .001

Source: Milliman analysis of MarketScan medical claim data 2009-2013 and disability data 2012-2014 claims
Notes: Primary surgery: 2013 decompression or fusion with no decompression or surgery claim in 2009-2012
Work days were defined as week days.

We used the cost assumptions below to calculate the incremental STD and labor costs to employers per surgery. In Appendix A, we provide alternate scenarios without replacement worker costs for employers or particular jobs where replacement workers are not used.

Employer Cost Assumptions for Employees Initiating STD (per work day)	
Average Daily Worker Wages (1)	$181.36
Average STD Work Day Benefit (60% of Daily Wages) (2)	$108.82
Temporary Replacement Worker's Wages (89.4% of Daily Worker Wages) (3)	$162.14
Additional Temporary Agency Fee (30% of Daily Temp Worker Wages) (4)	$48.64
Total Daily STD Cost to Employer = (2) + (3) + (4)	**$319.60**

Notes: (1) Based on a 2014 Average Annual Wages of $44,569.20 from the Official Social Security Website, trended to 2016 using an average 3% wage trend - $47,283.46 and divided by the average number of week days in a year, ~261 days (https://www.ssa.gov/oact/cola/central.html). (2) 60% of daily income is standard STD payment to employees based on the National Compensation Survey http://www.bls.gov/ncs/ebs/benefits/2015/ownership/private/table26a.pdf (3) Based on the Government Accountability Office report "Contingent Workforce: Size, Characteristics, Earnings, and Benefits" estimate of contingent workers making on average 10.6% less than permanent employees (4) http://smallbusiness.chron.com/difference-pay-between-fulltime-employee-temporary-employee-34798.html

Using the cost assumptions above and the STD findings in the MarketScan data, we calculated the incremental cost incurred by an employer *per surgery case that initiated STD* to be approximately $10,727 for fusions and $8,488 for decompressions, a $2,239 higher cost per fusion case (see table below).

Employer STD and Labor Costs per Primary Decompression and Fusion Surgery Initiating STD

Per surgery initiating STD	STD costs per fusion surgery initiating STD (77.6 STD work days)	STD costs per decompression surgery initiating STD (61.4 STD work days)	Difference between fusion and decompression STD costs per surgery initiating STD (16.2 STD work day difference)
STD Benefit Payments ($108.82 x the # of STD work days)	$8,444.44	$6,681.54	$1,762.88
Replacement Worker Wages ($162.14 x the # of STD work days)	$12,582.06	$9,955.40	$2,626.67
Additional Temporary Agency Fee ($48.64 x the # of STD work days)	$3,774.46	$2,986.50	$787.97
Total STD Cost To Employer	**$24,800.96**	**$19,623.44**	**$5,177.52**
Employee Wages ($181.36 x the # of STD work days)	**($14,073.54)**	**($11,135.50)**	**($2,938.03)**
Incremental Cost to Employer per surgery initiating STD	**$10,727.42**	**$8,487.94**	**$2,239.49**

Source: Milliman analysis of MarketScan medical claim data 2009-2013 and disability data 2012-2014 claims

Using the cost assumptions above and the STD findings in the MarketScan data, we calculated the incremental cost incurred by an employer *per surgery case* to be approximately $7,188 for fusions and $5,143 for decompressions, a $2,046 higher cost per fusion case (see table below).

Employer STD and Labor Costs per Primary Decompression and Fusion Surgery

Per surgery	STD costs per fusion surgery (52.0 STD work days) 67% of cases with STD	STD costs per decompression surgery (37.2 STD work days) 61% of cases with STD	Difference between fusion and decompression STD costs per surgery (14.8 STD work day difference)
STD Benefit Payments ($108.82 x the # of work days)	$5,658.64	$4,048.10	$1,610.54
Replacement Worker Wages ($162.14 x the # of work days)	$8,431.28	$6,031.61	$2,399.67
Additional Temporary Agency Charge ($48.64 x the # of work days)	$2,529.28	$1,809.41	$719.87
Total STD Cost To Employer	**$16,619.20**	**$11,889.12**	**$4,730.08**
Employee Wages ($181.36 x the # of STD work days)	**($9,430.72)**	**($6,746.59)**	**($2,684.13)**
Incremental Cost to Employer per surgery	**$7,188.48**	**$5,142.53**	**$2,045.95**

Source: Milliman analysis of MarketScan medical claim data 2009-2013 and disability data 2012-2014 claims

Our results are based on the experience of decompression and fusion surgery patients identified in the MarketScan data as well as the cost assumptions we noted above. STD costs associated with decompression and fusions will vary for individual employers who offer STD coverage based on several factors including:

- Employee wages
- STD benefit payment as a portion of wages and STD benefit period covered
- Employer decision to temporarily replace the STD worker and replacement worker fees
- Incidence of decompressions and fusion among employees and distribution of decompressions versus fusions
- Industry and job duties

We provide alternative scenarios assuming higher and lower employee wages and with and without temporarily replacement worker fees in Appendix A.

This analysis does not account for the cost impact to employees. With an average 40% reduction in employee wages under STD, the employee having fusion versus decompression will have more STD days of reduced wages.

As employers evaluate opportunities to impact costs associated with STD as well as opportunities for medical cost offsets, patterns of fusion versus decompression utilization for LSS should be investigated.

This report was commissioned by Paradigm Spine, which manufactures Coflex, an intralaminar stabilization device indicated for use in decompression surgeries for lumbar spinal stenosis. One of the authors, Tyler Engel, is a member of the American Academy of Actuaries and meets its qualification standards for this communication. The findings reflect the research of the authors; Milliman does not intend to endorse any product or organization. If this report is reproduced, we ask that it be reproduced in its entirety, as pieces taken out of context can be misleading. As with any economic or actuarial analysis, it is not possible to capture all factors that may be significant. Because we present national average data, the findings should be interpreted carefully before they are applied to any particular situation. These results are based on analysis of Truven MarketScan commercial claims and disability data for procedures performed in 2013. Different data sets, time periods and methodologies will produce different results.

FINDINGS FROM COMMERCIAL STD CLAIM DATA ANALYSIS

We used the MarketScan medical claim database to identify commercially insured members having a primary decompression or fusion in 2013. Primary surgeries were identified as those with no prior decompression or fusion in the 4 years prior to the 2013 surgery. Claim coding logic for identifying these procedures and the 4-year look back criteria is described in Appendix A.

For members with primary decompressions or fusions, we identified employees (dependents of employees are not covered under employee's disability policy) with STD eligibility in the 2013 MarketScan disability database. MarketScan provides STD claims experience through 2014 for STD claims that initiate in 2013 which allowed us to follow STD claims that initiated in the latter half of 2013, for 6 months post STD initiation.

CHARACTERISTICS OF THE STUDY POPULATION

Table 1 provides characteristics of our study population including the impact on the MarketScan sample size with each additional eligibility requirement. In particular, the STD eligibility requirement reduced the sample size substantially as only a portion of contributors to MarketScan contribute disability data. We restricted the sample to 2013 primary decompressions and fusions that were discharged by November 15th in order to capture cases where the employee used their PTO benefit before initiating their disability benefit.

The final count of cases with disability eligibility was 660 for primary decompressions and 422 for primary fusions. The average age was similar between the cohorts while a higher portion of the fusions were for women compared to decompressions. We also noted differences in % of fusion versus decompression cases in particular industries.

Table 1: Characteristics of the Study Population

Size of 2013 MarketScan denominator population meeting all standard eligibility criteria	29,584,715	
Size of 2013 MarketScan denominator population meeting all eligibility criteria plus 4 year look back eligibility	6,006,693	
	Decompression	Fusion
All 2013 Surgeries	3,393	2,608
Primary surgeries (no surgery in prior 4 years)	3,050	2,167
Primary surgeries employee only (69% & 65%)	2,108	1,409
Primary surgeries with STD eligibility and discharged by November 15th	660	422
Average age	51.3	52.2
Percentage female*	27.7%	40.8%
Distribution by major industry		
Manufacturing, Durable Goods	36.2%	31.3%
Transportation, Communications, Utilities	25.2%	27.5%
Finance, Insurance, Real Estate	18.0%	17.8%
Manufacturing, Nondurable Goods	16.4%	15.6%
Services	3.5%	5.2%
Retail Trade	0.8%	1.4%
Oil & Gas Extraction, Mining	0.0%	0.9%
Wholesale	0.0%	0.2%

Source: Milliman analysis of MarketScan medical claim data 2009-2013 and disability data 2012-2014 claims. See methodology for details of longitudinal analysis.
Notes: Primary surgery: 2013 decompression or fusion with no decompression or surgery claim in 2009-2012
Standard eligibility and look back criteria: see Appendix A for methodology
MarketScan provides an industry category per individual in the disability database. 2 major industries (agriculture, forestry, fishing; construction) had no representation among the decompression and fusion population with disability eligibility
* - Difference is statistically significant (p-value < .001)

INCIDENCE AND DURATION OF SHORT TERM DISABILITY

Table 2 provides the details of the STD claim incidence and duration among the primary decompression and fusion cases. We identified cases with a STD claim initiating within 6 months prior to the surgery date through 6 weeks after the discharge date for inpatient procedures, and through 6 weeks following the outpatient surgery date for outpatient procedures.

Of the decompression and fusion population with STD eligibility, 61% of the decompressions and 67% of the fusions had a STD claim. The average duration of the STD claims was 85.9 days for decompressions versus 108.6 days for fusions, or 22.7 fewer days for decompression cases with a STD disability claim. The day difference on a per surgery basis (with and without STD claims) results in a 20.7 day shorter duration of STD for each decompression case. Table 2 provides the surgery cohort comparison of incidence and duration of STD claims.

Table 2: Incidence and Duration of STD Claims: Decompression Versus Fusion Cases

	Primary Fusion	Primary Decompression	Difference between Fusion and Decompression	P-Value
Number of surgeries with STD coverage	422	660		
Number of surgeries with a STD claim	283	400		
% of surgeries with a STD claim	67%	61%	6%	0.030
Average age with STD claim	52.1	51.5	0.6	0.348
% Female with a STD claim	39.6%	30.3%	9.3%	0.012
Average STD days per surgery with a STD claim	108.6	85.9	22.7	< .001
Average STD work days per surgery with a STD claim	77.6	61.4	16.2	< .001
Average STD days per surgery	72.8	52.1	20.7	< .001
Average STD work days per surgery	52.0	37.2	14.8	< .001

Source: Milliman analysis of MarketScan medical claim data 2009-2013 and disability data 2012-2014 claims
Notes: Primary surgery: 2013 decompression or fusion with no decompression or surgery claim in 2009-2012
Work days were defined as week days.

In order to consider differences in characteristics between the decompression and fusion cohort that may impact the incidence and duration of STD days, we examined age, gender and work industry. Age and work industry had a minimal impact on our STD outcomes while adjusting for gender reduced the STD day difference per surgery between the decompression and fusion cohort by 1.1 days. In Table 3, we provide the STD results for males and females separately. Differences in the mix of severity between the decompression and fusion cases could impact STD initiation rates and STD day duration. We attempted to control for severity of the underlying LSS by requiring that the decompressions and fusions were primary surgeries without decompression or fusion in the prior 4 years.

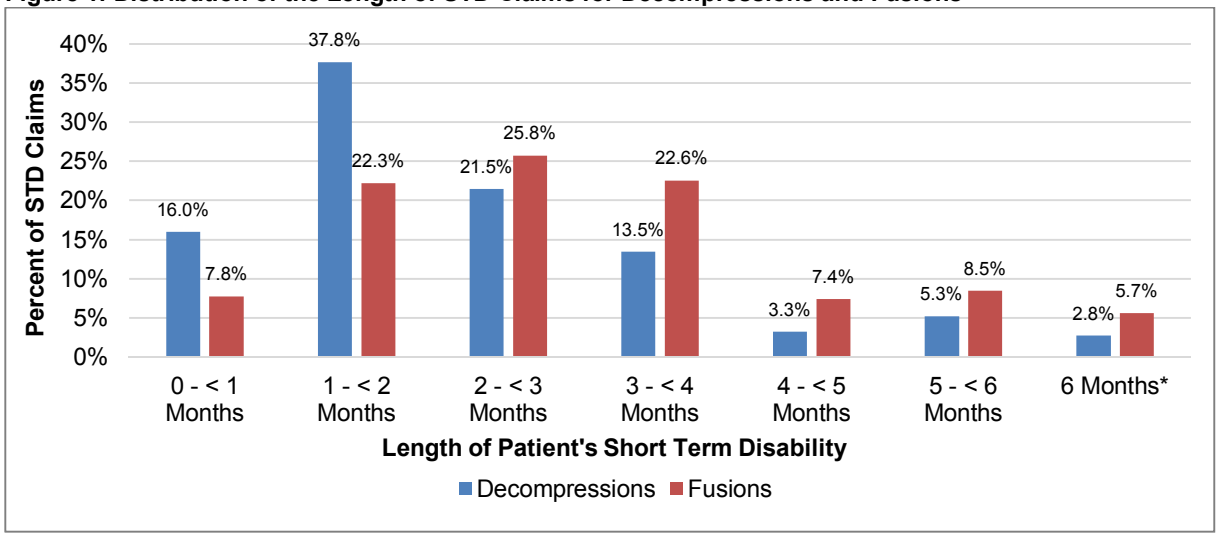
Table 3: Incidence and Duration of STD Claims: Decompression Versus Fusion Cases (By Patient Gender)

	Male			Female		
	Primary Fusion	Primary Decompression	Difference between Fusion and Decompression	Primary Fusion	Primary Decompression	Difference between Fusion and Decompression
Number of Surgeries with STD coverage	250	477		172	183	
% of Total Surgeries for each surgery type	59.2%	72.3%		40.8%	27.7%	
Number of Surgeries with a STD claim	171	279		112	121	
% of Total STD claims for each surgery type	60.4%	69.8%		39.6%	30.3%	
% of Surgeries with a STD claim	68.4%	58.5%	**9.9%**	65.1%	66.1%	**-1.0%**
Average STD Days per surgery with a STD claim	109.2	85.1	**24.1**	107.7	88.0	**19.7**
Average STD work days per surgery with a STD claim	78.0	60.8	**17.3**	76.9	62.9	**14.1**
Average STD Days per surgery	74.7	49.8	**24.9**	70.1	58.2	**11.9**
Average STD work days per surgery	53.4	35.5	**17.8**	50.1	41.6	**8.5**

Source: Milliman analysis of MarketScan medical claim data 2009-2013 and disability data 2012-2014 claims
Notes: Primary surgery: 2013 decompression or fusion with no decompression or surgery claim in 2009-2012
Work days calculated as average number of week days in a year, ~261 days

MarketScan does not provide an indicator for the number of covered days for the STD policy of each policy holder. STD policies typically provide coverage for 3 - 6 months. If the fusion cases had STD policies with significantly longer benefit coverage days, the results could be biased and vice versa for decompression cases. We examined the distribution of STD days for decompressions and fusions and found that 75% of the decompression cases had less than a 3 month duration of STD claims, as compared to 56% of fusion cases with STD claims. This suggests the longer day duration of STD claims for fusions is not being driven by a higher rate of 6 month versus 3 month disability policies for fusions. For those members who initiated STD, Figure 1 shows the distribution of STD claims by length for the decompression and fusion cases.

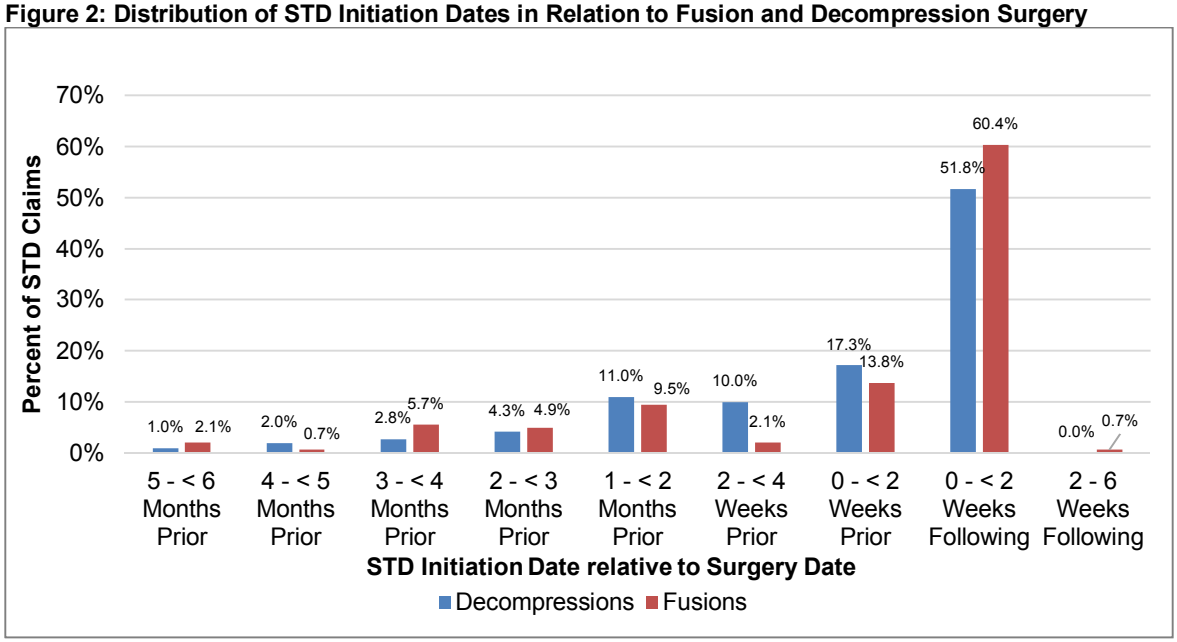
Figure 1: Distribution of the Length of STD Claims for Decompressions and Fusions



Source: Milliman analysis of MarketScan medical claim data 2009-2013 and disability data 2012-2014 claims
Notes: * - Typically, short term disability plans do not have benefit periods lasting longer than 6 months. In our analysis, the length of each short term disability claim was limited to 6 months.

We examined the timing of STD initiation between the decompression and fusion cases for members who initiated STD. Figure 2 shows the portion of members who initiated STD prior to, during or after the surgery. 48.3% of decompression cases initiated STD prior to surgery while 38.9% of fusion cases initiated STD prior to surgery. 51.8% of decompression cases initiated STD within 2 weeks following surgery while 60.4% of fusion cases initiated STD within 2 weeks following surgery. Less than 1% of cases for either surgery initiated STD 2-6 weeks after surgery.

Figure 2: Distribution of STD Initiation Dates in Relation to Fusion and Decompression Surgery



Source: Milliman analysis of MarketScan medical claim data 2009-2013 and disability data 2012-2014 claims

EMPLOYER'S STD AND LABOR COST IMPACT: COMPARISON OF DECOMPRESSION AND FUSION CASES

To calculate the cost impact to employers of the difference in STD days between employees having decompression versus fusion surgery, we used several assumptions noted in Table 4.

Table 4: Employer Incurred Cost Assumptions for Employees Initiating STD (per work day)

Employer Cost Assumptions for Employees Initiating STD (per work day)	
Average Daily Worker Wages (1)	$181.36
Average STD Work Day Benefit (60% of Daily Wages) (2)	$108.82
Temporary Replacement Worker's Income (89.4% of Daily Worker Wages) (3)	$162.14
Additional Temporary Agency Fee (30% of Daily Temp Worker Wages) (4)	$48.64
Total Daily STD Cost to Employer = (2) + (3) + (4)	**$319.60**

Notes: (1) Based on a 2014 Average Annual Wages of $44,569.20 from the Official Social Security Website, trended to 2016 using an average 3% wage trend - $47,283.46 and divided by the average number of week days in a year, ~261 days. (2) 60% of daily income is standard STD payment to employees based on the National Compensation Survey http://www.bls.gov/ncs/ebs/benefits/2015/ownership/private/table26a.pdf (3) Based on the Government Accountability Office report "Contingent Workforce: Size, Characteristics, Earnings, and Benefits" estimate of contingent workers making on average 10.6% less than permanent employees (4) http://smallbusiness.chron.com/difference-pay-between-fulltime-employee-temporary-employee-34798.html

Using the cost assumptions in Table 4 and the STD day differences noted in Table 2, we calculated the incremental cost incurred by an employer *per surgery case that initiated STD* to be approximately $10,727 for fusions and $8,488 for decompressions, a $2,239 higher cost per fusion case. Table 5 presents the components of the cost comparison.

Table 5: Employer STD Costs per Primary Decompression and Fusion Surgery Initiating STD

Per surgery initiating STD	STD costs per fusion surgery initiating STD (77.6 STD work days)	STD costs per decompression surgery initiating STD (61.4 STD work days)	Difference between fusion and decompression STD costs per surgery initiating STD (16.2 STD work day difference)
STD Benefit Payments ($108.82 x the # of STD work days)	$8,444.44	$6,681.54	$1,762.88
Replacement Worker Wages ($162.14 x the # of STD work days)	$12,582.06	$9,955.40	$2,626.67
Additional Temporary Agency Fee ($48.64 x the # of STD work days)	$3,774.46	$2,986.50	$787.97
Total STD Cost To Employer	**$24,800.96**	**$19,623.44**	**$5,177.52**
Employee Wages ($181.36 x the # of STD work days)	**($14,073.54)**	**($11,135.50)**	**($2,938.03)**
Incremental Cost to Employer per surgery initiating STD	**$10,727.42**	**$8,487.94**	**$2,239.49**

Source: Milliman analysis of MarketScan medical claim data 2009-2013 and disability data 2012-2014 claims

Using the cost assumptions in Table 4 and the STD day differences noted in Table 2, we calculated the incremental cost incurred by an employer *per surgery case* to be approximately $7,188 for fusions and $5,143 for decompressions, a $2,046 higher cost per fusion case. Table 6 presents the components of the cost comparison.

Table 6: Employer STD Costs per Primary Decompression and Fusion Surgery (includes cases with and without STD claims)

Per surgery	STD costs per fusion surgery (52.0 STD work days) 67% of cases with STD	STD costs per decompression surgery (37.2 STD work days) 61% of cases with STD	Difference between fusion and decompression STD costs per surgery (14.8 STD work day difference)
STD Benefit Payments ($108.82 x the # of work days)	$5,658.64	$4,048.10	$1,610.54
Replacement Worker Wages ($162.14 x the # of work days)	$8,431.28	$6,031.61	$2,399.67
Additional Temporary Agency Charge ($48.64 x the # of work days)	$2,529.28	$1,809.41	$719.87
Total STD Cost To Employer	**$16,619.20**	**$11,889.12**	**$4,730.08**
Employee Wages ($181.36 x the # of STD work days)	**($9,430.72)**	**($6,746.59)**	**($2,684.13)**
Incremental Cost to Employer per surgery	**$7,188.48**	**$5,142.53**	**$2,045.95**

Source: Milliman analysis of MarketScan medical claim data 2009-2013 and disability data 2012-2014 claims

DISCUSSION

Our analysis identified a significantly higher initiation of STD claims and a significantly longer duration of STD days among fusion surgery patients compared to decompression surgery patients. The difference in average STD days for fusion versus decompression surgeries was 22.7 days or 16.2 work days higher per surgery that initiated STD. On a per surgery case that initiates STD, the STD associated cost to an employer is approximately $8,488 for decompressions and $10,727 for fusions, a $2,239 higher cost per fusion case.

Our results are based on the experience of decompression and fusion surgery patients identified in the MarketScan data as well as the cost assumptions we note in Table 2. STD and labor costs associated with decompression and fusions will vary for individual employers who offer STD coverage based on several factors including:

- Employee wages
- STD benefit payment as a portion of wages and STD benefit period covered
- Employer decision to temporarily replace the STD worker and replacement worker fees
- Incidence of decompressions and fusion among employees and distribution of decompressions versus fusions
- Industry and job duties

In appendix A, we provide several employer incremental STD cost scenarios based on alternative assumptions.

The cost impact to employers does not account for the cost impact to employees. With an average 40% reduction in wages under STD, the employee having fusion versus decompression will have more STD days of reduced wages.

The use of lumbar fusion surgery in the United States has increased significantly since 2002. A United Health Care commercial claim data analysis, based on a 25 million member commercial population, reported an overall 41% increase in lumbar fusions for lumbar spine conditions (not limited to lumbar spinal stenosis) between 2004 and 2009, increasing from a rate of 11.6/10,000 members to 16.4/10,000 members. Another Medicare analysis identified a 15 fold increase in complex fusions for LSS between 2002 and 2007 while the rate of simple fusions and decompressions fell.[8]

As employers evaluate opportunities to impact STD costs associated with decompression and fusions as well as opportunities for medical claim cost offsets, patterns of fusion versus decompression utilization for LSS should be investigated. With the increase in rate of fusion surgery and an increase in STD claims for musculoskeletal related conditions, employers should consider the opportunities associated with shifting appropriate fusion surgeries to decompression surgery.

APPENDIX A: SENSITIVITY TESTING OF STD AND LABOR COST ASSUMPTIONS

The employers' STD and labor costs presented are based on national average findings described in Table 2. In the following tables, we provide employer cost associated with STD claims based on alternative assumptions to average wages per worker and impact without temporary replacement of workers.

We provide the cost impact on a *per surgery initiating STD basis* and not on a *per surgery basis*. Per surgery cost will vary based on the incidence of decompressions and fusions among an employee population.

Tables A1, A2 and A3 provide STD cost to an employer based on different employee wages: 75%, 100% and 125% of the national average. Figures A4, A5 and A6 provide STD cost to an employer who does not temporarily replace the STD employee under the 3 employee wage assumptions. The cost to the employer for lost productivity/revenue without temporary worker replacement, needs to be considered in scenario A4, A5 and A6.

Table A1: Employer STD and Labor Costs per Primary Decompression and Fusion Surgery Initiating STD with Replacement Worker and Average Wages ($47,283)

	STD costs per fusion surgery initiating STD	STD costs per decompression surgery initiating STD	Difference between fusion and decompression STD costs per surgery initiating STD
STD Benefit Payments	$8,444.43	$6,681.55	$1,762.88
Replacement Worker Wages	$12,582.06	$9,955.40	$2,626.67
Additional Temporary Agency Charge	$3,774.46	$2,986.50	$787.97
Total STD Cost To Employer	**$24,800.96**	**$19,623.44**	**$5,177.52**
Employee Wages	**($14,073.54)**	**($11,135.50)**	**($2,938.03)**
Incremental Cost to Employer per surgery initiating STD	**$10,727.42**	**$8,487.94**	**$2,239.49**

Table A2: Employer STD and Labor Costs per Primary Decompression and Fusion Surgery Initiating STD with Replacement Worker and 25% Higher Wages ($59,104)

	STD costs per fusion surgery initiating STD	STD costs per decompression surgery initiating STD	Difference between fusion and decompression STD costs per surgery initiating STD
STD Benefit Payments	$10,555.54	$8,351.94	$2,203.61
Replacement Worker Wages	$15,727.58	$12,444.25	$3,283.34
Additional Temporary Agency Charge	$4,718.08	$3,733.12	$984.96
Total STD Cost To Employer	**$31,001.20**	**$24,529.30**	**$6,471.90**
Employee Wages	**($17,591.92)**	**($13,919.38)**	**($3,672.54)**
Incremental Cost to Employer per surgery initiating STD	**$13,409.28**	**$10,609.92**	**$2,799.36**

Table A3: Employer STD and Labor Costs per Primary Decompression and Fusion Surgery Initiating STD with Replacement Worker and 25% Lower Wages ($35,463)

	STD costs per fusion surgery initiating STD	STD costs per decompression surgery initiating STD	Difference between fusion and decompression STD costs per surgery initiating STD
STD Benefit Payments	$6,333.32	$5,011.16	$1,322.16
Replacement Worker Wages	$9,436.55	$7,466.55	$1,970.00
Additional Temporary Agency Charge	$2,830.85	$2,239.87	$590.98
Total STD Cost To Employer	**$18,600.72**	**$14,717.58**	**$3,883.14**
Employee Wages	**($10,555.15)**	**($8,351.63)**	**($2,203.52)**
Incremental Cost to Employer per surgery initiating STD	**$8,045.57**	**$6,365.95**	**$1,679.62**

Table A4: Employer STD and Labor Costs per Primary Decompression and Fusion Surgery Initiating STD without Replacement Worker Cost and with Average Wages ($47,283)

	STD costs per fusion surgery initiating STD	STD costs per decompression surgery initiating STD	Difference between fusion and decompression STD costs per surgery initiating STD
STD Benefit Payments	$8,444.43	$6,681.55	$1,762.88
Replacement Worker Wages	$0.00	$0.00	$0.00
Additional Temporary Agency Charge	$0.00	$0.00	$0.00
Total STD Cost To Employer	**$8,444.43**	**$6,681.55**	**$1,762.88**
Employee Wages	**($14,073.54)**	**($11,135.50)**	**($2,938.03)**
Incremental Cost to Employer per surgery initiating STD	**($5,629.10)**	**($4,453.96)**	**($1,175.15)**

Table A5: Employer STD and Labor Costs per Primary Decompression and Fusion Surgery Initiating STD without Replacement Worker Costs and with Higher Wages ($59,104)

	STD costs per fusion surgery initiating STD	STD costs per decompression surgery initiating STD	Difference between fusion and decompression STD costs per surgery initiating STD
STD Benefit Payments	$10,555.54	$8,351.94	$2,203.61
Replacement Worker Wages	$0.00	$0.00	$0.00
Additional Temporary Agency Charge	$0.00	$0.00	$0.00
Total STD Cost To Employer	**$10,555.54**	**$8,351.94**	**$2,203.61**
Employee Wages Without STD	**($17,591.92)**	**($13,919.38)**	**($3,672.54)**
Incremental Cost to Employer per surgery initiating STD	**($7,036.38)**	**($5,567.45)**	**($1,468.94)**

Table A6: Employer STD and Labor Costs per Primary Decompression and Fusion Surgery Initiating STD without Replacement Worker Cost and with Lower Wages ($35,463)

	STD costs per fusion surgery initiating STD	STD costs per decompression surgery initiating STD	Difference between fusion and decompression STD costs per surgery initiating STD
STD Benefit Payments	$6,333.32	$5,011.16	$1,322.16
Replacement Worker Wages	$0.00	$0.00	$0.00
Additional Temporary Agency Charge	$0.00	$0.00	$0.00
Total STD Cost To Employer	**$6,333.32**	**$5,011.16**	**$1,322.16**
Employee Wages	**($10,555.15)**	**($8,351.63)**	**($2,203.52)**
Incremental Cost to Employer per surgery initiating STD	**($4,221.83)**	**($3,340.47)**	**($881.36)**

APPENDIX B: METHODOLOGY

Data Source

Truven Health Analytics MarketScan Commercial Claims Database

The Truven Health Analytics MarketScan Commercial Claims Database (MarketScan) contains all paid claims generated by 15-50 million commercially insured lives annually (depending on the year of data). The MarketScan database represents the inpatient and outpatient healthcare service use of individuals nationwide who are covered by the benefit plans of large employers, health plans, government, and public organizations. The data includes diagnosis codes, procedure codes, DRG codes, and NDC codes, along with site of service information and the amounts paid by commercial insurers. The MarketScan database links paid claims and encounter data to detailed patient information across sites and to types of providers. Patient identifiers are consistent over time, allowing for longitudinal studies. The annual medical database includes private sector health data from approximately 100 payers. We used the MarketScan data from 2009-2013.

Medical Claim Data Analysis

Longitudinal claim data analysis to identify "primary" LSS related decompressions and spinal fusions

Step 1: Identified the 2013 denominator population
The denominator population for the 2013 longitudinal analysis included members with:

- At least one month of coverage in 2013
- Eligibility in all months of 2009-2012
- Prescription drug coverage in all months of eligibility
- Not covered by a capitated plan in all months of eligibility
- Not covered by Medicare in all months of eligibility
- Inclusive of employees and dependents

Step 2: Identified all LSS related spinal procedures occurring in 2013 among 18-64 year olds using the code list below.

List of ICD9 Procedure and CPT/HCPCS codes used to identify LSS related decompressions and lumbar fusions

Procedure Code		Description	Treatment/Procedure Type
HCPCS	22533	Lateral lumbar spine fusion	Fusion
HCPCS	22534	Lateral thoracic/lumbar additional segment	Fusion
HCPCS	22558	Lumbar spine fusion	Fusion
HCPCS	22585	Additional spinal fusion	Fusion
HCPCS	22586	Presacral fusion w/ instrumentation L5-S1	Fusion
HCPCS	22612	Lumbar spine fusion	Fusion
HCPCS	22614	Spine fusion extra segment	Fusion
HCPCS	22630	Lumbar spine fusion	Fusion
HCPCS	22632	Spine fusion extra segment	Fusion
HCPCS	22633	Lumbar spine fusion combined	Fusion
HCPCS	22634	Spine fusion extra segment	Fusion

Procedure Code		Description	Treatment/Procedure Type
HCPCS	22840	Posterior non-segmental instrumentation (e.g., Harrington rod technique, pedicle fixation across 1 interspace, atlantoaxial transarticular screw fixation, sublaminar wiring at C1, facet screw fixation) (List separately in addition to code for primary procedure)	Fusion
HCPCS	63005	Remove spine lamina 1/2 lumbar	Decompression
HCPCS	63017	Remove spine lamina >2 lumbar	Decompression
HCPCS	63030	Low back disk surgery	Decompression
HCPCS	63035	Spinal disk surgery add-on	Decompression
HCPCS	63042	Laminotomy single lumbar	Decompression
HCPCS	63044	Laminotomy additional lumbar	Decompression
HCPCS	63047	Remove spine lamina 1 lumbar	Decompression
HCPCS	63048	Remove spinal lamina add-on	Decompression
HCPCS	63056	Decompress spinal cord lumbar	Decompression
HCPCS	63057	Decompress spine cord add-on	Decompression
HCPCS	0171T	Insertion of posterior spinous process distraction device, single level	Decompression
HCPCS	0172T	Insertion of posterior spinous process distraction device, each additional level	Decompression
HCPCS	0275T	Percutaneous laminotomy/laminectomy, lumbar	Decompression
HCPCS	0309T	Arthrodesis, pre-sacral interbody technique, discectomy, lumbar, L4-5 interspace	Fusion
HCPCS	C1821	Interspinous process distraction device (implantable)	Decompression
ICD-9 Proc	03.02	reopening of laminectomy site	Decompression
ICD-9 Proc	03.09	other exploration and decompression of spinal canal	Decompression
ICD-9 Proc	80.50	excision/destruction intervertebral disc not otherwise specified	Decompression
ICD-9 Proc	80.51	excision intervertebral disc	Decompression
ICD-9 Proc	81.00	spinal fusion nos	Fusion
ICD-9 Proc	81.04	dorsal/dorsal-lumbar anterior/anterior fusion anterior/anterior	Fusion
ICD-9 Proc	81.05	dorsal/dorsal-lumbar fusion posterior/posterior	Fusion
ICD-9 Proc	81.06	lumbar/lumbosacral fusion anterior/anterior	Fusion
ICD-9 Proc	81.07	lumbar/lumbosacral fusion posterior/posterior	Fusion
ICD-9 Proc	81.08	lumbar/lumbosacral fusion anterior/posterior	Fusion
ICD-9 Proc	81.30	spinal refusion not otherwise specified	Fusion

Procedure Code		Description	Treatment/Procedure Type
ICD-9 Proc	81.34	refusion dorsal/dorsal-lumbar anterior/anterior	Fusion
ICD-9 Proc	81.35	refusion dorsal/dorsal-lumbar posterior/posterior	Fusion
ICD-9 Proc	81.36	refusion lumbar/lumbosacral anterior/anterior	Fusion
ICD-9 Proc	81.37	refusion lumbar/lumbosacral posterior/posterior	Fusion
ICD-9 Proc	81.38	refusion lumbar/lumbosacral anterior/posterior	Fusion
ICD-9 Proc	81.39	refusion of spine not elsewhere classified	Fusion
ICD-9 Proc	84.51	ins spinal fusion device	Fusion
ICD-9 Proc	84.80	insertion/replacement interspine device	Decompression
ICD-9 Proc	84.81	revision interspine device	Decompression
ICD-9 Proc	84.84	Insert/replace facet replacement device	Decompression
ICD-9 Proc	84.85	revision facet replace device	Decompression

Step 3: Included only procedures that had:

- An LSS ICD-9 diagnosis code on the procedure claim: 724.00, 724.02, 724.03, 724.09
- OR an LSS associated DRG for the inpatient procedure and LSS coded on 1+ claim during 2013 – see table below
- OR an LSS associated ICD-9 diagnosis code in the primary position of the outpatient procedure and LSS coded on 1+ claim during 2013 – see table below
- Excluded all scoliosis cases identified as procedures coded with the following ICD-9 diagnosis codes in any position of the claim: 737.30-737.34, 737.39

DRGs and Primary ICD-9 Diagnosis codes required for IP and OP Procedures without an LSS diagnosis coded on the procedure to be included in decompression and fusion cases

Procedure Code		Description
DRG	028	Spinal procedures w MCC
DRG	029	Spinal procedures w CC or spinal neurostimulators
DRG	030	Spinal procedures w/o CC/MCC
DRG	453	Combined anterior/posterior spinal fusion w MCC
DRG	454	Combined anterior/posterior spinal fusion w CC
DRG	455	Combined anterior/posterior spinal fusion w/o CC/MCC
DRG	456	Spinal fusion except cervical with spinal curvature/malignancy/infection or 9+ fusion w MCC
DRG	457	Spinal fusion except cervical with spinal curvature/malignancy/infection or 9+ fusion w CC
DRG	458	Spinal fusion except cervical with spinal curvature/malignancy/infection or 9+ fusion w/o CC/MCC
DRG	459	Spinal fusion except cervical w MCC
DRG	460	Spinal fusion except cervical w/o MCC
DRG	052	Spinal disorders & injuries w CC/MCC
DRG	053	Spinal disorders & injuries w/o CC/MCC
DRG	490	Back & neck proc except spinal fusion w CC/MCC or disc device/neurostimulator

Procedure Code		Description
DRG	491	Back & neck proc except spinal fusion w/o CC/MCC
DRG	518	Back & Neck Proc Except Spinal Fusion W MCC Or Disc Device/Neurostimulator
DRG	519	Back & Neck Proc Except Spinal Fusion W CC
DRG	520	Back & Neck Proc Except Spinal Fusion W/O CC/MCC
DRG	551	Medical back problems w MCC
DRG	552	Medical back problems w/o MCC
DRG	553	Bone diseases & arthropathies w MCC
DRG	554	Bone diseases & arthropathies w/o MCC
DRG	555	Signs & symptoms of musculoskeletal system & conn tissue w MCC
DRG	556	Signs & symptoms of musculoskeletal system & conn tissue w/o MCC
DRG	559	Aftercare, musculoskeletal system & connective tissue w MCC
DRG	560	Aftercare, musculoskeletal system & connective tissue w CC
DRG	561	Aftercare, musculoskeletal system & connective tissue w/o CC/MCC
DRG	856	Postoperative or post-traumatic infections w O.R. proc w MCC
DRG	857	Postoperative or post-traumatic infections w O.R. proc w CC
DRG	858	Postoperative or post-traumatic infections w O.R. proc w/o CC/MCC
DRG	862	Postoperative & post-traumatic infections w MCC
DRG	863	Postoperative & post-traumatic infections w/o MCC
ICD-9 Diag	338.18	acute postop pain not elsewhere classified
ICD-9 Diag	338.19	acute pain not elsewhere classified
ICD-9 Diag	338.28	chronic postop pain not elsewhere classified
ICD-9 Diag	338.29	chronic pain not elsewhere classified
ICD-9 Diag	338.4	chronic pain syndrome
ICD-9 Diag	344.60	cauda equina syndrome not otherwise specified
ICD-9 Diag	344.61	neurogenic bladder
ICD-9 Diag	353.1	lumbosacral plexus lesion
ICD-9 Diag	353.4	lumbosacral root lesion not elsewhere classified
ICD-9 Diag	355.0	sciatic nerve lesion
ICD-9 Diag	720.81	spondylopathy in other diseases
ICD-9 Diag	721.3	lumbosacral spondylosis
ICD-9 Diag	721.42	Spondylopathy with compression of lumbar spinal cord
ICD-9 Diag	721.8	spinal disorders not elsewhere classified
ICD-9 Diag	721.90	spondylosis not otherwise specified w/o myelopathy
ICD-9 Diag	721.91	spondylosis not otherwise specified w myelopathy
ICD-9 Diag	722.10	lumbar disc displacement
ICD-9 Diag	722.2	disc displacement not otherwise specified
ICD-9 Diag	722.52	lumbar/lumbosacral disc degeneration
ICD-9 Diag	722.6	disc degeneration not otherwise specified

Procedure Code		Description
ICD-9 Diag	722.70	disc disease w myelopathy not otherwise specified
ICD-9 Diag	722.73	lumbar disc disease w myelopathy
ICD-9 Diag	722.80	postlaminectomy syndrome not otherwise specified
ICD-9 Diag	722.83	postlaminectomy syndrome-lumbar
ICD-9 Diag	722.90	disc disease not elsewhere classified/not otherwise specified-unspecified
ICD-9 Diag	722.93	disc disease not elsewhere classified c/nos-lumbar
ICD-9 Diag	724.00	spinal stenosis not otherwise specified
ICD-9 Diag	724.02	spinal stenosis, lumbar wo claudication
ICD-9 Diag	724.03	spin stenosis, lumbar w claudication
ICD-9 Diag	724.2	lumbago
ICD-9 Diag	724.3	sciatica
ICD-9 Diag	724.4	lumbosacral neuritis not otherwise specified
ICD-9 Diag	724.5	backache not otherwise specified
ICD-9 Diag	724.6	disorders of sacrum
ICD-9 Diag	724.8	other back symptoms
ICD-9 Diag	724.9	back disorder not otherwise specified
ICD-9 Diag	737.12	postlaminectomy kyphosis
ICD-9 Diag	737.21	postlaminectomy lordosis
ICD-9 Diag	737.22	other postsurgery lordosis
ICD-9 Diag	756.11	lumbosacral spondylolysis
ICD-9 Diag	756.12	spondylolisthesis
ICD-9 Diag	V57.89	rehabilitation proc not elsewhere classified
ICD-9 Diag	V57.9	rehabilitation procedure not otherwise specified
ICD-9 Diag	V58.78	aftercare surgery musculoskeletal system not elsewhere classified

Step 4: Identify “Primary” LSS related decompressions and spinal fusions

We performed a 4 year look back from the date of the first 2013 decompression or fusion for each patient to identify prior decompression or fusion surgeries. All patients with prior decompression or fusion surgery were excluded from our study cohort of primary decompressions and fusions. The patient was assigned to the first surgery type that occurred in 2013.

Step 5: Included only employees - identified in each patient’s eligibility file

Step 6: Included only patients with decompression or fusion surgery discharge date by 10/15/13

Disability Claim Data Analysis

Step 7: Using the MarketScan disability database, we identified members from Step 6 with STD eligibility; **The Study Population**

Step 8: For the study population, we identified those with a STD disability claim initiating within a period of 6 months prior to the surgery through 6 weeks after the surgery discharge. The STD claims were followed for up to 6 months after STD initiation for an end date.

Step 9: We calculated STD day duration as the number of days from the initiation date to the end date. We converted these to work days based on 261 average number of week days in a year.

Step 10: We compared the number of STD days between the decompression and fusion cases and calculated a cost for the average day difference using the following assumptions

Employer Cost Assumptions for Employees Initiating STD (per work day)	
Average Daily Worker Wages (1)	$181.36
Average STD Work Day Benefit (60% of Daily Wages) (2)	$108.82
Temporary Replacement Worker's Income (89.4% of Daily Worker Wages) (3)	$162.14
Additional Temporary Agency Fee (30% of Daily Temp Worker Wages) (4)	$48.64
Total Daily STD Cost to Employer = (2) + (3) + (4)	**$319.60**

Notes: (1) Based on a 2014 Average Annual Wages of $44,569.20 from the Official Social Security Website, trended to 2016 using an average 3% wage trend - $47,283.46 and divided by the average number of week days in a year, ~261 days. (2) 60% of daily income is standard STD payment to employees based on the National Compensation Survey http://www.bls.gov/ncs/ebs/benefits/2015/ownership/private/table26a.pdf (3) Based on the Government Accountability Office report "Contingent Workforce: Size, Characteristics, Earnings, and Benefits" estimate of contingent workers making on average 10.6% less than permanent employees (4) http://smallbusiness.chron.com/difference-pay-between-fulltime-employee-temporary-employee-34798.html

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