

# Influence of Workers' Compensation Status on Patient-Reported Outcomes following Cervical Disc Replacement

Andrea Roca, Fatima Anwar, Keith R. Macgregor<sup>1</sup>, Timothy J Hartman, James Nie<sup>2</sup>, Alexandra Loya, Srinath Medakkar, Eileen Zheng, Omolabake Oyeyayo<sup>1</sup>, Vincent Federico<sup>2</sup>, Dustin H Massel, Arash J Sayari, Gregory Lopez<sup>3</sup>, Kern Singh<sup>1</sup>

<sup>1</sup>Midwest Orthopaedics At Rush, <sup>2</sup>Rush University Medical Center, <sup>3</sup>Rush University

**INTRODUCTION:** Workers' compensation (WC) status may negatively affect outcomes in spine surgery. This has been studied limitedly in patients undergoing cervical disc replacement (CDR). The aim of this study is to assess the influence of WC status on patient-reported outcome measures (PROMs) following CDR.

**METHODS:** Patients undergoing primary, elective CDR as indicated for disc herniation were retrospectively reviewed from a single-surgeon database. Patients were divided by insurance status into two groups: WC versus Private Insurance (PI). Patients with Medicare/Medicaid were excluded. PROMs assessed included Patient-Reported Outcomes Measurement Information System-Physical Function (PROMIS-PF), Neck Disability Index (NDI), Visual Analog Scale-Neck (VAS-N), VAS-Arm (VAS-A), and the 9-item Patient Health Questionnaire (PHQ-9). PROMs were assessed and compared between groups preoperatively, at 6-weeks postoperatively, and at final follow up. Mean time to final follow up was 12.0±9.3 months. Improvement within groups was assessed at 6-week and final follow-up periods. Magnitude of improvements (ΔPROMs) were assessed and compared between groups at 6-weeks (ΔPROM-6W) and final follow up (ΔPROM-FF). Achievement rates of minimal clinically important difference were compared between groups. Comparisons accounted for demographic variations between cohorts via multivariable regression.

**RESULTS:** A total of 162 patients were included with 38 having WC. Significant demographic differences included ethnicity and presence of hypertension (p≤0.018, both). No significant differences in preoperative PROMs were found. At 6 weeks, the WC cohort demonstrated improvement in VAS-N (p=0.048). The PI cohort demonstrated improvement in all PROMs at 6 weeks (p<0.001). Between groups, the PI cohort reported superior scores in PROMIS-PF, NDI, VAS-N, and VAS-A (p≤0.014, all) at 6-weeks. At final follow up, the WC cohort demonstrated improvements in PROMIS-PF, NDI, VAS-N, and VAS-A. The PI cohort demonstrated improvement in all PROMs at final follow up (p<0.001, all). Between cohorts at final follow up, the PI cohort demonstrated superior scores in NDI, VAS-N, and PHQ-9 (p≤0.037, all). ΔPROM-6W was greater in NDI, VAS-N, and PHQ-9 in the PI cohort (p≤0.040, all). ΔPROM-FF in PHQ-9 was greater in the PI cohort (p=0.009). MCID achievement rates were higher in NDI in the PI cohort and PHQ-9 in the WC cohort (p≤0.049, both).

**DISCUSSION AND CONCLUSION:** Despite reimbursement method, patients with both WC and PI demonstrated improvements in physical function, disability, and pain by final follow up. Patients with PI additionally demonstrated improvement in mean PHQ-9 scores. While no differences between cohorts were noted preoperatively, the PI cohort reported superior scores in function, disability, and pain and 6-week follow up and in disability, neck pain, and mental health at final follow up. Additionally, patients with PI demonstrated larger magnitudes of improvement in disability, neck pain, and mental health. While PI patients were more likely to achieve clinically meaningful improvements in disability, WC patients were more likely to achieve clinically meaningful improvements in mental health.

Characteristic	Total (n=162)	Workers' Comp (n=38)	Private Insurance (n=124)	*p-value
Age (mean±SD, years)	46.5±10.3	46.8±12.0	46.4±9.7	0.815
Female Gender	36.4% (59)	29.0% (11)	38.7% (48)	0.274
BMI (mean ± SD, kg/m <sup>2</sup> )	29.0±6.0	29.4±7.5	28.9±5.5	<b>0.654</b>
Ethnicity				<b>&lt;0.001</b>
Asian	2.5% (4)	2.7% (1)	2.5% (3)	
Black	7.0% (11)	13.5% (5)	5.0% (6)	
Hispanic	10.1% (16)	27.0% (10)	5.0% (6)	
White	79.1% (125)	56.8% (21)	86.0% (104)	
Other	1.3% (2)	0.0% (0)	1.7% (2)	
Comorbidities				
Smoker	6.8% (11)	13.2% (5)	4.8% (6)	0.075
Hypertension	14.9% (24)	27.0% (10)	11.3% (14)	<b>0.018</b>
Diabetes	4.3% (7)	5.3% (2)	4.0% (5)	0.744
ASA Score (mean ± SD)	1.9±0.6	1.9±0.6	1.9±0.6	0.625
CCI Score (mean ± SD)	0.9±1.1	1.1±1.1	0.9±1.1	0.284

BMI = Body Mass Index; ASA = American Society of Anesthesiologists; CCI = Charlson Comorbidity Index; SD = Standard Deviations; Workers' Comp = workers' compensation

\*p-value calculated using Chi-square analysis for categorical variables or Student's t-test for continuous variables

**Boldface** indicates significance

Characteristic	Total (n=162)	Workers' Comp (n=38)	Private Insurance (n=124)	*p-value
No. Consecutively Operated Levels				0.487
One	75.3% (122)	71.1% (27)	76.6% (95)	
Two	24.7% (40)	29.0% (11)	23.4% (29)	
Operative Time (min)				
Mean±SD	50.9±15.7	51.1±21.0	50.9±13.9	0.951
Estimated Blood Loss (ml)				
Mean±SD	26.6±6.7	25.7±4.1	26.9±7.3	0.324
Postoperative Length of Stay (hours)				
Mean±SD	7.8±5.7	7.7±5.4	7.9±5.9	0.873
POD 0 VAS Pain	4.7±2.2	4.9±2.5	4.6±2.1	0.471
POD 0 Narcotic Consumption (OME)	20.7±18.0	17.3±15.4	21.7±18.6	0.193

POD = postoperative day of discharge; No = Number of; SD = standard deviation; VAS = Visual analog scale; OME = oral morphine equivalents

\*p-value calculated using Chi-square analysis for categorical variables or Student's t-test for continuous variables

**Boldface** indicates significance

Table 3. Patient-reported outcome measures and minimum clinically important difference

	Workers' Comp	*p-value	Private Insurance	*p-value	*p-value
<b>Pre-Op</b>					
PROMIS-PF	38.8±6.6		40.5±7.4		0.568
NDI	47.3±18.9		39.8±18.0		0.077
VAS-N	6.3±2.2		6.3±2.3		0.959
VAS-A	5.8±2.6		5.7±2.7		0.803
PHQ-9	5.6±5.4		6.6±5.8		0.480
<b>6-week Post-Op</b>					
PROMIS-PF	40.4±8.7	0.188	46.8±7.4	<b>&lt;0.001</b>	<b>0.009</b>
NDI	38.4±21.1	0.355	20.8±16.3	<b>&lt;0.001</b>	<b>&lt;0.001</b>
VAS-N	4.2±2.6	<b>0.048</b>	2.4±2.3	<b>&lt;0.001</b>	<b>0.001</b>
VAS-A	3.7±3.0	0.053	1.8±2.6	<b>&lt;0.001</b>	<b>0.014</b>
PHQ-9	5.5±5.1	0.964	4.1±4.9	<b>&lt;0.001</b>	0.232
<b>Final Post-Op</b>					
PROMIS-PF	46.9±10.9	<b>0.001</b>	49.3±9.8	<b>&lt;0.001</b>	0.361
NDI	29.5±19.4	<b>&lt;0.001</b>	16.5±15.6	<b>&lt;0.001</b>	<b>0.001</b>
VAS-N	3.6±2.2	<b>&lt;0.001</b>	2.3±2.4	<b>&lt;0.001</b>	<b>0.018</b>
VAS-A	2.7±2.6	<b>&lt;0.001</b>	2.2±2.7	<b>&lt;0.001</b>	0.416
PHQ-9	6.0±6.6	0.684	3.7±4.4	<b>&lt;0.001</b>	<b>0.037</b>
<b>Δ Pre-Op to 6-week Post-Op</b>					
PROMIS-PF	2.4±5.7		5.3±8.3		0.359
NDI	4.2±18.1		18.4±15.9		<b>0.002</b>
VAS-N	1.4±2.9		3.6±2.8		<b>0.003</b>
VAS-A	1.6±3.3		3.5±3.7		0.052
PHQ-9	-0.1±5.1		2.8±5.1		<b>0.040</b>
<b>Δ Pre-Op to Final Post-Op</b>					
PROMIS-PF	9.5±9.5		9.0±9.0		0.936
NDI	17.4±19.7		23.5±18.1		0.234
VAS-N	2.8±2.8		3.8±2.9		0.094
VAS-A	2.8±3.0		3.2±3.6		0.657
PHQ-9	-0.6±6.7		3.1±4.3		<b>0.009</b>
<b>MCID Achievement</b>					
PROMIS-PF	75.0%		80.3%		0.634
NDI	60.9%		84.7%		<b>0.049</b>
VAS-N	60.9%		78.1%		0.100
VAS-A	31.8%		47.2%		0.207
PHQ-9	50.0%		9.2%		<b>&lt;0.001</b>

\*All postoperative and ΔPROM p-values calculated using multivariable linear and logistic regression tests accounting for significant univariate group demographic differences for patient-reported outcome measures and MCID achievement rates respectively. Preoperative p-values calculated via independent samples t-tests

\*p-value calculated using paired samples t-tests assessing 6-week PROMs and Final PROMs to Preoperative PROMs

**Boldface** denotes statistical significance (p<0.05)