# Washington State Spine Surgery

## Spine SCOAP Statistics and Key Findings, 2015-2017


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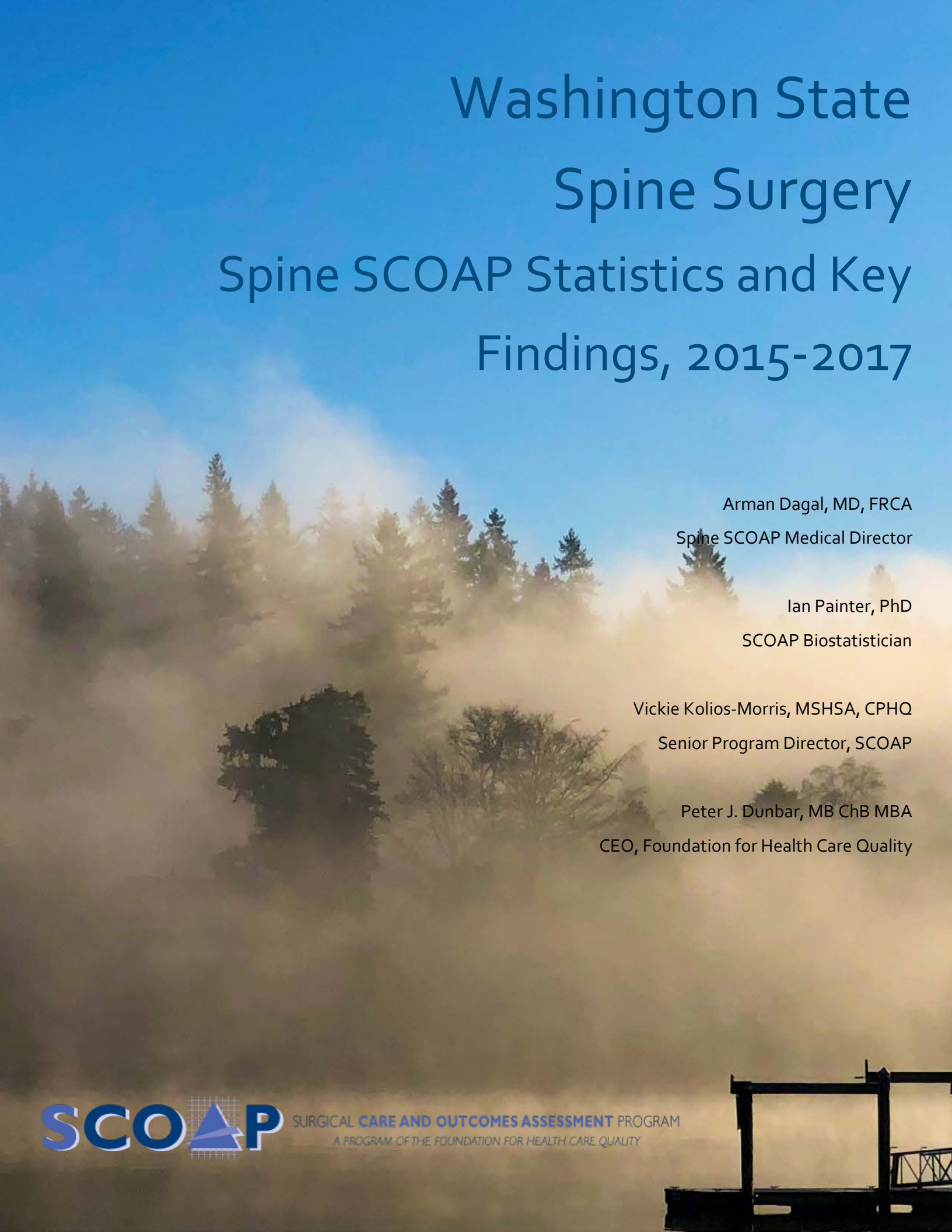


SCOAP SURGICAL CARE AND OUTCOMES ASSESSMENT PROGRAM

A PROGRAM OF THE FOUNDATION FOR HEALTH CARE QUALITY

# Statistics and Key Findings

Spine SCOAP 2015-2017

## Brief

The Foundation for Health Care Quality (FHCQ) is a neutral, nonprofit organization with the mission of producing a trustworthy, independent, third-party resource to bring stakeholders with varied backgrounds together. FHCQ aims to support continual improvement of sustainable health care that meets or exceeds established standards and houses a number of quality improvement programs which deal with variability and outcomes in medical and surgical services.

The Spine Surgical Care and Outcomes Assessment Program (SCOAP) is a learning collaborative of the FHCQ that uses performance surveillance to help providers deliver more appropriate, safer and higher quality surgical spine care across Washington State. The Spine SCOAP registry collects prospective data of cervical and lumbar elective spine procedures from participating hospitals. Data is abstracted by trained abstractors at each participating hospital and entered at minimum on a quarterly basis, audited regularly. The registry includes clinical process and outcomes data which enables participating centers to benchmark their performance. Detection of practice variation helps to formulate solutions through evidence-based deliberation. Participating physicians, hospitals and health related organizations may then focus on actionable measures to improve performance and quality. In many surgery centers quality improvement opportunities will be limited due to low-volume surgeries so as to draw meaningful conclusions. Access to an extensive collection of data, peer review and collaboration will help to speed up this process.

This Three-Year Report is a sample of the potential power behind the Spine SCOAP learning collaborative and is reflective of the level of detail that can be derived.

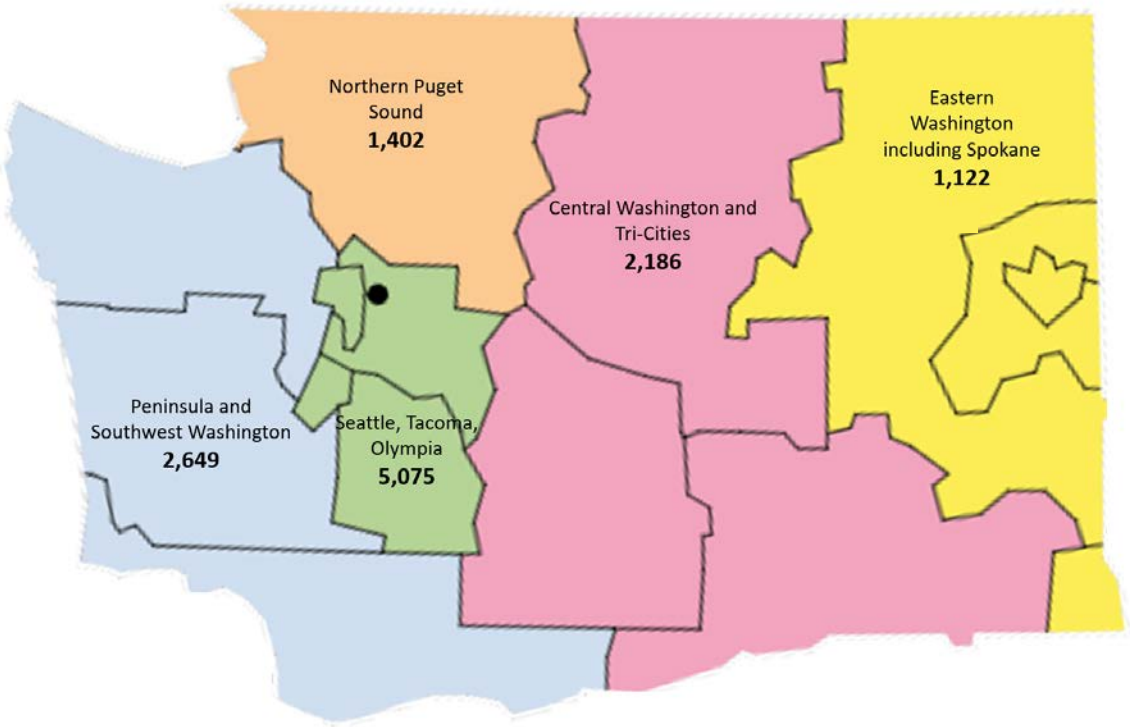
# Frequency

Spine SCOAP currently captures approximately 70% of inpatient spine surgeries in Washington State. The registry is heavily weighted towards the capture of spine fusions (100% capture of fusions by participating hospitals, but only 30% capture of non-fusions).

For this report, the Spine SCOAP registry noted 13,042 cases between the 4th calendar quarter of 2014 to the 3rd calendar quarter of 2017. Of these, 12,183 cases presented with radiculopathy, 856 without and 3 cases were missing radiculopathy information. Four cases were missing the 'any fusion' variable and one was from facility 'Z' (which had one case in total). These cases and the 3 cases missing radiculopathy were omitted, leaving 13,034 cases total.

Spine SCOAP procedure volume is noted by region, based on the first three digits of the patient zip code where available (Figure 1).

**Figure 1. Distribution of lumbar spine surgery in Washington State, Spine SCOAP cases: Q4 2014 to Q3 2017 discharges**



The number of facilities and therefore the number of cases in the registry varies by year. Spine SCOAP analyses take this aspect into account (Table 1).

**Table 1. Number of cases by facility by discharge calendar quarter during reporting period**

| Facility | 2014 Q4 | 2015 Q1 | 2015 Q2 | 2015 Q3 | 2015 Q4 | 2016 Q1 | 2016 Q2 | 2016 Q3 | 2016 Q4 | 2017 Q1 | 2017 Q2 | 2017 Q3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A** | | | | | | 13 | 13 | 5 | 10 | 9 | 7 | 12 |
| **B** | 183 | 100 | | | | | | | | | | |
| **C** | | 48 | 49 | 32 | 38 | 32 | 25 | 37 | 47 | | | |
| **D** | | 43 | 147 | 160 | 129 | 61 | 47 | 60 | 60 | 61 | 35 | |
| **E** | 33 | 34 | 43 | 22 | 32 | | | | | | | |
| **F** | 69 | 67 | 63 | 57 | 55 | 56 | 73 | 59 | 70 | 67 | 52 | 55 |
| **G** | 89 | 94 | 101 | 113 | 96 | 108 | 87 | 84 | 81 | | | |
| **H** | 55 | 1 | 82 | | | | | | | | | |
| **I** | 107 | 83 | 79 | 81 | 91 | 98 | 4 | | | | | |
| **J** | | | 75 | 62 | 61 | 63 | 62 | 51 | 54 | 60 | 59 | 53 |
| **K** | 41 | 53 | 64 | 65 | 54 | 32 | 35 | 15 | 41 | 22 | 38 | 26 |
| **L** | 90 | 79 | 96 | 58 | 62 | 64 | 52 | 56 | 36 | 64 | 44 | 31 |
| **M** | | | | | | 99 | 117 | 115 | 111 | 86 | 78 | 91 |
| **N** | 121 | 61 | 61 | 114 | 113 | 94 | 116 | 137 | 137 | 127 | 93 | 62 |
| **O** | 228 | 194 | 178 | 165 | 283 | 207 | 188 | 200 | 188 | | | |
| **P** | 35 | 27 | 27 | 19 | 43 | 30 | 37 | 33 | 33 | 25 | 29 | 26 |
| **Q** | 89 | 68 | 71 | 79 | 68 | 77 | 74 | 72 | 94 | 79 | 81 | 72 |
| **R** | 58 | 18 | 7 | 7 | | | | | | | | |
| **S** | 24 | 34 | 25 | 38 | 41 | 40 | 60 | 33 | 29 | 40 | 29 | 45 |
| **U** | 52 | 23 | 30 | 23 | 25 | 24 | 9 | | | | | |
| **W** | 109 | 114 | 107 | 100 | 90 | 85 | 91 | 72 | 89 | 57 | 52 | 50 |
| **Y** | | | 14 | 18 | | 87 | 67 | 72 | 74 | 65 | 73 | 67 |
| **Total** | **1383** | **1141** | **1319** | **1213** | **1281** | **1270** | **1157** | **1101** | **1154** | **762** | **670** | **590** |

Started to participate  No longer participates

The following analyses apply to within-hospital metrics.

In Spine SCOAP hospitals there was a 10% decrease in the number of lumbar spine surgeries per hospital per year.

The percentage decrease in spine surgery was greater in females (13.6%) than males (8.0%), with the greatest decrease occurring in the 50-59 year age group (16.7% decrease) and the least occurring in the 30-39 year age group (0.2% increase) (Table 2).

**Table 2. Distribution of spine surgeries per age group**

| Age group | Percent change | | |
|---|---|---|---|
| **< 30** | 3.9 | decrease | ↓ |
| **30-39** | 0.2 | increase | ↑ |
| **40-49** | 12.6 | decrease | ↓ |
| **50-59** | 16.7 | decrease | ↓ |
| **60-69** | 9.1 | decrease | ↓ |
| **70-79** | 8.9 | decrease | ↓ |
| **>= 80** | 5.8 | decrease | ↓ |

The intensity of spine surgery: Number of levels, fusion vs non-fusion, likewise decreased (Table 3; Figures 2 and 3).

**Table 3. Rate of decrease per year of number of surgeries by number of levels and type**

| Number of levels | No fusion (%) | With fusion (%) |
|---|---|---|
| **1** | 14.8 | 4.3 |
| **2** | 18.0 | 10.2 |
| **3** | 8.3 | 10.5 |
| **4** | 20.3 | 20.2 |
| **>4** | 21.3 | 30.7 |

These data demonstrate a statistically significant trend towards fewer levels performed among all types of spine surgery.

**Figure 2. Percent of Spine SCOAP non-fusion cases by level across discharge quarter**

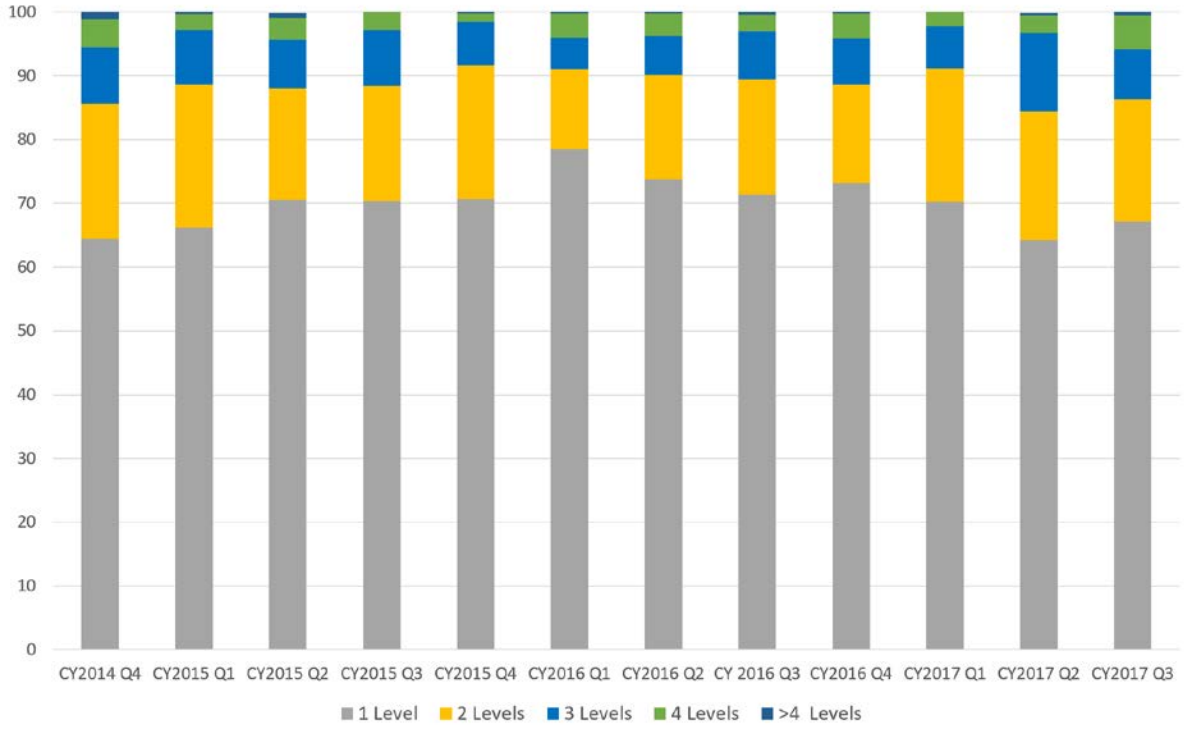
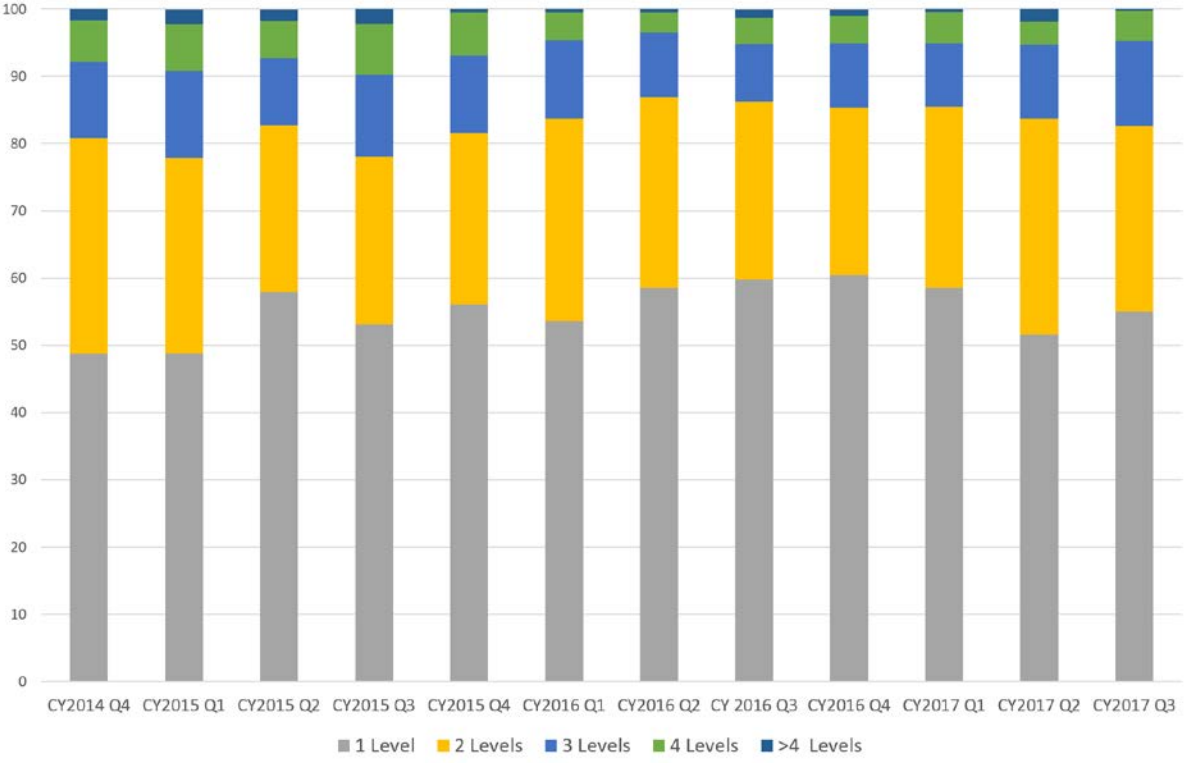



**Figure 3. Percent of Spine SCOAP fusion cases by level across discharge quarter**



# Complications

The risk of complications is not evenly distributed across patients nor hospitals. Spine SCOAP is exceptionally detailed, enabling us to characterize the following risk factors.

While 2.0% of all Spine SCOAP patients required reoperation within 30 days, and 2.9% of patients required blood transfusion after surgery (1.5% within 24 hours of it and 1.8% later), the risk of complication depended upon measurable risk factors. Hospital volumes and blood use are two such factors (Table 4).

**Table 4. Complication rates per case volume range**

| Hospitals with case ranges per quarter | Reoperation (%) | Postop blood transfusion (%) |
|---|---|---|
| **<50** | 2.4 | 4.2 |
| **50-100** | 2.2 | 2.4 |
| **>100** | 1.3 | 2.9 |

Although hospitals with higher volumes are associated with lower complication rates, it is not possible to distinguish between the effect of the number of cases performed and individual hospitals' effects on reoperation or post operative blood use. Further analysis is required.

Fusion surgery (as opposed to non-fusion) and preoperative anemia are significant risk factors for post operative blood transfusion and extended length of stay (LOS) (Table 5).

**Table 5. Complication rate by surgery and anemia status**

| Surgery | Anemia[1] status | Post operative blood transfusion (%) | Reoperation (%) | LOS (days) |
|---|---|---|---|---|
| **Fusion** | Anemic | 14.3 | 3.4 | 3.6 |
| **Fusion** | Not anemic | 3.2 | 2.1 | 2.8 |
| **No fusion** | Anemic | 1.7 | 1.5 | 2.0 |
| **No fusion** | Not anemic | 0.1 | 1.6 | 1.0 |

[1] Anemia is defined as hemoglobin (Hb) <12 g/dl for females and Hb <13 g/dl for males.

Spine SCOAP captures clinical data that reveals a wide variety of risks, including new neurological deficits, dural tears, glycemic control, infection rates, implant revision/removal and readmission rates. These variables are currently undergoing further review.

Complications following surgery add to the overall cost of care through additional days spent in the hospital and increased payments. On average, patients who required a blood transfusion stayed in hospital 3.1 days compared to 2.1 days for patients who did not require a blood transfusion.

The Spine SCOAP Management Committee continuously evaluates relevant metrics for inclusion in data collection.

Complication rates varied considerably between hospital sites based on their volume.

Preoperative glycemic control is deteriorating.

Preoperative anemia is a significant risk factor.

Opioid use is a significant risk factor.

# Summary Demographics

Tables 6 and 7, and Figure 4 illustrate the demographics of the Spine SCOAP population during the review period.

**Table 6. Spine SCOAP Demographics**

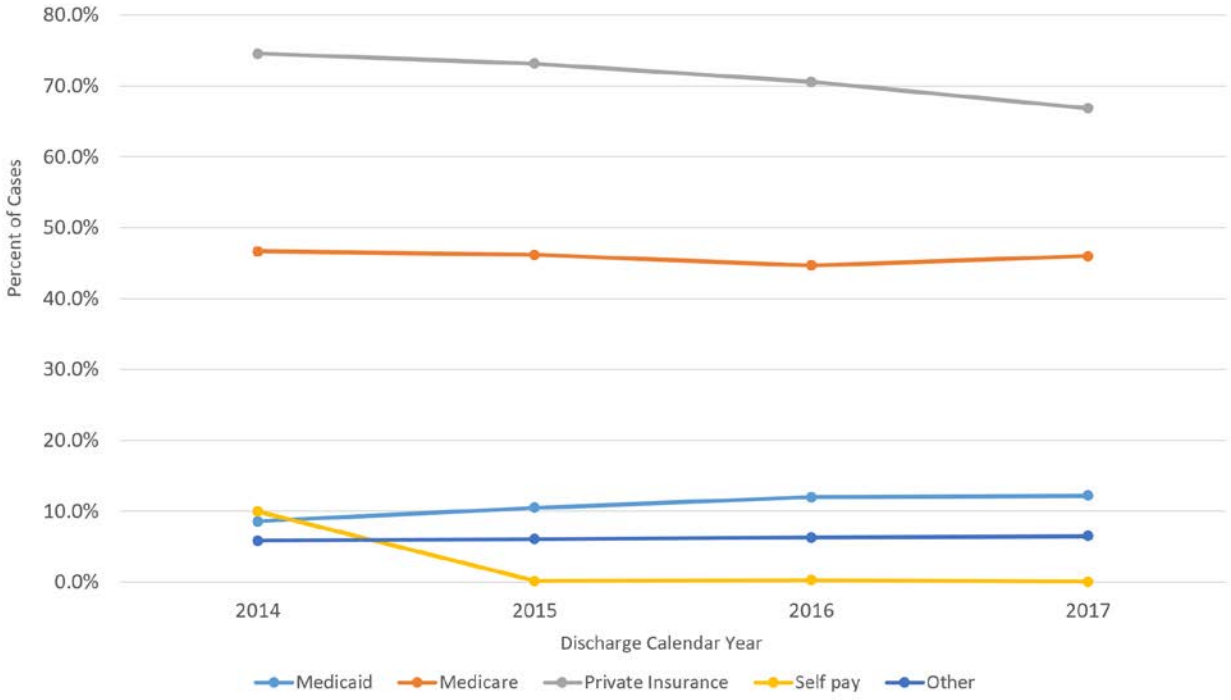
| | 2014[2] N=1382 | 2015 N=4950 | 2016 N=4681 | 2017[3] N=2021 |
|---|---|---|---|---|
| Age | | | | |
| < 30 | 3.3 | 2.0 | 2.5 | 2.8 |
| 30-39 | 6.0 | 6.3 | 8.3 | 7.8 |
| 40-49 | 11.1 | 12.1 | 12.7 | 11.8 |
| 50-59 | 21.3 | 21.4 | 20.2 | 19.8 |
| 60-69 | 31.0 | 30.4 | 29.1 | 28.6 |
| 70-79 | 21.5 | 21.8 | 21.5 | 23.1 |
| >= 80 | 5.9 | 6.0 | 5.7 | 6.2 |
| Gender | | | | |
| Female | 51.0 | 49.6 | 50.0 | 49.1 |
| Male | 49.0 | 50.4 | 50.0 | 50.9 |
| ASA Physical Status[4] | | | | |
| I | 5.6 | 6.0 | 7.5 | 8.2 |
| II | 61.6 | 60.2 | 59.2 | 57.3 |
| III | 31.9 | 33.1 | 32.6 | 33.6 |
| IV | 0.9 | 0.4 | 0.5 | 0.6 |
| V | 0.0 | 0.3 | 0.1 | 0.2 |
| BMI[5] | 30.4 (6.2) | 30.1 (6.2) | 30.3 (6.3) | 30.5 (6.6) |
| Race/Ethnicity | | | | |
| Black/African American | 2.1 | 2.3 | 2.2 | 2.6 |
| White/Caucasian | 73.1 | 81.8 | 86.7 | 86.8 |
| Hispanic/Latino | 3.0 | 2.9 | 3.2 | 4.8 |
| Asian | 2.1 | 2.0 | 2.1 | 2.2 |
| Native American/Alaska Native | 0.9 | 0.9 | 1.0 | 0.9 |
| Native Hawaiian/Pacific Islander | 0.3 | 0.4 | 0.4 | 0.1 |
| Multiple or Other | 1.9 | 2.3 | 2.0 | 3.0 |

[2] 2014 data includes only discharges from 10/01/2014-12/31/2014
[3] 2017 data includes only discharges from 1/1/2017-09/30/2017
[4] American Society of Anesthesiologists Physical Status Classification
[5] Body Mass Index, Mean (Standard Deviation (SD))

**Table 6 Continued**

| Payor | | | | |
|---|---|---|---|---|
| Medicaid | 8.6 | 10.5 | 12.0 | 12.2 |
| Medicare | 46.7 | 46.2 | 44.7 | 46.0 |
| Private Insurance | 74.6 | 73.2 | 70.6 | 66.9 |
| Self-pay | 0.1 | 0.2 | 0.3 | 0.1 |
| Other | 5.9 | 6.1 | 6.3 | 6.5 |

**Figure 4. Percent of Spine SCOAP cases by payor and discharge calendar year**




Since late 2014, smoking cessation and opioid dependence prior to surgery are improving. Preoperative glycemic control is deteriorating. There was no change in the renal disease and nutritional fitness prior to surgery in the same time period (Tables 7 and 8).

**Table 7. Preoperative fitness measures**[6]

| | 2014* N=1382 | 2015 N=4950 | 2016 N=4681 | 2017** N=2021 |
|---|---|---|---|---|
| Smoking | | | | |
| No smoking within 1 year | 81.6 | 83.1 | 83.9 | 84.5 |
| Smoking within 1 year | 18.4 | 16.9 | 16.1 | 15.5 |
| HbA1c | | | | |
| HbA1c < 8% | 93.7 | 87.3 | 86.6 | 85.7 |
| HbA1c >= 8% | 6.3 | 12.7 | 13.4 | 14.3 |
| Creatinine | | | | |
| Creatinine 0.51-1.18 mg/dl | 85.6 | 84.7 | 86.3 | 85.6 |
| Creatinine not 0.51-1.18 mg/dl | 14.4 | 15.3 | 13.7 | 14.4 |
| Albumin | | | | |
| Albumin < 3.5 g/dl | 6.5 | 5.3 | 5.5 | 6.6 |
| Albumin >= 3.5 g/dl | 93.5 | 94.7 | 94.5 | 93.4 |
| Opioids | | | | |
| No | 56.0 | 57.5 | 56.4 | 60.7 |
| Yes | 44.0 | 42.5 | 43.6 | 39.3 |

**Table 8. Effect of preoperative fitness on hospital LOS**

| | Mean LOS (days) | SD | p-Value |
|---|---|---|---|
| HbA1c | | | |
| HbA1c < 8% | 2.59 | 2.21 | 0.200 |
| HbA1c >= 8% | 2.76 | 3.29 | |
| Creatinine | | | |
| Creatinine 0.51-1.18 mg/dl | 2.21 | 2.14 | <0.001 |
| Creatinine not 0.51-1.18 mg/dl | 2.51 | 2.37 | |
| Albumin | | | |
| Albumin < 3.5 g/dl | 4.28 | 4.01 | <0.001 |
| Albumin >= 3.5 g/dl | 2.34 | 2.00 | |
| Opioids | | | |
| No | 2.00 | 1.92 | <0.001 |
| Yes | 2.39 | 2.30 | |

[6] All Spine SCOAP variables are defined in a data dictionary and are available by request.

# Outcomes

Patient Reported Outcomes (PROs) are collected within Spine SCOAP. The Oswestry Disability Index (ODI) and Numeric Rating Scale (NRS) of pain for both the back and lower extremity are available at baseline and post-operatively at select time points for a subset of patients (Tables 9, 10 and 11).

**Table 9. Number of cases with ODI completed**

| | 2015 | 2016 | 2017 |
|---|---|---|---|
| Before surgery | 579 | 858 | 427 |
| Post-op: 30-90 days | 54 | 13 | 38 |
| Post-op: 12 months | 3 | 0 | 0 |
| Post-op: 24 months | 5 | 0 | 0 |

**Table 10. NRS score completion – Back**

| | 2015 | 2016 | 2017 |
|---|---|---|---|
| Before surgery | 2295 | 2163 | 1092 |
| Post-op: 30-90 days | 224 | 225 | 167 |
| Post-op: 12 months | 11 | 1 | 0 |
| Post-op: 24 months | 11 | 0 | 0 |

**Table 11. NRS score completion – Lower Extremity**

| | 2015 | 2016 | 2017 |
|---|---|---|---|
| Before surgery | 1983 | 1982 | 1021 |
| Post-op: 30-90 days | 204 | 242 | 177 |
| Post-op: 12 months | 8 | 0 | 0 |
| Post-op: 24 months | 5 | 0 | 0 |

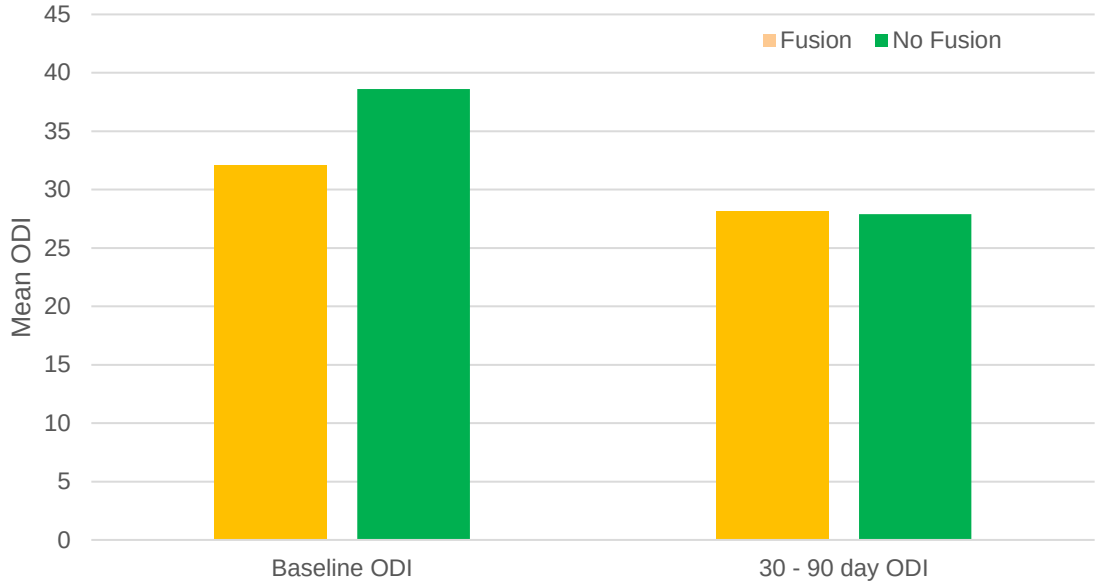
Baseline rates of reporting PROs are increasing over time. The majority of the reporting comes from four hospitals.

The Minimally Clinically Important Difference (MCID) in PROs are available in the four hospitals reporting post-op PROs. MCID for ODI scores is defined as a 10 point reduction in score. MCID for NRS scores is defined as a 2-point reduction in score. Patients undergoing fusion had a lower rate of clinical improvement in ODI, but similar rates of clinical improvements in NRS (Table 12 and Figure 5):

**Table 12. Patient reported outcomes**

| | % MCID ODI | % MCID NRS - back | % MCID NRS - leg |
|---|---|---|---|
| **No fusion** | 40.5 | 67.6 | 60.6 |
| **Fusion** | 18.2 | 57.9 | 55.9 |

**Figure 5. Mean ODI for fusion vs. non-fusion Spine SCOAP cases at baseline and 30-90 days post-operatively**




Only 40.5% of the non-fusion patients and 18.2% of fusion patients had a clinically important reduction in their ODI scores. Due to lack of full long term postoperative ODI and NRS, it is difficult to interpret the Patient Reported Outcome data accurately. It is important to develop statewide strategies to improve compliance to the completion of these metric by the patients to guide future decision making.

Note: Figure 5 represents the mean ODI scores among patients with BOTH baseline and follow-up ODIs. We detected that the results would be different for baseline if we include all cases; in particular, patients who do not have a follow-up ODI tended to have a higher baseline ODI than patients who did have an ODI.

## Resource & Workforce Distribution

Spine surgery is undertaken by both neurosurgeons and orthopedic surgeons in Spine SCOAP. The distribution thereof is noted in Figure 6.

**Figure 6. Distribution of Spine SCOAP cases by surgical specialty**