

SUPPLEMENTARY APPENDIX

Specific Procedures Identified for inclusion from the S3 database

Low-Intensity Procedures

Posterior lumbar laminectomy
 Lumbar discectomy
 Lateral lumbar discectomy
 Lumbar laminectomy
 Lumbar laminotomy
 Lumbar foraminotomy

High-Intensity Procedures

Anterior lumbar interbody fusion with allograft spacer
 Anterior lumbar interbody fusion with cage implants
 Posterior lumbar interbody fusion (PLIF)
 Lumbar arthroplasty

Supplementary Table 1: Codes used to Identify Surgical Complications

| Complications and Adverse Events | ICD9 | ICD10 |
|---------------------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Intraoperative and Postprocedural Complications* | All codes 996-999, All codes E870-E879 | All G97 codes, M96.0, M96.8xx, M96.Axx, All codes T80-T88, All codes Y62-Y84 |
| Acute Myocardial Infarction ¹ | 410.x0, 410.x1 | I21.xx, I22.x |
| Deep Vein Thrombosis or Pulmonary Embolism ² | 415.11, 415.13, 415.19, 453.40, 453.41, 453.42 | I26.09, I26.92, I126.99, I82.401-I82.409, I82.411-I82.419, I82.431-I82.439, I82.441-I82.449, I82.4Y1-I82.4Y9, I82.4Z1-I82.4Z9 |
| Spine Fracture | 733.13, 805.xx | M48.5xxx, M84.58xx, S12.xxxx, S22.xxxx, S32.xxxx |
| Spine Infection | 730.08, 730.18, 730.28, 730.88, 730.98 | M00.08, M00.18, M00.28, M00.88, M01.X8, M02.18, M02.28, M46.2x, M46.3x, M46.5x |
| Stroke ^{3,4} | All codes 430-434, 436, 997.02 | All codes I60-I63 |

Note: *Codes from ICD9 and ICD10 indicating intraoperative and postprocedural complications from lumbar spine surgery were used, along with <https://www.srs.org/Education/Coding--Reimbursement>, to build this list.

Supplementary Table 2: Codes used to Identify Traumatic Injury Events

| Traumatic Events | ICD9 | ICD10 |
|-----------------------|----------------------------------------------|---------------------------------------------------------------------------|
| Trauma or Accident | All codes E800-E999 | All codes V01-V99, W00-W64, X00-X99, Y00-Y38 |
| Cauda Equina Syndrome | 344.6x, 806.61, 806.62, 952.4 | G83.4, S34.3XXA, S34.3XXD, S34.3XXS |
| Spinal Cord Injury | 013.4x, 013.5x, 336.x, 806.xx, 907.2, 952.xx | G95.xx, G99.2, S14.0xxx, S14.1xxx, S24.0xxx, S24.1xxx, S34.0xxx, S34.1xxx |

Note: Excluded Trauma or Accident cases if those codes were found in the 30 days before surgery. Excluded Cauda Equina and Spinal Cord Injury cases if those codes were found 30 days before surgery or were the reason for the index surgery.

Supplementary Table 3: Long-term opioid use 1 year prior and 1 year after surgery

| | Total N=356 | Low-Intensity N=232 | High-Intensity N=124 |
|-----------------------------|----------------|------------------------|-------------------------|
| LTOU Prior Only | 55 (15.4%) | 37 (15.9%) | 18 (14.5%) |
| LTOU After Only | 24 (6.7%) | 15 (6.5%) | 9 (7.3%) |
| LTOU Prior and After | 73 (20.5%) | 37 (15.9%) | 36 (29.0%) |
| No LTOU | 204 (57.3%) | 143 (61.6%) | 61 (49.2%) |

Note: Values represent N(%); LTOU = long term opioid utilization / chronic opioid use; LTOU Prior was defined as having ≥ 4 prescription fills in the 7 months (210 days) before surgery, with at least 3 of those fills outside of the perioperative period (outside of 30 days before surgery); LTOU After was defined as ≥ 4 opioid prescriptions filled within 7 months (210 days) after surgery, with at least 3 occurring > 30 days after surgery

Supplementary Table 4: Continued Opioid Utilization 6 months Postoperatively

| | TOTAL N=356 | Low-Intensity N=232 | High-Intensity N=124 |
|------------------------------------------------------------------|----------------|------------------------|-------------------------|
| At least 1 Opioid Fill ≥ 180 days Post-op | 187 (52.5%) | 111 (47.8%) | 76 (61.3%) |
| Prior opioid use | 173 (48.6%) | 102 (44.0%) | 71 (57.3%) |
| Opioid naive | 14 (3.9%) | 9 (3.9%) | 5 (4.0%) |

Note: Values represent N(%).

Supplementary Table 5: Non-opioid pain medication use 12mo prior to surgery

| | Low-Intensity N=232 | High-Intensity N=124 |
|------------------------------------------------------------------------|--------------------------------|---------------------------------|
| Non-steroidal anti-inflammatory drugs | | |
| -365 to -1 days (whole 12mo b4) | 200 (86.2%) | 105 (84.7%) |
| -365 to -31 days | 194 (83.6%) | 104 (83.9%) |
| Oral Analgesics | | |
| -365 to -1 days (whole 12mo b4) | 52 (22.4%) | 38 (30.6%) |
| -365 to -31 days | 46 (19.8%) | 38 (30.6%) |
| Toradol Injections | | |
| -365 to -1 days (whole 12mo b4) | 19 (8.2%) | 15 (12.1%) |
| -365 to -31 days | 18 (7.8%) | 12 (9.7%) |
| Analgesic Patches | | |
| -365 to -1 days (whole 12mo b4) | 59 (25.4%) | 26 (21.0%) |
| -365 to -31 days | 52 (22.4%) | 25 (20.2%) |
| Muscle Relaxers | | |
| -365 to -1 days (whole 12mo b4) | 150 (64.7%) | 86 (69.4%) |
| -365 to -31 days | 144 (62.1%) | 84 (67.7%) |
| Anticonvulsants (gabapentin, pregablin, etc.) | | |
| -365 to -1 days (whole 12mo b4) | 131 (56.5%) | 61 (49.2%) |
| -365 to -31 days | 120 (51.7%) | 59 (47.6%) |
| Topical Agents (biofreeze, topical gabapentin, capsaicin, etc.) | | |
| -365 to -1 days (whole 12mo b4) | 10 (4.3%) | 11 (8.9%) |
| -365 to -31 days | 9 (3.9%) | 11 (8.9%) |

Note: Values represent N(%) unless otherwise stated.

Supplementary Table 6: ICD complication codes from the *Intraoperative and Postprocedural Complications* category

| ICD Code | Description | Unique Individuals with Code & Days to Complication Coded in Medical Record |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 996.1 | Mechanical complication of other vascular device, implant, and graft | 1 person had this within 2d |
| 996.39 | Other mechanical complication of genitourinary device, implant, and graft | 1 person had this within 12d |
| 996.49 | Other mechanical complication of other internal orthopedic device, implant, and graft | 7 people had this on DOS |
| 996.77 | Other complications due to internal joint prosthesis | 1 person had this on DOS |
| 996.78 | Other complications due to other internal orthopedic device, implant, and graft | 1 person had this within 7d |
| 997.01 | Central nervous system complication | 1 person had this within 20d |
| 997.09 | Other nervous system complications | 1 person had this within 1d |
| 997.39 | Other respiratory complications | 1 person had this within 30d |
| 997/49 | Other digestive system complications | 6 people had this within 0-24d |
| 997/5 | Urinary complications, not elsewhere classified | 2 people had this within 0-1d |
| 998.11 | Hemorrhage complicating a procedure | 1 person had this on DOS |
| 998.12 | Hematoma complicating a procedure | 5 people had this within 0-5d |
| 998.2 | Accidental puncture or laceration during a procedure, not elsewhere classified | 5 people had this on DOS |
| 998.31 | Disruption of internal operation (surgical) wound | 1 person had this within 22d |
| 998.32 | Disruption of external operation (surgical) wound | 1 person had this within 19d |
| 998.51 | Infected postoperative seroma | 1 person had this within 28d |
| 998.59 | Other postoperative infection | 4 people had this within 16-28d |
| 998.89 | Other specified complications of procedures not elsewhere classified | 5 people had this within 1-13d |
| E87.00 | Accidental cut, puncture, perforation or hemorrhage during surgical operation | 7 people had this on DOS |
| E87.81 | Surgical operation with implant of artificial internal device causing abnormal patient reaction, or later complication, without mention of misadventure at time of operation | 4 people had this within 0-8d |
| E87.88 | Other specified surgical operations and procedures causing abnormal patient reaction, or later complication, without mention of misadventure at time of operation | 15 people had this within 0-28d |
| E87.99 | Unspecified procedure as the cause of abnormal reaction of patient, or of later complication, without mention of misadventure at time of procedure | 1 person had this within 2d |
| Y83.8 | Other surgical procedures as the cause of abnormal reaction of the patient, or of later complication, without mention of misadventure at the time of the procedure | 1 person had this on DOS |

DOS = Date of Surgery

Supplementary Table 7: ICD complication codes from the *Intraoperative and Postprocedural Complications* category, split by surgery severity.

| All ICD Codes Found in the Cohort within 30d after Surgery | Number of Individuals with each Code | |
|---------------------------------------------------------------|--------------------------------------|------------------------|
| | High-intensity Severity | Low-intensity Severity |
| 453.40 | 1 | 0 |
| 733.13 | 1 | 0 |
| 996.1 | 1 | 0 |
| 996.39 | 1 | 0 |
| 996.49 | 5 | 2 |
| 996.77 | 1 | 0 |
| 996.78 | 1 | 0 |
| 997.01 | 0 | 1 |
| 997.09 | 1 | 0 |
| 997.39 | 0 | 1 |
| 997.49 | 5 | 1 |
| 997.5 | 1 | 1 |
| 998.11 | 1 | 0 |
| 998.12 | 3 | 2 |
| 998.2 | 4 | 1 |
| 998.31 | 1 | 0 |
| 998.32 | 1 | 0 |
| 998.51 | 0 | 1 |
| 998.59 | 1 | 3 |
| 998.89 | 3 | 2 |
| E870.0 | 6 | 1 |
| E878.1 | 3 | 1 |
| E878.8 | 9 | 6 |
| E879.9 | 1 | 0 |
| Y83.8 | 0 | 1 |

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