**Appendix A. Identification of utilization measures.**

|  |  |
| --- | --- |
| **Measure** | **Codes/identification criteria** |
|  |  |
| Lumbar MRI | CPT 72148, 72149, 72158 |
|  |  |
| Lumbar CT | CPT 72131, 72132, 72133 |
|  |  |
| Lumbar radiography | CPT 72100, 72110, 72114, 72120, 72265, 72295 |
|  |  |
| Lumbosacral injection (includes epidural steroid, facet joint, sacroiliac joint, and other injections) | CPT 27096, 62282, 62311, 62319, 64475, 64476, 64483, 64484 |
|  |  |
| Surgery (includes arthrodesis, instrumentation, laminectomy, laminotomy, and vertebral corpectomy) | CPT 20930, 20931, 20937, 20938, 22585, 22558 , 22612, 22614, 22630, 22632, 22830, 22840, 22842, 22843, 22844, 22845, 22846, 22847, 22851, 62287, 63005, 63012, 63015, 63017, 63030, 63035, 63042, 63043, 63044, 63046, 63047, 63048, 63056, 63057, 63087, 63088, 63090, 63091, 63102, 63103, 63267, 63709 |
|  |  |
| Chiropractor visits | CPT 98940-92842, 98925-98929  CPT 99201-99380, 97110-97112 and provider type or specialty indicating chiropractor  L&I type of service for chiropractic  L&I local code for chiropractor visit |
|  |  |
| Physical/Occupational therapy visit | CPT 97001-97004  CPT 99201-99380, 97110-97112 and provider type or specialty indicating physical/occupational therapist  L&I type of service for physical therapist |
|  |  |
| Outpatient visit (any office visit not designated chiropractor or physical/occupational therapy) | CPT 99201-99380 and provider type or specialty not chiropractor or physical/occupational therapist  CPT 99201-99380 and L&I type of service not physical therapist, chiropractic, or vocational |
|  |  |
| Abbreviations: CT, computed tomography; CPT, common procedural terminology (refers to CPT-4 codes); L&I, Washington State Department of Labor and Industries; MRI, magnetic resonance imaging. | |

**Appendix B. Variables included in logistic regression model to develop propensity score weights.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  | **Adherence to clinical practice guidelines that advise against early MRI for patients without “red flags”** | |  |
| **Measure description and source** | **Categories** | **Non-adherent**  **(N=336)** | **Adherent**  **(N=1434)** | **Sig** |
|  |  |  |  |  |
| **Demographics** |  |  |  |  |
| **Age (at injury)** |  |  |  | 0.019 |
| Source: WC records | Continuous measure | 40.5 (10.4) | 38.9 (11.4) |  |
|  |  |  |  |  |
| **Sex** |  |  |  | 0.029 |
| Source: WC records | Female | 91 (27.1) | 477 (33.3) |  |
|  | Male | 245 (72.9) | 957 (66.7) |  |
|  |  |  |  |  |
| **Race/ethnicity** |  |  |  | 0.060 |
| Source: Interviews | Non-Hispanic white | 253 (75.3) | 976 (68.1) |  |
|  | Non-Hispanic non-white | 33 (9.8) | 205 (14.3) |  |
|  | Hispanic non-white | 31 (9.2) | 170 (11.9) |  |
|  | Hispanic white | 11 (3.3) | 36 (2.5) |  |
|  |  |  |  |  |
| **Education** |  |  |  | 0.299 |
| Source: Interviews | Less than high school | 44 (13.1) | 191 (13.3) |  |
|  | High school diploma/GED | 126 (37.5) | 476 (33.2) |  |
|  | Some college | 146 (43.5) | 636 (44.4) |  |
|  | College degree | 20 (6.0) | 130 (9.1) |  |
|  |  |  |  |  |
| **Household income ($)** |  |  |  | 0.074 |
| Source: Interviews | < 30,000 | 116 (34.5) | 591 (41.2) |  |
|  | 30-45,000 | 88 (26.2) | 351 (24.5) |  |
|  | 45-70,000 | 88 (26.2) | 311 (21.7) |  |
|  | >70,000 | 36 (10.7) | 126 (8.8) |  |
|  |  |  |  |  |
| **Marital status** |  |  |  | 0.132 |
| Source: Interviews | Married | 177 (52.7) | 727 (50.7) |  |
|  | Living with partner | 48 (14.3) | 203 (14.2) |  |
|  | Divorced | 73 (21.7) | 265 (18.5) |  |
|  | Other | 38 (11.3) | 236 (16.5) |  |
|  |  |  |  |  |
| **Residence** |  |  |  | 0.300 |
| Source: WC records | Urban | 199 (59.2) | 844 (58.9) |  |
|  | Suburban | 59 (17.6) | 217 (15.1) |  |
|  | Large town | 31 (9.2) | 178 (12.4) |  |
|  | Small town | 33 (9.8) | 153 (10.7) |  |
|  |  |  |  |  |
| **Has health insurance** |  |  |  | 0.845 |
| Source: Interviews | Yes, not through employer | 55 (16.4) | 249 (17.4) |  |
|  | Yes, through employer | 167 (49.7) | 719 (50.1) |  |
|  | No | 144 (33.9) | 466 (32.5) |  |
|  |  |  |  |  |
| **General health status** |  |  |  |  |
| **Body Mass Index** |  |  |  | 0.09 |
| Source: Calculated from height & weight reported in interview | Normal (<25) | 86 (25.6) | 444 (30.7) |  |
|  | Overweight (25-29) | 133 (39.6) | 550 (38.4) |  |
|  | Obese (30-34) | 79 (23.5) | 283 (19.7) |  |
|  | Severe obesity (>34) | 34 (10.1) | 119 (8.3) |  |
|  |  |  |  |  |
|  |  |  |  |  |
| **Health in year before injury** |  |  |  | 0.485 |
| Source: Interviews | Excellent | 87 (25.9) | 324 (22.6) |  |
|  | Very good | 113 (33.6) | 523 (36.5) |  |
|  | Good | 96 (28.6) | 435 (30.3) |  |
|  | Fair/Poor | 40 (11.9) | 149 (10.4) |  |
|  |  |  |  |  |
| **Health status at time of interview** |  |  |  | 0.187 |
| Source: Interviews | Excellent | 67 (19.9) | 282 (19.7) |  |
|  | Very good | 110 (32.7) | 521 (36.3) |  |
|  | Good | 110 (32.7) | 454 (31.7) |  |
|  | Fair/poor | 47 (14.0) | 176 (12.3) |  |
|  |  |  |  |  |
| **SF36 Mental health score** |  |  |  | <0.001 |
| Source: Interviews | 2 SD below population mean | 82 (24.4) | 174 (12.1) |  |
|  | 1-2 SD below population mean | 95 (28.3) | 285 (19.9) |  |
|  | 1 SD below population mean | 93 (27.7) | 351 (24.5) |  |
|  | At or above population mean | 66 (19.6) | 622 (43.4) |  |
|  |  |  |  |  |
| **Catastrophizing (0-4)** |  |  |  | <0.001 |
| Source: Interviews | Low (<1) | 39 (11.6) | 373 (26.0) |  |
|  | Moderate (1-2.9) | 173 (51.5) | 781 (54.5) |  |
|  | High (3-4) | 124 (36.9) | 280 (19.5) |  |
|  |  |  |  |  |
| **Work fear-avoidance (0-6)** |  |  |  | <0.001 |
| Source: Interviews | Low (0-2.9) | 30 (8.9) | 324 (22.6) |  |
|  | Moderate (3-4.9) | 87 (25.9) | 486 (33.9) |  |
|  | High (5-5.9) | 133 (39.6) | 398 (27.8) |  |
|  | Very high (6) | 86 (25.6) | 226 (15.8) |  |
|  |  |  |  |  |
| **Accomplished less in last week due to physical health** |  |  |  | <0.001 |
| Source: Interviews | All of the time | 149 (44.4) | 234 (16.3) |  |
|  | Most of the time | 96 (28.6) | 285 (19.9) |  |
|  | Some of the time | 50 (14.9) | 274 (19.1) |  |
|  | A little of the time | 24 (7.1) | 211 (14.7) |  |
|  | None | 16 (4.8) | 424 (29.6) |  |
|  |  |  |  |  |
| **Limited in the kind of work or other daily activities in last week due to physical health** |  |  |  | <0.001 |
| Source: Interviews | All of the time | 175 (52.1) | 254 (17.7) |  |
|  | Most of the time | 85 (25.3) | 254 (17.7) |  |
|  | Some of the time | 45 (13.4) | 317 (22.1) |  |
|  | A little of the time | 21 (6.3) | 234 (16.3) |  |
|  | None | 10 (3.0) | 370 (25.8) |  |
|  |  |  |  |  |
| **SF36 physical functioning score, normalized** |  |  |  | <0.001 |
| Source: Interviews | Continuous measure | 29.7 | 40.3 |  |
|  |  |  |  |  |
| **SF36 role physical score, normalized** |  |  |  | <0.001 |
| Source: Interviews | Continuous measure | 27.6 | 39.9 |  |
|  |  |  |  |  |
| **Use tobacco products** |  |  |  | <0.001 |
| Source: Interviews | Never | 156 (46.3) | 804 (56.1) |  |
|  | Occasionally | 37 (11.0) | 159 (11.1) |  |
|  | Frequently | 10 (3.0) | 71 (5.0) |  |
|  | Daily | 133 (39.6) | 397 (27.7) |  |
|  |  |  |  |  |
| **Frequency of drinking alcohol** |  |  |  | 0.645 |
| Source: Interviews | Never | 137 (40.8) | 516 (36.0) |  |
|  | Monthly or less | 76 (22.6) | 362 (25.2) |  |
|  | 2-4 times per month | 59 (17.6) | 270 (18.8) |  |
|  | 2-3 times per week | 46 (13.7) | 194 (13.5) |  |
|  | 4 or more times per week | 18 (5.4) | 91 (6.4) |  |
|  |  |  |  |  |
| **Injury characteristics** |  |  |  |  |
| **Roland-Morris score** (0-24) |  |  |  | <0.001 |
| Source: Interviews | Low (0-6) | 13 (3.9) | 409 (28.5) |  |
|  | Moderate (7-12) | 43 (12.8) | 331 (23.1) |  |
|  | High (13-18) | 112 (33.3) | 400 (27.9) |  |
|  | Very high (19-24) | 168 (50.0) | 294 (20.5) |  |
|  |  |  |  |  |
| **Pain intensity in the last week from injury** (0-10) |  |  |  | <0.001 |
| Source: Interviews | Low/no pain (0-3) | 35 (10.4) | 406 (28.3) |  |
|  | Mild pain (4-6) | 110 (32.7) | 563 (39.3) |  |
|  | Moderate/high pain (7-10) | 191 (56.8) | 462 (32.2) |  |
|  |  |  |  |  |
| **Injury severity** |  |  |  | <0.001 |
| Source: Medical record review | Mild sprain/strain and/or minor physical exam findings | 99 (29.6) | 905 (63.5) |  |
|  | Major sprain/strain evidenced by substantial immobility | 72 (21.6) | 305 (21.4) |  |
|  | Evidence of radiculopathy | 163 (48.8) | 216 (15.1) |  |
|  |  |  |  |  |
| **Pain from injury interfered with daily activities in last week (0-10)** |  |  |  | <0.001 |
| Source: Interviews | Low/no interference (0-3) | 31 (9.2) | 542 (37.8) |  |
|  | Mild interference (4-6) | 100 (29.8) | 462 (32.2) |  |
|  | Moderate/high interference (7-10) | 204 (60.7) | 422 (29.4) |  |
|  |  |  |  |  |
| **Pain from injury interfered with work in last week (0-10)** |  |  |  | <0.001 |
| Source: Interviews | Low/no interference (0-3) | 32 (9.5) | 578 (40.3) |  |
|  | Mild interference (4-6) | 71 (21.1) | 384 (26.8) |  |
|  | Moderate/high interference (7-10) | 230 (68.5) | 463 (32.3) |  |
|  |  |  |  |  |
| **Pain down leg** |  |  |  | <0.001 |
| Source: Interviews | None | 57 (17.0) | 749 (52.2) |  |
|  | To thigh | 33 (9.8) | 184 (12.8) |  |
|  | To knee | 69 (20.5) | 206 (14.4) |  |
|  | Below knee | 175 (52.1) | 289 (20.2) |  |
|  |  |  |  |  |
| **Work characteristics** |  |  |  |  |
| **Industry** |  |  |  | 0.109 |
| Source: WC records | Trade/transportation | 79 (23.5) | 355 (24.8) |  |
|  | Natural resources | 10 (3.0) | 75 (5.2) |  |
|  | Construction | 69 (20.5) | 250 (17.4) |  |
|  | Manufacturing | 36 (10.7) | 104 (7.3) |  |
|  | Management | 57 (17.0) | 229 (16.0) |  |
|  | Education/health | 45 (13.4) | 227 (15.8) |  |
|  | Hospitality | 40 (11.9) | 194 (13.5) |  |
|  |  |  |  |  |
| **Job satisfaction** |  |  |  | 0.689 |
| Source: Interviews | Not at all | 15 (4.5) | 86 (6.0) |  |
|  | Not too satisfied | 29 (8.6) | 128 (8.9) |  |
|  | Somewhat satisfied | 144 (42.9) | 593 (41.4) |  |
|  | Very satisfied | 148 (44.0) | 623 (43.4) |  |
|  |  |  |  |  |
| **Physical demands at work** |  |  |  | 0.014 |
| Source: Interviews | Light | 53 (15.8) | 296 (20.6) |  |
|  | Medium | 101 (30.1) | 460 (32.1) |  |
|  | Heavy | 78 (23.2) | 348 (24.3) |  |
|  | Very heavy | 100 (29.8) | 324 (22.6) |  |
|  |  |  |  |  |
| **Offered job accommodation for disability** |  |  |  | <0.001 |
| Source: Interviews | Yes | 118 (35.1) | 689 (48.0) |  |
|  | No | 211 (62.8) | 729 (50.8) |  |
|  |  |  |  |  |
| **Heavy lifting at work, >25 lbs** |  |  |  | 0.035 |
| Source: Interviews | Not at all | 20 (6.0) | 127 (8.9) |  |
|  | Rarely | 46 (13.7) | 219 (15.3) |  |
|  | Occasionally | 74 (22.0) | 342 (23.9) |  |
|  | Frequently | 102 (30.4) | 453 (31.6) |  |
|  | Constantly | 94 (28.0) | 290 (20.2) |  |
|  |  |  |  |  |
| **Answer to question - I am asked to do excessive work** |  |  |  | 0.165 |
| Source: Interviews | Strongly disagree | 16 (4.8) | 69 (4.8) |  |
|  | Disagree | 118 (35.1) | 569 (39.7) |  |
|  | Agree | 109 (32.4) | 483 (33.7) |  |
|  | Strongly agree | 90 (26.8) | 296 (20.6) |  |
|  |  |  |  |  |
| **Answer to question - I can take a break when I want to** |  |  |  | 0.709 |
| Source: Interviews | Strongly disagree | 58 (17.3) | 249 (17.4) |  |
|  | Disagree | 118 (35.1) | 508 (35.4) |  |
|  | Agree | 129 (38.4) | 550 (38.4) |  |
|  | Strongly agree | 31 (9.2) | 119 (8.3) |  |
|  |  |  |  |  |
| **Answer to question - Supervisor is willing to listen to my work-related problems** |  |  |  | 0.158 |
| Source: Interviews | Strongly disagree | 24 (7.1) | 59 (4.1) |  |
|  | Disagree | 53 (15.8) | 210 (14.6) |  |
|  | Agree | 118 (53.9) | 829 (57.8) |  |
|  | Strongly agree | 74 (22.0) | 313 (21.8) |  |
|  |  |  |  |  |
| **Get along with coworkers** |  |  |  | 0.585 |
| Source: Interviews | Not at all | 3 (0.9) | 15 (1.1) |  |
|  | Somewhat | 12 (3.6) | 72 (5.0) |  |
|  | Moderately/mostly | 319 (94.9) | 1334 (93.0) |  |
|  |  |  |  |  |
| **Work status** |  |  |  | 0.650 |
| Source: Interviews | Full time | 309 (92.0) | 1298 (90.5) |  |
|  | Part time | 27 (8.0) | 135 (9.4) |  |
|  |  |  |  |  |
| **Other** |  |  |  |  |
| **1+ previous WC back claims** |  |  |  | 0.011 |
| Source: Interviews | Yes | 82 (24.4) | 259 (18.1) |  |
|  | No | 254 (75.6) | 1165 (81.2) |  |
|  |  |  |  |  |
| **Blame for injury** |  |  |  | 0.208 |
| Source: Interviews | Work | 176 (52.4) | 679 (47.4) |  |
|  | Self | 49 (14.5) | 205 (14.3) |  |
|  | No one | 50 (14.9) | 289 (20.2) |  |
|  | Someone else | 54 (16.1) | 222 (15.5) |  |
|  |  |  |  |  |
| **Number of work days missed due to back in the last year** |  |  |  | 0.003 |
| Source: Interviews | None | 226 (67.3) | 965 (67.3) |  |
|  | 0-7 days | 69 (20.5) | 340 (23.7) |  |
|  | 8-14 days | 9 (2.7) | 65 (4.5) |  |
|  | 15-31 days | 13 (3.9) | 27 (1.9) |  |
|  | 32-62 days | 2 (0.6) | 10 (0.7) |  |
|  | > 2 months | 2 (0.6) | 5 (0.6) |  |
|  |  |  |  |  |
| **Type of first medical visit** |  |  |  | <0.001 |
| Source: WC records | Primary care | 164 (48.8) | 622 (43.4) |  |
|  | Occupational medicine | 17 (5.1) | 39 (2.7) |  |
|  | Chiropractor | 66 (19.6) | 474 (33.1) |  |
|  | Surgeon | 11 (3.3) | 25 (1.7) |  |
|  | Emergency room/clinic | 71 (21.1) | 250 (17.4) |  |
|  | Other | 7 (2.1) | 24 (1.7) |  |
|  |  |  |  |  |
| Abbreviations: SD, standard deviation; WC, workers’ compensation  “Consistent with guidelines” reflects workers who received an MRI after the first 6 weeks of injury (N=255), or did not receive an MRI at all (N=1179).  Frequency counts do not always sum to total because of missing responses or rounding.  For categorical variables, values are N (%); for continuous variables, values are mean (SD). For categorical variables, significance values indicate results from χ2 tests; for continuous variables, significance values indicate results from t-tests. | | | | |