## Supplemental Table 1: ICD-9 codes for procedures/surgeries

|  |  |  |
| --- | --- | --- |
| **Category** | **Code** | **Procedure description** |
| Cesarean | 74 | Cesarean Section And Removal Of Fetus |
| Cesarean | 74.0 | Classical cesarean section |
| Cesarean | 74.1 | Low cervical cesarean section |
| Cesarean | 74.2 | Extraperitoneal cesarean section |
| Cesarean | 74.3 | Removal of extratubal ectopic pregnancy |
| Cesarean | 74.4 | Cesarean section of other specified type |
| Cesarean | 74.9 | Cesarean Section Of Unspecified Type |
| Cesarean | 74.91 | Hysterectomy to terminate pregnancy |
| Cesarean | 74.99 | Other cesarean section of unspecified type |
| Hysterectomy | 68.31 | Laparoscopic supracervical hysterectomy [LSH] |
| Hysterectomy | 68.39 | Other and unspecified subtotal abdominal hysterectomy |
| Hysterectomy | 68.41 | Laparoscopic total abdominal hysterectomy |
| Hysterectomy | 68.49 | Other and unspecified total abdominal hysterectomy |
| Hysterectomy | 68.51 | Laparoscopically assisted vaginal hysterectomy (LAVH) |
| Hysterectomy | 68.59 | Other and unspecified vaginal hysterectomy |
| Hysterectomy | 68.61 | Laparoscopic radical abdominal hysterectomy |
| Hysterectomy | 68.69 | Other and unspecified radical abdominal hysterectomy |
| Hysterectomy | 68.71 | Laparoscopic radical vaginal hysterectomy [LRVH] |
| Hysterectomy | 68.79 | Other and unspecified radical vaginal hysterectomy |
| Hysterectomy | 68.9 | Other and unspecified hysterectomy |
| Hysterectomy | 69.19 | Other excision or destruction of uterus and supporting structures |

*NOTE: Equivalent ICD-10 codes were determined by using CMS’s ICD-9 to ICD-10 general equivalence mapping (www.cms.gov).*

**Supplemental Table 2: Full demographics and baseline characteristics for cesarean section surgery patients.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | IV APAP  (N= 4512) | % | Oral APAP (N= 24,612) | % |
| **Age (mean, SD)** | 30.9 (6.0) |  | 29.6 (5.9) |  |
| **Imputed BMI (mean, SD)** | 33.3 (6.8) |  | 33.8 (7.0) |  |
| **Race** |  |  |  |  |
| Caucasian | 2181 | 48.3% | 17,180 | 69.8% |
| African American | 1656 | 36.7% | 3127 | 12.7% |
| Asian/Other | 465 | 10.3% | 3006 | 12.2% |
| Hispanic | 54 | 1.2% | 960 | 3.9% |
| Missing/Unknown | 156 | 3.5% | 339 | 1.4% |
| **Insurance Type** |  |  |  |  |
| Commercial  | 1530 | 33.9% | 11,818 | 48.0% |
| Medicaid | 1043 | 23.1% | 8253 | 33.5% |
| Medicare | 22 | 0.5% | 209 | 0.9% |
| Other | 204 | 4.5% | 2079 | 8.4% |
| Self-pay | 33 | 0.7% | 186 | 0.8% |
| Unknown | 1680 | 37.2% | 2067 | 8.4% |
| **Marital Status** |  |  |  |  |
| Married | 2607 | 57.8% | 13,892 | 56.4% |
| Single | 1774 | 39.3% | 9182 | 37.3% |
| Divorced | 98 | 2.2% | 738 | 3.0% |
| Widowed | 3 | 0.1% | 20 | 0.1% |
| Unknown | 30 | 0.7% | 780 | 3.2% |
| **Admission Source** |  |  |  |  |
| Emergency  | 1717 | 38.1% | 109 | 0.4% |
| Healthcare Facility | 844 | 18.7% | 137 | 0.6% |
| Non-Healthcare Facility | 1559 | 34.6% | 20,245 | 82.3% |
| Other | 56 | 1.2% | 2170 | 8.8% |
| Unknown | 336 | 7.5% | 1951 | 7.9% |
| **Admission type** |  |  |  |  |
| Emergency  | 1785 | 39.6% | 415 | 1.7% |
| Urgent | 520 | 11.5% | 3806 | 15.5% |
| Elective | 1980 | 43.9% | 18,430 | 74.9% |
| Other | 4 | 0.1% | 677 | 2.8% |
| Unknown | 223 | 4.9% | 1284 | 5.2% |
| **Patient type** |  |  |  |  |
| Inpatient | 3827 | 84.8% | 23,777 | 96.6% |
| Other | 681 | 15.1% | 824 | 3.4% |
| Outpatient | 3 | 0.1% | 10 | 0.0% |
| Unknown | 1 | 0.0% | 1 | 0.0% |
| **Drugs on the Day of Surgery or Prior** |  |  |  |  |
| Oral APAP Prior to Day 0 | 267 | 5.9% | 1779 | 7.2% |
| IV APAP Prior to Day 0 | 58 | 1.3% | 0 | 0.0% |
| Oral Opioids on Day 0 | 3967 | 87.9% | 22,050 | 89.6% |
| IV Opioids on Day 0 | 4135 | 91.6% | 19,689 | 80.0% |
| Oral NSAIDS on Day 0 | 3728 | 82.6% | 18,277 | 74.3% |
| IV NSAIDS on Day 0  | 2636 | 58.4% | 1876 | 7.6% |
| **Elixhauser Comorbidities (8 Oral APAP and 5 IV APAP patients had missing Elixhauser data)** |  |  |  |  |
| Congestive Heart Failure | 15 | 0.3% | 34 | 0.1% |
| Valvular Disease | 23 | 0.5% | 173 | 0.7% |
| Pulmonary Circulation Disease | 7 | 0.2% | 31 | 0.1% |
| Peripheral Vascular Disease | 8 | 0.2% | 39 | 0.2% |
| Chronic Pulmonary Disease | 334 | 7.4% | 2291 | 9.3% |
| Paralysis | 2 | 0.0% | 41 | 0.2% |
| Neurological Disorders | 50 | 1.1% | 387 | 1.6% |
| Diabetes without Complications | 175 | 3.9% | 1010 | 4.1% |
| Diabetes with Complications | 19 | 0.4% | 126 | 0.5% |
| Hypothyroidism | 175 | 3.9% | 1503 | 6.1% |
| Renal Failure | 9 | 0.2% | 62 | 0.3% |
| Liver Disease | 25 | 0.6% | 160 | 0.7% |
| Peptic Ulcer Disease/bleeding | 1 | 0.0% | 1 | 0.0% |
| AIDS | 7 | 0.2% | 45 | 0.2% |
| Lymphoma | 0 | 0.0% | 30 | 0.1% |
| Metastatic Cancer | 3 | 0.1% | 15 | 0.1% |
| Solid Tumor | 21 | 0.5% | 93 | 0.4% |
| Rheumatoid Arthritis/Collagen Disease | 27 | 0.6% | 187 | 0.7% |
| Coagulopathy | 270 | 6.0% | 753 | 3.1% |
| Obesity | 380 | 8.4% | 3789 | 15.4% |
| Weight Loss | 18 | 0.4% | 107 | 0.4% |
| Fluid and Electrolyte Disorders | 175 | 3.9% | 1142 | 4.6% |
| Chronic Blood Loss Anemia | 735 | 16.3% | 5281 | 21.5% |
| Deficiency Anemia | 506 | 11.2% | 3611 | 14.7% |
| Alcohol Abuse | 20 | 0.4% | 177 | 0.7% |
| Drug Abuse | 89 | 2.0% | 911 | 3.7% |
| Psychoses | 59 | 1.3% | 617 | 2.5% |
| Depression | 116 | 2.6% | 1583 | 6.4% |
| Hypertension | 325 | 7.2% | 1811 | 7.4% |
|  |  |  |  |  |
|  |  |  |  |  |
| **Hospital Characteristics** |  |  |  |  |
| Urban | 1497 | 33.2% | 18,716 | 76.0% |
| Teaching Hospital (missing 111 patients) | 3793 | 84.2% | 14,651 | 59.8% |
| **Bed Size** |  |  |  |  |
| <200 | 345 | 7.7% | 7282 | 29.6% |
| 200 to 299 | 618 | 13.7% | 2991 | 12.2% |
| 300 to 499 | 831 | 18.4% | 7540 | 30.6% |
| 500+ | 2718 | 60.2% | 6799 | 27.6% |
| **Census Region** |  |  |  |  |
| Midwest  | 490 | 10.9% | 6977 | 28.4% |
| Northeast | 2852 | 63.2% | 8448 | 34.3% |
| South | 739 | 16.4% | 5970 | 24.3% |
| West | 431 | 9.6% | 3217 | 13.1% |
|  |  |  |  |  |
| **Year** |  |  |  |  |
| 2011 | 225 | 5.0% | 3482 | 14.2% |
| 2012 | 1322 | 29.3% | 3219 | 13.1% |
| 2013 | 1259 | 27.9% | 5359 | 21.8% |
| 2014 | 1175 | 26.0% | 6811 | 27.7% |
| 2015 | 531 | 11.8% | 5741 | 23.3% |

**Supplemental Table 3: Full demographics and baseline characteristics for hysterectomy surgery patients.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | IV APAP (N = 4181) | % | Oral APAP (N = 5586) | % |
| **Age (mean, SD)** | 47.4 (12.0) |  | 47.1 (11.5) |  |
| **Imputed BMI (mean, SD)** | 30.9 (7.7) |  | 30.8 (7.4) |  |
| **Race** |  |  |  |  |
| Caucasian | 2833 | 67.8% | 4013 | 71.8% |
| African American | 1009 | 24.1% | 1069 | 19.4% |
| Asian/Other | 265 | 6.3% | 369 | 6.6% |
| Hispanic | 18 | 0.4% | 79 | 1.4% |
| Missing/Unknown | 56 | 1.3% | 56 | 1.0% |
| **Insurance Type** |  |  |  |  |
| Commercial  | 2117 | 50.6% | 2958 | 53.0% |
| Medicaid | 412 | 9.9% | 589 | 10.5% |
| Medicare | 418 | 10.0% | 572 | 10.2% |
| Other | 397 | 9.5% | 905 | 16.2% |
| Self-pay | 69 | 1.7% | 103 | 1.8% |
| Unknown | 768 | 18.4% | 459 | 8.22% |
| **Marital Status** |  |  |  |  |
| Married | 2407 | 57.6% | 3217 | 57.6% |
| Single | 988 | 23.6% | 1177 | 21.1% |
| Divorced | 543 | 13.0% | 767 | 13.7% |
| Widowed | 194 | 4.6% | 223 | 4.0% |
| Unknown | 49 | 1.2% | 202 | 3.6% |
| **Admission Source** |  |  |  |  |
| Emergency  | 31 | 0.7% | 11 | 0.2% |
| Healthcare Facility | 10 | 0.2% | 10 | 0.2% |
| Non-Healthcare Facility | 3448 | 82.5% | 4939 | 88.4% |
| Other | 141 | 3.4% | 95 | 1.7% |
| Unknown | 246 | 5.9% | 531 | 9.5% |
| **Admission type** |  |  |  |  |
| Emergency  | 165 | 4.0% | 136 | 2.4% |
| Urgent | 56 | 1.3% | 149 | 2.7% |
| Elective | 3833 | 91.7% | 5213 | 93.3% |
| Other | 85 | 2.0% | 2 | 0.04% |
| Unknown | 42 | 1.0% | 86 | 1.5% |
| **Patient type** |  |  |  |  |
| Inpatient | 2448 | 58.6% | 3125 | 55.9% |
| Other | 1175 | 28.1% | 2016 | 36.1% |
| Outpatient | 538 | 12.9% | 419 | 7.5% |
| Unknown | 20 | 0.5% | 26 | 0.5% |
| **Drugs on the Day of Surgery** |  |  |  |  |
| Oral APAP Prior to Day 0 | 33 | 0.8% | 81 | 1.5% |
| IV APAP Prior to Day 0 | 13 | 0.3% | 0 | 0.0% |
| Oral Opioids on Day 0 | 2764 | 66.1% | 4731 | 84.7% |
| IV Opioids on Day 0 | 3727 | 89.1% | 4968 | 88.9% |
| Oral NSAIDS on Day 0 | 1272 | 30.4% | 2732 | 48.9% |
| IV NSAIDS on Day 0  | 2242 | 53.6% | 2848 | 51.0% |
| **Elixhauser Comorbidities (3 Oral APAP and 31 IV APAP patients had Missing Elixhauser Data)** |  |  |  |  |
| Congestive Heart Failure | 48 | 1.2% | 41 | 0.7% |
| Valvular Disease | 131 | 3.2% | 134 | 2.4% |
| Pulmonary Circulation Disease | 33 | 0.8% | 39 | 0.7% |
| Peripheral Vascular Disease | 60 | 1.5% | 70 | 1.3% |
| Chronic Pulmonary Disease | 579 | 14.0% | 742 | 13.3% |
| Paralysis | 26 | 0.6% | 19 | 0.3% |
| Neurological Disorders | 164 | 4.0% | 210 | 3.8% |
| Diabetes without Complications | 514 | 12.4% | 608 | 10.9% |
| Diabetes with Complications | 86 | 2.1% | 60 | 1.1% |
| Hypothyroidism | 483 | 11.6% | 681 | 12.2% |
| Renal Failure | 83 | 2.0% | 78 | 1.4% |
| Liver Disease | 90 | 2.2% | 107 | 1.9% |
| Peptic Ulcer Disease/Bleeding | 0 | 0.0% | 1 | 0.0% |
| AIDS | 12 | 0.3% | 10 | 0.2% |
| Lymphoma | 13 | 0.3% | 15 | 0.3% |
| Metastatic Cancer | 90 | 2.2% | 81 | 1.5% |
| Solid Tumor | 336 | 8.1% | 310 | 5.6% |
| Rheumatoid Arthritis/Collagen Disease | 85 | 2.1% | 130 | 2.3% |
| Coagulopathy | 57 | 1.4% | 134 | 2.4% |
| Obesity | 808 | 19.5% | 1009 | 18.1% |
| Weight Loss | 44 | 1.1% | 68 | 1.2% |
| Fluid and Electrolyte Disorders | 262 | 6.3% | 393 | 7.0% |
| Chronic Blood Loss Anemia | 185 | 4.5% | 254 | 4.6% |
| Deficiency Anemia | 825 | 19.9% | 1048 | 18.8% |
| Alcohol Abuse | 53 | 1.3% | 59 | 1.1% |
| Drug Abuse | 85 | 2.1% | 110 | 2.0% |
| Psychoses | 164 | 4.0% | 223 | 4.0% |
| Depression | 537 | 12.9% | 867 | 15.5% |
| Hypertension | 1478 | 35.6% | 1737 | 31.1% |
|  |  |  |  |  |
| **Procedure Type** |  |  |  |  |
| Laparoscopic | 1933 | 46.2% | 2817 | 50.4% |
| Total Vaginal Hysterectomy | 638 | 15.3% | 1010 | 18.1% |
| Total Abdominal Hysterectomy | 1508 | 36.1% | 1702 | 30.5% |
|  |  |  |  |  |
| **Hospital Characteristics** |  |  |  |  |
| Urban | 2690 | 64.3% | 5056 | 90.5% |
| Teaching Hospital (22 patients missing) | 2962 | 71.2% | 3317 | 59.4% |
| **Bed Size** |  |  |  |  |
| <200 | 848 | 20.3% | 1389 | 24.9% |
| 200 to 299 | 763 | 18.3% | 1120 | 20.1% |
| 300 to 499 | 1533 | 36.7% | 1539 | 27.6% |
| 500+ | 1037 | 24.8% | 1538 | 27.5% |
| **Census Region** |  |  |  |  |
| Midwest  | 957 | 22.9% | 1298 | 23.2% |
| Northeast | 1046 | 25.0% | 2047 | 36.7% |
| South | 1507 | 36.0% | 1668 | 29.9% |
| West | 671 | 16.1% | 573 | 10.3% |
|  |  |  |  |  |
| **Year** |  |  |  |  |
| 2011 | 237 | 5.7% | 1068 | 19.1% |
| 2012 | 783 | 18.7% | 953 | 17.1% |
| 2013 | 1252 | 29.9% | 967 | 17.3% |
| 2014 | 1181 | 28.3% | 1448 | 25.9% |
| 2015 | 728 | 17.4% | 1150 | 26.6% |

**Supplemental Table 4: Unadjusted Outcomes**

**Cesarean Section:**

|  |  |  |
| --- | --- | --- |
| **Variable** | **IV APAP (N = 4512)** | **Oral APAP (N = 24,612)** |
| Length of Stay | 3.6 Days (3.1) | 3.7 Days (3.6) |
| Total Morphine Consumption (MME) Per Day, Over Day 0 to Day 3, Mean (SD) | 7.2 mg (9.7) | 8.1 mg (12.6) |
| Admission to the ICU, N(%) | 19 (0.4%) | 83 (0.3%) |
| Total Pharmacy Costs (Winsorized at 2.5%), Mean (SD) | $2844 (4059) | $2685 (3644) |
| ORADE rate, N(%) | 41 (0.9%) | 297 (1.2%) |

**Hysterectomy:**

|  |  |  |
| --- | --- | --- |
| **Variable** | **IV APAP (N = 4181)** | **Oral APAP (N = 5586)** |
| Length of Stay | 2.0 Days (2.5) | 2.1 Days (3.7) |
| Total Morphine Consumption (MME) Per Day, Over Day 0 to Day 3, Mean (SD) | 13.4 mg (26.4) | 13.3 mg (27.4) |
| Admission to the ICU, N(%) | 39 (0.9%) | 55 (1.0%) |
| Total Pharmacy Costs (Winsorized at 2.5%), Mean (SD) | $3712 (6695) | $3336 (6065) |
| ORADE rate, N(%) | 196 (4.7%) | 200 (3.6%) |