**Derivation and validation of a Case-Mix Group based diagnostic score to predict 30-day death or urgent hospital readmission.**

**Carl van Walraven**1,2**,** MD, MSc is a senior scientist in Clinical Epidemiology at the Ottawa Hospital Research Institute (OHRI), adjunct scientist at the Institute for Clinical Evaluative Sciences (ICES), and associate professor of Medicine at the University of Ottawa. Email: carlv@ohri.ca

**Jenna Wong**, MSc is a methodologist in Clinical Epidemiology at OHRI and an analyst at ICES. Email: jewong@ohri.ca

**Alan J. Forster**1,2**,** MD, MSc is a senior scientist in Clinical Epidemiology at OHRI, adjunct scientist at ICES, and associate professor of Medicine at the University of Ottawa. Email: aforster@ohri.ca

1. Ottawa Hospital Research Institute and Institute for Clinical Evaluative Sciences, 1053 Carling Avenue, Ottawa, K1Y 4E9, Canada
2. Department of Medicine, University of Ottawa, 1053 Carling Avenue, Ottawa, K1Y 4E9, Canada

Corresponding author: Carl van Walraven; 1053 Carling Avenue, Administrative Services Building, 1st floor, Room 1003; Ottawa ON; K1Y 4E9; Phone: 613-761-4903; Fax: 613-761-5355; email: [carlv@ohri.ca](mailto:carlv@ohri.ca) (e-mail address to be published)

Abstract count: 272

Text count: 2809

Tables: 4

Figures: 4

**Abstract:**

**Background**: Between 5 and 10% of patients die or are urgently readmitted within 30 days of discharge from hospital. Readmission risk indexes have either excluded acute diagnoses or modeled them as multiple distinct variables. In this study, we derived and validated a score that summarized the influence of acute hospital diagnoses and procedures on 30-day death or urgent readmission.

**Methods:** From population-based hospital abstracts in Ontario, we randomly sampled 200 000 live-discharges between April 2003 and March 2009 and determined who were readmitted urgently and or died within 30 days of discharge. We used generalized estimating equation modeling in 100 000 patients to measure the adjusted association of each case-mix group (CMG) with 30-day death or urgent readmission. This was transformed to a score that was validated in the remaining 100 000 patients.

**Results:** Patients in the derivation set had one of 506 different CMGs and a 6.8% risk of 30-day death or urgent readmission. 47 CMG codes (more than half of which were directly related to chronic diseases) were independently associated with this outcome, creating a CMG score that ranged from -6 to 7 points. The CMG score was significantly associated with 30-day death or urgent readmission (unadjusted odds ratio for a 1 point increase in CMG score of 1.52 [95% CI 1.49-1.56]). Alone, the CMG score was only moderately discriminative (c-statistic 0.650 [0.644-0.656]); when added to a validated risk index for death or readmission, the c-statistic increased to 0.759 (0.753-0.765). The CMG score was well calibrated for 30-day death or readmission.

**Conclusions:** The influence of particular acute diagnoses and procedures on post-discharge outcomes can be quantified in the CMG score.

**Introduction:**

Early death or urgent readmission is common after patients are discharged from hospital. These events are undeniably important to patients and are expensive for the healthcare system. Being able to accurately predict who will die or get readmitted to hospital can help: direct extra care to those at greatest risk; risk-adjust analyses for which death or readmission is an outcome; and potentially identify mechanisms for early death or readmission.

We recently published a simple, externally validated scoring system to predict the risk that patients discharged from medical or surgical services die or are urgently readmitted within 30 days of discharge (1). The LACE index used values of a patient’s hospital length of stay (L), acuity of admission (A), comorbidity (C), and emergency room utilization prior to admission (E) to determine the expected risk of 30-day death or urgent readmission. It is relatively simple to calculate, works with both primary and administrative data, and was very well calibrated. However, it had only moderate discrimination (c-statistic of 69.4%).

Clinically, hospital diagnoses and procedures importantly influence post-discharge outcomes. Oddly enough, however, none of the twenty most common diagnoses or eleven most common procedures that we considered in our study was independently associated with death or urgent readmission independent of the other LACE index covariates. Two previously published validated risk prediction models for hospital readmission (with significantly larger sample sizes) found specific diagnoses that significantly predicted readmission (2;3). In these models, diagnoses were expressed as a categorical variable having as many as 71 categories.

Summarizing the influence of the reason for admission to hospital on post-discharge outcomes as a score has several advantages. First, such a score facilitates the comparing or ranking of various diagnoses on such outcomes. Second, entering *n* diagnoses in a statistical model requires at least *n-1* binary variables. This significantly increases the number of terms in the model (which could be problematic with limited sample sizes). A score lets analysts model the effect of admission diagnosis in as few as one term. Third, detecting interactions between admission diagnoses and other terms in the regression model is cumbersome when the former is expressed as multiple, distinct covariates. A score that summarizes the influence of admission diagnosis on post-discharge outcomes would greatly facilitate the analysis of such interactions.

In this study, we derived and validated a scoring system (or index) that summarized the influence of acute hospital diagnoses and procedures on 30-day death or urgent readmission.

**Methods:**

Our study methods are outlined in Figure 1. Our study was approved by The Ottawa Hospital Research Ethics Board.

***Datasets Used in the Study:***

This study used four population-based administrative databases that captured data on all Ontarians. The Discharge Abstract Database (DAD) records all non-psychiatric hospitalizations. The Ontario Mental Health Reporting System (OMHRS) captures all inpatient mental health encounters after 2006 (prior to which these hospitalizations were captured in DAD). The National Ambulatory Care Reporting System (NACRS) records all emergency room visits. The Registered Patient Database (RPDB) records all death dates.

***Study Cohort***

We used the DAD to create the study cohort. We first identified all adult medical or surgical patients discharged alive to the community between 1 April 2003 and 31 March 2009. We excluded psychiatric and obstetrical patients since the LACE score – the primary covariate in our models – did not apply to these patients. Our study period was chosen to ensure that we had NACRS data for at least 6 months prior to each admission (required to calculate the LACE score required for our analysis) and 30-day urgent readmission data in DAD and OMHRS for all patients. If a patient had more than one live hospital discharge during the study period, we randomly selected one. From this sample, we randomly selected 200 000 patients (100 000 for model derivation; 100 000 for model validation).

***LACE Index***

The LACE index estimates the risk of 30-day death or urgent readmission based on the values of 4 covariates from the index hospitalization: **L**ength of stay (in days); **A**cuity of the admission (categorized as urgent or planned); **C**omorbidity of the patient (measured using the Charlson score); and **E**mergency room utilization (measured as the number of visits to the emergency room in the 6 months prior to the index admission). A specific number of points are assigned to each covariate value and these points are summed to determine the total LACE score. The total LACE score indicates the expected risk of 30-day death or urgent readmission. The LACE score was moderately discriminative (69.4%) and well calibrated with 30-day death or urgent readmission.

As in our previous study, we measured the LACE score for all people in our study. The length of stay and urgency of each index hospitalization were noted from the DAD. We calculated each person’s Charlson score using the international classification of disease (ICD) codes cited by Quan et. al (4). Finally, we linked to NACRS to measure the number of visits to an emergency department in the 6 months prior to the index hospitalization.

***Case Mix Group (CMG)***

The Canadian Institute for Health Information (CIHI) has developed methods to categorize acute care inpatients with similar clinical and resource-utilization characteristics. These categories are called “Case Mix Groups” (CMG) and are based on that admission’s codes for the most responsible diagnosis and the primary procedure. In 2007, CIHI updated the CMG algorithm (known as ‘CMG+’) to group patients based on primary diagnoses using the ICD-10-CA system and primary procedures using Canadian Classification of Intervention codes. Minor revisions are made to this algorithm yearly (that is, patients with the same diagnostic and procedural codes may be assigned to different CMGs in different years). There are more than 500 distinct codes (Appendix A). For the primary analysis in this study, we used the 2008 CMG algorithm that was applied to all hospitalizations back to 2003. To represent each patient’s 2008 CMG value, we created a series of binomial (with values of 0 or 1) covariates for each 2008 CMG value in the derivation set.

***Outcome:***

The primary outcome was death or urgent readmission within 30 days of hospital discharge. Death status was determined by linking to RPDB. Urgent readmission status was determined by linking to DAD and OMHRS. Readmissions were included regardless of their diagnosis as long as they were categorized as ‘urgent’ (i.e. ‘unplanned’) and were not preceded by an earlier ‘non-urgent’ (i.e. ‘planned’) readmission.

***Analysis:***

100 000 patients were used to derive the CMG score model. We used generalized estimating equations (GEE) methods to determine the association of each CMG category with the risk of 30-day death or urgent readmission independent of each person’s LACE score. The GEE model clustered patients within hospitals and accounted for possible non-independence of such patients when calculating standard errors for the model’s parameter estimates.

For variable selection, we first excluded all CMGs whose association with the primary outcome (independent of the LACE score) had a p-value exceeding 0.05. Since the model could not generate a parameter estimate for CMGs having no events, we excluded 79 CMGs with no events and less than 50 admissions (i.e. < 0.05% of all admissions). Eleven CMGs having no events but more than 50 admissions were combined another clinically similar CMG (Appendix A). We then used forward variable selection (with an inclusion p-value of ≤0.001) to identify the CMGs significantly associated with 30-day death or urgent readmission independent of the LACE score and other CMGs.

We used the methods described by Sullivan et. al. (5)to modify parameter estimates for the CMG categories in the final model into a risk score. The number of points assigned to each statistically significant CMG covariate equaled its regression coefficient divided by the CMG parameter estimate having the smallest absolute value rounded to the nearest whole number. Each patient’s final “CMG Score” was the number of points assigned to their CMG. If a patient’s CMG was not included in the model, they received a CMG score of ‘0’.

We validated this CMG Score in the remaining 100 000 patients in a GEE logistic regression model with 30-day death or urgent readmission as the outcome and the CMG score as the independent variable. We repeated this model after adding the LACE index as a covariate.

We measured each model’s discrimination using the c-statistic with 95% confidence intervals (6). We measured calibration by comparing the expected to observed event risk within each CMG score. The expected outcome risk for each patient was calculated as the inverse of 1 + *e*-(intercept + β(LACE)\*Lace Score + β(CMG Score)\*CMG score) (where β was the coefficient of each covariate in the regression model). This was summed across all patients with the same CMG score to calculate the expected number of 30-day deaths or urgent readmissions in patients with each CMG score. The expected and observed rates were considered similar if the expected rate was within the exact 95% CI (7) around the observed rate. We summarized each model’s overall calibration using the Hosmer-Lemeshow statistic [7]. Finally, we assessed CMG score discrimination and calibration after stratifying by LACE score quartile.

As a secondary analysis, we refit these same models but used 30-day death and 30-day urgent readmission separately as separate outcomes. For a sensitivity analysis, we measured the ability of the CMG score to predict 30-day death or urgent readmission when the score was determined using the CMG code based on the discharge year algorithm (rather than the 2008 algorithm). We assessed discrimination and calibration separately in patients discharged between 2003 and 2006 (when the previous CMG grouping methodology was being used), in 2007, and in 2008.

**RESULTS:**

Figure 2 outlines the creation of the study cohort. Of approximately 6.5 million hospitalizations in Ontario during the study period, almost 3.3 million hospitalizations were eligible for the study. This sample included more than 1.8 million individuals, from which 200 000 were randomly selected for the study. These patients were discharged from one of 183 hospitals with each hospital contributing a median of 320 patients to the study (IQR 116-1827 patients).

***Study Cohort:***

The study cohort is described in Table 1. Patients were middle aged and one third had visited the emergency department in the previous six months. Most hospitalizations were less than a half a week in duration and had a median LACE score of 5 (which is associated with a predicted risk of 30-day death or urgent readmission of 5.1%). The derivation and validation group were essentially identical.

Patients in the derivation set were assigned one of 506 different CMGs (Appendix A) with the most common being hysterectomy without malignancy (CMG 502), unilateral knee replacement (CMG 321), and stable angina or chest pain without cardiac catheterization (CMG 208) (Table 1).

The overall risk of 30-day death or urgent readmission was 6.8% (Table 1). Most of these patients had an urgent readmission; only 0.7% of patients dying in the month post-discharge without a prior urgent readmission. The event rate was nearly identical in the derivation (6.8%) and the validation (6.7%) group.

***CMG Score Derivation:***

Ninety-one CMG groups (comprising 96 CMG codes) were individually associated with 30-day death or urgent readmission (Appendix A). When these variables were offered to the multivariable model, 47 CMG groups (comprising 50 individual CMG codes) remained in the final model (Table 2). Many of the CMGs associated with an increased risk of 30-day death or readmission were related to neoplasia, important chronic comorbidities, or diagnoses indicative of poor overall functional status. More than half of the categories dealt directly with chronic diseases (Table 2). All CMGs having a *decreased* risk of outcomes were therapeutic procedures. This model was modified into the CMG score that ranged from -6 to 7 (Table 2), with negative scores indicating CMGs that were protective for 30-day death or urgent readmission.

***CMG Score Validation:***

In the validation set, the CMG score had a modal distribution with 0 being the most common value (Figure 1). The CMG score was significantly associated with 30-day death or urgent readmission with an unadjusted odds ratio (OR) of 1.52 (95% CI 1.49-1.56) for a 1 point increase in the CMG score. This association persisted when the LACE score was added to the model (adjusted OR 1.34, 95% CI 1.31-1.36). The CMG score was also significantly associated with each outcome separately but the association was stronger with 30-day death (adjusted OR 1.55 [1.50-1.59]) than with urgent readmission (OR 1.28 [1.26-1.31]).

By itself, the CMG score was only moderately discriminative for predicting 30-day death or urgent readmission (c-statistic 0.650, 95% CI 0.644-0.656) (Table 3). However, adding the CMG score significantly improved the performance of the LACE index, significantly increasing the c-statistic from 0.735 (0.729-0.741) to 0.759 (0.753-0.765). The CMG score was well calibrated since the expected event rate within the confidence intervals of the observed rate in 11 of the 14 CMG scores (78.5%) (Figure 3). Model calibration improved when stratified by quartiles of the LACE score with the expected event rate falling within the confidence intervals of the observed rates in 50 of 56 (89.3%) strata.

The CMG score alone was also only moderately discriminative for 30-day urgent readmission, but was very discriminative for 30-day death (Table 3). The discrimination of the CMG score for each outcome separately improved with the addition of the LACE index and was significantly better than that of the LACE alone (as observed with the primary outcome).

***Sensitivity Analysis:***

When the CMG code was assigned based on the algorithm of the discharge year (rather than the 2008 algorithm), the discrimination of the CMG score (both alone and combined with the LACE index) for predicting 30-day death or urgent readmission was similar for discharges occurring in 2007 and 2008 (Table 4). However, for discharges occurring before 2007, the discrimination was notably lower for the CMG score alone and slightly (but still significantly) lower when the LACE index was added to the model (Table 4).

**DISCUSSION:**

In this study of patients discharged from medical or surgical hospital services, we identified the Case Mix Groups (CMGs) that were associated with risk of 30-day death or urgent readmission independent of a validated risk index. Those CMGs that increased the risk of these outcomes indicated neoplastic processes, other important chronic diseases, and poor overall function; only procedure-related CMGs were protective. When expressed as a single index, the CMG score was significantly associated with 30-day death or readmission independent of the LACE index. When added, the CMG significantly improved the LACE’s ability to predict the risk of early post-discharge death or urgent readmission.

The CMG score efficiently summarized the effect of a large number of diagnostic and procedural groups on post-discharge outcomes. We identified those CMGs whose association with 30-day death or urgent readmission was beyond that from factors known to influence this outcome (including length of stay, hospitalization acuity, patient comorbidity, and pre-admission emergency room utilization). We also quantified this association with a score.

The CMG score has several advantages for researchers. It reduces the independent influence of acute hospitalization conditions on post-discharge outcomes to a single number. This simplifies regression modeling by decreasing the number of parameters required to capture important confounders. This is especially important when study sample size is limited and model over-fitting is a concern. Reducing the influence of multiple conditions to a single number also simplifies the search for interactions between acute conditions and other model covariates. The CMG score can be used to adjust for potential confounding whenever Canadian administrative data are used to examine early death or unplanned hospital readmission.

Our study has several advantages and limitations. Since we used a population-based, random sample to derive our model, it will be applicable to other medical and surgical patients hospitalized in Ontario. We believe that the results should be applicable to other provinces but this should be established before the CMG score is widely applied to data from other Canadian provinces. Second, because our study used CMG codes to cluster acute diagnoses and procedures, our index can only be used with abstract data that have been grouped using CIHI’s CMG classifier. This means that researchers from other countries will need to derive their own acute diagnosis score. Third, we derived the CMG score using the 2008 CMG algorithm. Our sensitivity analysis showed that the CMG score worked as well when applied with the score using the 2007 algorithm. However, the CMG score was not as discriminative when applied using CMG algorithms prior to 2007. This is likely due to CIHI using a substantially different CMG algorithm prior to this year that was based on ICD-9-CM codes translated to ICD-10-CA. These results show that our algorithm will likely apply to future CMG algorithms as long as it contains no large methodological shifts. Annual testing of the CMG score with new CMG algorithms will be required to ensure its applicability.

This study derived and validated an index that quantifies the influence of particular acute diagnoses and procedures on post-discharge outcomes.

**Author Contributions**

Carl van Walraven conceived the project idea, wrote the study protocol, directed the study analysis, wrote the first draft of the paper, and is the guarantor for the study. Jenna Wong conducted the statistical analysis, produced the tables and figures, and contributed to the writing and editing of the manuscript. Alan Forster helped guide the analysis and interpretation of the study results, and also critically reviewed the paper for intellectual content. All authors have read and approved the final version of the manuscript.

**Competing Interests**

All authors declare no competing interests.

**Acknowledgements**

This study was funded by the Department of Medicine, University of Ottawa.

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**Figure 1:** Outline of study methods.

A. Randomly selected 200 000 distinct adults discharged live from hospital to community from a medical or surgical service.

B. Determined covariate values (LACE score and CMG) and outcome status (30-day death or urgent readmission) for each patient.

C. Used GEE modeling to identify CMGs that are significantly associated with outcome independent of LACE score, clustered by index hospital.

D. Modified model from C into Point system. Measured discrimination and calibration of CMG score in validation group.

**Figure 2**: Outline for creation of study cohort

All discharges from acute care hospitals in Ontario between 1 April 2003 and 31 March 2009

(6 516 313)

Patient died in hospital (261 336)

Patient < 18 years of age (1 296 820)

Psychiatric and obstetrical admissions

(1 021 732)

Patient discharged to long-term care, rehabilitation, or other hospital (656 011)

Patient ineligible for OHIP coverage at discharge or during 30-day period following discharge (3 381)

Eligible hospitalizations

(3 277 033)

Randomly selected 1 admission per person

(n=1 851 930)

Randomly select 200 000 admissions:

**FINAL COHORT**

**EXCLUSIONS**

**Figure 3:** CMG score distribution and its association with 30-day death or urgent readmission in the validation cohort.



The bars present the number of people in the validation cohort (left vertical axis) with each CMG score (horizontal axis). The grey line presents the expected risk of 30-day death or urgent readmission (right vertical axis). The black line presents the observed event rate (right vertical axis) with 95% confidence intervals calculated using exact methods (7). “x” indicates CMG strata where the expected rate excludes the 95% confidence interval of the observed rate.

**Figure 4.** Calibration of CMG score for 30-day death or urgent readmission by LACE index strata.



These plots present the observed (black line) and expected (grey line) risk of 30-day death or urgent readmission (vertical axis) by CMG score (horizontal axis) for quartiles of LACE score in the validation set (top title of each plot). The observed rates are presented with 95% confidence intervals calculated using exact methods (7). The stars indicate strata where the 95% confidence interval around the observed rate excludes the expected rate. The c-statistic of the model within each LACE quartile is presented in the top left corner.

**Table 1**: Description of study cohort.

|  |  |  |  |
| --- | --- | --- | --- |
| **Factor\*** | **Overall**  **(n= 200,000)** | **Derivation (n=100,000)** | **Validation (n=100,000)** |
| Mean Age (SD) | 57.9 (18.4) | 58.0 (18.5) | 57.9 (18.4) |
| Female | 103 709 (51.9) | 52 087 (52.1) | 51 622 (51.6) |
| **Lace Index:** |  |  |  |
| - Median Length of Stay (IQR) | 3 (1-5) | 3 (1-5) | 3 (1-5) |
| - Emergent hospitalization | 128 777 (64.4) | 64 407 (64.4) | 64 370 (64.4) |
| - Charlson Index > 0 | 49 611 (24.8) | 24 816 (24.8) | 24 795 (24.8) |
| - At least 1 ED visit in previous 6 months | 75 148 (37.6) | 37 835 (37.8) | 37 313 (37.3) |
| - Median LACE score (IQR) | 5 (4-8) | 5 (4-8) | 5 (4-8) |
| **Ten most common CMGs (CMG number)** | |  |  |
| - Hysterectomy without malignancy (502) | 8 423 (4.2) | 4 249 (4.2) | 4 174 (4.2) |
| - Unilateral knee replacement (321) | 4631 (2.3) | 2 303 (2.3) | 2 328 (2.3) |
| - Stable angina/chest pain without cath. (208) | 4 423 (2.2) | 2 189 (2.2) | 2 234 (2.2) |
| - Chronic obstructive pulmonary disease (139) | 4 093 (2.0) | 2 067 (2.1) | 2 026 (2.0) |
| - Arrhythmia without cardiac cath. (202) | 3 481 (1.7) | 1 689 (1.7) | 1 792 (1.8) |
| - Viral/unspecified pneumonia (138) | 3 396 (1.7) | 1 710 (1.7) | 1 686 (1.7) |
| - Symptom/sign of digestive system (257) | 3 372 (1.7) | 1 692 (1.7) | 1 680 (1.7) |
| - Non-severe enteritis (249) | 3 168 (1.6) | 1 564 (1.6) | 1 604 (1.6) |
| - Heart failure without cardiac cath. (196) | 3 087 (1.5) | 1 564 (1.6) | 1 523 (1.5) |
| - Simple appendectomy (234) | 3 033 (1.5) | 1 539 (1.5) | 1 494 (1.5) |
| **Outcomes:** |  |  |  |
| - 30-day death or urgent readmission | 13 553 (6.8) | 6 822 (6.8) | 6 731 (6.7) |
| - Urgent readmission in 30 days | 12 126 (6.1) | 6 113 (6.1) | 6 013 (6.0) |
| - Death in 30 days† | 1427 (0.7) | 709 (0.7) | 718 (0.7) |

cath. = catheterization

\* unless otherwise indicated, the number (proportion, %) is provided.

† not preceded by an urgent readmission post-discharge

**Table 2:** CMG Risk Score model

|  |  |  |  |
| --- | --- | --- | --- |
| **Factor** | **Parameter Estimate** | **Adjusted Odds Ratio**  **(95% CI)** | **Points** |
| **LACE score** | 0.21 | 1.23 (1.22-1.24) | - |
| **CMG group (CMG number):** |  |  |  |
| Ectopic Pregnancy treated Medically (547) | 2.261 | 9.59 (4.26-21.6) | 7 |
| *aMalignant Neoplasm of Other Site (630)* | 2.162 | 8.69 (5.25-14.4) | 7 |
| Management of Nervous System Device/Other Minor Intervention (011) | 2.048 | 7.76 (4.27-14.1) | 7 |
| *aAcute Myeloid Leukemia (624)* | 2.018 | 7.52 (3.96-14.3) | 6 |
| *aHepatobiliary/Pancreatic Malignancy (284)* | 1.959 | 7.09 (5.40-9.30) | 6 |
| *bPalliative Care (810)* | 1.635 | 5.13 (3.25-8.10) | 5 |
| *aLymphoma (628)* | 1.523 | 4.59 (3.07-6.86) | 5 |
| *aDigestive Malignancy (250)* | 1.521 | 4.58 (3.45-6.08) | 5 |
| bDehydration (438) | 1.456 | 4.29 (3.12-5.90) | 5 |
| *dOrgan Transplant with Trauma/Complication of Treatment (725)* | 1.435 | 4.20 (4.04-4.37) | 5 |
| *aOther Leukemia (626)* | 1.397 | 4.04 (2.33-7.02) | 4 |
| *aNeoplasm of Central Nervous System (038)* | 1.397 | 4.04 (2.58-6.32) | 4 |
| *aMalignant Neoplasm of Respiratory System* *(132)* | 1.357 | 3.88 (3.14-4.80) | 4 |
| *aMusculoskeletal Malignant Neoplasm (357)* | 1.328 | 3.77 (2.61-5.47) | 4 |
| *aMalignant Neoplasm of Urinary System (478)* | 1.279 | 3.59 (1.94-6.64) | 4 |
| Cancelled Intervention (815) | 1.218 | 3.38 (2.07-5.51) | 4 |
| *cCirrhosis/Alcoholic Hepatitis (285)* | 1.090 | 2.98 (2.24-3.95) | 3 |
| *aChemotherapy/Radiotherapy Session for Neoplasm (638)* | 1.072 | 2.92 (1.79-4.77) | 3 |
| *Other Anemia (635)* | 0.942 | 2.57 (1.97-3.34) | 3 |
| *cOther Lung Disease (142)* | 0.887 | 2.43 (1.70-3.46) | 3 |
| Pituitary/Pineal Gland Intervention (420) | 0.870 | 2.39 (1.47-3.88) | 3 |
| Deep Vein Thrombophlebitis (211) | 0.859 | 2.36 (1.46-3.81) | 3 |
| bAspiration Pneumonia (135) | 0.858 | 2.36 (1.48-3.76) | 3 |
| Minor Upper Gastrointestinal Intervention (231) | 0.834 | 2.30 (1.55-3.41) | 3 |
| *cHeart Failure without Cardiac Catheter (196)* | 0.790 | 2.20 (1.94-2.50) | 3 |
| bOther Factor Causing Hospitalization (812) | 0.771 | 2.16 (1.41-3.33) | 2 |
| Symptom/Sign of Digestive System (257) | 0.684 | 1.98 (1.67-2.35) | 2 |
| Other Gastrointestinal Disorder (258) | 0.656 | 1.93 (1.48-2.50) | 2 |
| *Myocardial Infarction/Shock/Arrest without Cardiac Catheter (194)* | 0.644 | 1.90 (1.54-2.35) | 2 |
| General Symptom/Sign (811) | 0.634 | 1.89 (1.46-2.44) | 2 |
| Gastrointestinal Obstruction (255) | 0.626 | 1.87 (1.52-2.30) | 2 |
| *dCoronary Artery Bypass Graft with Cardiac Catheter without MI/Shock/Arrest without Pump (169)* | 0.607 | 1.83 (1.51-2.23) | 2 |
| Disorder of Biliary Tract (288) | 0.605 | 1.83 (1.42-2.36) | 2 |
| *cRenal Failure (477)* | 0.579 | 1.78 (1.41-2.25) | 2 |
| *cChronic Obstructive Pulmonary Disease (139)* | 0.562 | 1.75 (1.54-2.00) | 2 |

aNeoplasia-related hospitalization

bHospitalization potentially indicative of overall poor functional status

cHospitalization related to important chronic comorbidity

dProcedure-related hospitalization

(Table 2 cont’d)

|  |  |  |  |
| --- | --- | --- | --- |
| **Factor** | **Parameter Estimate** | **Adjusted Odds Ratio**  **(95% CI)** | **Points** |
| Arrhythmia without Cardiac Catheter (202) | 0.373 | 1.45 (1.22-1.73) | 1 |
| *dCoronary Artery Bypass Graft without Cardiac Catheter without MI/Shock/Arrest with/without Pump (172)* | -0.314 | 0.73 (0.62-0.87) | -1 |
| *dUnilateral Knee Replacement (321)* | -0.647 | 0.52 (0.38-0.73) | -2 |
| dHysterectomy with Non Malignant Diagnosis (502) | -0.656 | 0.52 (0.40-0.67) | -2 |
| dReduction/Fixation/Repair of Ankle/Foot (747) | -1.057 | 0.35 (0.22-0.54) | -3 |
| dComplicated Appendectomy (233) | -1.197 | 0.30 (0.16-0.56) | -4 |
| dSimple Appendectomy (234) | -1.220 | 0.30 (0.18-0.48) | -4 |
| dReduction/Fixation/Repair Upper Body/Limb except Fixation/Repair of Shoulder (739) | -1.411 | 0.24 (0.11-0.54) | -4 |
| dReplacement/Fixation/Repair of Tibia/Fibula/Knee (729) | -1.589 | 0.20 (0.11-0.39) | -5 |
| dThyroid/Parathyroid/Thymus Gland Intervention (424) | -1.728 | 0.18 (0.08-0.41) | -6 |
| dOther Intervention on Bone of Upper Body with Trauma/Complication of Treatment (743); Muscle/Tendon/Minor Joint Intervention with Trauma/Complication of Treatment, Lower Limb (744); Nerve Intervention with Trauma (745); Muscle/Tendon/Minor Joint Intervention with Trauma/Complication of Treatment, Upper Limb (750) | -1.819 | 0.16 (0.06-0.44) | -6 |
| *dAngina (except Unstable)/Chest Pain with Cardiac Catheter (207)* | -2.004 | 0.13 (0.06-0.33) | -6 |

CMG categories that are directly related to chronic diseases have been italicized.

aNeoplasia-related hospitalization

bHospitalization potentially indicative of overall poor functional status

cHospitalization related to important chronic comorbidity

dProcedure-related hospitalization

**Table 3:** Predictive performance of the LACE index and the CMG score\*

|  |  |  |  |
| --- | --- | --- | --- |
| **OUTCOME** | **PREDICTOR(S)** | **DISCRIMINATION C-STATISTIC**  **(95% CI)** | **CALIBRATION**  **H-L STATISTIC**  **(*p*-value)** |
| 30-day death or urgent readmission | CMG score | 0.650 (0.644-0.656) | 15.11 (0.0569) |
| LACE index | 0.735 (0.729-0.741) | 21.19 (0.0067) |
| CMG score + LACE index | 0.759 (0.753-0.765) | 40.14 (<.0001) |
| 30-day death | CMG score | 0.739 (0.727-0.750) | 17.88 (0.0222) |
| LACE index | 0.818 (0.808-0.828) | 13.31 (0.1017) |
| CMG score + LACE index | 0.858 (0.849-0.867) | 27.92 (0.0005) |
| 30-day urgent readmission | CMG score | 0.637 (0.631-0.643) | 20.72 (0.0079) |
| LACE index | 0.720 (0.713-0.726) | 34.73 (<.0001) |
| CMG score + LACE index | 0.743 (0.736-0.749) | 57.18 (<.0001) |

CI = confidence interval; H-L = Hosmer-Lemeshow

\*In all models, the CMG score was assigned using the CMG code based on the 2008 algorithm

**Table 4.** Predictive performance of the CMG score for 30-day death or urgent readmission using the CMG code assigned in the discharge year\*

|  |  |  |  |
| --- | --- | --- | --- |
| **DISCHARGE YEAR** | **PREDICTOR(S)** | **DISCRIMINATION C-STATISTIC**  **(95% CI)** | **CALIBRATION**  **H-L STATISTIC**  **(*p*-value)** |
| 2008 | CMG score | 0.650 (0.636-0.665) | 10.30 (0.2448) |
| LACE index + CMG score | 0.757 (0.743-0.772) | 13.79 (0.0875) |
| 2007 | CMG score | 0.655 (0.640-0.670) | 9.49 (0.3030) |
| LACE index + CMG score | 0.762 (0.747-0.777) | 5.21 (0.7351) |
| 2003-2006 | CMG score | 0.507 (0.504-0.510) | 4.01 (0.8566) |
| LACE index + CMG score | 0.735 (0.728-0.742) | 19.34 (0.0131) |

CI = confidence interval; H-L = Hosmer-Lemeshow

**\***Prior to 2007, CMG codes were assigned using the CMG/Plx methodology. In 2007, a new methodology (CMG+) was implemented to assign CMG codes. Minor revisions are made to the CMG+ methodology yearly.

**APPENDIX A. Univariate association (independent of the LACE index) of each Case Mix Group (CMG) with 30-day death or urgent readmission**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CMG code** | **Description** | **Number of admissions** | **Number of events** | **Adjusted odds ratio\***  **(95% CI\*\*)** | ***p-*value** |
| 001 | Intracranial Vessel Intervention except Extraction, Open Approach | 34 | 0 | - | - |
| 002 | Intracranial Vessel Intervention except Extraction, Percutaneous Approach | 42 | 1 | 0.23 (0.03-1.68) | 0.1486 |
| 003 | Other Vascular Intervention with Nervous System Diagnosis | 59 | 5 | 1.83 (0.75-4.49) | 0.1855 |
| 004 | Craniotomy for Drainage | 7 | 1 | 0.63 (0.05-7.57) | 0.7156 |
| 005 | Insertion of Shunt/Brain Monitor | 51 | 3 | 0.70 (0.33-1.50) | 0.3584 |
| 006 | Cranium Intervention | 63 | 5 | 1.08 (0.36-3.23) | 0.8863 |
| 007 | Thoracic/Major Intervention on Spine/Spinal Canal/Vertebra | 78 | 2 | 0.45 (0.12-1.62) | 0.2194 |
| 008 | Other Site/Non-Major Intervention on Spine/Spinal Canal/Vertebra | 107 | 2 | 0.46 (0.11-1.89) | 0.2846 |
| 009 | Excision/Repair of Brain | 191 | 15 | 1.09 (0.78-1.53) | 0.6035 |
| 010 | Drainage/Release of Brain | 70 | 6 | 1.27 (0.43-3.73) | 0.6606 |
| 011 | Management of Nervous System Device/Other Minor Intervention | 51 | 16 | 6.76 (3.61-12.65) | <.0001 |
| 012 | Open Carotid Endarterectomy | 186 | 7 | 1.06 (0.49-2.26) | 0.8886 |
| 013 | Major Nerve Intervention or Intervention on other Site | 41 | 0 | - | - |
| 014 | Non-Major Intervention on Nerve | 10 | 0 | - | - |
| 023 | Parkinson's Disease/Other Parkinsonian Disorder | 60 | 8 | 1.09 (0.50-2.36) | 0.8347 |
| 024 | Other Degenerative Disease of Nervous System | 51 | 9 | 2.17 (1.00-4.71) | 0.0502 |
| 025 | Hemorrhagic Event of Central Nervous System | 137 | 12 | 0.92 (0.46-1.83) | 0.8144 |
| 026 | Ischemic Event of Central Nervous System | 477 | 46 | 0.87 (0.60-1.24) | 0.4327 |
| 027 | Cerebrovascular Disorder | 71 | 7 | 1.14 (0.53-2.45) | 0.7292 |
| 028 | Unspecified Stroke | 398 | 29 | 0.73 (0.50-1.07) | 0.1065 |
| 029 | Transient Ischemic Attack | 444 | 22 | 0.67 (0.43-1.05) | 0.0819 |
| 030†, 031 | Viral Meningitis (030); Meningitis except Viral (031) | 111 | 4 | 0.47 (0.20-1.13) | 0.0932 |
| 032 | Infection/Inflammation of Central Nervous System except Meningitis | 53 | 4 | 0.58 (0.21-1.60) | 0.2942 |
| 033 | Neuropathy/Polyneuropathy | 39 | 5 | 1.17 (0.44-3.07) | 0.7532 |
| 034 | Other Disorder of Nerve | 92 | 8 | 1.03 (0.44-2.41) | 0.9541 |
| 035 | Neuromuscular Disorder | 20 | 2 | 0.73 (0.19-2.83) | 0.6453 |
| 036 | Multiple Sclerosis/Demyelinating Disorder | 73 | 4 | 0.57 (0.20-1.62) | 0.2918 |
| 037 | Other Dysfunction of Central Nervous System | 218 | 18 | 0.91 (0.50-1.64) | 0.7514 |
| 038 | Neoplasm of Central Nervous System | 137 | 45 | 3.09 (1.91-4.99) | <.0001 |
| 039 | Status Epilepticus | 27 | 3 | 1.18 (0.27-5.09) | 0.8269 |
| 040 | Seizure Disorder, except Status Epilepticus | 536 | 47 | 1.25 (0.88-1.78) | 0.2183 |
| 041 | Migraine/Other Headache | 201 | 13 | 1.08 (0.63-1.84) | 0.7734 |
| 042 | Other Disorder of Central Nervous System | 100 | 9 | 1.03 (0.47-2.29) | 0.9386 |
| 050 | Orbit/Eyeball Intervention | 50 | 2 | 1.28 (0.30-5.45) | 0.7380 |
| 051 | Lens Extraction/Insertion | 39 | 0 | - | - |
| 052 | Vitrectomy | 178 | 4 | 0.69 (0.31-1.56) | 0.3754 |
| 053 | Extraocular Intervention except Lacrimal System | 22 | 1 | 1.86 (0.24-14.15) | 0.5505 |

\*Adjusted for the LACE index. Adjusted odds ratios not presented for CMGs with no events and fewer than 50 admissions (these CMGs were excluded from consideration in the final multivariable model).

\*\*CI = confidence interval

†CMG with no events and 50 or more admissions that was combined with another clinically similar CMG

‡CMG with 1 admission and 1 event that was combined with another clinically similar CMG

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CMG code** | **Description** | **Number of admissions** | **Number of events** | **Adjusted odds ratio\***  **(95% CI\*\*)** | ***p-*value** |
| 054 | Sclera/Choroid/Retina Intervention without Vitrectomy | 56 | 1 | 0.64 (0.20-2.07) | 0.4614 |
| 055 | Lacrimal System Intervention | 4 | 0 | - | - |
| 056 | Other Ophthalmic Intervention | 26 | 1 | 0.82 (0.15-4.47) | 0.8138 |
| 063 | Inflammation of Orbit | 23 | 0 | - | - |
| 064 | Major Ophthalmology Disorder | 30 | 3 | 1.58 (0.50-5.05) | 0.4393 |
| 065 | Other Ophthalmology Disorder | 62 | 2 | 0.57 (0.15-2.08) | 0.3901 |
| 070 | Cochlear Implant | 24 | 0 | - | - |
| 071 | Radical Excision of Head and Neck | 37 | 3 | 0.57 (0.18-1.78) | 0.3320 |
| 072 | Temporomandibular Joint Implant | 4 | 0 | - | - |
| 073 | Oropharynx Excision | 17 | 0 | - | - |
| 074 | Lymphatic Intervention with Ear/Nose/Throat Diagnosis | 77 | 1 | 0.24 (0.04-1.45) | 0.1203 |
| 075 | Larynx/Trachea Intervention with Ear/Nose/Throat Diagnosis | 19 | 0 | - | - |
| 076 | Artery Occlusion for Epistaxis | 7 | 0 | - | - |
| 077 | Partial Excision Musculoskeletal Tissue of Head | 30 | 0 | - | - |
| 078 | Other Musculoskeletal Intervention on Head | 341 | 2 | 0.27 (0.07-1.09) | 0.0656 |
| 079 | External Ear Intervention | 13 | 0 | - | - |
| 080†, 082 | Other Ear Intervention (080); Mastoid Intervention (082) | 147 | 1 | 0.35 (0.05-2.70) | 0.3140 |
| 081 | Hard/Soft Palate/Gingiva Intervention | 22 | 0 | - | - |
| 083 | Ear/Nose/Throat Gland Intervention | 156 | 3 | 0.99 (0.33-2.92) | 0.9809 |
| 084 | Sinus Intervention | 116 | 4 | 1.63 (0.57-4.66) | 0.3640 |
| 085 | Glottis Intervention | 12 | 0 | - | - |
| 086 | Oral Cavity/Pharynx Intervention | 301 | 6 | 0.75 (0.37-1.54) | 0.4352 |
| 087 | Nose/Nasal Cartilage Intervention | 206 | 6 | 1.63 (0.73-3.63) | 0.2325 |
| 088 | Skin Intervention with Ear/Nose/Throat Diagnosis | 21 | 0 | - | - |
| 094 | Ear/Nose/Throat Malignancy | 69 | 12 | 2.14 (1.10-4.16) | 0.0244 |
| 095 | Sleep Apnea | 19 | 1 | 0.40 (0.05-3.06) | 0.3787 |
| 096 | Epiglottitis | 36 | 1 | 0.43 (0.05-3.35) | 0.4187 |
| 097 | Influenza/Acute Upper Respiratory Infection | 86 | 8 | 1.47 (0.72-2.99) | 0.2937 |
| 098 | Dysequilibrium/Hearing Loss | 464 | 19 | 0.59 (0.39-0.90) | 0.0149 |
| 099 | Epistaxis | 102 | 6 | 0.69 (0.32-1.51) | 0.3523 |
| 100 | Sinusitis | 24 | 0 | - | - |
| 101 | Disease of Oral Cavity/Salivary Gland/Jaw | 101 | 2 | 0.34 (0.08-1.44) | 0.1435 |
| 102 | Otitis Media with/without Ventilation Tube | 5 | 0 | - | - |
| 103 | Tonsillitis/Pharyngitis | 278 | 3 | 0.23 (0.08-0.72) | 0.0112 |
| 104 | Croup | 3 | 0 | - |  |
| 105 | Miscellaneous Ear/Nose/Throat Disorder | 77 | 4 | 0.83 (0.29-2.37) | 0.7247 |
| 110 | Lung Transplant | 6 | 0 | - | - |
| 111 | Open Intrapericardial Lung Resection | 9 | 1 | 2.73 (0.41-18.08) | 0.2990 |
| 112 | Open Thoracic Lung Resection | 321 | 17 | 0.79 (0.50-1.22) | 0.2870 |
| 113 | Pleurectomy | 50 | 3 | 0.43 (0.12-1.52) | 0.1912 |
| 114 | Endoscopic Lung Resection | 89 | 3 | 0.54 (0.18-1.65) | 0.2793 |
| 115 | Respiratory Biopsy/Inspection | 83 | 14 | 2.00 (1.12-3.56) | 0.0192 |
| 116 | Pleurodesis | 11 | 1 | 0.93 (0.11-7.93) | 0.9465 |
| 117 | Other Respiratory Intervention | 71 | 13 | 1.73 (0.85-3.50) | 0.1288 |
| 118 | Bone Intervention with Respiratory Diagnosis | 5 | 0 | - | - |
| 119 | Lymph Node Excision/Biopsy with Respiratory Diagnosis | 19 | 3 | 1.18 (0.38-3.61) | 0.7734 |
| 120 | Other Intervention with Respiratory Diagnosis | 13 | 4 | 4.84 (1.53-15.32) | 0.0074 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CMG code** | **Description** | **Number of admissions** | **Number of events** | **Adjusted odds ratio\***  **(95% CI\*\*)** | ***p-*value** |
| 130 | Respiratory Failure | 101 | 22 | 1.39 (0.87-2.21) | 0.1648 |
| 131 | Failure/Rejection Lung Transplant | 1 | 0 | - | - |
| 132 | Malignant Neoplasm of Respiratory System | 461 | 176 | 2.89 (2.32-3.59) | <.0001 |
| 133 | Infectious/Parasitic Disease of Respiratory System | 29 | 0 | - | - |
| 134 | Respiratory Tuberculosis | 19 | 0 | - | - |
| 135 | Aspiration Pneumonia | 114 | 23 | 1.83 (1.14-2.96) | 0.0126 |
| 136 | Bacterial Pneumonia | 114 | 12 | 1.01 (0.55-1.84) | 0.9859 |
| 137 | Bacterial Disease of Respiratory System | 11 | 1 | 0.50 (0.06-4.14) | 0.5177 |
| 138 | Viral/Unspecified Pneumonia | 1710 | 167 | 1.00 (0.85-1.17) | 0.9717 |
| 139 | Chronic Obstructive Pulmonary Disease | 2067 | 283 | 1.42 (1.24-1.62) | <.0001 |
| 140 | Bronchiectasis | 28 | 2 | 0.73 (0.17-3.16) | 0.6779 |
| 141 | Upper/Lower Respiratory Infection | 96 | 5 | 0.58 (0.24-1.40) | 0.2270 |
| 142 | Other Lung Disease | 218 | 46 | 1.88 (1.30-2.72) | 0.0008 |
| 143 | Disease of Pleura | 142 | 24 | 1.43 (0.90-2.27) | 0.1293 |
| 144 | Pneumothorax | 99 | 7 | 0.93 (0.43-1.99) | 0.8421 |
| 145 | Postprocedural Respiratory Disorder | 102 | 5 | 0.61 (0.21-1.75) | 0.3539 |
| 147 | Asthma | 466 | 17 | 0.50 (0.30-0.81) | 0.0049 |
| 148 | Other Respiratory Disorder | 94 | 10 | 1.29 (0.71-2.36) | 0.4086 |
| 149 | Symptom/Sign of Respiratory System | 237 | 23 | 1.21 (0.82-1.80) | 0.3394 |
| 160 | Heart or Lung Transplant | 2 | 1 | 2.83 (0.15-55.12) | 0.4925 |
| 161 | Implantation of Cardioverter/Defibrillator | 108 | 6 | 0.57 (0.27-1.20) | 0.1381 |
| 162 | Cardiac Valve Replacement | 386 | 38 | 1.13 (0.91-1.39) | 0.2621 |
| 163 | Major Cardiothoracic Intervention with Pump | 26 | 1 | 0.58 (0.07-4.85) | 0.6172 |
| 164 | Major Cardiothoracic Intervention without Pump | 30 | 2 | 0.71 (0.24-2.11) | 0.5409 |
| 165 | Cardiac Valve Repair except Percutaneous Transluminal Approach | 100 | 5 | 0.61 (0.34-1.07) | 0.0864 |
| 166 | Coronary Artery Bypass Graft with Cardiac Catheter with MI/Shock/Arrest with Pump | 91 | 9 | 0.60 (0.31-1.19) | 0.1433 |
| 167 | Coronary Artery Bypass Graft with Cardiac Catheter with MI/Shock/Arrest without Pump | 27 | 3 | 0.65 (0.24-1.76) | 0.3923 |
| 168 | Coronary Artery Bypass Graft with Cardiac Catheter without MI/Shock/Arrest with Pump | 90 | 8 | 0.64 (0.35-1.16) | 0.1447 |
| 169 | Coronary Artery Bypass Graft with Cardiac Catheter without MI/Shock/Arrest without Pump | 28 | 4 | 1.45 (1.16-1.83) | 0.0014 |
| 170 | Coronary Artery Bypass Graft without Cardiac Catheter with MI/Shock/Arrest with Pump | 134 | 12 | 0.64 (0.31-1.31) | 0.2169 |
| 171 | Coronary Artery Bypass Graft without Cardiac Catheter with MI/Shock/Arrest without Pump | 21 | 1 | 0.37 (0.11-1.31) | 0.1245 |
| 172 | Coronary Artery Bypass Graft without Cardiac Catheter without MI/Shock/Arrest with/without Pump | 963 | 51 | 0.59 (0.50-0.70) | <.0001 |
| 173 | Minor Cardiothoracic Intervention | 20 | 2 | 1.29 (0.30-5.42) | 0.7321 |
| 174 | Pacemaker Implantion/Removal Except Cardioverter/Defibrillator Implant | 612 | 32 | 0.59 (0.42-0.84) | 0.0035 |
| 175 | Percutaneous Coronary Intervention with MI/Shock/Arrest/Heart Failure | 1008 | 59 | 0.68 (0.55-0.83) | 0.0002 |
| 176 | Percutaneous Coronary Intervention without MI/Shock/Arrest/Heart Failure | 1390 | 54 | 0.79 (0.58-1.07) | 0.1330 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CMG code** | **Description** | **Number of admissions** | **Number of events** | **Adjusted odds ratio\***  **(95% CI\*\*)** | ***p-*value** |
| 177 | Management of Pacemaker/Epicardial Lead | 38 | 0 | - | - |
| 178 | Percutaneous Transluminal Cardiothoracic Intervention except Percutaneous Coronary Intervention | 75 | 6 | 1.03 (0.53-1.99) | 0.9337 |
| 179 | Cardiac Conduction System Intervention | 286 | 5 | 0.63 (0.26-1.52) | 0.2988 |
| 180 | Amputation of Limb except Hand/Foot | 12 | 2 | 1.13 (0.38-3.38) | 0.8256 |
| 181 | Abdominal Aorta Intervention | 305 | 15 | 0.75 (0.42-1.33) | 0.3249 |
| 182 | Bypass/Extraction of Vein/Artery of Limb | 235 | 23 | 1.40 (0.93-2.11) | 0.1117 |
| 183 | Amputation of Hand/Foot | 21 | 3 | 1.39 (0.31-6.12) | 0.6655 |
| 184 | Vein Ligation/Stripping | 21 | 0 | - | - |
| 185 | Other/Miscellaneous Vascular Intervention | 170 | 14 | 1.40 (0.70-2.84) | 0.3435 |
| 193 | Myocardial Infarction/Shock/Arrest with Cardiac Catheter | 589 | 44 | 0.77 (0.57-1.03) | 0.0758 |
| 194 | Myocardial Infarction/Shock/Arrest without Cardiac Catheter | 1100 | 165 | 1.53 (1.23-1.90) | 0.0001 |
| 195 | Heart Failure with Cardiac Catheter | 103 | 12 | 0.78 (0.32-1.90) | 0.5864 |
| 196 | Heart Failure without Cardiac Catheter | 1564 | 302 | 1.74 (1.52-1.99) | <.0001 |
| 197 | Hypertensive Disease except Benign Hypertension | 48 | 5 | 0.99 (0.40-2.43) | 0.9772 |
| 198 | Congenital Cardiac Disorder | 8 | 0 | - | - |
| 199 | Cardiac Valve Disease | 88 | 12 | 1.06 (0.54-2.07) | 0.8620 |
| 200 | Pulmonary Embolism | 363 | 39 | 1.03 (0.76-1.39) | 0.8544 |
| 201 | Arrhythmia with Cardiac Catheter | 76 | 3 | 0.43 (0.14-1.33) | 0.1432 |
| 202 | Arrhythmia without Cardiac Catheter | 1689 | 141 | 1.24 (1.04-1.48) | 0.0191 |
| 203 | Unstable Angina/Atherosclerotic Heart Disease with Cardiac Cath | 514 | 30 | 0.78 (0.52-1.17) | 0.2297 |
| 204 | Unstable Angina/Atherosclerotic Heart Disease without Cardiac Cath | 964 | 76 | 1.10 (0.87-1.40) | 0.4197 |
| 205 | Syncope | 861 | 41 | 0.79 (0.57-1.10) | 0.1565 |
| 206 | Benign Hypertension | 254 | 17 | 1.12 (0.70-1.79) | 0.6273 |
| 207 | Angina (except Unstable)/Chest Pain with Cardiac Catheter | 481 | 4 | 0.11 (0.05-0.28) | <.0001 |
| 208 | Angina (except Unstable)/Chest Pain without Cardiac Catheter | 2189 | 81 | 0.74 (0.57-0.96) | 0.0249 |
| 209 | Other/Miscellaneous Cardiac Disorder | 658 | 65 | 1.20 (0.91-1.57) | 0.2013 |
| 210 | Embolism/Thrombosis except Deep Vein Thrombophlebitis | 38 | 4 | 1.13 (0.51-2.54) | 0.7584 |
| 211 | Deep Vein Thrombophlebitis | 103 | 18 | 1.89 (1.16-3.09) | 0.0104 |
| 212 | Peripheral Vascular Disease | 38 | 2 | 0.52 (0.11-2.44) | 0.4047 |
| 213 | Other/Miscellaneous Vascular Disease | 156 | 16 | 1.09 (0.63-1.89) | 0.7482 |
| 220 | Major Upper Gastrointestinal Reconstruction/Excision | 47 | 9 | 1.04 (0.49-2.22) | 0.9183 |
| 221 | Colostomy/Enterostomy | 443 | 51 | 1.01 (0.72-1.41) | 0.9756 |
| 222 | Open Large Intestine/Rectum Resection without Colostomy, Unplanned | 337 | 26 | 0.47 (0.30-0.73) | 0.0010 |
| 223 | Open Large Intestine/Rectum Resection without Colostomy, Planned | 944 | 42 | 0.67 (0.49-0.92) | 0.0140 |
| 224 | Major Intervention on Esophagus | 38 | 2 | 0.39 (0.09-1.72) | 0.2135 |
| 225 | Non-Major Excision/Repair of Upper Gastrointestinal Tract, Unplanned | 297 | 31 | 0.83 (0.55-1.23) | 0.3435 |
| 226 | Non-Major Excision/Repair of Upper Gastrointestinal Tract, Planned | 419 | 17 | 0.82 (0.53-1.28) | 0.3912 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CMG code** | **Description** | **Number of admissions** | **Number of events** | **Adjusted odds ratio\***  **(95% CI\*\*)** | ***p-*value** |
| 227 | Endoscopic Large Intestine/Rectum Resection without Colostomy | 279 | 10 | 0.59 (0.28-1.22) | 0.1526 |
| 228 | Complex Hernia Repair | 1445 | 13 | 0.31 (0.12-0.81) | 0.0162 |
| 229 | Non-Complex Hernia Repair | 1214 | 9 | 0.26 (0.12-0.58) | 0.0011 |
| 230 | Repair/Fixation & Other Moderate Intervention on Lower Gastrointestinal Tract | 43 | 3 | 1.56 (0.40-6.14) | 0.5218 |
| 231 | Minor Upper Gastrointestinal Intervention | 218 | 35 | 1.86 (1.23-2.79) | 0.0030 |
| 232 | Minor Lower Gastrointestinal Intervention | 374 | 24 | 0.97 (0.64-1.48) | 0.9049 |
| 233 | Complicated Appendectomy | 530 | 9 | 0.26 (0.14-0.49) | <.0001 |
| 234 | Simple Appendectomy | 1539 | 18 | 0.28 (0.17-0.45) | <.0001 |
| 235 | Intervention on Anus Excluding Reconstruction | 135 | 4 | 0.82 (0.31-2.16) | 0.6856 |
| 236 | Simple Removal of Upper Gastrointestinal Foreign Body | 45 | 2 | 1.00 (0.23-4.38) | 0.9957 |
| 237 | Other Intervention with Gastrointestinal Diagnosis | 430 | 18 | 0.61 (0.35-1.06) | 0.0807 |
| 248 | Severe Enteritis | 338 | 41 | 1.29 (0.91-1.84) | 0.1515 |
| 249 | Non-severe Enteritis | 1564 | 92 | 0.82 (0.66-1.02) | 0.0701 |
| 250 | Digestive Malignancy | 287 | 106 | 3.50 (2.58-4.76) | <.0001 |
| 251 | Complicated Ulcer | 43 | 4 | 1.13 (0.39-3.26) | 0.8149 |
| 252 | Uncomplicated Ulcer | 115 | 11 | 1.62 (0.91-2.89) | 0.1024 |
| 253 | Inflammatory Bowel Disease | 365 | 28 | 0.93 (0.65-1.34) | 0.7083 |
| 254 | Gastrointestinal Hemorrhage | 1133 | 98 | 1.15 (0.91-1.45) | 0.2415 |
| 255 | Gastrointestinal Obstruction | 834 | 100 | 1.56 (1.26-1.92) | <.0001 |
| 256 | Esophagitis/Gastritis/Miscellaneous Digestive Disease | 422 | 34 | 1.10 (0.78-1.53) | 0.5880 |
| 257 | Symptom/Sign of Digestive System | 1692 | 182 | 1.72 (1.45-2.04) | <.0001 |
| 258 | Other Gastrointestinal Disorder | 515 | 59 | 1.63 (1.25-2.12) | 0.0003 |
| 270 | Liver/Pancreas/Duodenum Transplant | 23 | 3 | 0.78 (0.53-1.13) | 0.1887 |
| 271 | Excision Pancreas with Duodenum | 31 | 3 | 0.72 (0.26-1.97) | 0.5167 |
| 272 | Drainage/Biopsy of Pancreas | 4 | 1 | 2.12 (0.12-36.59) | 0.6042 |
| 273 | Bypass/Excision of Pancreas | 15 | 2 | 2.28 (0.59-8.84) | 0.2348 |
| 274 | Major Hepatobiliary Intervention | 95 | 9 | 1.19 (0.59-2.40) | 0.6291 |
| 275 | Non-Major Hepatobiliary Intervention | 75 | 12 | 1.82 (0.93-3.56) | 0.0829 |
| 276 | Open Cholecystectomy with Common Bile Duct Exploration | 20 | 1 | 0.60 (0.07-5.08) | 0.6391 |
| 277 | Open Cholecystectomy without Common Bile Duct Exploration | 148 | 9 | 0.73 (0.36-1.50) | 0.3942 |
| 278 | Laparoscopic Cholecystectomy with/without Common Bile Duct Exploration | 1070 | 27 | 0.49 (0.33-0.72) | 0.0004 |
| 279 | Hepatobiliary Drainage | 2 | 0 | - | - |
| 280 | Dilation/Drainage of Common Bile Duct | 108 | 18 | 1.87 (0.98-3.57) | 0.0581 |
| 281 | Extraction/Destruction of Calculus Common Bile Duct | 273 | 15 | 0.65 (0.37-1.15) | 0.1370 |
| 282 | Other Intervention related to Hepatobiliary System | 50 | 7 | 1.49 (0.63-3.52) | 0.3658 |
| 284 | Hepatobiliary/Pancreatic Malignancy | 187 | 92 | 5.40 (4.05-7.21) | <.0001 |
| 285 | Cirrhosis/Alcoholic Hepatitis | 268 | 67 | 2.31 (1.73-3.08) | <.0001 |
| 286 | Liver Disease except Cirrhosis/Malignancy | 153 | 17 | 1.11 (0.67-1.87) | 0.6801 |
| 287 | Disorder of Pancreas except Malignancy | 703 | 60 | 1.04 (0.77-1.41) | 0.7893 |
| 288 | Disorder of Biliary Tract | 740 | 76 | 1.58 (1.22-2.05) | 0.0006 |
| 300 | Joint Replacement with Malignant Neoplasm | 10 | 1 | 0.72 (0.08-6.25) | 0.7662 |

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| **CMG code** | **Description** | **Number of admissions** | **Number of events** | **Adjusted odds ratio\***  **(95% CI\*\*)** | ***p-*value** |
| 301 | Back/Neck Intervention with Malignant Neoplasm | 14 | 2 | 1.00 (0.16-6.44) | 0.9995 |
| 302 | Lower Limb Intervention with Flap/Graft with Malignant Neoplasm | 12 | 1 | 2.05 (1.01-4.17) | 0.0473 |
| 303 | Fixation of Lower Limb with Malignant Neoplasm | 5 | 2 | 2.42 (0.31-18.64) | 0.3971 |
| 304 | Other Lower Limb Intervention with Malignant Neoplasm | 15 | 0 | - | - |
| 305 | Craniofacial Bone Intervention with Malignant Neoplasm | 7 | 1 | 2.61 (0.87-7.81) | 0.0870 |
| 306 | Upper Limb Intervention with Flap/Graft with Malignant Neoplasm | 8 | 0 | - | - |
| 307 | Other Upper Limb Intervention with Malignant Neoplasm | 4 | 1 | 2.65 (0.46-15.36) | 0.2775 |
| 308 | Other Musculoskeletal Intervention with Malignant Neoplasm | 11 | 1 | 1.76 (0.16-19.30) | 0.6425 |
| 312 | C1/C2/Thoracic Spine Intervention | 52 | 3 | 1.04 (0.37-2.98) | 0.9366 |
| 313 | Spinal Vertebrae Intervention | 679 | 13 | 0.54 (0.35-0.83) | 0.0050 |
| 314 | Other Intervention on Back/Neck | 456 | 10 | 0.69 (0.33-1.47) | 0.3410 |
| 315 | Bilateral Hip/Knee Replacement | 49 | 0 | - | - |
| 316 | Revised Hip Replacement with Infection | 16 | 0 | - | - |
| 317 | Revised Hip Replacement without Infection | 116 | 4 | 0.72 (0.26-2.01) | 0.5328 |
| 318 | Revised Knee Replacement with Infection | 20 | 1 | 0.69 (0.09-5.59) | 0.7314 |
| 319 | Revised Knee Replacement without Infection | 82 | 2 | 0.57 (0.16-2.07) | 0.3941 |
| 320 | Unilateral Hip Replacement | 1401 | 30 | 0.55 (0.39-0.79) | 0.0011 |
| 321 | Unilateral Knee Replacement | 2303 | 42 | 0.50 (0.37-0.70) | <.0001 |
| 322 | Open Knee Intervention except Fixation with Infection | 14 | 1 | 0.61 (0.06-6.11) | 0.6748 |
| 323 | Open Knee Intervention except Fixation without Infection | 127 | 2 | 0.62 (0.15-2.59) | 0.5084 |
| 324 | Closed Knee Intervention except Fixation with Infection | 20 | 1 | 0.50 (0.07-3.35) | 0.4758 |
| 325 | Closed Knee Intervention except Fixation without Infection | 331 | 2 | 0.32 (0.08-1.24) | 0.1002 |
| 326†, 327 | Shoulder Replacement (326); Other Joint Replacement (327) | 184 | 3 | 0.63 (0.20-2.03) | 0.4402 |
| 328 | Resection/Amputation of Pelvis/Leg with Infection | 18 | 0 | - | - |
| 329 | Resection/Amputation of Pelvis/Leg without Infection | 38 | 1 | 0.41 (0.07-2.52) | 0.3385 |
| 330 | Fixation of Lower Limb except Ankle/Foot | 73 | 4 | 0.56 (0.15-2.06) | 0.3839 |
| 331 | Osteotomy of Lower Limb except Foot | 129 | 2 | 0.61 (0.14-2.59) | 0.5041 |
| 332 | Other Repair Bone of Leg except Ankle/Foot | 42 | 0 | - | - |
| 333 | Major Foot Intervention except Soft Tissue with Infection | 14 | 2 | 1.97 (0.62-6.30) | 0.2506 |
| 334, 335† | Major Foot Intervention except Soft Tissue without Infection (334); Other Foot Intervention, except Soft Tissue (335) | 358 | 2 | 0.26 (0.07-0.98) | 0.0468 |
| 336 | Resection/Amputation/Fixation of Upper Limb except Shoulder/Hand | 71 | 2 | 0.73 (0.16-3.44) | 0.6925 |
| 337 | Hand Intervention | 101 | 2 | 0.62 (0.16-2.43) | 0.4966 |
| 338 | Osteotomy of Upper Limb except Hand | 22 | 0 | - | - |
| 339 | Other Upper Limb Intervention except Hand | 10 | 0 | - | - |
| 340 | Elbow Intervention | 27 | 0 | - | - |
| 341 | Shoulder/Rotator Cuff Intervention | 500 | 4 | 0.39 (0.16-0.99) | 0.0471 |
| 342 | Biopsy/Invasive Inspection of Bone | 39 | 0 | - | - |

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| **CMG code** | **Description** | **Number of admissions** | **Number of events** | **Adjusted odds ratio\***  **(95% CI\*\*)** | ***p-*value** |
| 343 | Other Musculoskeletal Intervention except Soft Tissue | 17 | 1 | 2.34 (0.32-17.23) | 0.4044 |
| 344 | Soft Tissue Intervention of Upper Limb | 30 | 0 | - | - |
| 345 | Soft Tissue Intervention of Lower Limb | 202 | 2 | 0.29 (0.07-1.18) | 0.0834 |
| 346, 349† | Other Musculoskeletal Soft Tissue Intervention (346); Nerve Intervention with Musculoskeletal Diagnosis (349) | 86 | 1 | 0.33 (0.05-2.21) | 0.2522 |
| 347 | Craniofacial Bone Intervention with Musculoskeletal Diagnosis | 64 | 4 | 2.75 (1.48-5.09) | 0.0013 |
| 348 | Skin Intervention with Musculoskeletal Diagnosis | 23 | 0 | - | - |
| 357 | Musculoskeletal Malignant Neoplasm | 101 | 39 | 2.71 (1.84-4.01) | <.0001 |
| 358 | Pathological Fracture | 71 | 13 | 1.36 (0.69-2.68) | 0.3816 |
| 359 | Osteomyelitis/Septic Arthritis | 52 | 4 | 0.70 (0.26-1.91) | 0.4868 |
| 360 | Vertebral/Disc Disease | 221 | 25 | 1.14 (0.71-1.84) | 0.5853 |
| 361 | Systemic Connective Tissue Disorder | 52 | 9 | 1.81 (0.80-4.11) | 0.1562 |
| 362 | Arthritis | 232 | 17 | 0.73 (0.42-1.28) | 0.2672 |
| 363 | Other Soft Tissue Disorder | 90 | 5 | 0.63 (0.24-1.62) | 0.3353 |
| 364 | Back Pain/Strain | 241 | 25 | 1.40 (0.92-2.13) | 0.1203 |
| 365 | Pain/Stiffness, except Back | 109 | 7 | 0.83 (0.39-1.77) | 0.6230 |
| 366 | Other Musculoskeletal Disorder | 42 | 1 | 0.18 (0.03-1.20) | 0.0768 |
| 367 | Other Syndrome/Deformity | 3 | 0 | - | - |
| 368 | Orthopedic Aftercare | 74 | 8 | 1.94 (0.85-4.46) | 0.1173 |
| 369 | Strain/Sprain/Joint/Tendon Disorder | 110 | 8 | 0.98 (0.44-2.19) | 0.9682 |
| 380 | Major Bone/Joint Intervention with Skin Diagnosis | 17 | 0 | - | - |
| 381 | Minor Bone/Joint Intervention with Skin Diagnosis | 37 | 5 | 1.06 (0.42-2.65) | 0.9080 |
| 382 | Muscle/Tendon/Soft Tissue Intervention with Skin Diagnosis | 161 | 8 | 0.72 (0.33-1.56) | 0.4012 |
| 383 | Other Non-Skin Intervention with Skin Graft | 17 | 2 | 1.44 (0.19-11.14) | 0.7283 |
| 384 | Other Non-Skin Intervention without Skin Graft | 46 | 3 | 1.57 (0.47-5.26) | 0.4660 |
| 385 | Repair/Reconstruction of Breast | 113 | 2 | 0.68 (0.18-2.56) | 0.5653 |
| 386 | Bilateral Total/Radical Excision of Breast | 37 | 1 | 0.79 (0.11-5.99) | 0.8232 |
| 387 | Unilateral Total/Radical Excision of Breast | 482 | 5 | 0.29 (0.12-0.70) | 0.0058 |
| 388 | Partial Excision Breast with Malignant Breast Diagnosis | 359 | 6 | 0.63 (0.31-1.26) | 0.1936 |
| 389 | Partial Excision Breast without Malignant Breast Diagnosis | 55 | 1 | 0.80 (0.11-6.08) | 0.8298 |
| 390 | Other Breast Intervention | 533 | 4 | 0.37 (0.14-0.95) | 0.0393 |
| 391 | Lymphatic System Intervention with Skin Diagnosis | 28 | 0 | - | - |
| 392 | Other Skin/Subcutaneous Tissue Intervention | 236 | 4 | 0.51 (0.21-1.26) | 0.1445 |
| 401 | Decubitus Ulcer/Ulcer of Lower Limb NEC | 54 | 6 | 0.71 (0.30-1.68) | 0.4313 |
| 402 | Diabetes with Foot Ulcer | 46 | 12 | 1.66 (0.77-3.60) | 0.1982 |
| 403 | Malignant Neoplasm of Skin | 9 | 4 | 3.89 (0.68-22.20) | 0.1264 |
| 404 | Malignant Neoplasm of Breast | 39 | 11 | 1.40 (0.55-3.54) | 0.4789 |
| 405 | Cellulitis | 686 | 57 | 0.86 (0.66-1.13) | 0.2751 |
| 406 | Abscess | 72 | 3 | 0.45 (0.14-1.47) | 0.1875 |
| 407 | Other Disease/Disorder of Skin/Subcutaneous Tissue | 170 | 13 | 0.89 (0.49-1.61) | 0.7032 |
| 408 | Trauma of Skin/Subcutaneous Tissue/Breast | 86 | 4 | 0.67 (0.24-1.85) | 0.4353 |
| 409 | Non-Malignant Breast Disorder | 13 | 0 | - | - |

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| **CMG code** | **Description** | **Number of admissions** | **Number of events** | **Adjusted odds ratio\***  **(95% CI\*\*)** | ***p-*value** |
| 420 | Pituitary/Pineal Gland Intervention | 58 | 5 | 2.26 (1.37-3.72) | 0.0014 |
| 421 | Adrenal Gland Intervention | 43 | 1 | 0.65 (0.08-4.99) | 0.6763 |
| 422 | Reduction Gastroplasty/Stomach Bypass with Obesity | 62 | 2 | 1.05 (0.45-2.42) | 0.9105 |
| 423 | Size Reduction of Skin/Soft Tissue | 108 | 3 | 1.41 (0.46-4.33) | 0.5489 |
| 424 | Thyroid/Parathyroid/Thymus Gland Intervention | 1127 | 5 | 0.18 (0.08-0.41) | <.0001 |
| 425 | Other Intervention with Endocrine System Diagnosis | 5 | 1 | 2.30 (0.28-18.98) | 0.4393 |
| 432 | Cystic Fibrosis | 12 | 2 | 2.04 (0.38-11.14) | 0.4083 |
| 433 | Disorder related to Nutrition | 74 | 10 | 1.42 (0.69-2.90) | 0.3381 |
| 434†, 440 | Disease/Disorder of Adrenal/Pituitary Gland (434); Disease/Disorder of Thyroid/Parathyroid Gland (440) | 148 | 5 | 0.40 (0.17-0.94) | 0.0360 |
| 435 | Disorder of Metabolism | 69 | 12 | 1.66 (0.79-3.53) | 0.1837 |
| 436 | Disorder of Fluid/Electrolyte Balance | 431 | 52 | 1.35 (0.99-1.83) | 0.0574 |
| 437 | Diabetes | 877 | 64 | 0.72 (0.56-0.92) | 0.0083 |
| 438 | Dehydration | 204 | 54 | 3.52 (2.52-4.91) | <.0001 |
| 439 | Disease/Disorder of Pancreas | 28 | 1 | 0.45 (0.06-3.37) | 0.4370 |
| 450 | Kidney Transplant | 59 | 7 | 1.41 (0.58-3.43) | 0.4508 |
| 451 | Kidney Donor | 52 | 1 | 0.61 (0.08-4.70) | 0.6382 |
| 452 | Radical Excision/Reconstruction of Bladder | 49 | 5 | 1.12 (0.41-3.02) | 0.8238 |
| 453‡, 454 | Exteriorization of Upper Urinary Tract (453); Major Intervention on Upper Urinary Tract (454) | 381 | 15 | 0.77 (0.50-1.19) | 0.2328 |
| 455 | Minor Intervention on Upper Urinary Tract, Percutaneous Endoscopic Approach | 253 | 13 | 1.03 (0.55-1.96) | 0.9209 |
| 456 | Minor Intervention on Upper Urinary Tract, External/Per Orifice Approach | 612 | 27 | 0.75 (0.52-1.08) | 0.1249 |
| 457 | Major Intervention on Lower Urinary Tract | 57 | 1 | 0.44 (0.06-3.14) | 0.4106 |
| 458 | Non-Major Intervention on Lower Urinary Tract, Unplanned | 102 | 16 | 2.00 (1.05-3.80) | 0.0344 |
| 459 | Non-Major Intervention on Lower Urinary Tract, Planned | 479 | 17 | 1.31 (0.84-2.03) | 0.2367 |
| 460 | Major Intervention on Male Reproductive System | 103 | 4 | 0.94 (0.31-2.83) | 0.9102 |
| 461 | Non-Major Intervention on Male Reproductive System | 49 | 1 | 0.74 (0.10-5.51) | 0.7668 |
| 462 | Radical Excision of Prostate | 789 | 13 | 0.52 (0.30-0.90) | 0.0186 |
| 463 | Partial Excision of Prostate, Open Approach | 27 | 0 | - | - |
| 464 | Partial Excision/Destruction of Prostate, Closed Approach | 1379 | 56 | 1.17 (0.88-1.56) | 0.2844 |
| 465 | Intervention related to Dialysis, Unplanned Admission | 3 | 1 | 1.36 (0.21-8.91) | 0.7495 |
| 466 | Intervention related to Dialysis, Planned Admission | 23 | 0 | - | - |
| 467 | Other Intervention with Urinary System Diagnosis | 29 | 1 | 0.40 (0.05-3.29) | 0.3943 |
| 477 | Renal Failure | 418 | 74 | 1.35 (1.06-1.72) | 0.0149 |
| 478 | Malignant Neoplasm of Urinary System | 57 | 16 | 2.73 (1.40-5.33) | 0.0032 |
| 479 | Malignant Neoplasm of Male Reproductive System | 56 | 8 | 1.04 (0.46-2.34) | 0.9285 |
| 480 | Kidney Disease | 83 | 10 | 0.68 (0.38-1.24) | 0.2107 |
| 481 | Other Disorder of Urinary System | 46 | 5 | 1.43 (0.59-3.46) | 0.4337 |
| 482 | Other Disorder of Kidney/Ureter | 24 | 4 | 2.47 (0.90-6.81) | 0.0807 |
| 483 | Disease/Disorder of Male Reproductive System | 95 | 3 | 0.48 (0.15-1.47) | 0.1964 |

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| **CMG code** | **Description** | **Number of admissions** | **Number of events** | **Adjusted odds ratio\***  **(95% CI\*\*)** | ***p-*value** |
| 484 | Symptom/Sign of Urinary System | 230 | 17 | 1.06 (0.68-1.67) | 0.7852 |
| 485 | Urinary Obstruction with Percutaneous Drainage | 21 | 2 | 0.52 (0.13-2.02) | 0.3434 |
| 486 | Urinary Obstruction without Percutaneous Drainage | 468 | 18 | 0.79 (0.49-1.26) | 0.3251 |
| 487 | Lower Urinary Tract Infection | 736 | 72 | 1.06 (0.83-1.34) | 0.6425 |
| 488 | Upper Urinary Tract Infection | 353 | 11 | 0.40 (0.21-0.77) | 0.0062 |
| 500 | Radical Gynaecological Intervention | 57 | 4 | 1.45 (0.53-3.94) | 0.4653 |
| 501 | Hysterectomy with Malignancy | 455 | 21 | 1.07 (0.73-1.57) | 0.7347 |
| 502 | Hysterectomy with Non Malignant Diagnosis | 4249 | 62 | 0.51 (0.40-0.66) | <.0001 |
| 503 | Fixation/Occlusion/Removal Intervention on Female Reproductive System except Tube/Ovary | 394 | 4 | 0.36 (0.15-0.86) | 0.0218 |
| 504 | Ovarian/Fallopian Tube Intervention with Malignancy except Endoscopic Approach | 36 | 1 | 0.38 (0.04-3.16) | 0.3672 |
| 505 | Ovarian/Fallopian Tube Intervention with Non Malignant Diagnosis except Endoscopic Approach | 534 | 12 | 0.63 (0.35-1.13) | 0.1197 |
| 506 | Bladder Fixation | 439 | 6 | 0.62 (0.22-1.77) | 0.3738 |
| 507 | Repair/Brachytherapy/Other Intervention on Female Reproductive System except Tube/Ovary | 362 | 6 | 0.69 (0.32-1.51) | 0.3581 |
| 508 | Other Intervention with Female Reproductive System Diagnosis | 49 | 3 | 1.55 (0.50-4.82) | 0.4489 |
| 509 | Therapeutic Intervention on Female Reproductive System, Laparoscopic Approach | 408 | 3 | 0.29 (0.11-0.77) | 0.0137 |
| 510 | Diagnostic Laparoscopy with/without Biopsy | 30 | 0 | - | - |
| 511 | Vulva/Perineum Intervention | 78 | 2 | 0.82 (0.21-3.19) | 0.7779 |
| 512 | Dilation & Curettage/Other Minor Intervention on Uterus | 92 | 1 | 0.29 (0.04-2.18) | 0.2300 |
| 520 | Malignant Neoplasm of Female Reproductive System | 71 | 14 | 1.86 (0.81-4.25) | 0.1421 |
| 521 | Fibroid/Prolapse/Fistula/Other Disorder | 146 | 2 | 0.64 (0.15-2.67) | 0.5359 |
| 522 | Inflammatory Disorder of Female Reproductive System | 131 | 7 | 0.86 (0.47-1.58) | 0.6321 |
| 523 | Disorder of Fertility | 16 | 2 | 2.39 (0.43-13.42) | 0.3225 |
| 524 | Disorder of Menstruation/Endometriosis/Non-inflammatory Disorder of Female Reproductive System | 221 | 9 | 0.92 (0.46-1.81) | 0.8000 |
| 531 | Major Intervention not related to Obstetric Diagnosis | 2 | 0 | - | - |
| 536 | Repeat Caesarean Section | 3 | 0 | - | - |
| 537 | Primary Caesarean Section | 7 | 0 | - | - |
| 541 | Vaginal Birth After Caesarean without Instrumentation, No Other Intervention | 1 | 0 | - | - |
| 543 | Forceps/Vacuum Delivery, No Other Intervention | 4 | 0 | - | - |
| 545 | Vaginal Delivery, No Other Intervention | 8 | 0 | - | - |
| 546 | Ectopic Pregnancy Treated Surgically/Non-Major Intervention | 205 | 3 | 0.36 (0.11-1.10) | 0.0739 |
| 547 | Ectopic Pregnancy treated Medically | 27 | 7 | 9.35 (4.14-21.14) | <.0001 |
| 550†, 551 | Abortion Diagnosis Treated Surgically/Non-Major Intervention (550); Abortion Diagnosis Treated Medically (551) | 92 | 3 | 0.90 (0.22-3.61) | 0.8783 |

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| **CMG code** | **Description** | **Number of admissions** | **Number of events** | **Adjusted odds ratio\***  **(95% CI\*\*)** | ***p-*value** |
| 552 | Postpartum Disorder Treated Surgically/Non-Major Intervention | 12 | 0 | - | - |
| 553 | Postpartum Disorder treated Medically | 31 | 1 | 0.54 (0.08-3.66) | 0.5249 |
| 554 | Post Abortion Disorder Treated Surgically/Non-Major Intervention | 8 | 0 | - | - |
| 555 | Post Abortion Disorder treated Medically | 22 | 1 | 1.01 (0.13-7.75) | 0.9897 |
| 556 | Antepartum Disorder Treated Surgically/Non-Major Intervention | 2 | 0 | - | - |
| 557 | Antepartum Disorder treated Medically | 34 | 4 | 2.37 (0.92-6.08) | 0.0736 |
| 570 | Newborn/Neonate 1500+ gm with Major Gastrointestinal/Diaphragm Intervention | 1 | 0 | - | - |
| 591 | Newborn/Neonate 2500+ grams, Other Respiratory Problem | 1 | 0 | - | - |
| 601 | Newborn/Neonate 2500+ grams, Other Minor Problem | 1 | 0 | - | - |
| 610 | Bone Marrow/Stem Cell Transplant | 61 | 5 | 0.86 (0.18-4.03) | 0.8430 |
| 611 | Thymectomy | 18 | 1 | 1.24 (0.23-6.86) | 0.8016 |
| 612 | Splenectomy | 26 | 2 | 1.26 (0.28-5.72) | 0.7662 |
| 613 | Intervention with Leukemia | 7 | 1 | 0.91 (0.07-11.44) | 0.9386 |
| 614 | Intervention with Multiple Myeloma | 3 | 0 | - | - |
| 615 | Intervention with Lymphoma | 143 | 11 | 1.06 (0.51-2.20) | 0.8786 |
| 616 | Intervention with Neoplasm of Other Site | 58 | 5 | 0.95 (0.39-2.34) | 0.9168 |
| 617 | Intervention with Blood/Lymphatic System Diagnosis except Neoplasm | 96 | 9 | 1.07 (0.61-1.89) | 0.8182 |
| 624 | Acute Myeloid Leukemia | 58 | 25 | 6.01 (3.05-11.84) | <.0001 |
| 625 | Acute Leukemia except Myeloid | 12 | 6 | 5.86 (0.97-35.33) | 0.0537 |
| 626 | Other Leukemia | 75 | 20 | 3.26 (1.84-5.78) | <.0001 |
| 627 | Multiple Myeloma | 45 | 13 | 2.32 (1.11-4.85) | 0.0253 |
| 628 | Lymphoma | 145 | 48 | 3.60 (2.35-5.51) | <.0001 |
| 629 | Aplastic Anemia | 26 | 6 | 2.59 (1.01-6.62) | 0.0471 |
| 630 | Malignant Neoplasm of Other Site | 46 | 26 | 6.48 (3.87-10.85) | <.0001 |
| 631 | Non-Malignant Neoplasm of Other Site | 4 | 2 | 6.29 (0.76-52.07) | 0.0882 |
| 632 | Coagulation Defect | 49 | 2 | 0.39 (0.10-1.52) | 0.1761 |
| 633 | Agranulocytosis | 266 | 45 | 1.28 (0.94-1.75) | 0.1143 |
| 634 | Hemoglobinopathy | 27 | 2 | 0.94 (0.20-4.33) | 0.9378 |
| 635 | Other Anemia | 465 | 76 | 2.13 (1.63-2.79) | <.0001 |
| 636 | Purpura/Other Hemorrhagic Disorder | 66 | 7 | 1.46 (0.60-3.54) | 0.4021 |
| 637 | Other Disease/Disorder of Blood/Lymphatic System | 44 | 3 | 0.76 (0.25-2.30) | 0.6312 |
| 638 | Chemotherapy/Radiotherapy Session for Neoplasm | 249 | 40 | 2.48 (1.53-4.02) | 0.0002 |
| 639 | Other Chemotherapy | 8 | 2 | 5.06 (0.94-27.21) | 0.0590 |
| 640 | Acute Lymphadenitis | 7 | 0 | - | - |
| 650 | Multisystemic/Unspecified Site Infection with Intervention | 71 | 6 | 0.55 (0.24-1.28) | 0.1660 |
| 653 | Septicemia due to Staphylococcus Aureus/Pseudomonas/Enterococcus | 34 | 7 | 1.07 (0.45-2.54) | 0.8807 |
| 654 | Other/Unspecified Septicemia | 272 | 38 | 1.02 (0.74-1.40) | 0.9105 |
| 655 | HIV with Major Complication/Manifestation except Respiratory | 8 | 1 | 0.78 (0.12-5.25) | 0.7984 |
| 656 | HIV with General Symptom/Infection/GI/Hepatobiliary/Ophthalmic Disorder | 14 | 3 | 2.20 (0.63-7.71) | 0.2163 |
| 657 | HIV with Major Respiratory Complication/Manifestation | 21 | 5 | 2.52 (0.94-6.75) | 0.0663 |
| 658 | HIV with Other/Miscellaneous Diagnosis | 9 | 1 | 0.89 (0.06-12.79) | 0.9325 |

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| **CMG code** | **Description** | **Number of admissions** | **Number of events** | **Adjusted odds ratio\***  **(95% CI\*\*)** | ***p-*value** |
| 659 | Chickenpox/Herpes Zoster/Cytomegaloviral Disease | 19 | 1 | 0.41 (0.05-3.55) | 0.421 |
| 660 | Other Infectious/Parasitic Disease | 96 | 3 | 0.26 (0.10-0.68) | 0.0064 |
| 661 | Other/Unspecified Viral Illness | 168 | 9 | 0.86 (0.40-1.83) | 0.6914 |
| 662 | Fever | 196 | 21 | 0.98 (0.56-1.73) | 0.9474 |
| 670 | Dementia | 178 | 22 | 0.90 (0.57-1.40) | 0.6305 |
| 671 | Organic Mental Disorder | 140 | 11 | 0.57 (0.30-1.07) | 0.0822 |
| 672 | Miscellaneous Mental Disorder | 23 | 3 | 1.02 (0.33-3.15) | 0.9772 |
| 673 | Eating Disorder | 4 | 1 | 3.04 (0.31-29.77) | 0.3388 |
| 675 | Other Behavioural Syndrome | 2 | 0 | - | - |
| 677 | Schizophrenia without ECT | 16 | 3 | 2.97 (0.68-12.96) | 0.1473 |
| 678 | Schizotypal/Delusional Disorder | 22 | 6 | 4.28 (1.54-11.92) | 0.0054 |
| 680 | Schizoaffective Disorder without ECT | 3 | 1 | 6.00 (0.53-67.50) | 0.1467 |
| 683 | Disorder of Adult Personality Behaviour | 7 | 3 | 10.70 (2.23-51.41) | 0.0031 |
| 684 | Obsessive Compulsive Disorder | 1 | 0 | - | - |
| 685 | Somatoform/Dissociative Disorder | 31 | 3 | 1.27 (0.42-3.82) | 0.6724 |
| 686 | Anxiety Disorder | 61 | 4 | 0.92 (0.33-2.61) | 0.8825 |
| 687 | Stress Reaction/Adjustment Disorder | 35 | 3 | 1.49 (0.45-4.96) | 0.5133 |
| 689 | Bipolar Disorder without ECT | 26 | 4 | 1.87 (0.54-6.42) | 0.3213 |
| 691 | Bipolar Disorder, Severe Depression without ECT | 3 | 1 | 7.99 (0.33-193.27) | 0.2013 |
| 693 | Depressive Episode without ECT | 141 | 18 | 1.46 (0.95-2.23) | 0.0825 |
| 695 | Mental Retardation/Disorder of Development | 4 | 0 | - | - |
| 696 | Childhood/Adolescence Disorder | 2 | 1 | 23.82 (1.50-378.46) | 0.0246 |
| 698 | Psychoactive Substance Use, Acute Intoxication | 71 | 4 | 1.00 (0.35-2.83) | 0.9998 |
| 699 | Psychoactive Substance Use, Harmful Use | 20 | 1 | 0.69 (0.10-4.54) | 0.6967 |
| 700 | Psychoactive Substance Use, Dependence Syndrome | 64 | 11 | 2.59 (1.23-5.45) | 0.0121 |
| 701 | Psychoactive Substance Use, Withdrawal State | 131 | 8 | 0.80 (0.38-1.67) | 0.5504 |
| 702 | Psychoactive Substance Use, Withdrawal/Delirium | 53 | 3 | 0.55 (0.15-1.97) | 0.3589 |
| 703 | Psychoactive Substance Use, Residual/Late-onset/Psychotic Disorder | 7 | 0 | - | - |
| 704 | Psychoactive Substance Use, Amnesic/Other/Unspecified | 11 | 0 | - | - |
| 710 | Extensive Burn with Skin Graft | 5 | 0 | - | - |
| 711 | Non-Extensive Burn with Skin Graft | 35 | 0 | - | - |
| 712 | Burn Intervention without Skin Graft | 1 | 0 | - | - |
| 717 | Extensive Burn | 4 | 0 | - | - |
| 718 | Non-Extensive Burn | 47 | 1 | 0.37 (0.07-1.90) | 0.2320 |
| 725 | Organ Transplant with Trauma/Complication of Treatment | 4 | 1 | 3.49 (3.36-3.61) | <.0001 |
| 726 | Hip Replacement with Trauma/Complication of Treatment | 148 | 14 | 0.76 (0.40-1.41) | 0.3812 |
| 727 | Fixation/Repair Hip/Femur | 418 | 18 | 0.40 (0.24-0.65) | 0.0002 |
| 728 | Other Intervention on Hip/Lower Limb with Trauma/Complication of Treatment | 81 | 2 | 0.38 (0.09-1.65) | 0.1945 |
| 729 | Replacement/Fixation/Repair of Tibia/Fibula/Knee | 650 | 7 | 0.18 (0.09-0.34) | <.0001 |
| 730 | Other Major Bone Intervention with Trauma/Complication of Treatment | 83 | 3 | 0.37 (0.12-1.09) | 0.0722 |

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| **CMG code** | **Description** | **Number of admissions** | **Number of events** | **Adjusted odds ratio\***  **(95% CI\*\*)** | ***p-*value** |
| 731, 732† | Spinal Intervention with Trauma/Complication of Treatment (731); Intracranial Intervention with Trauma/Complication of Treatment (732) | 128 | 4 | 0.29 (0.08-1.10) | 0.0697 |
| 733 | Major Thoraco-abdominal/Vascular Intervention with Trauma/Complication of Treatment | 157 | 9 | 0.51 (0.26-0.99) | 0.0472 |
| 734 | Other Thoraco-abdominal Intervention with Trauma/Complication of Treatment | 165 | 8 | 0.58 (0.28-1.22) | 0.1493 |
| 735 | Skull Intervention with Trauma/Complication of Treatment | 4 | 0 | - | - |
| 736 | Skin/Soft Tissue Intervention with Trauma with Flap/Graft | 39 | 1 | 0.29 (0.04-2.22) | 0.2345 |
| 737 | Skin/Soft Tissue Intervention with Trauma without Flap/Graft | 168 | 7 | 0.57 (0.30-1.11) | 0.1010 |
| 738 | Fixation/Repair of Shoulder Joint | 67 | 2 | 0.60 (0.17-2.16) | 0.4390 |
| 739 | Reduction/Fixation/Repair Upper Body/Limb except Fixation/Repair of Shoulder | 695 | 7 | 0.23 (0.10-0.50) | 0.0002 |
| 740 | Internal Fixation of Facial Bone | 145 | 2 | 0.23 (0.06-0.85) | 0.0280 |
| 741 | Other Intervention on Facial Bone with Trauma/Complication of Treatment | 19 | 1 | 1.23 (0.15-9.91) | 0.8441 |
| 742 | Ear/Nose/Throat Intervention with Trauma/Complication of Treatment | 26 | 1 | 0.97 (0.12-7.82) | 0.9774 |
| 743, 744†, 745†, 750† | Other Intervention on Bone of Upper Body with Trauma/Complication of Treatment (743); Muscle/Tendon/Minor Joint Intervention with Trauma/Complication of Treatment, Lower Limb (744); Nerve Intervention with Trauma (745); Muscle/Tendon/Minor Joint Intervention with Trauma/Complication of Treatment, Upper Limb (750) | 444 | 3 | 0.15 (0.06-0.41) | 0.0002 |
| 746 | Reduction Lower Limb except Ankle/Foot | 7 | 0 | - | - |
| 747 | Reduction/Fixation/Repair of Ankle/Foot | 928 | 15 | 0.31 (0.20-0.49) | <.0001 |
| 748 | Other Intervention for Trauma/Complication of Treatment | 73 | 2 | 0.47 (0.12-1.85) | 0.2810 |
| 749 | Eye Intervention with Trauma/Complication of Treatment | 17 | 0 | - | - |
| 751 | Removal Foreign Body Skin/Soft Tissue | 10 | 0 | - | - |
| 760 | Significant Injury/Exposure to Element | 15 | 1 | 0.62 (0.07-5.73) | 0.6765 |
| 761 | Fracture/Dislocation/Rupture of Pelvis/Sacrum/Coccyx | 154 | 7 | 0.47 (0.24-0.94) | 0.0325 |
| 762 | Complication of Transplanted Organ | 5 | 2 | 5.18 (0.96-27.83) | 0.0552 |
| 763 | Intracranial Injury with Injury to Other Organ | 11 | 0 | - | - |
| 764 | Multiple Intracranial Injury | 39 | 2 | 0.61 (0.13-2.79) | 0.5218 |
| 765 | Single Intracranial Injury | 189 | 13 | 0.96 (0.59-1.57) | 0.8620 |
| 766 | Fracture of Femur | 55 | 3 | 0.50 (0.15-1.67) | 0.2587 |
| 767 | Other Fracture Dislocation of Leg | 92 | 9 | 1.48 (0.77-2.86) | 0.2419 |
| 768 | Fracture of Patella/Upper Tibia/Fibula | 30 | 2 | 1.14 (0.26-5.06) | 0.8626 |
| 769 | Fracture of Shoulder/Upper Humerus | 47 | 3 | 0.85 (0.26-2.81) | 0.7898 |
| 770 | Other Fracture/Dislocation of Arm/Shoulder | 94 | 5 | 1.05 (0.46-2.38) | 0.9082 |
| 771 | Spinal Injury | 220 | 14 | 0.72 (0.43-1.22) | 0.2243 |
| 772 | Rib Fracture/Flail Chest | 126 | 4 | 0.39 (0.15-1.03) | 0.0564 |
| 773 | Multiple Injuries to Internal Organ | 35 | 1 | 0.37 (0.07-1.97) | 0.2447 |
| 774 | Single Injury to Internal Organ | 181 | 8 | 0.67 (0.34-1.31) | 0.2443 |
| 775 | Fracture of Skull/Facial Bone | 107 | 3 | 0.61 (0.21-1.80) | 0.3697 |

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| **CMG code** | **Description** | **Number of admissions** | **Number of events** | **Adjusted odds ratio\***  **(95% CI\*\*)** | ***p-*value** |
| 776 | Open Wound/Other/Unspecified Minor Injury | 435 | 34 | 1.51 (1.02-2.25) | 0.0413 |
| 777 | Other/Unspecified Fracture/Dislocation | 30 | 2 | 0.90 (0.22-3.74) | 0.8858 |
| 778 | Poisoning/Toxic Effect of Drug | 749 | 43 | 0.96 (0.69-1.33) | 0.8067 |
| 779 | Concussion | 79 | 2 | 0.46 (0.12-1.78) | 0.2617 |
| 780 | Post-Operative Complication except Hemorrhage | 348 | 23 | 0.73 (0.49-1.09) | 0.1273 |
| 781 | Other/Unspecified Complication of Treatment | 286 | 12 | 0.81 (0.46-1.42) | 0.4649 |
| 782 | Post-Operative Hemorrhage | 354 | 16 | 0.89 (0.51-1.55) | 0.6849 |
| 783 | Fracture/Dislocation of Wrist/Hand/Ankle/Foot | 56 | 2 | 0.55 (0.13-2.27) | 0.4075 |
| 800 | Other Admission with Major Intervention | 19 | 1 | 0.25 (0.03-2.42) | 0.2304 |
| 801 | Other Admission with Non-Major Intervention | 97 | 5 | 0.52 (0.19-1.42) | 0.2006 |
| 805 | Rehabilitation | 236 | 14 | 0.34 (0.18-0.62) | 0.0004 |
| 806 | Convalescence | 977 | 56 | 0.69 (0.52-0.92) | 0.0110 |
| 809 | Awaiting Placement | 56 | 6 | 0.86 (0.31-2.37) | 0.7724 |
| 810 | Palliative Care | 134 | 69 | 3.61 (2.25-5.80) | <.0001 |
| 811 | General Symptom/Sign | 604 | 92 | 1.49 (1.14-1.95) | 0.0039 |
| 812 | Other Factor Causing Hospitalization | 147 | 29 | 1.62 (1.05-2.52) | 0.0308 |
| 813 | Follow-Up Treatment/Examination | 921 | 34 | 0.81 (0.57-1.14) | 0.2300 |
| 814 | Observation/Evaluation | 66 | 2 | 0.71 (0.27-1.89) | 0.4950 |
| 815 | Cancelled Intervention | 420 | 26 | 3.72 (2.30-6.01) | <.0001 |
| 901 | MCC 01 Unrelated Intervention | 44 | 3 | 0.73 (0.21-2.50) | 0.6161 |
| 902 | MCC 02 Unrelated Intervention | 6 | 0 | - | - |
| 903 | MCC 03 Unrelated Intervention | 9 | 1 | 1.59 (0.16-15.97) | 0.6956 |
| 904 | MCC 04 Unrelated Intervention | 65 | 12 | 1.18 (0.67-2.05) | 0.5709 |
| 905 | MCC 05 Unrelated Intervention | 91 | 7 | 0.52 (0.25-1.08) | 0.0788 |
| 906 | MCC 06 Unrelated Intervention | 78 | 12 | 1.36 (0.73-2.53) | 0.3358 |
| 907 | MCC 07 Unrelated Intervention | 44 | 9 | 2.18 (1.08-4.42) | 0.0300 |
| 908 | MCC 08 Unrelated Intervention | 33 | 4 | 1.21 (0.43-3.36) | 0.7188 |
| 909 | MCC 09 Unrelated Intervention | 29 | 2 | 0.78 (0.21-2.81) | 0.6986 |
| 910 | MCC 10 Unrelated Intervention | 109 | 10 | 0.58 (0.25-1.32) | 0.1927 |
| 911 | MCC 11 Unrelated Intervention | 35 | 4 | 0.84 (0.26-2.71) | 0.7690 |
| 912 | MCC 12 Unrelated Intervention | 10 | 1 | 2.31 (0.50-10.61) | 0.2817 |
| 918 | MCC 18 Unrelated Intervention | 1 | 0 | - | - |
| 993 | Diagnosis Not Generally Hospitalized | 35 | 0 | - | - |
| 999 | Ungroupable | 1 | 0 | - | - |