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

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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 $1 + e^{-(\text{intercept} + \beta(\text{LACE})*\text{Lace Score} + \beta(\text{CMG Score})*\text{CMG score})}$ (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

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Figure 1: Outline of study methods.

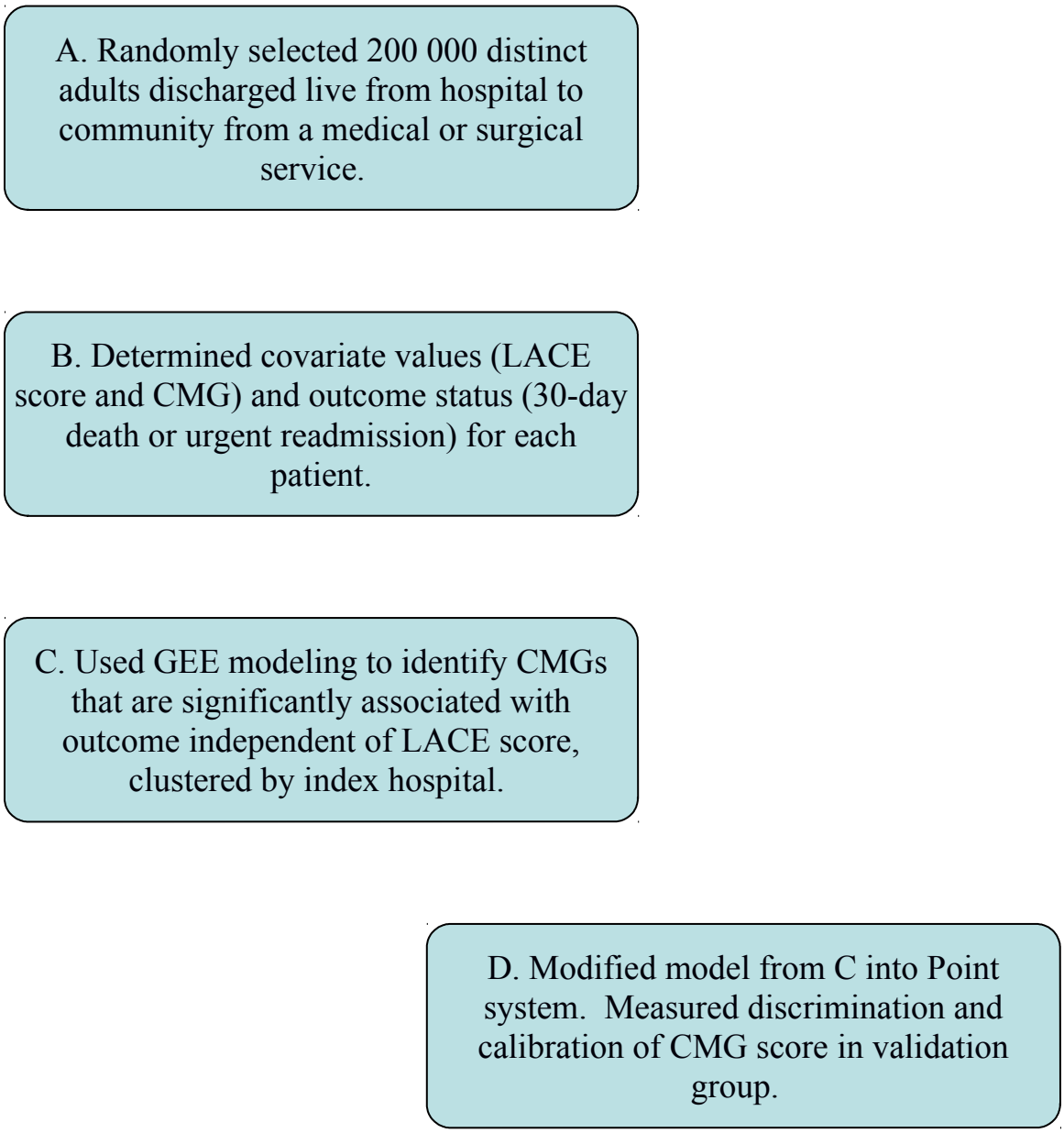


Figure 2: Outline for creation of study cohort

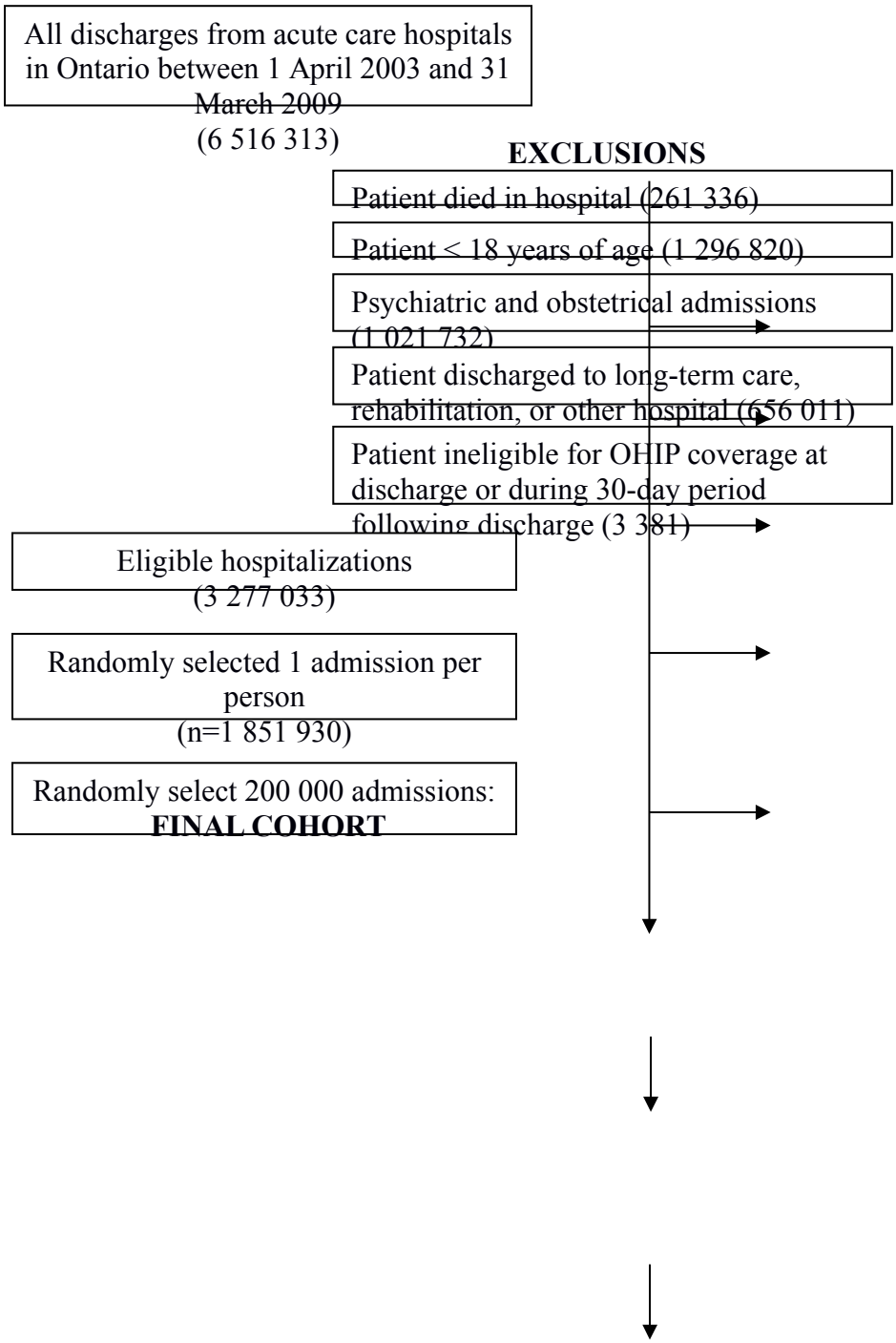
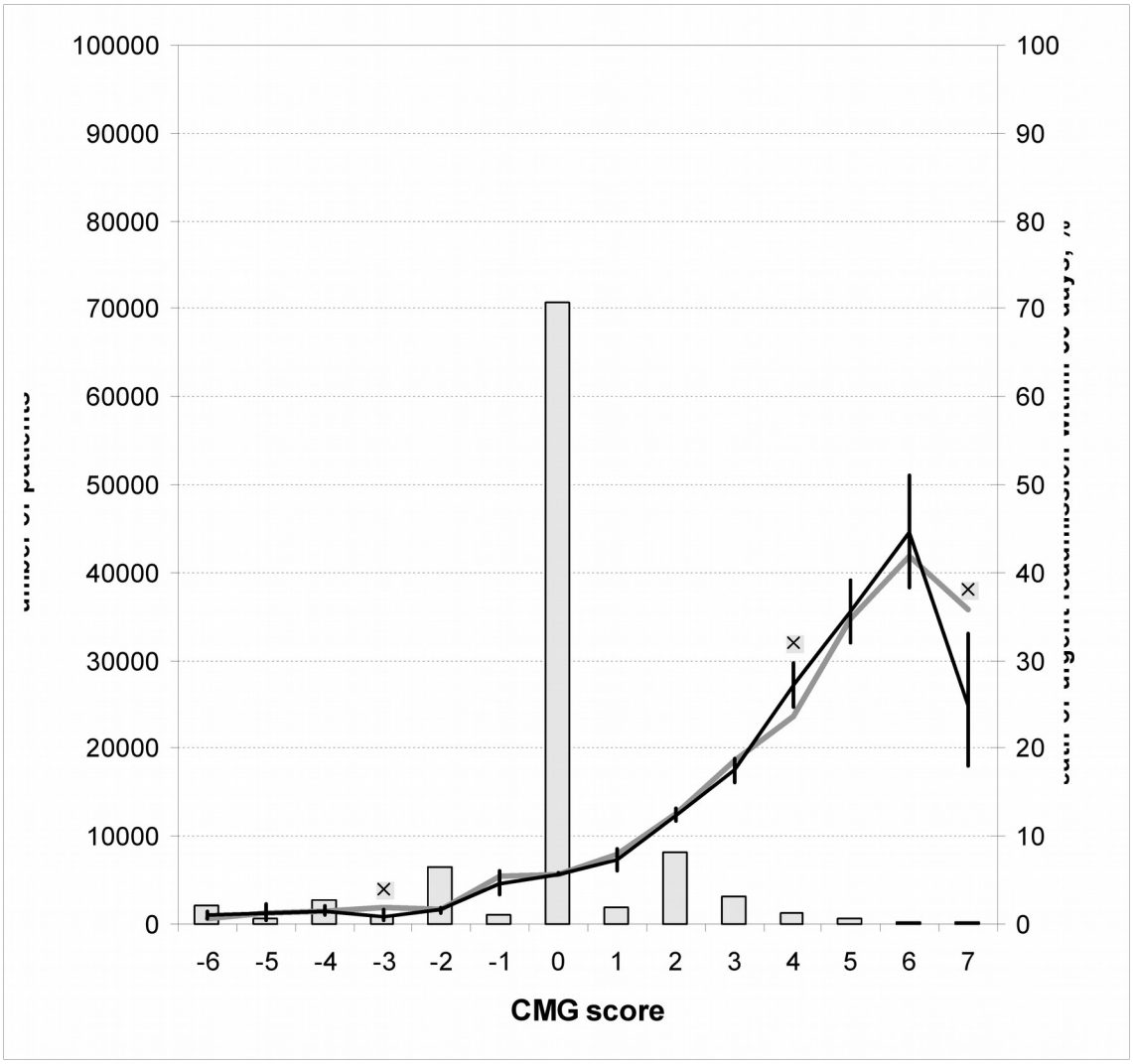
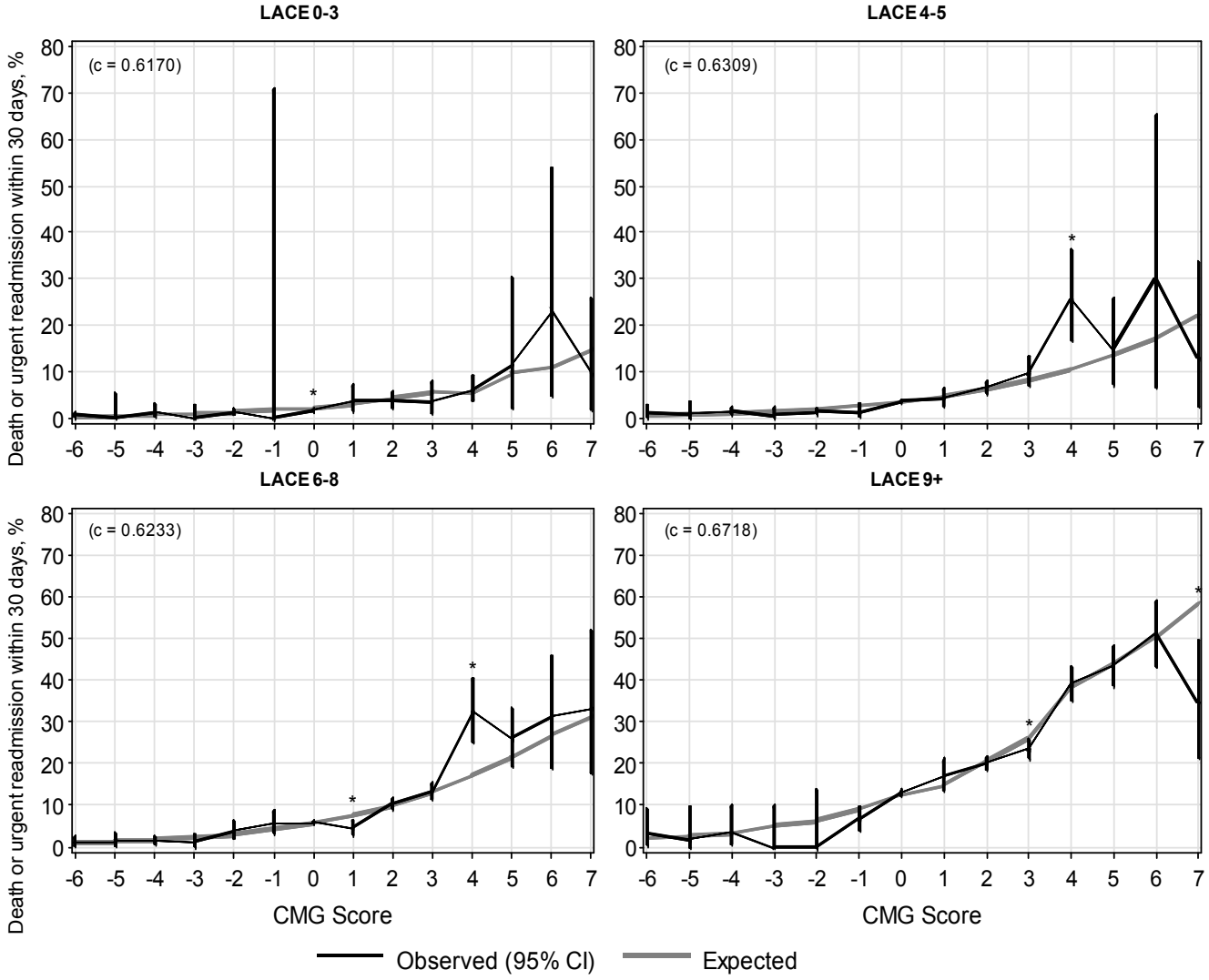


Figure 3: CMG score distribution and its association with 30-day death or urgent readmission in the validation cohort.



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
[a]*Malignant 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
[a]*Acute Myeloid Leukemia (624)*	2.018	7.52 (3.96-14.3)	6
[a]*Hepatobiliary/Pancreatic Malignancy (284)*	1.959	7.09 (5.40-9.30)	6
[b]*Palliative Care (810)*	1.635	5.13 (3.25-8.10)	5
[a]*Lymphoma (628)*	1.523	4.59 (3.07-6.86)	5
[a]*Digestive Malignancy (250)*	1.521	4.58 (3.45-6.08)	5
[b]Dehydration (438)	1.456	4.29 (3.12-5.90)	5
[d]*Organ Transplant with Trauma/Complication of Treatment (725)*	1.435	4.20 (4.04-4.37)	5
[a]*Other Leukemia (626)*	1.397	4.04 (2.33-7.02)	4
[a]*Neoplasm of Central Nervous System (038)*	1.397	4.04 (2.58-6.32)	4
[a]*Malignant Neoplasm of Respiratory System (132)*	1.357	3.88 (3.14-4.80)	4
[a]*Musculoskeletal Malignant Neoplasm (357)*	1.328	3.77 (2.61-5.47)	4
[a]*Malignant 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
[c]*Cirrhosis/Alcoholic Hepatitis (285)*	1.090	2.98 (2.24-3.95)	3
[a]*Chemotherapy/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
[c]*Other 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
[b]Aspiration 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
[c]*Heart Failure without Cardiac Catheter (196)*	0.790	2.20 (1.94-2.50)	3
[b]Other 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
[d]*Coronary 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
[c]*Renal Failure (477)*	0.579	1.78 (1.41-2.25)	2
[c]*Chronic Obstructive Pulmonary Disease (139)*	0.562	1.75 (1.54-2.00)	2

[a]Neoplasia-related hospitalization
[b]Hospitalization potentially indicative of overall poor functional status
[c]Hospitalization related to important chronic comorbidity
[d]Procedure-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
[d]*Coronary Artery Bypass Graft without Cardiac Catheter without MI/Shock/Arrest with/without Pump (172)*	-0.314	0.73 (0.62-0.87)	-1
[d]*Unilateral Knee Replacement (321)*	-0.647	0.52 (0.38-0.73)	-2
[d]Hysterectomy with Non Malignant Diagnosis (502)	-0.656	0.52 (0.40-0.67)	-2
[d]Reduction/Fixation/Repair of Ankle/Foot (747)	-1.057	0.35 (0.22-0.54)	-3
[d]Complicated Appendectomy (233)	-1.197	0.30 (0.16-0.56)	-4
[d]Simple Appendectomy (234)	-1.220	0.30 (0.18-0.48)	-4
[d]Reduction/Fixation/Repair Upper Body/Limb except Fixation/Repair of Shoulder (739)	-1.411	0.24 (0.11-0.54)	-4
[d]Replacement/Fixation/Repair of Tibia/Fibula/Knee (729)	-1.589	0.20 (0.11-0.39)	-5
[d]Thyroid/Parathyroid/Thymus Gland Intervention (424)	-1.728	0.18 (0.08-0.41)	-6
[d]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)	-1.819	0.16 (0.06-0.44)	-6
[d]*Angina (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.

[a]Neoplasia-related hospitalization
[b]Hospitalization potentially indicative of overall poor functional status
[c]Hospitalization related to important chronic comorbidity
[d]Procedure-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

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	-	-

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	-	-

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

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

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

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

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

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	-	-