

A machine learning-based approach to support the assessment of
clinical coded data quality in the context of Diagnosis-Related
Groups classification systems

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Title

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Table of Contents

Acknowledgments.....	x
List of Publications.....	xi
Abbreviations and Notation.....	xii
Abstract.....	xiii
Resumo.....	xvi
1. Outline.....	19
2. Rationale.....	22
2.1 <i>Diagnosis Related Groups (DRGs): concept and purposes</i>	23
2.2 <i>Evolution of DRGs</i>	25
2.3 <i>Medical Coding and DRGs</i>	30
3. Objectives.....	36
4. Medical coding quality assessment in hospital administrative datasets.....	38
5. How the different patient's underlying comorbidities drive APR-DRG classification?.....	57
6. How the APR-DRG system responds to the different types of hospital procedures?.....	184
7. Discussion and recommendations.....	271
References.....	282

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List of Publications

Research Papers and Abstracts

Quality of coding within clinical datasets: a case-study using burn-related hospitalizations

Burns, Accepted in September 12, 2018

Julio Souza, João Vasco Santos, Fernando Lopes, Alberto Freitas

Importance of coding comorbidities for APR-DRG assignment: a case-study on cardiovascular and respiratory diseases

Health Information Management Journal, Accepted in December 28, 2018

Julio Souza, João Vasco Santos, Veronica Bolón, Amparo Betanzos, Domingos Alves, Alberto Freitas

How different procedure codes drive APR-DRG classification and hospital funding for respiratory and circulatory system diseases? An approach using Support Vector Machine

Methods of Information in Medicine, Resubmitted in April 1, 2019

Julio Souza, João Vasco Santos, Domingos Alves, Alberto Freitas

Oral Communications

WorldCIST 2018, Naples, Italy

March 27th-29th, 2018

Miscoding Alerts Within Hospital Datasets: An Unsupervised Machine Learning Approach

EuHEA 2016, Hamburg, Germany

July 14th-16th, 2016

Potential differences in reimbursement rates for inpatient services between Portugal and Brazil

CNES 14, Lisbon, Portugal

October 15th-16th, 2015

Development of a Computational system for classifying patients into Diagnosis-Related Groups (DRGs) and calculating inpatient quality indicators and case-mix index to evaluate hospitals located in Ribeirao Preto, Sao Paulo, Brazil

Abbreviations and Notation

AHRQ: Agency for Health Care Research and Quality

NYDH: New York State Department of Health

DRG: Diagnosis-Related Groups

R-DRG: Refined Diagnosis-Related Groups

MS-DRG: Medicare Severity Diagnosis-Related Groups

AP-DRG: All Patients Diagnosis-Related Groups

APR-DRG: All Patients-Refined Diagnosis-Related Groups

SOI: Severity of Illness

ROM: Risk of Mortality

SVM: Support Vector Machine

ICD-9-CM: International Classification of Diseases, 9th Revision, Clinical Modification

ICD-10-CM: International Classification of Diseases, 10th Revision, Clinical Modification

ICD-10-WHO: International Statistical Classification of Diseases and Related Health Problems 10th Revision, World Health Organization version

Abstract

Diagnosis-Related Groups (DRGs) have been widely adopted to increase transparency and encourage the efficient use of hospital resources. As a case-mix-based funding model, a crucial issue to establish an effective DRG system relies upon the accuracy and completeness of coded clinical data held in administrative databases. In particular, additional diagnoses representing comorbidities are crucial to determine the patient's severity of illness, whereas surgical procedures have a major role on driving DRG classification. Coding guidelines provide a scope on what secondary diagnoses and procedures should be coded. However, evidence elsewhere has shown that comorbidities are usually under-reported in clinical datasets, whereas certain types of procedures tend to be neglected because they can be considered irrelevant in terms of DRG classification and reimbursement, such as those which are usually performed in routine (e.g. electrocardiography, computed tomography, ultrasound), leading to inter-hospital dissimilarities in coding. As these issues have an impact on the correct allocation of patients to the DRGs, acknowledging the specific effects of additional diagnoses, namely those representing comorbidities, and of different types of procedures on DRG classification and hospital funding should be of most concern in DRG-based hospital payment systems.

The principal motivation for this thesis was to provide information concerning coding of comorbidities and procedures and thus assist hospital stakeholders to improve the quality of coded clinical data and help to implement or optimize their DRG systems. The first objective was to assess variations between Portuguese hospitals regarding coding of diagnoses and procedures, in order to identify possible miscoding practices that could be affecting APR-DRG (All-Patient Refined Diagnosis-Related Groups) classification, which is the DRG variant that is currently used in Portugal. The second objective was to study the individual impact of Charlson and Elixhauser comorbidities on APR-DRG classification and hospital funding. The third and last objective was to perform the same analysis to assess the effects of different types of diagnostic and therapeutic procedures on APR-DRG grouping.

To achieve the first objective, we employed chi-square test with Bonferroni correction for multiple comparison to verify whether hospitals differed significantly in the frequencies of diagnosis and procedure codes. For the second objective, we opted for a Machine Learning (ML)-based approach to explore the APR-DRG technical remuneration structure and thus investigate how the different Charlson and Elixhauser comorbidities drive and modify APR-DRG grouping and thereby hospital funding. We opted for this automatic learning approach to employ a generic and reproducible method, which can be applied to different data sources and DRG versions. In the third objective, we used the same ML-based method to acknowledge the effects of different types of diagnostic and therapeutic procedures. In this case, we assessed four procedure categories defined by the Agency for Health Care Research and Quality (AHRQ), which indicates whether a procedure is for diagnostic or therapeutic reasons and whether it is minor or major in terms of invasiveness and resource use. We also extended the third objective to evaluate coded clinical data from a Brazilian inpatient database to perform those analyses in a country that has not implemented DRGs and thus verify the applicability of the proposed ML-based approach.

Using data on burn injury hospitalizations in Portugal in the period 2011-2015, we found significant inter-hospital variations in coding of diagnosis and mainly non-operating room procedures that could potentially be associated with miscoding practices impacting APR-DRG classification. The comprehensiveness of coding should be monitored, and using separate code counts within specific APR-DRGs for different types of hospitals would be useful to perform this task. Furthermore, comprehensive reporting of preexisting or newly acquired comorbidities should be encouraged in hospitals as they have a crucial impact on identifying costly episodes, with a higher severity of illness episodes thereby impacting hospital funding. We recommend that future guidelines to be used by medical coders should include more specific rules concerning coding of comorbidities. Moreover, our findings were useful to understand how specific procedures influence APR-DRG classification, reinforcing that reporting even routine procedures should be encouraged in hospital settings. In

addition, the results obtained with the ML approach were consistent with overall APR-DRG grouping logics, potentially being regarded as a generic and reproducible methodology that can be applied to assess different data sources from different DRG systems, including from countries that have not implemented a DRG system yet. Finally, all those findings should collaborate with initiatives of implementing or optimizing existing DRG systems and further enhance the quality of coded clinical data.

Keywords: Inpatients; Diagnosis-Related Groups; International Classification of Diseases; Clinical Coding; Hospital Administration; Comorbidities; Inpatient Procedures; Machine Learning; Support Vector Machine

Resumo

Os Grupos de Diagnósticos Homogêneos (GDH) têm sido amplamente adotados com o objetivo de aumentar a transparência dos serviços prestados nos hospitais e incentivar o uso eficiente dos recursos hospitalares. Visto que se trata de um modelo de financiamento baseado em *case-mix*, a eficácia dos sistemas baseados em GDH depende da qualidade e completude dos dados clínicos codificados mantidos em bases de dados administrativas. Em particular, os diagnósticos secundários que representam comorbidades são cruciais para determinar a gravidade da doença do paciente, enquanto que os procedimentos cirúrgicos têm um papel determinante na classificação em GDH. As *guidelines* de codificação fornecem um escopo sobre que diagnósticos e procedimentos secundários devem ser codificados. No entanto, diversos estudos têm mostrado que as comorbidades são geralmente sub-codificadas em bases de dados hospitalares, enquanto certos tipos de procedimentos tendem a ser negligenciados pois são considerados pouco importantes no âmbito da classificação em GDH e do financiamento, nomeadamente procedimentos de rotina (ex., eletrocardiograma, tomografia computadorizada, ultrassonografia), levando a discrepâncias na codificação entre os hospitais. Tendo em vista o impacto dessas questões no agrupamento em GDH, reconhecer como os diagnósticos secundários, nomeadamente aqueles que representam comorbidades, e os diferentes tipos de procedimentos são considerados na lógica do agrupamento, bem como o seu impacto no financiamento hospitalar, deve ser de grande relevância para implementar ou otimizar sistemas baseados em GDH.

A principal motivação para esta tese foi reunir informações relevantes relativamente à codificação de comorbidades e procedimentos de modo a auxiliar na melhoria da qualidade dos dados clínicos codificados e, desta forma, apoiar a implementação ou otimização de sistemas baseados em GDH. O primeiro objetivo foi avaliar as variações na codificação de diagnósticos e procedimentos entre hospitais portugueses de modo a identificar possíveis práticas de codificação

que poderiam vir a afetar a classificação no sistema APR-DRG (All Patient-Refined Diagnosis-Related Groups), que corresponde a versão do sistema GDH atualmente em vigor em Portugal. O segundo objetivo foi estudar individualmente o impacto das comorbilidades de Charlson e Elixhauser no agrupamento em APR-DRG e no financiamento hospitalar. O terceiro e último objetivo foi realizar a mesma análise para investigar os efeitos de diferentes tipos de procedimentos diagnósticos e terapêuticos no agrupamento.

Relativamente ao primeiro objetivo, utilizamos o teste de qui-quadrado com correção de Bonferroni para comparações múltiplas para verificar se as diferenças na frequência de códigos de diagnósticos e procedimentos entre os hospitais eram estatisticamente significativas e, portanto, rastrear os códigos que apresentavam maior variabilidade. Relativamente ao segundo objetivo, optamos por uma abordagem baseada em *Machine Learning* (ML) para explorar a estrutura técnica do sistema APR-DRG e, deste modo, caracterizar os efeitos das diferentes comorbilidades de Charlson e Elixhauser no agrupamento e perceber como as mesmas alteram os GDH e, conseqüentemente, o financiamento hospitalar. Optamos por essa abordagem por ser um método genérico e reprodutível, que pode ser aplicado a diferentes bases de dados e diferentes versões de GDH. No terceiro objetivo, o mesmo método baseado em ML foi empregue para caracterizar os efeitos de diferentes tipos de procedimentos diagnósticos e terapêuticos no agrupamento. Neste caso, avaliamos quatro categorias de procedimentos definidos pela *Agency for Health Care Research and Quality* (AHRQ), que define se um procedimento deve ser utilizado para fins diagnósticos ou terapêuticos e se é minor ou major em termos de invasividade e consumo de recursos. O terceiro objetivo foi também estendido para avaliar dados clínicos codificados de uma base hospitalar do Brasil para assim analisar os dados de um país que não tem experiência com os GDH e verificar a aplicabilidade do método baseado em ML proposto.

Utilizando dados de internamento por queimaduras em Portugal entre os anos de 2011 e 2015, foram encontradas variações significativas na codificação de diagnósticos e procedimentos não

cirúrgicos entre os hospitais avaliados, o que poderá potencialmente estar associado a práticas incorretas de codificação, com potencial impacto no agrupamento em GDH. A codificação completa de códigos diagnósticos e procedimentos deve ser monitorizada, podendo-se utilizar a contagem individual dos códigos no âmbito de cada GDH e ajustar as contagens para os diferentes tipos de hospital. Para além disso, incentivar a recolha completa de informações sobre comorbilidades pré-existentes ou adquiridas durante a hospitalização deve ser promovido nos hospitais, tendo em conta o potencial impacto destas condições clínicas na determinação da severidade da doença e, portanto, no financiamento hospitalar. Recomendamos que futuras *guidelines* a serem usadas pelos médicos codificadores incluam regras mais específicas e voltadas para a codificação de comorbilidades. Este trabalho também permitiu caracterizar a influência de procedimentos específicos na classificação em APR-DRG, reforçando que mesmo a codificação de procedimentos de rotina deve ser encorajada em ambientes hospitalares. Além disso, os resultados obtidos com o uso do ML foram consistentes com a lógica de agrupamento do APR-DRG e apresentou-se como uma metodologia genérica e reprodutível, que pode ser aplicada para avaliar diferentes fontes de dados, de diferentes sistemas e, portanto, pode ser inclusive empregada para avaliar dados administrativos hospitalares em países que não implementaram um sistema baseado em GDH. Por fim, os nossos achados devem colaborar com iniciativas de implementação ou otimização de sistemas baseados em GDH já existentes e auxiliar na melhoria da qualidade dos dados clínicos codificados.

Palavras-chave: Internamentos; Grupos de Diagnóstico Homogéneos; Classificação Internacional de Doenças; Codificação Clínica; Gestão Hospitalar; Comorbilidades; Procedimentos Hospitalares; Machine Learning; Support Vector Machine

Outline

1. Outline

This thesis was based on three different studies, each of which focused in three specific objectives that combined would address the main goal of this research, which consist in providing evidence on required features that should be present in administrative databases concerning coding of diagnoses and inpatient procedures for proper use of Diagnosis-Related Groups (DRGs). This document is organized as follows:

The next chapter, Chapter 2, presents a rationale and the theoretical background on DRG classification, its evolution over time and the relation between this system and clinical coding.

Chapter 3 summarizes the principal motivation and states the specific objectives of this thesis.

Chapter 4 presents a study aimed at investigating inter-hospital variability regarding coding of diagnoses and procedures and the possible impact of the observed coding discrepancies on DRG classification.

Chapter 5 presents a study that employed a machine learning-based method to explore the All Patients-Refined Diagnosis-Related Groups (APR-DRGs) technical remuneration structure and characterize the impact of each Charlson and Elixhauser comorbidity on DRG classification and hospital funding.

Chapter 6 presents a study that employed the method introduced in the study described in chapter 5, but to characterize the impact of different categories of inpatient procedures on DRG classification and hospital funding.

Finally, Chapter 7 presents the discussion, conclusions and recommendations based on the findings derived from the three studies described in chapters 4, 5 and 6.

Rationale

2. Rationale

2.1. Diagnosis Related Groups (DRGs): concept and purposes

In several countries, when a patient is admitted to a hospital, the facility is reimbursed according to a system based on Diagnosis Related Groups (DRG), which is a patient classification scheme mainly designed to group inpatient episodes into clinically and economically homogeneous clusters, the so-called DRGs, each of which presenting similar resource consumption patterns [Mathauer and Wittenbecher, 2013; Lagman et al., 2007; Aiello and Roddy, 2017]. The grouping process is done through a flowchart-based method implemented in a software called DRG grouper. For each inpatient episode, several variables characterizing the clinical pathway and demographic characteristics collected at the time of discharge should be entered in the grouper software for DRG classification, namely the principal and secondary diagnoses, procedures, age, sex, and, in the case of newborns, the birthweight. Diagnoses and procedures should be coded by using the International Statistical Classification of Diseases and Related Health Problems (ICD). Hospitals can then be remunerated according to the DRG each inpatient was assigned to at the time of discharge. Reimbursement rates for each DRG are calculated through a payment formula that considers the base rate multiplied by a DRG-specific relative cost weight [Gartner et al., 2015]. Although DRGs are mainly used to reimburse providers for acute inpatient care, they can also be used for paying non-inpatient care and even for other purposes beyond resource use, cost and payment, such as performance comparisons across hospitals and calculation of risk-adjusted health outcomes [Chong et al., 2011].

The main purpose of the implementation of DRGs was to provide an insight on the provision of health services within hospitals and encourage the efficient use of resources by paying hospitals based on the number and type of cases treated [Busse et al, 2011; Tan et al., 2014]. The DRG system was first developed at the Yale University in the late sixties and was first implemented in 1983 in the United States, within a hospital prospective payment system for Medicare [Langenbrunner et al., 1989]. Since then, especially after the 1990's, several versions of DRGs have been gradually adapted and implemented in high-income economies, such as Australia, Canada and Europe [Mihailovic et al., 2016]. Meanwhile, more low and middle-income countries have also introduced or begun to explore a DRG-based payment system, mostly for reimbursing acute inpatient care [Mathauer and Wittenbecher, 2013]. The DRGs' overall acceptance is related to many factors, namely: (i) their contribution to contain hospital costs by reducing the average length of stay [Busse et al, 2011]; (ii) promoting transparency by condensing the large number and variety of patients treated in hospitals into a manageable number of clinically and economically homogeneous groups of patients [Busse et al., 2013]; and (iii) leading hospitals to use resources efficiently by increasing the case volumes while reducing the average length of stay [Mathauer and Wittenbecher, 2013]. Furthermore, DRGs can be regarded as flexible tools, as the core DRG methodology has been adapted in different country settings, according to particular needs and available information [La Forgia GM and Couttolenc, 2008].

However, the whole process associated with the assignment of inpatient episodes to the different DRGs is difficult to understand and may not be clear to many physicians and other hospital professionals that deal with inpatient coding and documentation. In the basic DRG structure, the algorithm first determines one major diagnostic category

(MDC) according to the principal diagnosis (i.e., the reason for hospitalization). MDCs were developed by dividing all principal diagnosis into mutually exclusive diagnosis areas (i.e., diseases and disorders of the respiratory system). If the principal diagnosis is not accurately reported and no MDC is identified, an error DRG is returned. For very high-cost procedures (i.e., organ transplantation), the episode is instead assigned to a pre-MDC, which comprises a set of exceptionally high-cost DRGs. Following the determination of MDC (or pre-MDC), comorbidities and clinical procedures lead the episode to a specific medical or surgical DRG within the assigned MDC. The patient's age, sex, discharge status or birthweight (in the case of newborns) can further lead to different DRG subtypes [Gartner et al., 2015]. Among surgical DRGs, the subtypes include DRGs representing major surgery, minor surgery, other surgery and surgery not related with the principal diagnosis. Among medical DRGs, subtypes include DRGs comprising neoplasms, specific conditions relating to the organ system (represented by the MDC), symptoms and other conditions [Centers for Medicare and Medicaid Services, 2011].

2.2. Evolution of DRGs

The DRG system was first developed at the Yale Center for Health Studies in the late sixties to encourage physicians to use hospital resources more economically, register the relationship between medical and administrative decisions and define hospital services and products by diagnosis [Rimler et al., 2015]. In 1980, an experimental prospective hospital payment system using the DRGs was implemented in the state of New Jersey, in which hospitals were paid according to a fixed DRG-specific amount for each patient they treated [Rimler et al., 2015]. Based on the New Jersey experiences, in

1983 the American Congress decided to adopt a prospective payment system based on DRGs for Medicare reimbursements [Averill et al., 1998].

The initial DRGs developed at Yale encompassed all types of patients admitted to an acute care hospital. Nevertheless, with the implementation of a DRG-based prospective payment system for Medicare in 1983, the Health Care Financing Administration (HCFA) redesigned the Yale DRGs and created the Medicare DRGs to focus on problems primarily related to elderly patients and thereby address health issues within the Medicare population [Averill et al., 1998]. HCFA later funded a project at Yale University to revise the use of complications and comorbidities (CCs) in the Medicare DRGs. This project mapped all secondary diagnoses regarded as a CC that accounts for a significant increase in hospital resource use. A total of 136 secondary diagnosis groups were further created with this mapping, with which one of them being assigned to a specific CC complexity level. For medical episodes, each secondary diagnosis groups was assigned to one out of three CC complexity levels (non-CC, moderate or major CC and catastrophic CC). For surgical episodes, each secondary diagnosis group was attributed to one out of four CC complexity levels (non-CC, moderate CC, major CC and catastrophic CC). This DRG system developed by the Yale project is referred as Refined DRGs (RDRGs) [Averill et al., 1998].

In 1987, the state of New York approved a legislation that enacted a DRG-based prospective payment system for all non-Medicare patients, then requiring the New York State Department of Health (NYDH) to assess the applicability of the Medicare DRGs to a non-Medicare population, namely for neonates and patients with Human Immunodeficiency Virus (HIV) infections. Nevertheless, the evaluation concluded that Medicare DRGs were not applicable for a non-Medicare population and thus NYDH

agreed with 3M Health Information Systems (3M HIS) to research and develop all necessary DRG modifications. The new DRG definitions developed and introduced by NYDH and 3M is referred as All-Patient Diagnosis-Related Groups (AP-DRGs), which added a set of neonate DRGs using birth weight categories as primary variables and other two MDCs comprising cases of HIV infection and complications, as well as for multiple traumas. Another important modification introduced by the AP-DRG system involved patients who are on long-term mechanical ventilation requiring tracheostomy, which comprise a group of extremely expensive hospitalizations. In this sense, patients with a tracheostomy were put into one out of two tracheostomy AP-DRGs (depending on whether a tracheostomy with long term mechanical ventilation was performed with or without extensive procedure), regardless of the MDC they were assigned to. Moreover, patients with certain mouth, larynx, or pharynx diseases with the tracheostomy performed for therapeutic reasons are assigned to separate DRGs. Another group of very expensive patients addressed with the AP-DRG consisted in those that underwent transplants of liver, bone marrow, heart, kidney and lungs, which are procedures that can be performed for diagnoses in different MDCs. Thus, in the AP-DRG system, these cases were assigned to a DRG independent of the MDC representing the principal diagnosis [Averill et al., 1998].

Other updates added some enhancements for the AP-DRG system. In many MDCs, the presence of a major CC was responsible for a dominant effect on resource use. Therefore, to recognize the impact of major CCs, a single major CC DRG across all surgical and medical patients were formed for some MDCs, resulting in the creation of 60 specific major CC DRGs. Additionally, the AP-DRG system also included several pediatric modifications, as well as significant modifications for cystic fibrosis, nutritional disorders,

high risk obstetric care, acute leukemia, hemophilia and sickle cell anemia [Averill et al., 1998].

In 2007, the Centers for Medicare & Medicaid Services (CMS) remodeled the Medicare DRGs, leading to the creation of the Medicare Severity Diagnosis-Related Groups (MS-DRG), allowing for further stratification within each base DRG according to different severity levels. For instance, not all episodes of lower extremity bypass are identical in terms of severity. Therefore, in order to differentiate variations in severity within a specific DRG, the MS-DRG introduced a DRG variant based on CCs and major complications and comorbidities (MCCs) assignments. The CC and MCC are subdivisions for each DRG that represent increasing costs, with MCC having the highest reimbursement, followed by CC, and then no CC/MCC [Aiello et al., 2017].

A new concept of patient stratification was introduced afterwards with the creation of the All-Patient Refined Diagnosis-Related Groups (APR-DRG) system [Aiello et al., 2017]. In the APR-DRG system, the basic AP-DRG structure was modified so that four subclasses specifying the Severity of Illness (SOI) and Risk of Mortality (ROM) could be added to each AP-DRG. Like in the previous versions, inpatient episodes are assigned to a base DRG mostly according to the principal diagnosis, if it is a medical case, or an operating room procedure, if it is a surgical case, with each base DRG representing a group of patients with the same hospitalization reasons. Following the base DRG assignment, the episodes are further stratified by adding one SOI and one ROM level, both ranging sequentially from 1 to 4 (1 - minor; 2 - moderate; 3 - major; 4 - extreme), representing increasing reimbursement demands. While SOI refers to the degree of loss of function or physiologic decompensation of an organ system, ROM was designed to reflect the likelihood of death [Averill et al., 2013].

The determination of both SOI and ROM is performed in the same way, in a process which is divided into three complex phases, with each phase comprising several steps. In the first phase, all secondary diagnoses that are closely related to the principal diagnosis are discarded and a pre-defined severity level is attributed to each one of the remaining secondary diagnoses. In APR-DRG, each ICD code representing a secondary diagnosis is associated with a pre-defined severity level, also ranging from 1 (minor) to 4 (extreme). For instance, the pre-defined severity level for bronchitis is minor (1). The pre-defined severity level of asthma with status asthmaticus, however, is considered moderate (2) and may increase further to major (3) and extreme (4) for viral pneumonia and respiratory failure, respectively. In the second phase, all secondary diagnoses that are related to other secondary diagnoses are also eliminated. A preliminary SOI level for the episode is defined afterwards as the highest severity level among all the remaining secondary diagnoses. If the highest severity level found is 3 or 4, the preliminary SOI will be set to the immediate lower level, unless that episode presents a high number of secondary diagnoses with severity 3 or 4. In the last phase, the final SOI level is determined by systematically changing the preliminary SOI according to the combinations of principal diagnosis, age, presence of operating and non-operating-room procedures, multiple operating-room procedures, the base DRG itself and categories of secondary diagnoses [Averill et al., 2013].

In summary, both SOI and ROM levels were developed according to the underlying conditions of a patient and the effects of such conditions on the outcome and the risk of dying from the treatment. Besides their use for hospital payment, SOI and ROM subclasses have been used and studied for risk adjustment of in-hospital mortality [Iezzoni et al., 1996; Iezzoni et al., 1998; Baram et al., 2008; Romano and Chan, 2000;

McCormick et al., 2018]. Those levels, however, cannot be compared across the different disease classifications within the APR-DRG structure, as SOI and ROM levels are both disease-specific and their significance differs according to the base APR-DRG the episode was assigned to. In other words, an episode grouped into APR-DRG 203 (chest pain) with a SOI level 4 is certainly not as critical as one assigned to SOI 4 but grouped into APR-DRG 204 (syncope and collapse).

As other DRG versions, the APR-DRG system is currently organized into 25 Major Diagnostic Categories (MDC), with a total of 314 base APR-DRGs (version 31) across the 25 MDCs [Averill et al., 2013]. The MS-DRG and APR-DRG are the most commonly employed system for reporting and billing at the present time and the APR-DRG system, in particular, is currently employed for reimbursement purposes in some European countries, such as Portugal, Belgium, Spain and Italy, some Arab countries and in over 30 states in the US [Dewilde et al., 2018].

2.3. Medical coding and DRGs

The DRG system was conceived to provide a reproducible method to reimburse inpatient care based on patient complexity and resource utilization, while promoting cost containment [Busse et al, 2011]. Since its creation, the basic DRG structure has undergone numerous revisions, leading to a less stable and a more complex and often confusing process [Aiello et al., 2017]. In addition to that, there are several types of coding errors with potential impact on DRG allocation. The most common include selecting the wrong principal diagnosis, omitting additional codes that should be reported and choosing less specific diagnosis and procedure codes [Reid et al., 1999]. Another sources of coding

errors that can impact DRGs are misspecification, miscoding and resequencing of diagnoses [Aelvoet et al., 2009]. If a patient is admitted due to a pneumonia and an unrelated post-admission myocardial infarction is selected as the principal diagnosis, there is a case of misspecification [Aelvoet et al., 2009]. If a transient ischemic attack is coded as a cerebrovascular accident, the error is denominated miscoding, whereas changing the principal diagnosis from acute bronchitis to chronic obstructive lung disease is an example of resequencing [Hsia et al., 1998].

There are also deliberate coding errors which are denominated in the literature as upcoding, and its contrary, under-coding [Doremus and Michenzi, 1983]. Upcoding is the practice of deliberately miscode patient data to receive higher payments, moving patients from lower-paying DRGs into higher-paying DRGs [Dafny 2005]. [Pongpirul and Robinson, 2013] described three types of upcoding: (1) a hospital coder may try to explore the discharge summary to come up with the best possible codes, which includes switching between the principal and secondary diagnosis [Steinbusch, 2007; Serden et al., 2009]; (2) a hospital coder may look for reimbursable conditions in the medical records [Silverman et al., 2004]; and (3) hospital coders may exaggerate the choice of codes without supportive evidence in the patient record, which includes the addition of secondary diagnoses, making the patient's condition look more complicated [Steinbusch, 2007; Serden et al., 2009]. Undercoding is a miscode practice that leads inpatient episodes to be assigned to lower resource intensity DRGs [Aelvoet et al., 2009]. In APR-DRG, hospitals are reimbursed based on the length of stay, which is compared against the national mean length of stay of patients in the same APR-DRG and SOI level. Lengthy hospital stays are penalized in terms of reimbursement; thus, it may be rewarding to undercode the discharge record to regroup the episode into another APR-DRG with a

shorter LOS or lower SOI in the same APR-DRG to make it an outlier, achieving the complete reimbursement [Aelvoet et al., 2009].

In this sense, it is essential that physicians and other hospital professionals responsible for inpatient coding and documentation become facile with the whole process behind DRG classification in order to work towards better and complete documentation and coding of diagnoses and procedures, optimizing then the performance of the DRG grouper to achieve fairer hospital funding. The principal diagnosis, which is the reason for the admission, is the most crucial for correct grouping and reimbursement as it drives MDC and the DRG in several cases. However, the impact of a comprehensive recording of secondary diagnosis codes on the performance of the DRG was found in previous studies to be striking [Reid et al., 1999]. Under-reporting of additional diagnoses will impact more those DRG versions that use complications/comorbidities and resource intensity classes more widely. For instance, in APR-DRG, all additional diagnoses can contribute to the severity of illness and increased cost weights, with comorbidities being what typically drive SOI and ROM levels. Dewilde et al (2018) confirmed that patients grouped into higher SOI levels in APR-DRG present a higher number of comorbidities affecting different organ systems, resulting in a higher volume of resource utilization. In fact, the authors also found that the number of comorbidities registered in the patient's record determine the severity level of the episode. Rimier et al (2015) stated that the presence of comorbidities can justify changes in DRG classification, such as the case of diabetes without complication, whose financial compensation more than doubles when associated with cases of end-stage renal disease [Rimier et al., 2015].

Thus, accurate and complete coding of comorbidities is particularly important in APR-DRG classification as the patient's SOI has a significant role in hospital payment [Spurgeon et al., 2011]. Due to their important role on determining patient outcomes, several methods have been developed to measure and control comorbidities, with Charlson and Elixhauser scores being the two most commonly used [Li et al., 2008; Chang et al., 2016]. The Charlson's method was developed by reviewing inpatient hospital charts and assessing the relevance of several clinical conditions in the prediction of mortality and a total of 17 comorbid categories were created. A weighted score was assigned to each of 17 comorbidities and the Charlson index was developed as an indicator of disease burden. The Elixhauser approach investigated groups of ICD-9-CM diagnosis codes to identify categories of comorbidities and further measured their association with mortality. The performance of the Charlson and Elixhauser measures in predicting poor outcomes has been evaluated and validated by several studies and are regarded as good predictors of patient outcomes [Li et al., 2008].

Despite their clinical significance, evidence elsewhere has shown that certain comorbidities are generally under-reported in administrative databases [Austin et al., 2005], while the prevalence of others is overestimated when compared with the information of medical charts [Spurgeon et al., 2011; Malenka et al., 1994; Iezzoni et al., 1992; Hawker et al., 1997; Kieszak et al., 1999; Powell 2001; Waite et al., 1994; Normand et al., 1995; Romano et al., 1994; Humphries et al., 2000; Blumenthal et al., 1996; Sarfati et al., 2010; Preen et al., 2004; Newschaffer et al., 1997; McCarthy et al., 2000; Mears et al., 2002; Chong et al., 2011]. Overall, asymptomatic conditions tend to be under-reported in administrative datasets [Powell et al., 2001; Romano et al., 1994], while certain acute medical conditions or complications tend to be regarded by medical coders

as more important than others, thereby originating this coding bias [Iezzoni et al., 1992]. In this context, several studies have evaluated the degree of agreement between the information on comorbidities obtained from administrative datasets and that obtained from medical charts. The prevalence of comorbidities obtained from administrative data was found to be typically lower than that obtained from medical charts for most of the evaluated comorbid conditions [Chong et al., 2011]. Comparing with chart review data, [Quan et al., 2002] demonstrated that administrative data from a Canadian hospital discharge underreported 29 out of 32 Charlson and Elixhauser comorbidities when ICD-9-CM (International Statistical Classification of Diseases and Related Health Problems, 9th Revision, Clinical Modification) is used, whereas this number increased to 31 with ICD-10-CM (International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Clinical Modification) data [Quan et al., 2002].

Apart from additional diagnoses, the presence of surgical procedures consistently affects hospital resources and has a major role on driving the grouper. For this reason, the classic DRG structure was divided into medical and surgical DRGs following the MDC assignment, with the latter branch comprising DRGs that are mainly characterized by the specific code representing the main operating room procedure performed. Moreover, since patients can be submitted to multiple procedures related or not with their principal diagnosis, a hierarchical order of surgical DRGs within each MDC was defined to address those situations in which certain procedures are more relevant than others for grouping purposes [Centers for Medicare and Medicaid Services, 2016].

Significant procedures in terms of DRG classification are those which are surgical in nature, requiring an operating room to be performed. On the contrary, coders are encouraged not to code routine procedures, which are those occurring in most

hospitalizations or multiple times during a hospital stay, as they are regarded to have little impact on the performance of groupers. This can bring a risk to assign episodes to certain DRGs which combines certain diagnosis with non-operating room procedures, such as catheterization and mechanical ventilation. Furthermore, non-operating room procedures can help to identify patients with higher resource consumption and costs, being thus potential modifiers of the DRG [Hughes et al., 1990]. For instance, the presence of flow-direct pulmonary artery catheter in patients with acute heart failure, combined with a secondary diagnosis of hypotension, which typically occurs after an acute myocardial infarction, might indicate a more complicated episode within those grouped into the acute myocardial infarction DRG [Centers for Medicare and Medicaid Services, 2016].

In this sense, the Agency for Health Care Research and Quality (AHRQ) has created four procedure categories that indicates whether a procedure is for diagnostic or therapeutic reasons and whether it is minor or major in terms of invasiveness and resource use: minor diagnostic, which consists of non-operating room procedures that are performed for diagnostic reasons; minor therapeutic, which also contains non-operating room procedures but that are for therapeutic reasons; major diagnostic, which comprises all operating-room procedures considered valid by the DRG grouper and that are performed for diagnostic reasons; and major therapeutic, which corresponds to all operating-room procedures considered valid by the DRG grouper and are performed for therapeutic reasons [Agency For Health Care Research and Quality, 2015].

Objectives

3. Objectives

The principal motivation for this thesis was to provide ways to assess and extract information from administrative datasets concerning coding of comorbidities and procedures to assist hospital stakeholders to improve the quality of their data and thus help to implement or optimize their DRG systems. This thesis has three main objectives:

Objective 1: Medical coding quality assessment in hospital administrative datasets (Chapter 4)

To assess variations in coding patterns of diagnoses and procedures in hospital administrative datasets in order to identify possible miscoding practices that could be affecting APR-DRG classification.

Objective 2: How the patient's underlying comorbidities drive APR-DRG classification? (Chapter 5)

To investigate the APR-DRG (All-Patient Refined Diagnosis-Related Groups) technical remuneration structure and characterize how it responds to the different Charlson and Elixhauser comorbidities.

Objective 3: How the APR-DRG system responds to the different types of hospital procedures? (Chapter 6)

To assess and characterize the effects of different types of diagnostic and therapeutic procedures on APR-DRG grouping and its hospital funding.

Medical coding quality assessment in hospital administrative datasets

4. Medical coding quality assessment in hospital administrative datasets

This first objective of this thesis was to assess variations in coding patterns of diagnoses and procedures in hospital administrative datasets to identify possible miscoding practices that could be affecting APR-DRG classification. We restricted this study to the MDC 22 (Burns), which is a small diagnosis area and thereby would facilitate a more detailed analysis of possible inter-hospital variabilities in coding. We found that proper coding of extensive third-degree burns might be related with some discrepant frequencies of certain APR-DRGs across the evaluated hospitals. Significant differences in reporting certain comorbidities and common hospital procedures, especially non-operating room procedures, might have influenced some of the observed discrepancies in SOI frequencies across the hospitals. Moreover, there seems to be a lack of standard in coding of debridement procedures among the evaluated hospitals. Overall, we found relevant variations in coding patterns that could potentially be associated with miscoding practices impacting APR-DRG classification in MDC 22.


One study was conducted:

Quality of coding within clinical datasets: a case-study using burn-related hospitalizations.

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1 Highlights

Quality of coding within clinical datasets: A case-study using burn-related hospitalizations

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Julio Souza*, João Vasco Santos, Fernando Lopes, Alberto Freitas

- Abnormal frequencies in at least one APR-DRG were observed in all hospitals.
- Under-coding extensive third degree burns might have affected APR-DRGs assignment
- Differences in coding common procedures might have influenced SOI frequencies.
- Hospitals differed significantly on coding burns in multiple sites.
- Hospitals differed significantly on reporting debridement procedures.

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1 Quality of coding within clinical datasets: 2 A case-study using burn-related hospitalizations

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ABSTRACT

The quality of clinical data held in administrative databases is crucial for appropriate funding of health care services. As Diagnosis-Related Groups (DRGs) continue to play an important role in hospital payment mechanisms, proper coding of diagnoses and procedures is of most concern. This study used an administrative, nationwide Portuguese inpatient database to characterize and assess coding patterns in burn-related hospitalization data, with a special focus on identifying suspected miscoding practices that could be affecting APR-DRG (All-Patient Refined Diagnosis-Related Groups) classification. Using coded clinical data of 4,182 burn-related admissions occurred between 2011 and 2015, we compared APR-DRG and Severity of Illness (SOI) frequencies between hospitals with a burn unit in Portugal. The frequencies of individual diagnosis and procedure codes among episodes grouped within the same APR-DRG were also compared. Hospitals with a burn unit in Portugal differed significantly in the frequencies of APR-DRGs 842 and 844. Proper coding of extensive third-degree burns might be related with the observed discrepant frequencies of APR-DRGs across the evaluated hospitals. Facilities also differed significantly concerning the proportions of SOI levels in certain APR-DRGs. Significant differences in reporting certain comorbidities and common hospital procedures, especially non-operating room procedures, might have influenced the observed discrepancies in SOI levels. Moreover, there seems to be a lack of standard in coding debridement procedures among the evaluated hospitals. Overall, we found some suspected coding patterns that could potentially be associated with miscoding practices impacting APR-DRG classification. Those findings could not only be relevant for planning future audit processes and improving medical coding practices, but also for discussing quality and desirable features of burn-related clinical data, keeping in mind their use for other purposes beyond DRG grouping, namely clinical and health care services research, as well as health care management.

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1. Introduction

Appropriate hospital production measurement and funding may depend on the reliability of assigning inpatient episodes to Diagnosis Related Groups (DRGs) [1], which represent clinically homogeneous groups that comprise patients with similar resource use [2]. Since the beginning of the 1990's, several countries worldwide have adopted case-adjustment methods such as DRGs for paying or reimbursing hospitals [3]. Nevertheless, DRG classification relies on the quality of coded clinical data held in administrative databases, mainly concerning accurate and complete coding of diagnoses and procedures [4]. Therefore, inappropriate clinical coding can incur deleterious consequences for DRG-based hospital funding systems [5].

There are several types of coding errors that could impact DRG grouping, such as selecting the incorrect principal diagnosis, systematic upcoding and undercoding, omitting codes that should have been reported or using less specific codes [6]. Incomplete or inaccurate reporting of all relevant codes, often referred as undercoding, may result in less money to the hospitals, as it leads inpatient episodes to be assigned to lower resource intensity DRGs [6]. Upcoding, unlike undercoding, is the practice of miscoding patient data to receive higher reimbursements for services provided within hospitals, moving patients from lower-paying DRGs into higher-paying DRGs [7]. Pongpirul and Robinson [8] proposed three types of upcoding: (1) a hospital coder may try to explore the discharge summary to come up with the best possible codes, which includes switching between the principal and secondary diagnosis [9,10]; (2) a hospital coder may look for reimbursable conditions in the medical records [11]; and (3) hospital coders may exaggerate the choice of codes without supportive evidence in the patient record, which includes the addition of secondary diagnoses, making the patient's condition look more complicated [9,10].

Several countries have reported different extents of miscoding practices in hospital datasets. For instance, after conducting a systematic literature search, Lungen and Lauterbach estimated that upcoding was related with up to 1% of the inpatient care payments in Germany [12], whereas a 1995-1996 coding audit revealed that in Australia, an estimated of 5.2% and 6.5% of the medical records were upcoded and undercoded, respectively [8]. In the United States, one-third and one-half of the case-mix increase was due to upcoding in the periods 1986-87 and 1987-88, respectively [13,14]. Using nationwide DRG data from Portugal, Barros and Braun found that the practice of upcoding has been used in Portuguese public hospitals to enlarge budgets, though with a small impact on hospitals' funding [15].

Given this context, we employed a methodology based on statistical analysis of coded clinical data from a Portuguese nationwide inpatient administrative database to compare the frequency of burn-related APR-DRGs between hospitals with a burn unit in Portugal. In addition to that, we also assessed the frequency of individual diagnosis and procedure codes among inpatient burns to investigate whether possible discrepancies in coding patterns between hospitals could be related with miscoding practices, such as upcoding and undercoding, and

whether they might be affecting burn-related APR-DRG classification.

2. All-patient refined diagnosis related groups (APR-DRG) in Portugal

Portugal's hospital financing system currently uses the APR-DRG (version 31) to provide reimbursement rates for hospital and ambulatory care. APR-DRG system is a proprietary tool of the 3M Health Information Systems Corporation designed to classify inpatient episodes according to their reason of admission, severity of illness and risk of mortality [16]. The basic approach to APR-DRG classification is to first assign the episode to a Major Diagnostic Category (MDC) based upon its principal diagnosis. There are 25 different MDCs defined for APR-DRG, with each one of them representing a mutually exclusive diagnosis area. The second step is to assign the episode to a specific base APR-DRG, which reflects the admission cause and is mostly based on the principal diagnosis, if it is a medical case, or an operating-room procedure, if it is surgical case [16]. A total of 314 base APR-DRGs (version 31) were developed in order to obtain clinically homogeneous patient groups, with similar resource use.

The full APR-DRG classification includes four subclasses to address patient differences regarding risk of mortality (ROM) and severity of illness (SOI), with both of them represented by levels, ranging from 1 to 4 (1 — minor; 2 — moderate; 3 — major; 4 — extreme). However, in APR-DRG system, only the SOI level is considered for hospital payment [16]. Determining the SOI level is considerably more complex and less straightforward than MDC and base APR-DRG assignment and can be divided into three phases, with each phase comprising several steps. In the first phase, a pre-defined severity level is attributed to each secondary diagnosis reported in the episode. In the second phase, the algorithm excludes all secondary diagnoses that are related to the principal or other secondary diagnoses. A preliminary SOI level is defined afterwards as the highest severity level among all the remaining secondary diagnoses. If the highest severity level is 3 or 4, the preliminary SOI will be the immediate lower level, unless that episode presents a high number of secondary diagnoses with severities 3 or 4. In the third and last phase, the final SOI level is determined by systematically changing the preliminary SOI level according to the impact and combinations of principal diagnosis, age, presence of operating-room procedures, non-operating room procedures, multiple operating-room procedures and combinations of categories of secondary diagnoses [16].

Therefore, the failure to properly report all necessary diagnoses and procedures may undermine proper SOI assignment and thus affect hospital payment. For instance, in Portugal, a hospital that has treated an episode grouped into the APR-DRG 842 with SOI 4 (patients who suffered full-thickness burns and underwent skin grafting with an extreme severity of illness) would be charged with a value that is about 10, 6 and 3 times higher than for a patient grouped in the same APR-DRG with a minor, moderate or major SOI level, respectively [17]. Each SOI level within a given APR-DRG is

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Table 1 – Relative APR-DRG payment weights for inpatient burns in Portugal (2017).

	APR-DRG 841	APR-DRG 842	APR-DRG 843	APR-DRG 844
SOI 1	11.8174	2.6025	0.9824	1.0054
SOI 2	13.1304	4.0759	1.4409	1.8080
SOI 3	15.2849	9.3606	2.0625	3.4056
SOI 4	49.7365	25.7035	7.9826	13.9638

132 associated with a relative weight, which is a coefficient that
 133 reflects the expected costs incurred following the treatment of
 134 a typical patient grouped in that APR-DRG and SOI relatively to
 135 the costs incurred following the treatment of a typical patient
 136 at national level [18]. In Table 1 we present the relative APR-
 137 DRG weights used by public hospitals in Portugal for paying
 138 burn-related hospitalizations, which were extracted from the
 139 2017 APR-DRG prices and weights table [17].

140 APR-DRGs 841 (Extensive third-degree burns with skin
 141 graft) and 842 (Full-thickness burns with skin graft) are surgical
 142 DRGs and thus tend to comprise the most complex and
 143 resource-demanding burn-related hospitalizations. APR-DRG
 144 841 includes cases that underwent skin grafting for the
 145 treatment of extensive third degree burns, which usually
 146 refers to patients with over 20% of the body affected by third
 147 degree burns. APR-DRG 842 consists of cases that underwent
 148 skin grafting for the treatment of full-thickness burns, which

149 also refers to patients with third degree burns, but with
 150 emphasis on the depth of the injury rather than the extent of
 151 the body affected, typically including patients with both layers
 152 of skin (epidermis and dermis) destroyed and injuries that may
 153 have penetrated more deeply into underlying structures [19].
 154 APR-DRG 843 (Extensive third-degree or full-thickness burns
 155 without skin graft) is a medical DRG which comprises the
 156 treatment of both, extensive third-degree and full-thickness
 157 burns, but it is less costly than APR-DRGs 841 and 842 because it
 158 does not involve the use of skin grafting. APR-DRG 844 (Partial-
 159 thickness burns with or without skin graft) is another medical
 160 DRG that comprises cases of partial-thickness burns, which
 161 usually correspond to episodes with one or both layers of the
 162 skin affected by second-degree burns [20] and thus tend to be
 163 less severe than the episodes comprised by the other APR-
 164 DRGs. Fig. 1 summarizes the general grouping logic for burn-
 165 related APR-DRGs.

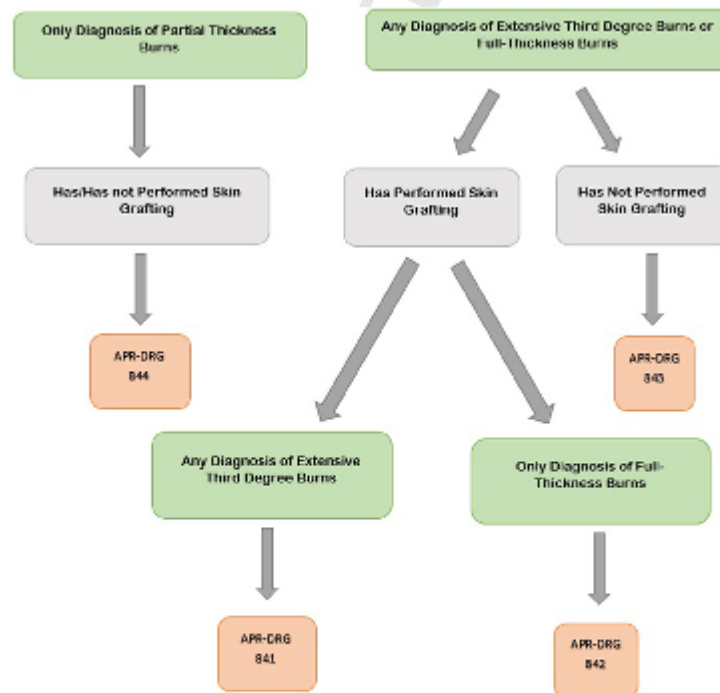


Fig. 1 – Overview of burn-related APR-DRG assignment.

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166 **3. Material and methods**

167 **3.1. Hospitalization data**

168 Hospitalization data used in this study was extracted from a
 169 nationwide, administrative inpatient database, the Portu-
 170 guese national DRG database, which contains coded clinical
 171 data provided by all public hospitals within the National
 172 Health Service (NHS) in mainland Portugal. We selected all
 173 hospitalizations assigned to MDC 22 (Burns) occurred between
 174 2011 and 2015, which correspond to the period in which APR-
 175 DRG data was available. It is important to state that, from all
 176 patients with a diagnosis of burns in Portugal (either principal
 177 or secondary), approximately 86% were assigned to MDC 22
 178 [21]. All diagnoses and procedures were coded using the ICD-9-
 179 CM classification system (International Classification of
 180 Diseases, 9th Revision, Clinical Modification). We restricted
 181 this analysis to five hospitals of reference for the treatment of
 182 burns, the ones with a burn unit in Portugal, here defined as
 183 hospitals A, B, C, D and E.

184 **3.2. Study design**

185 We firstly compared all hospitals with regard to the frequency
 186 of episodes assigned to the different burn-related APR-DRGs in
 187 an attempt to detect hospitals with a much higher or lower
 188 frequency of a specific APR-DRG. We also compared APR-DRG
 189 frequencies by restricting the sample to adult patients, as
 190 differences regarding patient age could eventually influence
 191 discrepancies in the frequencies of certain APR-DRGs. Addition-
 192 ally, we assessed the frequency of codes specifying the extent
 193 of the body surface affected by burns (ICD-9-CM category
 194 948. * - Burns classified according to extent of body surface involved)
 195 as this group of codes is crucial within APR-DRG grouping logic
 196 for inpatient burns. Regarding this latter analysis, we targeted
 197 three groups of interest: episodes that only reported a
 198 diagnosis code specifying less than 10% or unspecified extent
 199 of third-degree burns (category 948 code with last digit equal to
 200 zero), not representing, thus, extensive third-degree burns
 201 cases; episodes that reported diagnosis code 948.11 (burn
 202 involving 10-19 percent of body surface with third degree burn, 10-
 203 19%), which presents the last digit different than zero but
 204 places episodes in an APR-DRG of full-thickness burns rather
 205 than in a APR-DRG of extensive third degree burns; and
 206 episodes with at least one code specifying extensive third
 207 degree burns, which refers to patients with over 20% of the
 208 body affected by third-degree burns (category 948 code with
 209 last digit different than zero, except code 948.11).

210 Moreover, we also analyzed and compared hospitals
 211 regarding the frequency of individual diagnosis and procedure
 212 codes among episodes grouped within the same base APR-
 213 DRG. This comparison was important to detect hospitals with
 214 abnormal frequencies of specific codes among episodes that
 215 are supposedly homogenous, as the base APR-DRG should
 216 represent the average patient with a given hospitalization
 217 cause [16]. Our goal was to identify differences in coding
 218 patterns that could eventually explain differences in the
 219 frequency of APR-DRGs and SOI levels and thus be investigated
 220 as possible miscoding cases.

221 **3.3. Statistical analysis**

222 We implemented post hoc multiple-comparison tests on
 223 Pearson's Chi-square test to compare hospitals concerning the
 224 frequency of APR-DRGs and SOI levels. The rejection of the
 225 null hypothesis, which considered Bonferroni corrected p-
 226 values, indicates that hospitals differed significantly in APR-
 227 DRG or SOI frequencies. We also used adjusted residuals from
 228 the Chi-square table to identify hospitals that deviated
 229 significantly from their expected values. In this sense,
 230 considering a significance level of 95%, adjusted residuals
 231 higher than 1.96 indicates that the number of episodes
 232 assigned to a certain APR-DRG or SOI in a given hospital is
 233 significantly larger than would be expected if the null
 234 hypothesis was true, whereas adjusted residuals lower than
 235 -1.96 indicates significantly lower-than-expected values.

236 We also employed multiple-comparison tests on Pearson's
 237 Chi-square test to compare hospitals regarding the frequency
 238 of individual diagnosis and procedure codes among episodes
 239 grouped within the same base APR-DRG. Only codes with
 240 enough occurrences (contingency tables with over 20% of the
 241 cells with an expected value higher than five) to perform a
 242 viable Chi-Square test were selected for analysis. Contingency
 243 tables contained two lines (number of episodes assigned to a
 244 given APR-DRG with a certain diagnosis/procedure code; and
 245 number of episodes assigned to that same APR-DRG without
 246 that diagnosis/procedure code) and five columns (one column
 247 by hospital). The rejection of the null hypothesis based on
 248 Bonferroni corrected p-value indicates whether a given
 249 hospital presents an abnormal incidence of a certain code
 250 relatively to its peers. All inferential statistical analyses were
 251 performed using SPSS Statistics Software, version 25 (IBM
 252 Corp., USA).

253 **4. Results**

254 Our analysis included 6182 burn-related hospitalizations
 255 (inpatient episodes grouped within MDC 22 - Burns) occurred
 256 between 2011 and 2015 in all analyzed hospitals. We firstly
 257 compared hospitals regarding the frequency of each base APR-
 258 DRG (without considering the SOI level). Table 2 shows the
 259 APR-DRG proportions in each hospital (percentage of episodes
 260 with a given base APR-DRG from the total MDC 22 admissions
 261 in that hospital). These proportions are also represented in the
 262 graphic in Fig. 2.

263 Considering all hospitals, APR-DRG 844 accounted for more
 264 than half the total hospitalizations assigned to MDC 22,
 265 followed by APR-DRG 842, which was attributed to 28.7% of the
 266 episodes (Table 2). APR-DRG 841 presented the lowest
 267 proportion of cases (4.1%) and APR-DRG 843 comprised the
 268 second-lowest proportion (10.5%) in the assessed hospitals
 269 (Table 2). Nevertheless, when assessing individual APR-DRG
 270 proportions at hospital level, we noticed different patterns. For
 271 instance, APR-DRG 844 accounted for most of episodes in
 272 hospitals A, B and C, comprising, respectively, 76.2%, 42.3%
 273 and 63.4% of the total MDC 22 hospitalizations, whereas APR-
 274 DRG 842 accounted for the largest proportion of MDC
 275 22 episodes in hospitals D and E, with a percentage of 50.2%
 276 and 48.5%, respectively (Table 2). However, even at hospital

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Table 2 – Proportion of burn-related APR-DRGs, by Hospital (2011-2015).

	Hospital A	Hospital B	Hospital C	Hospital D	Hospital E	Total
APR-DRG 841	2.1% (30/1400)*	7.4% (21/284)	4.2% (49/1161)	5.1% (53/1040)	6.1% (18/297)	4.1%(171/4182)
Adjusted residuals	-4.51	2.91	0.27	1.89	1.78	
APR-DRG 842	13.5% (189/1400)*	38.7% (110/284)*	20.2% (234/1161)*	50.5% (525/1040)*	48.5% (144/297)*	28.7%(1202/4182)
Adjusted residuals	-15.45	3.85	-7.61	17.87	7.80	
APR-DRG 843	8.1% (134/1400)*	11.6% (33/284)	12.2% (142/1161)	10.9% (113/1040)	12.1% (36/297)	10.5%(438/4182)
Adjusted residuals	-3.49	0.65	2.30	0.48	0.96	
APR-DRG 844	76.2% (1067/1400)*	42.3% (120/284)*	63.4% (736/1161)*	33.6% (349/1040)*	33.3% (99/297)*	56.7%(2371/4182)
Adjusted residuals	18.07	-5.09	5.42	-17.37	-8.43	
Total	33.5% (1400/4182)	6.8% (284/4182)	27.8% (1161/4182)	24.9% (1040/4182)	7.1% (297/4182)	100%(4182/4182)

* p-value lower than Bonferroni-corrected significance levels.

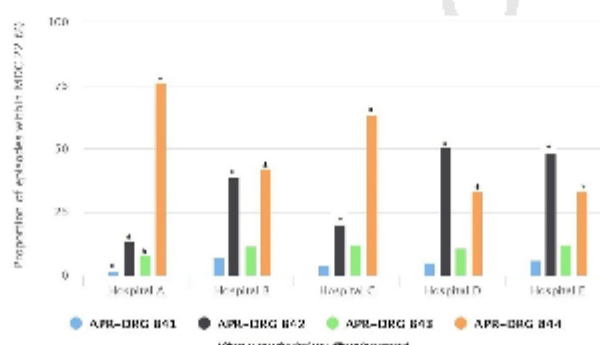


Fig. 2 – Proportion of burn-related APR-DRGs, by hospital (2011-2015).

277 level, APR-DRG 841 still presented the lowest proportion of
 278 episodes, followed by APR-DRG 843.

279 We detected 10 cases in which a given hospital presented a
 280 significantly different frequency of a given base APR-DRG
 281 relatively to its peers (Table 2, Fig. 2). These discrepant cases
 282 were determined through Bonferroni-corrected p-values and
 283 are marked with an asterisk in both, Table 2 and Fig. 2.
 284 Adjusted residuals from Chi-square analysis are also pre-
 285 sented in Table 2 to indicate whether hospitals presented a
 286 lower or a higher-than-expected frequency of a given base
 287 APR-DRG. Significantly different frequencies in at least one
 288 base APR-DRG were observed in all hospitals assessed in this
 289 study. From the discrepant cases, hospital A, in particular,
 290 drawn attention because it differed from all other hospitals,
 291 presenting significantly abnormal frequencies of episodes in

all burn-related APR-DRGs (Table 2, Fig. 2). Moreover, all
 292 hospitals differed significantly from each other regarding the
 293 frequencies of APR-DRGs 842 and 844. In fact, hospitals with a
 294 significantly higher frequency of APR-DRG 842 presented a
 295 significantly lower frequency of APR-DRG 844 and vice-versa
 296 (Table 2, Fig. 2).

297 Table 3 shows the age profile (range, mean and median age)
 298 of MDC 22 patients in each hospital. We also present separately
 299 in Table 3 the mean and median age of adult MDC 22 patients
 300 and the percentage of pediatric cases in each hospital. We
 301 noticed that the mean and median age of the patients admitted
 302 to hospitals with a significantly higher frequency of APR-DRG
 303 844 (hospitals A and C) were quite lower than the observed in
 304 hospitals B, D and E (Table 3). The graphic in Fig. 3 once again
 305 shows the individual proportions of APR-DRGs in each
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Table 3 – Age profile of patients admitted due to burns (MDC 22), by hospital (2011-2015).

Hospital	Overall mean age (years)	Overall median age (years)	Mean age- Adults (years)	Median age- Adults (years)	Range	% Pediatric patients (aged 17 or younger)
A	31.7	30	51.2	48	0-99	40.9%
B	51.0	49	52.0	49	0-98	2.1%
C	28.1	21	50.7	49	0-94	48%
D	50.8	53	58.7	59	0-99	14.7%
E	52.1	50	52.1	50	18-91	0

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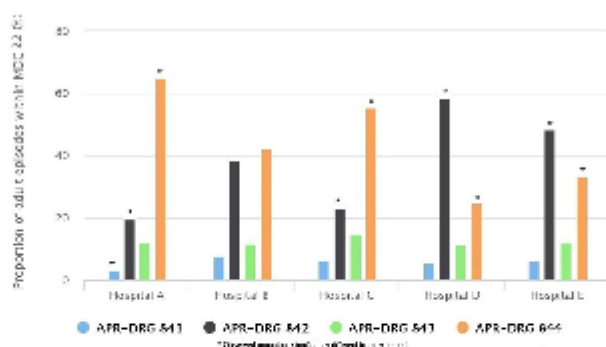


Fig. 3 – Proportion of burn-related APR-DRGs among adult patients, by hospital (2011-2015).

307 hospital, but only considering adult patients (aged 18 or more).
 308 A substantial reduction in the proportion of episodes with
 309 APR-DRG 844 can be observed in all hospitals when only adult
 310 admissions are considered (Fig. 3). Nevertheless, the individual
 311 proportions of APR-DRGs across the hospitals followed the
 312 same pattern as the one observed for overall patients (Fig. 3).
 313 Furthermore, the mean age among adult patients is relatively
 314 similar among all hospitals (Table 3).

315 We later assessed and compared hospitals regarding the
 316 incidence of codes specifying burns according to the extent of
 317 the body surface involved (ICD-9-CM category 948 - Burns
 318 classified according to extent of body surface involved). Table 4
 319 shows, by hospital, the proportion of episodes (of overall MDC
 320 22 episodes) with at least one code specifying burns according
 321 to the extent of the body affected. Overall, regarding ICD-9-CM
 322 category 948, hospitals tended to report considerably more
 323 episodes with less than 10% or unspecified percentage of the
 324 body with third-degree burns (codes from ICD-9-CM category
 325 948 with last digit equal to zero). In fact, in all assessed
 326 hospitals, these cases accounted for more than 80% of the total
 327 MDC 22 admissions (Table 4). In contrast, the frequencies of
 328 codes representing at least 10 or over 10% of the body with
 329 third-degree burns (category 948 code with last digit different
 330 than zero) were quite small, with hospital E presenting the
 331 largest proportion of episodes (18.2% of all MDC 22 hospital-
 332 izations) and Hospital A the lowest one, with only 5% of the
 333 total MDC 22 hospitalizations (Table 4).

334 We also compared hospitals regarding the frequency of SOI
 335 levels, which is the APR-DRG component used for hospital
 336 payment. Table 5 shows, by hospital, the proportion of SOI
 337 levels within each base APR-DRG (percentage of episodes with
 338 that base APR-DRG and SOI level in a given hospital from the

total MDC 22 admissions in that hospital). These proportions
 are also represented in Fig. 4, with each graphic showing, by
 hospital, the proportion of SOI levels within each base APR-
 DRG. Hospitals with significantly abnormal frequencies of SOI
 (also determined using Bonferroni-corrected p-values) are
 marked with an asterisk in Table 5 and Fig. 4. From the
 discrepant cases, an interesting scenario was observed for
 hospital B, which presented a significantly lower frequency of
 episodes with SOI 1 among APR-DRG 842 episodes, contrast-
 ing with a significantly higher-than-expected frequency of epi-
 sodes with SOI 3 and 4 in that APR-DRG. Conversely, all other
 hospitals presented a much lower frequency of episodes with
 SOI 3 and 4 among APR-DRG 842 patients. For APR-DRG 844,
 hospital B once again presented a significantly lower frequen-
 cy of SOI 1 episodes in contrast with a significantly higher
 frequency of episodes assigned to more resource-consuming
 severity levels, namely SOI 2 and 3 (Table 5).

We further compared hospitals concerning the frequencies
 of individual diagnosis and procedure codes among episodes
 with the same base APR-DRG. Table 6 presents the proportion
 of individual codes by APR-DRG and hospital (percentage of
 episodes with a given APR-DRG and code in a given hospital
 from the total MDC 22 episodes with that APR-DRG in that
 hospital). Only diagnosis or procedure codes with abnormal
 frequencies in at least one hospital is listed in Table 6. Codes
 with a significantly abnormal frequency (determined by
 Bonferroni-corrected p-values) are marked with an asterisk
 in Table 6. Also, only codes with enough occurrences to
 perform a viable Chi-Square test (contingency tables with over
 20% of the cells with an expected value higher than five) were
 considered in this analysis. We also presented in Table 6 the
 adjusted residuals to indicate whether a given code presented

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Table 4 – Proportion of MDC 22 episodes with codes specifying ICD-9-CM category 948 codes, by hospital (2011-2015).

Burns according to extent of body surface involved (ICD-9-CM category 948)	Hospital A	Hospital B	Hospital C	Hospital D	Hospital E
Less than 10% or unspecified third-degree burns	95.4% (1316/1400)	86.7% (239/284)	88.5% (1023/1161)	82.9% (807/1040)	81.7% (242/297)
10-19% third-degree burns	1.7% (23/1400)	2.9% (8/284)	3.8% (44/1161)	7.7% (75/1040)	4.4% (13/297)
Extensive third-degree burns	3.3% (42/1400)	10.3% (29/284)	7.9% (90/1161)	9.3% (90/1040)	13.8% (41/297)

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Table 5 – Proportion of SOI levels within each burn-related APR-DRG, by hospital (2011-2015).

APR-DRG 841	Hospital A	Hospital B	Hospital C	Hospital D	Hospital E	Total
SOI 1	6.7%(2/30)	4.8%(1/21)	6.1%(3/49)	1.9%(1/53)	0	4.1%(7/171)
Adjusted residuals	0.8	0.2	0.8	-1.0	-0.9	
SOI 2	23.3%(7/30)	14.3%(3/21) [*]	32.7%(16/49)	56.6%(30/53)	44.4%(8/18)	37.4%(64/171)
Adjusted residuals	-1.8	-2.3	-0.8	3.5	0.7	
SOI 3	26.7%(8/30)	38.1%(8/21)	40.8%(20/49)	26.4%(14/53)	50%(9/18)	34.5%(59/171)
Adjusted residuals	-1.0	0.4	1.1	-1.5	1.5	
SOI 4	43.3%(13/30)	42.9%(9/21)	20.4%(10/49)	15.1%(8/53)	5.6%(1/18)	24%(41/171)
Adjusted residuals	2.7	2.2	-0.7	-1.8	-1.9	
Total	17.5%(30/171)	12.3%(21/171)	28.7%(49/171)	31%(53/171)	10.5%(18/171)	100%(171/171)
APR-DRG 842	Hospital A	Hospital B	Hospital C	Hospital D	Hospital E	Total
SOI 1	64.6%(122/189)	43.6%(48/110) [*]	76.9%(180/234)	74.9%(398/525)	78.5%(113/144)	71.2%(856/1202)
Adjusted residuals	-2.2	-6.7	2.1	2.5	2.1	
SOI 2	27.5%(52/189)	27.3%(30/110)	15%(35/234)	22.1%(116/525)	16%(23/144)	21.3%(256/1202)
Adjusted residuals	2.3	1.6	-2.6	0.6	-1.7	
SOI 3	6.3%(12/189)	12.7%(14/110) [*]	3.8%(9/234)	2.1%(11/525) [*]	4.9%(7/144)	4.4%(53/1202)
Adjusted residuals	1.4	4.5	-0.5	-3.4	0.3	
SOI 4	1.6%(3/189)	16.4%(18/110) [*]	4.3%(10/234)	1%(5/525) [*]	0.7%(1/144)	3.1%(37/1202)
Adjusted residuals	-1.3	8.5	1.2	-3.8	-1.8	
Total	15.7%(189/1202)	9.2%(110/1202)	19.5%(234/1202)	43.7%(525/1202)	12%(144/1202)	100%(1202/1202)
APR-DRG 843	Hospital A	Hospital B	Hospital C	Hospital D	Hospital E	Total
SOI 1	64.9%(74/114) [*]	51.5%(17/33)	52.1%(74/142)	47.8%(54/113)	22.2%(8/36) [*]	51.8%(227/438)
Adjusted residuals	3.3	0.0	0.1	-1.0	-3.7	
SOI 2	18.4%(21/114)	15.2%(5/33)	13.4%(19/142)	31.9%(36/113) [*]	30.6%(11/36)	21%(92/438)
Adjusted residuals	-0.8	-0.9	-2.7	3.3	1.5	
SOI 3	7.9%(9/114)	21.2%(7/33)	14.1%(20/142)	4.4%(5/113)	13.9%(5/36)	10.5%(46/438)
Adjusted residuals	-1.1	2.1	1.7	-2.4	0.7	
SOI 4	8.8%(10/114) [*]	12.1%(4/33)	20.4%(29/142)	15.9%(18/113)	33.3%(12/36)	16.7%(73/438)
Adjusted residuals	-2.6	-0.7	1.5	-0.2	2.8	
Total	26.0%(114/438)	7.5%(33/438)	32.4%(142/438)	25.8%(113/438)	8.2%(36/438)	100%(438/438)
APR-DRG 844	Hospital A	Hospital B	Hospital C	Hospital D	Hospital E	Total
SOI 1	89.1%(95/1067)	71.7%(86/120) [*]	89.4%(68/736)	92.3%(322/349)	78.8%(78/99) [*]	88.4%(2095/2371)
Adjusted residuals	1.1	-5.9	1.1	2.5	-3.0	
SOI 2	9%(96/1067)	17.5%(21/120) [*]	8%(59/736)	6.6%(23/349)	17.2%(17/99)	9.1%(216/2371)
Adjusted residuals	-0.2	3.3	-1.2	-1.8	2.8	
SOI 3	1.8%(19/1067)	10.8%(13/120) [*]	2.3%(17/736)	1.1%(4/349)	4%(4/99)	2.4%(57/2371)
Adjusted residuals	-1.8	6.2	-0.2	-1.7	1.1	
SOI 4	0.1%(1/1067)	0	0.3%(2/736)	0%	0%	0.1%(3/2371)
Adjusted residuals	-0.4	-0.4	1.3	-0.7	-0.4	
Total	45%(1067/2371)	5.1%(120/2371)	31%(736/2371)	14.7%(349/2371)	4.2%(99/2371)	100%(2371/2371)

* p-value lower than Bonferroni-corrected significance levels.

371 a significantly higher or lower-than expected frequency in a
372 given hospital.

373 Overall, hospitals generally differed significantly on report-
374 ing a few common comorbidities, without straight relation
375 to burn injuries, namely hypertension (401.9) and obesity
376 (278.00), both highly reported in hospital B among APR-DRG
377 844 episodes; depressive disorder (311), which had significant-
378 ly higher frequency in hospital D among APR-DRG 844 epis-
379 odes; and alcohol dependence (303.90), which was highly
380 reported in hospital D among APR-DRG 842 episodes (Table 6).
381 Hospital D also presented a higher frequency of hypertension
382 and depressive disorder codes among APR-DRG 842 episodes.
383 Still regarding diagnoses, we observed that certain hospitals
384 tended to report more codes specifying burns in multiple sites
385 within the same body area than others (Table 6). Noticeable
386 cases included hospital C, which was the only facility that did

387 not report principal diagnosis 943.39 (Full-thickness skin loss of
388 multiple sites of upper limb, except wrist and hand) among APR-
389 DRG 842 patients; Hospitals D and E, which presented
390 significantly higher proportions of episodes with code 941.29
391 (Blisters, epidermal loss of multiple sites of face, head, and neck) as
392 secondary diagnosis. We also observed significant discrepan-
393 cies in the frequency of several secondary diagnosis codes
394 specifying the site of the burns among APR-DRG 844 episodes
395 (Table 6).

396 Facilities mostly differed on reporting codes representing
397 certain common hospital procedures, mostly non-operating
398 room procedures, such as codes 38.93 (venous catheterization),
399 99.04 (packed cell transfusion), 99.07 (serum transfusion) and
400 57.94 (insertion of indwelling urinary catheter). Coding proce-
401 dures to assist respiratory functions of patients, such as
402 96.71 (continuous invasive mechanical ventilation for less than

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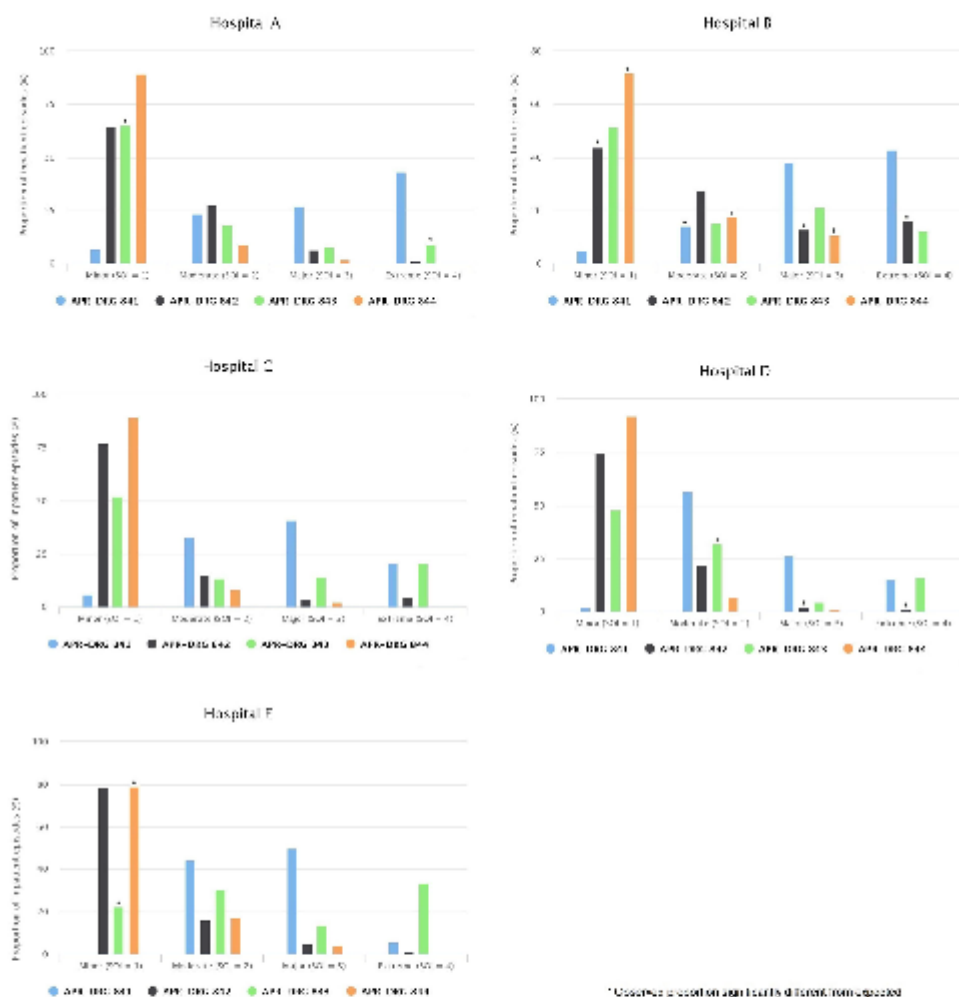


Fig. 4 – Proportion of SOI levels within each burn-related APR-DRG (2011-2015).

403 96 consecutive hours), 96.72 (continuous invasive mechanical
 404 ventilation for 96 consecutive hours or more) and 96.04 (endotracheal
 405 intubation) also differed significantly between the
 406 hospitals. Also, hospital B, in particular, tended to report
 407 considerably more episodes with procedure code 33.22
 408 (Fiber-optic bronchoscopy), which is a diagnostic procedure
 409 that allows the inspection of breathing passages of the
 410 lungs, possibly to assess lesions caused by burns [22]. We
 411 also noticed significant discrepancies on reporting procedure
 412 codes 86.22 (Excisional debridement of wound, infection, or
 413 burn) and 86.28 (Non-excisional debridement of wound, infection or
 414 burn) across all hospitals.

5. Discussion

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 416 In the absence of historical audit data, we employed a
 417 methodology based on statistical techniques to detect sus-
 418 pected cases of miscoding practices (outliers) using
 419 burn-related hospitalization data from a nationwide Portu-
 420 guese inpatient database. Our main goal was to provide useful
 421 information for medical coders, health professionals and
 422 researchers by filtering relevant cases that could be associated
 423 with miscoding practices impacting APR-DRG classification
 424 and thus hospital payment for inpatient burns.

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Table 6 – Proportion of diagnosis and procedure codes with abnormal frequencies in at least one hospital, by APR-DRG and hospital (2011-2015).

APR-DRG 841					
Code and abbreviated title	Hospital A	Hospital B	Hospital C	Hospital D	Hospital E
Procedures					
38.93 – Venous cath NEC	86.7%(26/30); 3.6 ⁺	42.9%(9/21); -1.4	51%(25/49); -1.1	71.7%(38/53); 2.5	0%(0/18); -5.2 ⁻
86.28 – Nonexds debridement wnd	46.7%(14/30); 0.4	71.4%(15/21); 2.8	16.3%(8/49); -4.5 ⁻	69.8%(37/53); 4.7 ⁺	0%(0/18); -3.9 ⁻
96.04 – Insert endotracheal tube	56.7%(17/30); 3.9 ⁺	23.8%(5/21); -0.4	38.8%(19/49); 2.1	9.4%(5/53); -3.5 ⁻	5.6%(1/18); -2.2
96.6 – Entral infus nutrit sub	43.3%(13/30); 3.7 ⁺	33.3%(7/21); 1.7	16.3%(8/49); -0.6	9.4%(5/53); -2.2	0%(0/18) -2.2
99.04 – Packed cell transfusion	90%(27/30); 4.2 ⁺	81%(17/21); 2.6	75.5%(37/49); 3.4	18.9%(10/53); -6.4 ⁻	36.7%(3/8); -3.5 ⁻
APR-DRG 842					
Code and abbreviated title	Hospital A	Hospital B	Hospital C	Hospital D	Hospital E
Principal diagnosis					
943.39 – 3rd deg burn arm-mult	4.2%(8/189); 0.1	5.5%(6/110); 0.8	0%(0/234); -3.5 ⁻	5.5%(29/525); 2.2	4.2%(6/144); 0.1
Secondary diagnosis					
303.90 – Alcoh dep NEC/NOS-unspec	2.6%(5/189); -1.6	4.5%(5/110); -0.2	4.3%(10/234); -0.6	7.6%(40/525); 3.7 ⁺	0%(0/144); -2.9
311 – Depressive disorder NEC	3.7%(7/189); -1.9	10.9%(12/110); 1.7	5.1%(12/234); -1.2	9.9%(52/525); 3.5 ⁺	0.7%(1/144); -3.2
401.9 – Hypertension NOS	28.6%(54/189); 1	25.5%(28/110); -0.1	18.8%(44/234); -2.7	32.8%(172/525); 4.9 ⁺	8.3%(12/144); -5.1 ⁻
427.31 – Atrial fibrillation	4.2%(8/189); 1.1	10%(11/110); 4.5 ⁺	3%(7/234); 0	1.7%(9/525); -2.3	0.7%(1/144); -1.7
599.0 – Urin tract infection NOS	11.1%(21/189); 5.3 ⁺	10.9%(12/110); 3.8 ⁺	2.6%(6/234); -1.3	1.1%(6/525); -4.5 ⁻	2.8%(4/144); -0.8
943.21 – 2nd deg burn forearm	10.6%(20/189); 5.8 ⁺	4.5%(5/110); 0.6	4.3%(10/234); 0.7	1.3%(7/525); -3.6 ⁻	0%(0/144); -2.4
948.10 – 10-19% bdy brn/3 deg NOS	12.7%(24/189); -1.6	25.5%(28/110); 2.6	8.5%(20/234); -3.7 ⁻	16.6%(87/525); -0.1	29.2%(42/144); 4.3 ⁺
Procedures					
33.22 – Fiber-optic bronchoscopy	2.6%(5/189); -0.9	16.4%(18/110); 7.2 ⁺	3.8%(9/234); 0	2.7%(14/525); -1.8	0%(0/144); -2.6
38.93 – Venous cath NEC	17.5%(33/189); 0.5	41.8%(46/110); 7.7 ⁺	9.8%(23/234); -2.9	17.5%(92/525); 1.1	0%(0/144); -5.6 ⁻
57.94 – Insert indwelling cath	12.2%(23/189); 3.6 ⁺	22.7%(25/110); 7.4 ⁺	9%(21/234); 1.9	1.1%(6/525); -6.5 ⁻	0.7%(1/144); -3
86.22 – Exc wound debridement	82.5%(156/189); -7.2 ⁻	90%(99/110); -1.9	95.7%(224/234); 1.2	96.6%(507/525); 3.3	100%(144/144); 3.2
86.28 – Nonexds debridement wnd	60.3%(114/189); 5.1 ⁺	64.5%(71/110); 4.7 ⁺	7.7%(18/234); -12.3 ⁻	60.8%(319/525); 10.6 ⁺	0.7%(1/144); -11 ⁻
86.62 – Hand skin graft NEC	7.4%(14/189); -1.4	14.5%(16/110); 1.6	23.9%(56/234); 7.7 ⁺	5.7%(30/525); -4.6 ⁻	4.9%(7/144); -2.3

(continued on next page)

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Table 6 (continued)

APR-DRG 842					
Code and abbreviated title	Hospital A	Hospital B	Hospital C	Hospital D	Hospital E
86.89 - Free skin graft NEC	58.7%(111/189); -10.3 [†]	89.1%(98/110); 1.5	77.8%(182/234); -2.9	92.2%(484/525); 6.8 [†]	93.8%(135/144); 3.4
93.57 - Dressing of wound NEC	28.6%(54/189); -6.4 [†]	26.4%(29/110); -5.2 [†]	49.6%(116/234); -0.1	74.3%(390/525); 14.9 [†]	6.9%(10/144); -11 [†]
96.72 - Cont inv mec ven 96+h	6.9%(13/189); -1.7	36.4%(40/110); 9.4 [†]	12%(28/234); 0.9	6.9%(36/525); -3.5 [†]	4.9%(7/144); -2.3
99.04 - Packed cell transfusion	29.6%(56/189); 5.2 [†]	54.5%(60/110); 11.2 [†]	29.9%(70/234); 6 [†]	2.5%(13/525); -11.7 [†]	1.4%(2/144); -5.3 [†]
99.07 - Serum transfusion NEC	4.8%(9/189); -1.7	48.2%(53/110); 16.4 [†]	9.8%(23/234); 1.2	1.9%(10/525); -6.8 [†]	0%(0/144); -3.7 [†]
APR-DRG 843					
Code and abbreviated title	Hospital A	Hospital B	Hospital C	Hospital D	Hospital E
Secondary diagnosis					
948.00 - Bdy brn < 10%/3d deg NOS	68.4%(78/114); 4.9 [†]	45.5%(15/33); -0.4	54.9%(78/142); -6.8 [†]	32.7%(37/113); -4 [†]	16.7%(6/36); -4 [†]
Procedures					
935.7 - Dressing of wound NEC	34.2%(39/114); -4.6 [†]	27.3%(9/33); -3	70.4%(100/142); 5.1 [†]	62.8%(71/113); 2.5	33.3%(12/36); -2.4
86.28 - Nonexcis debridement wnd	57.9%(66/114); 7.1 [†]	39.4%(13/33); 1	9.9%(14/142); -6.8 [†]	39.8%(45/113); 2.2	0%(0/36); -4.2 [†]
APR-DRG 844					
Code and abbreviated title	Hospital A	Hospital B	Hospital C	Hospital D	Hospital E
Principal diagnosis					
941.29 - 2nd deg burn head-mult	13.1%(340/1067); -4.5 [†]	32.5%(39/120); 4.6 [†]	9.1%(67/736); -6.9	34.1%(119/349); 9.2 [†]	38.4%(38/99); 5.8 [†]
945.29 - 2nd deg burn leg-mult	3.1%(33/1067); 3.2	4.2%(5/120); 1.7	0.1%(1/736); -4.4 [†]	14%(5/349); -0.9	5.1%(5/99); 2.1
Secondary diagnosis					
278.00 - Obesity NOS	0.7%(8/1067); -1.3	5%(6/120); 4.3 [†]	0.8%(6/736); -0.8	14%(5/349); 0.7	0%(0/99); -1
311 - Depressive disorder NEC	1.1%(12/1067); -2.6	5%(6/120); 2.5	1.6%(12/736); -0.7	46%(16/349); 3.9 [†]	0%(0/99); -1.4
401.9 - Hypertension NOS	9.4%(100/1067); -0.6	23%(30/120); 5.8 [†]	8%(59/736); -1.9	10.6%(37/349); 0.6	6.1%(6/99); -1.3
941.28 - 2nd deg burn neck	5.7%(61/1067); -2	10%(12/120); 1.4	9.1%(71/736); 3.6 [†]	34.1%(18/349); -1.4	38.4%(1/99); -24
942.22 - 2nd deg burn chest wall	8.1%(86/1067); -3.6 [†]	7.5%(9/120); -1.1	13.7%(101/736); 3.3	15.5%(54/349); 3.2	1%(1/99); -3.2
943.21 - 2nd deg burn forearm	11.6%(124/1067); -0.7	8.3%(10/120); -1.3	13.9%(102/736); 1.7	14.6%(51/349); 1.5	1%(1/99); -3.5 [†]
943.29 - 2nd deg burn arm-mult	6.7%(71/1067); 1.2	9.2%(11/120); 1.5	1%(7/736); -7 [†]	11.2%(39/349); 4.4 [†]	15.2%(15/99); 3.9 [†]

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Table 6 (continued)

APR-DRG 844					
Code and abbreviated title	Hospital A	Hospital B	Hospital C	Hospital D	Hospital E
944.28 – 2nd deg burn hand-mult	3.7%(39/1067); -5 [*]	16.7%(20/120); 4.7 [*]	1.1%(8/736); -7.1	17.8%(62/349); 9.4 [*]	23.2%(23/99); 7 [*]
947.1 – Burn larynx/trachea/lung	2.3%(25/1067); 1.3	6.7%(8/120); 3.9 [*]	0.8%(6/736); -2.7	0.6%(2/349); 2	5.1%(5/99); 2.3
948.00 – Bdy brn <10%/3d deg NOS	74%(790/1067); -1.4	63.3%(76/120); -3.1	86.1%(634/736); 8.2 [*]	64.8%(228/349); -5 [*]	61.6%(61/99); -3.2
948.10 – 10-19% bdy brn/3 deg NOS	17.1%(182/1067); 2.5	20.8%(25/120); 1.8	9.4%(69/736); -5.2	16%(56/349); 0.6	25.3%(25/99); 2.9
Procedures					
33.22 – Fiber-optic bronchoscopy	1.7%(18/1067); -3.5 [*]	11.7%(14/120); 5.7 [*]	3.8%(28/736); 1.5	3.4%(12/349); 0.5	0%(0/99); -1.8
86.22 – Exc wound debridement	18.5%(197/1067); -0.2	12.5%(15/120); -1.8	24.5%(180/736); 4.9 [*]	8%(28/349); -5.5 [*]	22.2%(22/99); 0.9
86.28 – Nonexcis debridement wnd	69.2%(738/1067); 19.9 [*]	51.7%(62/120); 1.1	9.6%(71/736); -24.2 [*]	67%(234/349); 8.3 [*]	0%(0/99); -9.5 [*]
86.69 – Free skin graft NEC	11.6%(124/1067); 1.9	8.3%(10/120); -0.7	12.4%(91/736); 2.2	4.9%(17/349); -3.6 [*]	3%(3/99); -2.4
93.57 – Dressing of wound NEC	51.5%(549/1067); -15.5 [*]	59.2%(71/120); -2.1	80.8%(595/736); 9.1 [*]	90.5%(318/349); 9.8 [*]	79.8%(79/99); 2.6
96.71 – Cont inv mec ven <96 h	3.4%(36/1067); 0.3	4.2%(5/120); 0.6	1.6%(12/736); -3	4%(14/349); 0.9	10.1%(10/99); 3.9 [*]
96.72 – Cont inv mec ven 96+h	1.6%(17/1067); -4	15%(18/120); 7.6 [*]	2.2%(16/736); -1.8	4.6%(16/349); 1.6	8.1%(8/99); 2.9

* p-value lower than Bonferroni-corrected significance levels.

425 We firstly compared hospitals concerning individual APR-
426 DRG frequencies. As these facilities are reference for the
427 treatment of burns in Portugal due to the presence of a burn
428 unit, we considered that the level of complexity between them
429 should not differ greatly. Thus, we assumed that hospitals
430 with a much higher frequency of "more complex" APR-DRGs
431 relatively to their peers might be eventually upcoding their
432 episodes, whereas hospitals with a much lower frequency of a
433 given APR-DRG or with a much higher frequency of "simple"
434 APR-DRGs might be experiencing an undercoding scenario.

435 All hospitals of the sample differed significantly on the
436 frequencies of APR-DRGs 842 and 844. Particularly, hospitals B,
437 D and E presented significantly higher frequencies of APR-DRG
438 842 episodes, contrasting with a significantly lower frequency
439 of episodes assigned to APR-DRG 844. The exactly opposite
440 trend, however, was observed for hospitals A and C (Table 2),
441 showing thus two groups of hospitals that might be similar
442 either in terms of the complexity of burn patients they treat or
443 in terms of coding practices. The observed discrepancies
444 regarding these two APR-DRGs could also be explained by
445 understanding how hospitals differed in terms of patient age.

446 In Portugal, children aged 0-4 years old accounted for one-fifth
447 of all burn admissions between 2000 and 2013 [23], though
448 burns in pediatric patients are typically less severe when
449 compared to adults [24]. Thus, a hospital that admitted much
450 more pediatric patients would present a higher frequency of
451 less severe burn-related APR-DRGs (such as APR-DRG 844) than
452 hospitals that mostly or exclusively received adult patients. As
453 the basic difference between APR-DRGs 842 and 844 relies
454 upon the burn degree, one of the reasons behind the observed
455 discrepancies would have been related with patient age.
456 Nevertheless, even when only considering adult patients, the
457 evaluated hospitals still presented the same patterns in
458 frequencies of these two APR-DRGs, discarding thus the
459 possible influence of age.

460 Another factor that could have explained the observed
461 discrepancies related with APR-DRGs 842 and 844 includes
462 proper coding of the extent of the body surface affected by
463 burns (codes from ICD-9-CM category 948). Regarding this
464 group of codes, the most important digit for APR-DRG
465 grouping is the last one, as it indicates the percentage of
466 body affected by third-degree burns and thus is crucial for

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467 differentiating patients with extensive third-degree burns
 468 from patients with full-thickness burns only. In all assessed
 469 hospitals, most episodes only reported episodes with less
 470 than 10% or unspecified percentage of third-degree burns
 471 (last digit equal to zero of any code from ICD-9-CM category
 472 948), which prevents a patient from being assigned to an
 473 APR-DRG of extensive third degree burns, which only
 474 comprises episodes with over 20% of the body surface
 475 affected by third degree burns. It is not clear, however,
 476 whether this reflects the real patient profile admitted in
 477 these hospitals or if was due to a possible difficulty faced by
 478 coders in accurately evaluate the extent of the body affected
 479 by third-degree burns and thus report unspecified percentage.
 480 The proper evaluation of the extent of body affected by
 481 burns might also rely upon the accuracy and completeness of
 482 the information in clinical reports and discharge summaries.
 483 Moreover, these findings regarding codes from ICD-9-CM
 484 category 948 is important in a way it could affect hospital
 485 payment. For instance, an episode that reported skin grafting
 486 but does not present a diagnosis code of extensive third-
 487 degree burns would be necessarily assigned to a cheaper and
 488 less-resource consuming APR-DRG, as it would be directed to
 489 APR-DRG 842 rather than 841, characterizing an undercoding
 490 scenario.

491 After assessing frequencies in APR-DRG, we further
 492 compared hospitals regarding the frequency of SOI levels.
 493 We also compared the facilities regarding the frequencies of
 494 individual diagnosis and procedure codes. Particularly, we
 495 found some abnormal frequencies of diagnoses and procedures
 496 between hospitals that are worth investigating as they
 497 could have influenced some of the observed discrepancies
 498 related with SOI levels across the evaluated hospitals.

499 Regarding medical diagnoses, we found that some hospitals
 500 presented a significantly higher frequency of some
 501 common comorbidities (Table 6). Although these codes are
 502 not related with burn injuries, any case involving differences
 503 in reporting comorbidities is relevant because such conditions
 504 play an important role on determining the SOI level in APR-
 505 DRG [25]. In fact, Dewilde et al. found that patients grouped
 506 into higher SOI levels tend to present many comorbidities
 507 affecting different organs/systems, resulting in a higher volume
 508 of resource utilization. Additionally, the authors highlighted
 509 the importance of collecting information on pre-existing or
 510 newly acquired comorbidities in hospital settings [25].
 511 Regarding this issue, Portugal has achieved improvements
 512 in reporting comorbidities [26]. Freitas et al. found that the
 513 number of comorbidities reported by inpatient episode has
 514 generally increased in Portuguese hospital datasets, with the
 515 average number of Elixhauser and Charlson comorbidities
 516 reported by episode increasing, respectively, by 81% and 48% in
 517 the period 2000-2010 [26].

518 Still regarding medical diagnoses, we observed that some
 519 hospitals tended to report more codes specifying burns in
 520 multiplesites within the same body area than others. This is an
 521 interesting aspect in a sense that coding guidelines in the
 522 United States recommend the use of codes specifying multiple
 523 burns only when there is a limited number of diagnosis fields
 524 in the discharge sheet. In Portugal, there is no limit number of
 525 secondary diagnosis fields to be reported per episode and thus
 526 coders are recommended to choose those codes specifying

527 burns individually rather than codes specifying burns in
 528 multiple sites. Therefore, discrepancies involving these codes
 529 should be investigated more in depth as they could be
 530 indicators of miscoding practices.

531 Most of the abnormal code frequencies across the assessed
 532 hospitals involved common procedures, usually those that do
 533 not require an operating room to be performed and are not
 534 directly related with burn injuries. Nevertheless, they might
 535 indicators of more resource-demanding hospitalizations, such
 536 as insertion of endotracheal tube and mechanical ventilation.
 537 In fact, findings elsewhere have already reported that
 538 procedure codes for temporary tracheostomy, mechanical
 539 ventilation and endotracheal intubation serve as markers of
 540 costlier and complicated hospitalizations [27]. One previous
 541 study assessing advantages and disadvantages of using non-
 542 operating room procedures as modifiers of medical DRGs
 543 concluded that "non-operating room procedures that are
 544 usually coded on hospital discharges can often help to identify
 545 groups of costlier and severely ill patients" [28].

546 Another non-operating room procedure whose frequency
 547 was significantly discrepant between hospitals was venous
 548 catheterization. We observed that hospitals A and B presented
 549 significantly higher-than-expected frequencies of this code
 550 among APR-DRGs 841 and 842 episodes. On the contrary,
 551 hospital E did not present any episode grouped into APR-DRGs
 552 841 and 842 with venous catheterization, for instance (Table 6).
 553 Even if venous catheterization does not influence base APR-
 554 DRG or SOI assignment, a lower or higher sensitivity to this
 555 code is interesting in a sense that nearly all burn patients are
 556 submitted to venous catheterization, especially for serum
 557 injection, which is a basic practice for the treatment of burn
 558 injuries. Therefore, the question on reporting venous catheterization
 559 is an example of what could be relevant to discuss the
 560 quality of administrative clinical data considering their use
 561 for other tasks beyond DRG grouping, such as health care
 562 services research and management (e.g., resource use
 563 evaluation).

564 Another important source of discrepancies was related
 565 with codes 86.22 (Excisional debridement of wound, infection, or
 566 burn) and 86.28 (Non-excisional debridement of wound, infection or
 567 burn) as all hospitals differed significantly on reporting these
 568 procedures. Excisional debridement is a surgical removal of
 569 devitalized tissue, which may or not be performed in an
 570 operating room, whereas non-excisional debridement is a
 571 simpler procedure and it just refers to a non-operative
 572 brushing or washing away of devitalized tissue [29]. Since
 573 past studies have reported overpayments within Medicare
 574 services related with inappropriate coding of debridement
 575 procedures [29], these findings might raise important concerns
 576 among coders. In fact, properly coding of debridement
 577 procedures is difficult because it depends on the completeness
 578 and accuracy of the information in patient records, as the
 579 correct identification of excisional debridement should clearly
 580 indicate that the procedure involved cutting outside or beyond
 581 the wound margin [29]. Thus, lower-than-expected frequencies
 582 of excisional debridement and higher-than-expected
 583 frequencies of non-excisional debridement, for instance,
 584 might be related with this difficulty in identifying and
 585 differentiating these procedures. It is not clear, however,
 586 whether these procedures have an impact on APR-DRG

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587 classification, though these discrepancies reflect a relevant
588 problem which has already been identified by coders in
589 another context as a potential source of miscoding.

590 A notorious outlier case involving SOI assignment was
591 verified in hospital B, which presented a significantly lower
592 frequency of episodes assigned to SOI 1 in APR-DRG 842,
593 whereas registered a significantly higher frequency of cases
594 assigned to SOI 3 and 4 in this APR-DRG, with proportions that
595 were much higher than the ones observed in other hospitals
596 (Table 5), raising suspicion that this facility might present
597 particular coding practices that could have been influenced
598 these numbers, rather than just natural case-mix. Among
599 APR-DRG 842 episodes, we observed that hospital B reported a
600 significantly higher number of several non-operating room
601 procedures, namely venous catheterization (38.93), packed
602 cell transfusion (99.04), serum transfusion (99.07), continuous
603 invasive mechanical ventilation for 96 consecutive hours or
604 more (96.72) and fiber-optic bronchoscopy (33.22). As these
605 codes might be related with complications and higher
606 resource consumption levels, they could be responsible for
607 the observed discrepant SOI levels among APR-DRG 842 epi-
608 sodes in hospital B. Hospital B presented a significantly
609 higher incidence of fiber-optic bronchoscopy, might just be
610 related with a higher volume of pulmonology services in this
611 facility or with a higher sensitivity of coders to report this
612 diagnostic procedure, which is not a procedure of mandatory
613 reporting.

614 Following an opposite trend, hospital D presented signifi-
615 cantly lower frequencies of episodes assigned to SOI 3 and SOI
616 4 in APR-DRG 842. Also, this hospital reported significantly
617 lower-than-expected frequencies of some procedures whose
618 frequency was significantly higher in hospital B, such as
619 continuous invasive mechanical ventilation for 96 consecutive
620 hours or more (96.72), serum transfusion (99.07) and packed
621 cell transfusion (99.04). It is important to highlight, however,
622 that reporting mechanical ventilation for 96 consecutive hours
623 or more is mandatory and thus significantly lower frequencies
624 of this code should be more closely watched.

625 Although our methodology was useful to identify coding
626 patterns that could be associated with potential miscoding
627 practices impacting APR-DRG grouping, some limitations
628 should be mentioned. Our methodology was mostly based
629 on Chi-Square test and the statistics associated with it, so we
630 were able, at most, to identify some discrepancies in APR-DRG
631 assignment among hospitals and provide a global view of
632 discrepancies in medical coding that might indicate potential
633 miscoding practices. We do not discard the hypothesis that the
634 suspected cases discussed in this study are false positives as
635 we did not consider the possible influence of certain factors
636 that are not represented in the data on the case-mix of
637 hospitals, such as available hospital resources (e.g. medical
638 technology) and hospital referral. Another explanation for the
639 observed discrepancies would be related with the way coding
640 practices are carried out throughout each hospital. In Portugal,
641 a set of standards and rules to guide medical coding preconize
642 that each inpatient episode should be coded by a trained coder
643 based upon a discharge summary, which is mandatory in all
644 hospitals within the NHS, complemented by other information
645 from daily medical reports, emergency room records, as well
646 as surgical and pathological anatomy reports [30]. Despite

647 these general guidelines, facilities might still differ in terms of
648 training methods and frequency, as well as the number of
649 professionals in charge of reporting and coding clinical
650 information.

651 Another limitation of this study is related with differences
652 in hospital capacity, as facilities with more hospitalizations
653 due to burns would present a higher influence on the results of
654 the statistical tests. Moreover, as a study which only
655 comprised five hospitals, there were not enough cases to
656 perform a more refined subgroup analysis, such as comparing
657 hospitals regarding the frequency of individual codes among
658 episodes grouped within the same base APR-DRG and SOI
659 level, which would be useful to identify which codes might
660 have been crucial for placing episodes to that specific SOI level.
661 As the subgroups only comprised episodes with the same base
662 APR-DRG, we were able, at most, to indicate which codes could
663 potentially explain the distribution of episodes across the
664 different SOI levels within a given base APR-DRG.

665 In summary, all those differences in coding patterns might
666 have had some impact on burn-related APR-DRG classifica-
667 tion. Additionally, hospitals significantly differed from each
668 other in reporting some comorbidities and several common
669 hospital procedures, which could eventually result in hospitals
670 presenting significant variances in SOI levels. Other findings
671 also raised questions on some aspects that could be the
672 reasons behind the observed discrepancies in individual code
673 frequencies, such as the lack of knowledge regarding coding
674 guidelines (e.g., discrepancies on reporting codes specifying
675 the site of the burns injuries) or the interpretation and quality
676 of discharge summaries (e.g. difficulties related with coding
677 debridement procedures). These latter cases might not
678 necessarily represent cases impacting APR-DRG, but they
679 are relevant to describe real examples of how proper medical
680 coding and inpatient documentation is essential for ensuring
681 the quality of administrative clinical data quality and make
682 their reutilization feasible for other purposes beyond DRG
683 grouping, namely clinical and health care services research
684 and health care management.

685 6. Conclusion

686 This study aimed at providing useful information on coding
687 practices that might affect proper APR-DRG assignment in
688 the context of burn-related admissions. In this paper, we
689 described and applied a methodology for possible triage of
690 miscoding cases impacting APR-DRG classification and thus
691 hospital payment for burn patient care. Hospitals with a
692 burn unit in Portugal differed significantly in the frequency
693 of APR-DRGs 842 and 844 and all hospitals presented lower
694 frequencies of APR-DRGs 841 and 843. Those discrepancies
695 might be related with undercoding the extent of the body
696 affected by third degree burns. When assessing the
697 incidence of SOI levels within each APR-DRG across
698 hospitals, we observed some cases that could be investigat-
699 ed as possible upcoding practices, as some hospitals
700 presented significantly higher frequencies of most severe
701 SOI levels relatively to other hospitals. Possible undercoding
702 scenarios were also observed as some hospitals concentrat-
703 ed significantly higher frequencies of lower SOI levels

704 relatively to their peers. Hospitals mostly differed on
 705 reporting some comorbidities and certain common proce-
 706 dures that might be indicators of more severe and costly
 707 episodes. Moreover, hospital coders might be facing diffi-
 708 culties on properly coding debridement procedures and,
 709 though these codes may not be important in terms of APR-
 710 DRG classification, they represent an important and well-
 711 known problem among coders. It is important to keep in
 712 mind that the observed discrepancies might be due to
 713 natural differences in the mix and capacity of hospitals and
 714 code audit is undoubtedly the most reliable way for
 715 detecting miscoding practices. Nevertheless, as the scope
 716 and frequency of auditing is limited and depends on
 717 resource availability [31], this study is important in a way
 718 that it provides information that could be useful for filtering
 719 cases that could be relevant for audit planning. Additionally,
 720 our findings are also useful to discuss quality and desirable
 721 features of administrative coded clinical data, keeping in
 722 mind their use for clinical and health care services research,
 723 as well as for health care management. Future research
 724 focusing on the discussed cases should be performed in
 725 order to validate this methodology.

726 **Conflicts of interest**

727 The authors declare that there are no conflicts of interest.

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How the different patient's underlying
comorbidities drive APR-DRG
classification?

5. How the different patient's underlying comorbidities drive APR-DRG classification?

The second objective of the thesis focused on the individual effect of different comorbidities on APR-DRG classification and hospital funding in the context of respiratory (MDC 4) and cardiovascular diseases (MDC 5). Using six years of coded clinical data from a nationwide Portuguese inpatient database and a machine learning-based approach, we explored the APR-DRG system to understand its response to each Charlson and Elixhauser comorbidity. We also estimated the amount of hospital payments that could have been lost when comorbidities are under-reported. In our scenario, most Charlson and Elixhauser comorbidities did considerably influence SOI determination but little impacted base APR-DRG assignment and the degree of influence of each comorbidity varied greatly according to the base APR-DRG. Furthermore, our results based on the SVM models were consistent with overall APR-DRG grouping logics.

One study was conducted:

Importance of coding comorbidities for APR-DRG assignment: focus on cardiovascular and respiratory diseases.

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Importance of coding comorbidities for APR-DRG assignment: focus on cardiovascular and respiratory diseases

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Abstract

Background The All Patient-Refined Diagnosis-Related Groups (APR-DRGs) has adjusted the basic DRG structure by incorporating four severity of illness (SOI) levels, which are used for determining hospital payment. A comprehensive report of all relevant diagnoses, namely the patient's underlying comorbidities, is a key factor for ensuring that SOI determination will be adequate. **Objective** In this study, we aimed at characterizing the individual impact of comorbidities on APR-DRG classification and hospital funding in the context of respiratory and cardiovascular diseases. **Methods** Using six years of coded clinical data from a nation-wide Portuguese inpatient database and Support Vector Machine (SVM) models, we simulated and explored the APR-DRG classification to understand its response to individual removal of Charlson and Elixhauser comorbidities. We also estimated the amount of hospital payments that could have been lost when comorbidities are under-reported. **Results** In our scenario, most Charlson and Elixhauser comorbidities did considerably influence SOI determination but little impacted base APR-DRG assignment. The degree of influence of each comorbidity on SOI was, however, quite specific to the base APR-DRG. Under-coding of all studied comorbidities led to losses in hospital payments. Furthermore, our results based on the SVM models were consistent with overall APR-DRG grouping logics. **Conclusion and implications** Comprehensive reporting of preexisting or newly acquired comorbidities should be encouraged in hospitals as they have an important influence on SOI assignment and thus on hospital funding. Furthermore, we recommend that future guidelines to be used by medical coders should include specific rules concerning coding of comorbidities.

Keywords (MeSH): hospitals, diagnosis-related groups, clinical coding, medical informatics.

Supplementary Keywords: support vector machine, data accuracy, hospital administration, machine learning.

Introduction

The quality of coded clinical data is a relevant issue in the context of health care management. The accuracy and completeness of reporting all additional diagnoses in a hospital stay is of most concern as appropriate and fair hospital funding may depend upon the reliability of grouping coded inpatient episodes into clinically homogeneous groups with similar resource use, the so-called Diagnosis-Related Groups (DRGs) (Cheng, 2009; Mathauer, 2013). The DRG classification was designed at the Yale University in the late 60s (Buss, 2011) and was first used in 1983 as part of a prospective payment system for reimbursing Medicare patients (Langenbrunner, 1989). The original DRGs were redesigned afterwards, resulting in the creation of the Medicare Severity Diagnosis Related Groups (MS-DRGs), which added three distinct complication levels (major complication and comorbidities, complications and comorbidities and no complications and comorbidities) in order to obtain smaller and more clinically homogenous groups (Centers for Medicare and Medical Services, 2018). A new methodology of DRG stratification was later introduced with the All-Patient Refined Diagnosis-Related Groups (APR-DRG) classification, which modified the basic DRG structure by including four levels of severity of illness (SOI) (Aiello, 2017), which refers to the degree of loss of function or physiologic decompensation of an organ system, and risk of mortality (ROM), which reflects the likelihood of dying (Averill, 2013). Both SOI and ROM are characterized by a score ranging from 1 to 4 (1 - minor; 2 - moderate; 3 - major; 4 - extreme), representing increasing reimbursement demands. The APR-DRG classification is currently employed for reimbursement purposes in some European countries, such as Belgium, Spain, Portugal and Italy, some Arab countries and in over 30 states in the US (Dewilde 2018). Figure 1 shows the overall APR-DRG grouping logic.

In the APR-DRG classification, episodes within a given a Major Diagnostic Category (MDC), which correspond to a specific diagnosis area, will be assigned to a disease or procedure-specific base APR-DRG. Medical episodes will be grouped into a base APR-DRG mostly according to the principal diagnosis, whereas surgical episodes will be grouped according to an operating room procedure (Averill, 2013). The base APR-DRG is further stratified into SOI and ROM levels considering combinations of base APR-DRG, diagnoses, age and procedures (Averill, 2013). Despite the influence of nearly all patient features, secondary diagnoses representing comorbidities and complications are what typically drive SOI and ROM levels (Aiello, 2017). In fact, episodes with higher SOI levels usually present multiple comorbidities affecting different organ systems (Averill, 2013). Thus, accurate and complete coding of comorbidities is particularly important in APR-DRG classification as the patient's SOI has a significant role in hospital payment (Spurgeon 2011). For instance, in Portugal, a hospital that treats a patient assigned to APR-DRG 1944, which represents heart failure patients (base APR-DRG 194) with an extreme SOI, will be paid with an amount about 5, 3 and 2 times higher than cases assigned to the same base APR-DRG with SOI levels 1, 2 and 3, respectively (Administração Central do Sistema de Saúde, 2017).

Due to their important role on determining patient outcomes, several methods have been developed to measure comorbidities, with Charlson and Elixhauser scores being the two most commonly used (Li 2008; Chang 2016). The Charlson's method was developed by reviewing inpatient hospital charts and assessing the relevance of several clinical conditions in the prediction of mortality and a total of 17 comorbid categories were created. A weighted score was assigned to each of 17 comorbidities and the Charlson index was developed as an indicator of disease burden. The Elixhauser investigated groups of ICD-9-CM diagnosis codes to identify categories of comorbidities and further measured their association with mortality. The performance of the Charlson and Elixhauser measures in predicting poor outcomes has been evaluated and validated by several studies and are regarded as good predictors of patient outcomes (Li 2008).

Despite their clinical significance, evidence elsewhere has shown that certain comorbidities are generally under-reported in administrative databases (Austin 2005), while the prevalence of others is overestimated when compared with the information of medical charts (Spurgeon 2011; Malenka, 1994; Iezzoni, 1992; Hawker 1997; Kieszak 1999; Powell 2001; Waite 1994; Normand 1995; Romano 1994; Humphries 2000; Blumenthal 1996; Sarfati 2010; Preen 2004; Newschaffer 1997; McCarthy, 2000; Mears, 2002; Chong, 2011). Overall, asymptomatic conditions tend to be under-reported in administrative datasets (Powell, 2001; Romano, 1994), while certain acute medical conditions or complications tend to be regarded by medical coders as more important than others, thereby originating this coding bias (Iezzoni, 1992). In this context, several studies have evaluated the degree of agreement between the information on comorbidities obtained from administrative datasets and that obtained from medical charts. The prevalence of comorbidities obtained from administrative data was found to be typically lower than that obtained from medical charts for most of the evaluated conditions (Chong, 2011). Comparing with chart review data, Quan et al (2002) demonstrated that administrative data from a Canadian hospital discharge underreported 29 out of 32 Charlson and Elixhauser comorbidities when ICD-9-CM (International Statistical Classification of Diseases and Related Health Problems, 9th Revision, Clinical Modification) is used, whereas this number increased to 31 with ICD-10-CM (International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Clinical Modification) data (Quan, 2002).

In this paper, we present a machine learning approach to explore the technical structure of the APR-DRG classification in order to characterize the impact of under-reporting secondary diagnoses representing Elixhauser and Charlson comorbidities on APR-DRG classification and hospital funding.

Methods

Inpatient Data

Inpatient data used in this study were extracted from Portugal's national DRG database, which currently does not impose a limit on the number of secondary diagnoses to be reported per episode and contains coded hospitalization data provided by all National Health Service (NHS) public hospitals in mainland Portugal. We collected data of all inpatient episodes assigned to MDC 4 (Diseases and Disorders of the Respiratory System) and 5 (Diseases and Disorders of the Circulatory System) that occurred between 2011 and 2016, which corresponded to the period in which APR-DRG data were available. We applied this methodology on respiratory (MDC 4) and cardiovascular diseases (MDC 5) because they were the two diagnosis areas with the

highest number of hospitalizations among all MDCs, accounting for over one million hospitalizations during the studied period, with a total of 577,313 episodes assigned to MDC 4 and other 526,611 episodes in MDC 5. Thus, we believe that both areas are relevant for hospitals and public authorities due to this high hospitalization burden. Each inpatient episode contained all variables required for APR-DRG grouping, namely principal diagnosis and up to 30 secondary diagnoses, up to 30 operating and non-operating room procedures (as the original APR-DRG grouper only considers the first 30 secondary diagnoses and procedures), discharge status, sex and age. All diagnoses and procedures were coded in ICD-9-CM classification system (International Classification of Diseases, 9th Revision, Clinical Modification). Our sample included hospitalizations grouped across 49 base APR-DRGs (version 31), 17 respiratory APR-DRGs (MDC 4) and 32 cardiovascular APR-DRGs (MDC 5).

SVM classification models for simulating APR-DRG classification

We employed Support Vector Machine (SVM) algorithm on Portuguese inpatient data originally grouped with the 3M APR-DRG grouper software to programmatically learn how these hospitalizations were assigned to their APR-DRGs. SVM models learn how to group episodes by finding a separating boundary between them, the so-called hyperplanes (Son, 2016), to segregate the different classes (APR-DRGs). The main advantage of this algorithm is that it can overcome high dimensionality problems occurring when there is a large number of input variables relative to the number of available observations (Verplancke, 2016), which is the case of APR-DRG assignment, as its algorithm relies on several input variables such as discharge status, a wide variety of diagnosis and procedure codes and other intrinsic patient characteristics (e.g. age and sex) (Averill, 2013). Additionally, SVM has demonstrated high performance in solving classification problems in bioinformatics (Chu, 2008).

For each studied MDC, we built two classification models: one aimed at assigning the coded episodes to a base APR-DRG and the other one to attribute the SOI level. As ROM subclass is not used for payment and we were interested in investigating the individual impact of comorbidities on hospital payments, we did not assess changes in ROM levels in our study. All variables required for APR-DRG assignment were used to build the SVM models. The first model (base APR-DRG assignment) included age as a numeric variable, sex and discharge status as categorical variables, as well as all ICD-9-CM diagnosis and procedure codes present in the dataset. As SOI algorithm does not consider sex and discharge status, the second model (SOI assignment) only included age as numeric variable, the base APR-DRG itself as a categorical variable and all diagnosis and procedure codes. In both models, each diagnosis and procedure code was treated as a separate binary variable (1 if the episode reported the code, 0 otherwise). We trained SVM classifiers on two thirds of the inpatient data for the period 2011-2015 (training set) and evaluated their performance on the remaining third (testing set). As evaluation metrics, we estimated the percentage of correctly classified episodes, recall and precision. Although the testing phase provides us with a reasonable estimate of the model performance, we tested the models on unseen data from 2016 and estimated the percentage of correctly classified episodes to add critical validation to the models and assess their capacity of generalization. The evaluation metrics of the SVM models are presented in table 6, in supplementary material.

Sensitivity Analysis

Using the previously constructed SVM models, we performed a first classification phase using the complete dataset, with all available codes. A second classification phase

was conducted afterwards, but all secondary diagnosis codes representing Charlson and Elixhauser comorbidities were individually removed to assess grouping changes. We calculated and compared the model's sensitivity before and after removing each comorbidity. We further employed paired-sample Wilcoxon signed-ranks test to verify whether differences in sensitivity before and after removing each comorbidity were statistically significant. We considered each APR-DRG combined with a respective SOI level as a unit of analysis to employ this statistical test. We also assessed the proportion of episodes that changed their base-APR-DRGs or SOI level as a result of missing comorbidities. All comorbidity codes were selected through Charlson and Elixhauser ICD-9-CM enhanced definitions presented by Quan et al (2005). Those definitions identify a set of conditions characterized by high-prevalence or severity and have been extensively used as alternatives to the complexity of acute episodes (Jackson, 2015). All 17 Charlson's comorbidities and all 30 Elixhauser's comorbidities were considered in this study.

Besides evaluating changes in APR-DRG classification, we also studied the financial impact of under-reporting for each studied comorbidity by estimating the total hospital payments that could have been lost when these comorbidity codes are missing. For this analysis, we used official APR-DRG prices derived from the 2017 APR-DRG prices and weights table defined for NHS public hospitals in Portugal (Administração Central do Sistema de Saúde, 2017).

Ethical considerations

Since inpatient data used in this study was completely anonymized and only contained the discharge year, diagnosis and procedure codes, sex, age, discharge status and an arbitrary episode identification number, there was no need for ethical approval.

Results

A total of 935,139 inpatient episodes were included in our sample for constructing and testing the SVM models, which corresponded to all inpatient episodes assigned to MDC 4 (485,233 episodes) and MDC 5 (446,906 episodes) between 2011 and 2015. Overall, the SVM models showed a good sensitivity when employed on the complete dataset (first classification phase), with overall rates above 0.8 (Table 1). Using unseen hospitalization data from the whole year of 2016, we verified that SVM models presented a high capacity of generalization, achieving a percentage of correctly classified cases of more than 90% for nearly all base APR-DRGs and over 80% for all SOI levels (see Table 6 in supplementary material).

The removal of most comorbidities caused a reduction in the model's sensitivity in both studied MDCs (Table 1). Metastatic solid tumor/metastatic cancer accounted for the highest impact in both MDCs, reducing the model's sensitivity by almost a half (49.0%) (Tables 1 and 2). Furthermore, the removal of most Charlson comorbidities (12 out of 17) and nearly half of the Elixhauser comorbidities (14 out of 30) caused a significant reduction in sensitivity (p -value < 0.05). In general, the same comorbidities significantly impacted APR-DRG assignment in both MDCs, apart from: Charlson's diabetes, either with or without complication, which only significantly impacted the sensitivity for cardiovascular APR-DRGs; and AIDS/HIV, which only significantly impacted the sensitivity for respiratory APR-DRGs (Tables 1 and 2). A total of 2 Charlson's comorbidities and 16 Elixhauser's comorbidities did not cause any significant impact on APR-DRG classification (see Tables 1 and 2).

In terms of financial impact, we observed that removing any comorbidity would cause a considerable difference in the total amount to be reimbursed to hospitals (Table 3). Considering the entire period of 2011-2015, the absence of Charlson's comorbidity renal disease alone would account for a difference of more than 107 million € in the total hospital payments for treating MDC 4 patients (Table 3). This same comorbidity also presented the highest impact on reimbursement for MDC 5 patients, with an estimated difference in hospital payments of more than 45 million € (Table 3). The top-5 comorbidities that would have accounted for the highest differences in hospital payments for charging MDC 4 patients included metastatic solid tumor/metastatic cancer (-22.2%), renal disease (-18.3%), moderate or severe liver disease (-17.8%), pulmonary circulatory disorders (-14.1%) and weight loss (-13.7%) (Table 3). The top-5 comorbidities accounting for the highest differences in hospital payments for charging MDC 5 patients were moderate or severe liver disease (-16.9%), metastatic solid tumor/metastatic cancer (-15.1%), renal disease (-11.5%), congestive heart failure (-10.7%) and any malignancy or fluid and electrolyte disorders (-9.7%) (Table 3).

Moreover, removing either Charlson or Elixhauser comorbidities had a much higher impact on SOI assignment than on base APR-DRG assignment, regardless of the diagnosis area, as a very small percentage (close to zero) of episodes changed their base APR-DRG in the absence of comorbidities (Tables 4 and 5). Tables 4 and 5 present the number of episodes (and the percentage of total) that changed their base-APR-DRG or SOI level when a given comorbidity was missing in MDC 4 and 5 data, respectively. The classification results obtained with the SVM models using the complete dataset were used as reference. SOI columns correspond to cases that maintained their base-APR-DRG but changed their SOI level, whereas the last column corresponds to cases that changed to another base APR-DRG.

Overall, the highest percentage of episodes that changed their SOI level were those initially grouped into the higher SOI levels, though the magnitude of change varied considerably according to the comorbidity. Among MDC 4 episodes, the top-5 comorbidities that accounted for the highest percentage changes in SOI 4 were renal disease (64%), pulmonary circulation disorders (53.3%), moderate or severe liver disease (48.8%), weight loss (43.2%) and myocardial infarction (35.8%). In SOI 3, the top-5 comorbidities were renal disease (61.4%), moderate or severe liver disease (45.6%), metastatic solid tumor/metastatic cancer (45.6%), weight loss (35.8%) and any malignancy (27.7%). Among MDC 5 episodes, the top-5 comorbidities for SOI 4 were renal disease (48.1%), moderate or severe liver disease (44.5%), fluid and electrolyte disorders (33.0%), myocardial infarction (27.0%) and liver disease (25.4%). In SOI 3, the top-5 comorbidities were metastatic solid tumor/metastatic cancer (47.9%), renal disease (42.2%), weight loss (37.1%), moderate or severe liver disease (30.4%) and myocardial infarction (27.4%). Under-coding these comorbidities would thus lead to the highest changes in the proportion of episodes grouped into higher SOI levels.

To evaluate the influence of each comorbidity across the different base APR-DRGs, considering that their influence is disease-specific, we presented in tables 7 and 8 (in supplementary material), by each base APR-DRG, the number of episodes (and the percentage of the total) that changed their SOI levels or shifted to another base APR-DRG following the removal of each studied comorbidity. Table 7 shows the results for each respiratory APR-DRG, while table 8 contains the same analysis for each cardiovascular APR-DRG. Overall, even when assessing at base APR-DRG level,

higher SOI levels were still the most affected and little to no changes in base AR-DRG were observed (Tables 7 and 8). Moreover, the percentage change in SOI level varied greatly according to the base APR-DRG for most comorbidities. Certain comorbidities, however, were crucial for SOI assignment, regardless of the base AR-DRG, such as renal disease, which considerably influenced the classification into higher SOI levels for all respiratory APR-DRGs and almost all cardiovascular APR-DRGs (Tables 7 and 8). On the other hand, comorbid conditions such as uncomplicated hypertension or depression little influenced SOI assignment in any respiratory or cardiovascular APR-DRG (Tables 7 and 8). Other comorbidities were against the trend and did considerably impact base APR-DRG assignment, such as the case of comorbidity myocardial infarction, which changed the base-APR-DRG in 29.3% of the episodes initially grouped into APR-DRG 190 (Acute Myocardial Infarction) (Table 8).

Discussion

Pursuing higher quality of clinical administrative data and investing in medical coding are highly needed for ensuring that the correct amount of hospital funding will be allocated, especially in countries that employ DRG-based payment systems. The APR-DRG classification has provided means to achieve this goal by subdividing base APR-DRGs into SOI levels to obtain smaller and more homogeneous clusters in terms of resource use. SOI assignment is highly dependent on all necessary diagnosis codes, as its complex algorithm considers the interactions between all diagnoses, age and procedures (Averill, 2013). In this context, a comprehensive report of all relevant diagnoses, namely the patient's underlying comorbidities, can be a key factor for ensuring that SOI level and thereby hospital funding will be adequate.

Since January 2015, Portugal uses APR-DRGs for budget allocation and reimbursement of hospital care (Administração Central do Sistema de Saúde, 2014), with a percentage share of hospital revenues related to DRGs at about 80% (Mihailovic, 2016). In Portugal, each inpatient episode should be coded by a trained coder based upon a discharge summary, which is mandatory in all hospitals within the NHS, complemented by other information from daily medical reports, emergency room records, as well as surgical and pathological anatomy reports (Administração Central do Sistema de Saúde_B, 2014). Medical coding of diagnoses in Portugal is based on the official guidelines provided by The Centers for Medicare and Medicaid Services (CMS) and the National Center for Health Statistics (NCHS), two departments within the U.S. Federal Government's Department of Health and Human Services (DHHS) (Centers for Disease Control and Prevention, 2011). Those guidelines do not contain specific rules for coding comorbidities, but they provide specific information on coding additional diagnoses, including preexisting conditions, which can thereby influence coding of comorbidities. In those guidelines, additional diagnoses mean "all conditions that coexist at the time of admission, that develop subsequently, or that affect the treatment received and/or the length of stay. Diagnoses that relate to an earlier episode which have no bearing on the current hospital stay are to be excluded." Furthermore, these guidelines clearly state that additional diagnoses to be coded are those requiring clinical evaluation, therapeutic treatment, diagnostic procedures, extended length of stay or increased nursing and monitoring care, which can be the case with comorbidities Centers for Disease Control and Prevention, 2011).

Using the same database employed in our study, Freitas et al (2016) found that the number of comorbidities reported by inpatient episode has increased, with the average number of Elixhauser and Charlson comorbidities by episode increasing, respectively, by 81% and 48% in the period 2000-2010 (Freitas, 2016), though this increasing trend was not equal for all comorbidities. The proportion of episodes with Charlson's AIDS/HIV and peptic ulcer disease, as well as Elixhauser's drug abuse, blood loss anemia, peptic ulcer disease excluding bleeding and complicated diabetes has decreased over the studied period (Freitas, 2016). On the contrary, the proportion of episodes with Charlson's myocardial infarction, dementia and renal disease, as well as Elixhauser's complicated and uncomplicated hypertension, uncomplicated diabetes, hypothyroidism, renal failure, coagulopathy, obesity and depression have increased above 100% (Freitas, 2016). Those discrepancies in reporting certain comorbidities found by Freitas et al (2016), which was also described elsewhere in the literature (Chong, 2011), should be more closely watched. Thus, investigating and acknowledging how each comorbidity affects the different base APR-DRGs and knowing whether and which comorbidities are key within the grouping logic, is a relevant matter to improve medical coding. To the best of our knowledge, this was the first study to employ a machine learning approach to explore the APR-DRG classification in order to provide information on the individual impact of each Charlson and Elixhauser comorbidity on APR-DRGs, raising awareness on the importance of a comprehensive report of these conditions.

We first built SVM models to simulate the APR-DRG classification and assess the model's sensitivity to the removal of each studied comorbidity. As removing these codes caused little to no impact on base APR-DRG classification, our analyses focused on changes in SOI levels. Our findings were consistent with the general grouping logic of the APR-DRG as the sensitivity for calculating higher SOI levels was clearly the most negatively affected by the removal of comorbidities and base APR-DRG classification, which is mainly determined by the principal diagnosis or operating-room procedure, was little affected by the absence of comorbidities (Tables 2 and 3). Dewilde et al (2018) also found that certain comorbidities were strongly associated with higher SOI levels and thus with higher funding. Moreover, while Dewilde et al (2018) focused on ischemic stroke APR-DRG, our results strengthened these previous findings on the role and importance of comorbidities regarding SOI determination by adding evidence that included all respiratory and cardiovascular APR-DRGs. We initially considered, however, that the impact of removing comorbidities was disproportional and specific to the base APR-DRG, which was later confirmed when assessing grouping changes at base APR-DRG level (Tables 7 and 8), indicating that certain comorbidities might be crucial for attributing a SOI level within a given APR-DRG, while it would not influence SOI in others. Thus, these findings are in accordance with the basic clinical principle of the APR-DRG classification as our scenario showed that the role of comorbidities for the calculation of SOI levels was disease-specific and the significance of comorbidities depends on the underlying problem, which is characterized by the base APR-DRG. The consistency of our results strengthens the methodology based on the constructed SVM models.

In APR-DRG, the subcategorizations into SOI levels were created to achieve more correct funding within each base APR-DRG, considering that the mix of resources used at different SOI levels leads to substantial differences in total costs. Hospitals that admit proportionally more patients with higher severity of illness would be underfunded when clinical data fail to provide a more precise SOI calculation. In fact, the distribution of

episodes across the different SOI levels might have a substantial impact on hospital budgets. Measuring how under-coding of comorbidities alone can affect hospital payment is thereby relevant for hospitals and medical coders as such conditions usually drive SOI assignment. Thus, we estimated the amount of hospital payments in the period 2011-2015 that could have been lost when each comorbidity is not present in the data. We found that all comorbidities would lead hospitals to receive less money (see Table 3).

In summary, our findings clearly showed how incomplete coding of comorbidities alone could substantially affect SOI assignment and thus hospital funding. In addition to that, we should also keep in mind that incomplete reporting of comorbidities could make unfeasible the reutilization of clinical data for health care quality measurement, which often relies on coded clinical data for the calculation of quality indicators (e.g. risk-adjusted in-hospital mortality), for biomedical research, namely for studies that employ more sophisticated methodologies, such as the calculation of risk-adjusted health outcomes, and for other tasks related to health care management, as the use of APR-DRGs in conjunction with SOI can be applied for evaluating resource use and establishing patient care guidelines (Averill, 2013). Therefore, collecting information on preexisting or acquired comorbidities should always be encouraged in hospitals and the construction of specific guidelines for coding of comorbidities is highly recommended to achieve a more comprehensive report of such conditions and thus improve quality of clinical data and hospital funding in APR-DRG-based payment systems.

Limitations of the study

We used clinical data from an administrative database as gold standard and thus our findings are limited to the reality abstracted from this data. Certain comorbidities might have had little or no significant impact on APR-DRG grouping because they could have been under-reported and thus the SVM models, which were constructed through patterns learned from the data, would minimize their importance in terms of classification, being less sensitive to their absence. Another important limitation is that our methodology is mostly based on results obtained from the SVM models, as we used their classification results obtained with the complete dataset as baseline to estimate and compare changes in APR-DRGs and hospital payments. Therefore, possible errors or shortcomings associated with the original SVM models may have influenced or been replicated in our results.

Conclusion

Using a machine learning approach, we found that most Charlson and Elixhauser comorbidities did considerably influence SOI assignment and the absence of all studied conditions may lead to losses in hospital payments at some extent. The degree of influence of each comorbidity, however, is quite specific to the base APR-DRG. Furthermore, our results based on the SVM models were consistent with overall APR-DRG grouping logic. Our findings reinforced that a comprehensive reporting of the patient's underlying comorbidities is relevant for APR-DRG grouping as our findings, in line with previous research, showed that such groups of diagnoses have an important influence on SOI determination, potentially undermining the correct identification of most resource-consuming patients and thus hospital funding. Better documentation of comorbidities should enable more accurate and complete medical coding, which in turn should lead to more accurate grouping into higher SOI levels. In this sense, hospitals

should be oriented to collect all information on any preexisting or newly acquired comorbidity and we recommend that future guidelines to be used by medical coders should include specific rules concerning medical coding of comorbidities.

Conflicts of interest

The authors declare that there are no conflicts of interest.

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Figure 1. Overview of the APR-DRG grouping logic

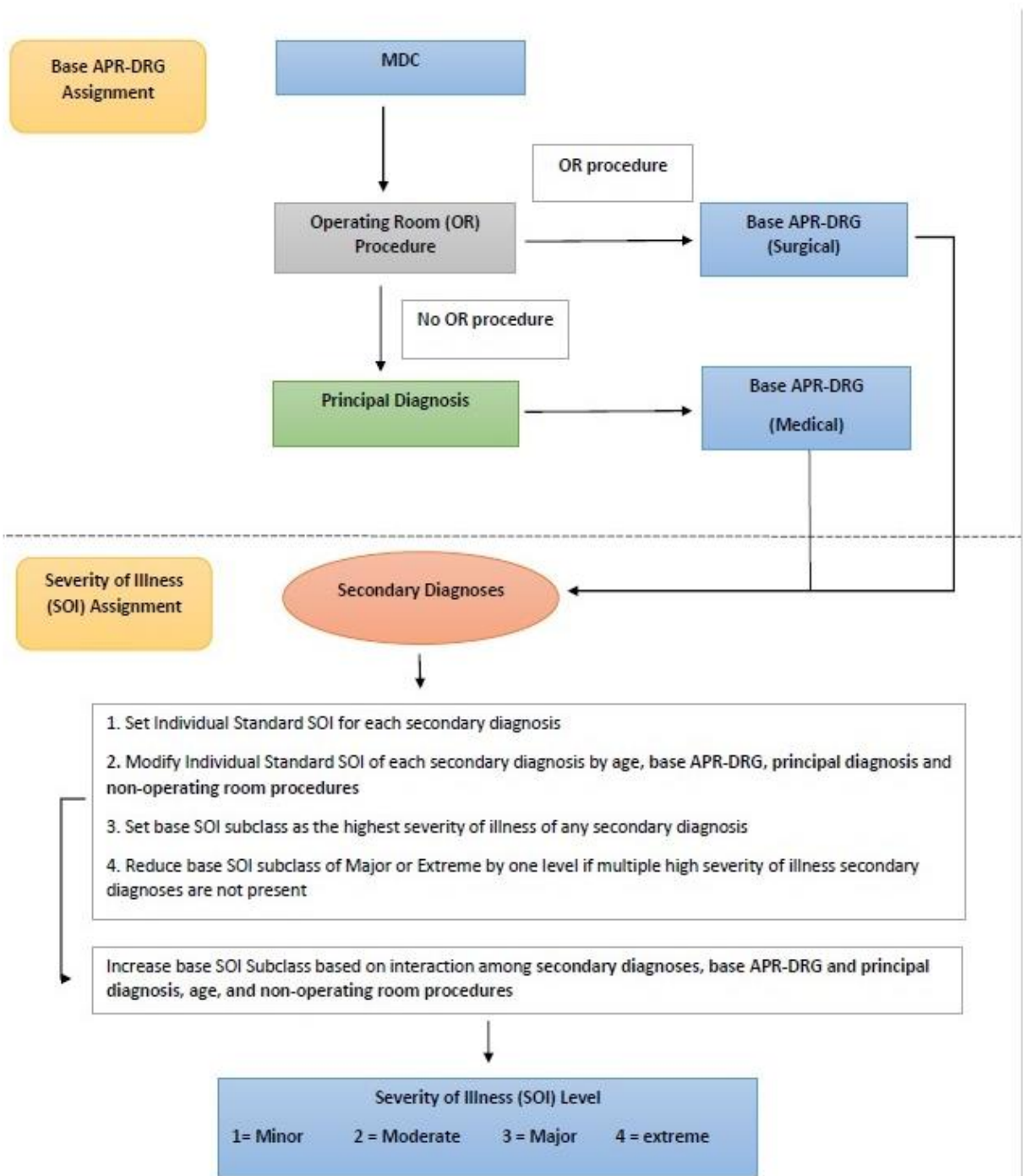


Table 1. Overall rates of sensitivity (true positives/total number of episodes) and percentage change in sensitivity for respiratory APR-DRGs classification

	Sensitivity rate - Phase 1 (Data with Comorbidity)	Sensitivity rate - Phase 2 (Data without Comorbidity)	Sensitivity Change (%)	p-value
Charlson comorbidities				
Myocardial infarction	0.90 (12,170/13,519 episodes)	0.80 (10,874/13,519 episodes)	-10.7	<0.001
Congestive heart failure	0.93 (101,000/109,017 episodes)	0.77 (84,321/109,017 episodes)	-16.5	0.028
Peripheral vascular disease	0.88 (11,130/12,621 episodes)	0.87 (11,026/12,621 episodes)	-0.9	0.004
Cerebrovascular disease	0.91 (50,148/55,124 episodes)	0.82 (45,174/55,124 episodes)	-10.0	0.012
Dementia	0.92 (31,590/34,183 episodes)	0.88 (30,163/34,183 episodes)	-4.5	0.771
Chronic pulmonary disease	0.88 (75,353/85,892 episodes)	0.86 (73,694/85,892 episodes)	-2.2	<0.001
Rheumatic disease	0.87 (4,950/5,680 episodes)	0.83 (4,730/5,680 episodes)	-4.4	0.059
Peptic ulcer disease	0.89 (2,193/2,453 episodes)	0.89 (2,188/2,453 episodes)	-0.2	0.809
Mild liver disease	0.87 (12,144/13,959 episodes)	0.80 (11,091/13,959 episodes)	-8.6	<0.001
Diabetes without chronic complication	0.90 (81,014/90,494 episodes)	0.85 (77,160/90,494 episodes)	-4.7	0.085
Diabetes with chronic complication	0.90 (11,734/13,086 episodes)	0.86 (11,200/13,086 episodes)	-4.6	0.229
Hemiplegia	0.85 (5,135/6,043 episodes)	0.73 (4,431/6,043 episodes)	-13.8	<0.001
Renal disease	0.89 (212,485/239,827 episodes)	0.60 (144,087/239,827 episodes)	-32.2	<0.001
Any malignancy	0.88 (29,263/33,255 episodes)	0.64 (21,421/33,255 episodes)	-26.8	<0.001
Moderate or severe liver disease	0.88 (1,809/2,061 episodes)	0.56 (1,149/2,061 episodes)	-36.6	<0.001
Metastatic solid tumor	0.83 (22,090/26,653 episodes)	0.42 (1,1287/26,653 episodes)	-49.0	<0.001
AIDS/HIV	0.85 (460/543 episodes)	0.73 (396/543 episodes)	-13.9	0.006

Elixhauser comorbidities				
Congestive heart failure	0.93 (101,000/109,017 episodes)	0.77 (84,321/109,017 episodes)	-16.5	0.028
Cardiac arrhythmias	0.91 (93,993/103,460 episodes)	0.87 (89,456/103,460 episodes)	-4.7	0.142
Valvular disease	0.89 (22,071/24,722 episodes)	0.88 (21,785/24,722 episodes)	-1.3	0.059
Pulmonary circulation disorders	0.82 (11,982/14,574 episodes)	0.66 (9,658/14,574 episodes)	-19.3	0.006
Peripheral vascular disorders	0.88 (11,130/12,621 episodes)	0.87 (11,026/12,621 episodes)	-0.9	0.004
Hypertension uncomplicated	0.89 (132,937/149,570 episodes)	0.89 (132,944/149,570 episodes)	0.0	0.631
Paralysis	0.85 (5,135/6,043 episodes)	0.73 (4,431/6,043 episodes)	-13.8	<0.001
Other neurological disorders	0.89 (34,685/38,796 episodes)	0.83 (32,312/38,796 episodes)	-6.8	<0.001
Chronic pulmonary disease	0.88 (75,353/85,892 episodes)	0.86 (73,694/85,892 episodes)	-2.2	<0.001
Diabetes uncomplicated	0.90 (78,354/87,546 episodes)	0.85 (74,618/87,546 episodes)	-4.8	0.086
Diabetes complicated	0.90 (13,996/15,603 episodes)	0.86 (13,333/15,603 episodes)	-4.7	0.216
Hypothyroidism	0.90 (15,562/17,331 episodes)	0.90 (15,574/17,331 episodes)	0.1	0.087
Renal failure	0.90 (51,378/56,882 episodes)	0.85 (48,076/56,882 episodes)	-6.4	<0.001
Liver disease	0.87 (14,402/16,491 episodes)	0.77 (12,621/16,491 episodes)	-12.4	<0.001
Peptic ulcer disease excluding bleeding	0.89 (1,702/1,908 episodes)	0.89 (1,704/1,908 episodes)	0.1	0.970
AIDS_HIV	0.85 (445/526 episodes)	0.73 (382/526 episodes)	-14.2	0.018
Lymphoma	0.91 (3,849/4,213 episodes)	0.67 (2,816/4,213 episodes)	-26.9	<0.001
Metastatic cancer	0.83 (22,090/26,653 episodes)	0.42 (11,287/26,653 episodes)	-49.0	<0.001
Solid tumor without metastasis	0.89 (11,642/13,112 episodes)	0.72 (9,463/13,112 episodes)	-18.7	<0.001
Rheumatoid arthritis/collagen vascular diseases	0.89 (12,174/13,733 episodes)	0.84 (11,568/13,733 episodes)	-5.0	0.071
Coagulopathy	0.88 (9,239/10,535 episodes)	0.83 (8,706/10,535 episodes)	-5.8	0.105
Obesity	0.88 (31,670/35,986 episodes)	0.88 (31,651/35,986 episodes)	0.0	0.860
Weight loss	0.89 (13,835/15,469 episodes)	0.67 (10,310/15,469 episodes)	-25.5	<0.001
Fluid and electrolyte disorders	0.90 (92,445/102,707 episodes)	0.78 (80,213/102,707 episodes)	-13.2	<0.001

Blood loss anemia	0.91 (2,562/2,821 episodes)	0.86 (2,437/2,821 episodes)	-4.8	0.462
Deficiency anemia	0.90 (16,069/17,894 episodes)	0.89 (15,900/17,894 episodes)	-1.0	0.798
Alcohol abuse	0.88 (19,743/22,543 episodes)	0.86 (19,479/22,543 episodes)	-1.4	0.163
Drug abuse	0.90 (2,945/3,256 episodes)	0.90 (2,931/3,256 episodes)	-0.4	0.509
Psychoses	0.87 (3,680/4,209 episodes)	0.86 (3,634/4,209 episodes)	-1.3	0.337
Depression	0.89 (21,528/24,280 episodes)	0.89 (21,522/24,280 episodes)	-0.1	0.923

Table 2. Overall rates of sensitivity (true positives/total number of episodes) and percentage change in sensitivity for cardiovascular APR-DRGs classification

	Sensitivity rate - Phase 1 (Data with Comorbidity)	Sensitivity rates - Phase 2 (Data without Comorbidity)	Sensitivity Change (%)	p-value
Charlson comorbidities				
Myocardial infarction	0.87 (34,157/39,509 episodes)	0.76 (30,080/39,509 episodes)	-12.0	<0.001
Congestive heart failure	0.88 (79,264/90,581 episodes)	0.61 (55,470/90,581 episodes)	-30.1	<0.001
Peripheral vascular disease	0.88 (22,098/25,167 episodes)	0.86 (21,577/25,167 episodes)	-2.4	<0.001
Cerebrovascular disease	0.88 (25,571/29,234 episodes)	0.78 (22,690/29,234 episodes)	-11.3	<0.001
Dementia	0.90 (7,886/8,759 episodes)	0.85 (7,434/8,759 episodes)	-5.7	0.436
Chronic pulmonary disease	0.88 (48,718/55,295 episodes)	0.86 (47,454/55,295 episodes)	-2.6	<0.001
Rheumatic disease	0.87 (3,413/3,942 episodes)	0.82 (3,249/3,942 episodes)	-4.8	0.005
Peptic ulcer disease	0.88 (2,146/2,445 episodes)	0.88 (2,145/2,445 episodes)	-0.1	0.942
Mild liver disease	0.87 (8,296/9,569 episodes)	0.78 (7,470/9,569 episodes)	-9.9	<0.001
Diabetes without chronic complication	0.87 (90,489/103,826 episodes)	0.83 (86,463/103,826 episodes)	-4.5	<0.001
Diabetes with chronic complication	0.88 (18,504/21,159 episodes)	0.82 (17,384/21,159 episodes)	-6.1	0.024
Hemiplegia	0.88 (1,456/1,648 episodes)	0.82 (1,358/1,648 episodes)	-6.7	<0.001
Renal disease	0.88 (110,834/126,652 episodes)	0.72 (91,070/126,652 episodes)	-17.8	<0.001
Any malignancy	0.88 (9,808/11,204 episodes)	0.63 (7,062/11,204 episodes)	-28.0	<0.001
Moderate or severe liver disease	0.86 (1,142/1,324 episodes)	0.66 (875/1,324 episodes)	-23.4	<0.001
Metastatic solid tumor	0.82 (2,308/2,822 episodes)	0.54 (1,530/2,822 episodes)	-33.7	<0.001
AIDS/HIV	0.83 (498/603 episodes)	0.78 (473/603 episodes)	-5.1	0.160

Elixhauser comorbidities				
Congestive heart failure	0.88 (79,264/90,581 episodes)	0.61 (55,470/90,581 episodes)	-16.5	0.028
Cardiac arrhythmias	0.87 (122,375/140,278 episodes)	0.80 (112,829/140,278 episodes)	-4.7	0.142
Valvular disease	0.87 (60406/69518 episodes)	0.84 (58,637/69,518 episodes)	-1.3	0.059
Pulmonary circulation disorders	0.89 (17,231/19,296 episodes)	0.80 (15,495/19,296 episodes)	-19.3	0.006
Peripheral vascular disorders	0.88 (22,098/25,167 episodes)	0.86 (21,577/25,167 episodes)	-0.9	0.004
Hypertension uncomplicated	0.90 (168,239/187,971 episodes)	0.90 (168,330/187,971 episodes)	0.0	0.631
Paralysis	0.88 (1,456/1,648 episodes)	0.82 (1,358/1,648 episodes)	-13.8	<0.001
Other neurological disorders	0.88 (1,1057/12,547 episodes)	0.81 (10,137/12,547 episodes)	-6.8	<0.001
Chronic pulmonary disease	0.88 (48,718/55,295 episodes)	0.86 (47,454/55,295 episodes)	-2.2	<0.001
Diabetes uncomplicated	0.87 (88,394/101,426 episodes)	0.83 (84,493/101,426 episodes)	-4.8	0.086
Diabetes complicated	0.88 (19,992/22,860 episodes)	0.82 (18,721/22,860 episodes)	-4.7	0.216
Hypothyroidism	0.89 (16,478/18,505 episodes)	0.89 (16,477/18,505 episodes)	0.1	0.087
Renal failure	0.88 (58,273/66,490 episodes)	0.79 (52,754/66,490 episodes)	-6.4	<0.001
Liver disease	0.87 (9,848/11,342 episodes)	0.77 (8,722/11,342 episodes)	-12.4	<0.001
Peptic ulcer disease excluding bleeding	0.88 (1,656/1,878 episodes)	0.88 (1,660/1,878 episodes)	0.1	0.970
AIDS_H1V	0.83 (497/601 episodes)	0.79 (472/601 episodes)	-14.2	0.018
Lymphoma	0.88 (1,285/1,464 episodes)	0.68 (991/1,464 episodes)	-26.9	<0.001
Metastatic cancer	0.82 (2,308/2,822 episodes)	0.54 (1,530/2,822 episodes)	-49	<0.001
Solid tumor without metastasis	0.90 (4,769/5,340 episodes)	0.69 (3,657/5,340 episodes)	-18.7	<0.001
Rheumatoid arthritis/collagen vascular diseases	0.87 (5,813/6,654 episodes)	0.83 (5,537/6,654 episodes)	-5.0	0.071
Coagulopathy	0.88 (7,597/8,677 episodes)	0.82 (7,119/8,677 episodes)	-5.8	0.105
Obesity	0.89 (48,760/55,000 episodes)	0.89 (48,774/55,000 episodes)	0.0	0.860
Weight loss	0.87 (1,925/2,210 episodes)	0.72 (1,586/2,210 episodes)	-25.5	<0.001
Fluid and electrolyte disorders	0.87 (36,654/41,979 episodes)	0.75 (31,343/41,979 episodes)	-13.2	<0.001

Blood loss anemia	0.87 (1,939/2,222 episodes)	0.83 (1,852/2,222 episodes)	-4.8	0.462
Deficiency anemia	0.88 (11,211/12,691 episodes)	0.87 (11,072/12,691 episodes)	-1.0	0.798
Alcohol abuse	0.86 (13,954/16,275 episodes)	0.85 (13,770/16,275 episodes)	-1.4	0.163
Drug abuse	0.90 (1,139/1,260 episodes)	0.90 (1,125/1,260 episodes)	-0.4	0.509
Psychoses	0.88 (1,280/1,463 episodes)	0.87 (1,277/1,463 episodes)	-1.3	0.337
Depression	0.89 (14,656/16,466 episodes)	0.89 (14,643/16,466 episodes)	-0.1	0.923

Table 3. Overall percentage change in hospital charges, by MDC

	Estimated Differences in Hospital Payments (in million euros) – MDC 4	% Hospital Payments Change – MDC 4	Estimated Differences in Hospital Payments (in million euros) – MDC 5	% Hospital Payments Change – MDC 5
Charlson Comorbidity				
Myocardial infarction	-2.368	-6.7	-10.906	-8.4
Congestive heart failure	-15.207	-5.9	-31.619	-10.7
Peripheral vascular disease	-290.393	-0.9	-1.424	-1.5
Cerebrovascular disease	-8.848	-6.7	-7.373	-7.7
Dementia	-2.784	-3.6	-0.672	-3.2
Chronic pulmonary disease	-4.319	-2.2	-2.787	-1.7
Rheumatic disease	-0.314	-2.4	-0.295	-2.7
Peptic ulcer disease	-0.003	-0.0	0.013	+0.2
Mild liver disease	-2.428	-6.2	-2.069	-6.2
Diabetes without chronic complication	-7.550	-3.7	-8.267	-2.9
Diabetes with chronic complication	-0.906	-2.8	-2.257	-3.6
Hemiplegia	-1.232	-7.8	-0.194	-2.1
Renal disease	-107.659	-18.3	-45.412	-11.5
Any malignancy	-8.456	-10.5	-3.030	-9.7
Moderate or severe liver disease	-1.185	-17.8	-0.830	-16.9
Metastatic solid tumor	-17.147	-22.2	-1.223	-15.1
AIDS/HIV	-0.071	-5.8	-0.069	-3.7
Elixhauser Comorbidities				
Congestive heart failure	-15.207	-5.9	-31.619	-10.7
Cardiac arrhythmias	-8.245	-3.3	-23.480	-5.5

Valvular disease	-0.475	-0.8	-3.721	-1.7
Pulmonary circulation disorders	-6.124	-14.1	-4.109	-6.4
Peripheral vascular disorders	-0.290	-0.9	-1.424	-1.5
Hypertension uncomplicated	0.200	+0.1	0.343	+0.1
Paralysis	-1.232	-7.8	-0.194	-2.1
Other neurological disorders	-4.342	-4.7	-1.969	-4.8
Chronic pulmonary disease	-4.319	-2.2	-2.787	-1.7
Diabetes uncomplicated	-7.296	-3.7	-8.020	-2.9
Diabetes complicated	-1.165	-3.1	-2.545	-3.7
Hypothyroidism	0.012	~0.0	0.042	+0.1
Renal failure	-4.899	-3.7	-8.479	-4.5
Liver disease	-3.608	-8.0	-2.935	-7.5
Peptic ulcer disease excluding bleeding	-0.024	-0.5	0.019	0.3
AIDS_HIV	-0.069	-6.0	-0.069	-3.7
Lymphoma	-0.791	-8.0	-0.267	-7.0
Metastatic cancer	-17.147	-22.2	-1.223	-15.1
Solid tumor without metastasis	-2.277	-7.3	-1.161	-8.0
Rheumatoid arthritis/collagen vascular diseases	-0.923	-2.7	-0.451	-2.0
Coagulopathy	-1.066	-3.3	-1.316	-3.6
Obesity	0.268	+0.3	0.747	+0.5
Weight loss	-6.316	-13.7	-0.646	-8.1
Fluid and electrolyte disorders	-22.257	-8.2	-13.823	-9.7
Blood loss anemia	-0.238	-3.7	-0.172	-2.6
Deficiency anemia	-0.401	-1.0	-0.293	-0.9
Alcohol abuse	-0.217	-0.4	-0.027	-0.1
Drug abuse	-0.059	-0.7	-0.029	-0.7
Psychoses	0.123	+1.2	0.021	+0.5
Depression	0.056	+0.1	0.084	+0.2

Table 4. Number and percentage of episodes that changed their base APR-DRG or SOI level after removing comorbidities, MDC 4 (Diseases and Disorders of the Respiratory System)

Charlson comorbidities	SOI 1	SOI 2	SOI 3	SOI 4	Base APR-DRG
Myocardial infarction	9/1568 (0.6%)	39/5349 (0.7%)	908/5189 (17.5%)	506/1413 (35.8%)	2/13519 (0%)
Congestive heart failure	0/542 (0%)	13018/55369 (23.5%)	8303/46658 (17.8%)	293/6448 (4.5%)	7/109017 (0%)
Peripheral vascular disease	12/1294 (0.9%)	182/5532 (3.3%)	189/4947 (3.8%)	29/848 (3.4%)	0/12621 (0%)
Cerebrovascular disease	9/1964 (0.5%)	3142/25602 (12.3%)	4337/23872 (18.2%)	872/3686 (23.7%)	4/55124 (0%)
Dementia	2/483 (0.4%)	1834/17173 (10.7%)	1883/14707 (12.8%)	7/1820 (0.4%)	0/34183 (0%)
Chronic pulmonary disease	180/18215 (1%)	1991/35117 (5.7%)	2548/28663 (8.9%)	234/3897 (6%)	17/85892 (0%)
Rheumatic disease	9/1151 (0.8%)	294/2473 (11.9%)	190/1793 (10.6%)	2/263 (0.8%)	1/5680 (0%)
Peptic ulcer disease	14/420 (3.3%)	31/1005 (3.1%)	27/844 (3.2%)	3/184 (1.6%)	1/2453 (0%)
Mild liver disease	21/2403 (0.9%)	744/5066 (14.7%)	897/4987 (18%)	304/1503 (20.2%)	7/13959 (0.1%)
Diabetes without chronic complication	14/11872 (0.1%)	4058/41621 (9.7%)	4923/32805 (15%)	98/4196 (2.3%)	4/90494 (0%)
Diabetes with chronic complication	10/585 (1.7%)	601/6314 (9.5%)	607/5288 (11.5%)	11/899 (1.2%)	1/13086 (0%)
Hemiplegia	12/1372 (0.9%)	539/1948 (27.7%)	557/2107 (26.4%)	114/616 (18.5%)	2/6043 (0%)
Renal disease	342/44697 (0.8%)	17584/84634 (20.8%)	57858/94192 (61.4%)	10434/16304 (64%)	67/239827 (0%)
Any malignancy	18/630 (2.9%)	6063/17564 (34.5%)	3667/13236 (27.7%)	215/1825 (11.8%)	7/33255 (0%)
Moderate or severe liver disease	0/29 (0%)	171/605 (28.3%)	514/1128 (45.6%)	146/299 (48.8%)	1/2061 (0%)
Metastatic solid tumor	3/244 (1.2%)	8074/13652 (59.1%)	5154/11302 (45.6%)	196/1455 (13.5%)	5/26653 (0%)
AIDS/HIV	0/205 (0%)	68/172 (39.5%)	32/149 (21.5%)	0/17 (0%)	0/543 (0%)
Elixhauser comorbidities					
Congestive heart failure	0/542 (0%)	13018/55369 (23.5%)	8303/46658 (17.8%)	293/6448 (4.5%)	7/109017 (0%)
Cardiac arrhythmias	22/5557 (0.4%)	4499/49047 (9.2%)	5424/42534 (12.8%)	110/6322 (1.7%)	8/103460 (0%)
Valvular disease	82/2076 (3.9%)	482/11546 (4.2%)	386/9500 (4.1%)	11/1600 (0.7%)	2/24722 (0%)

Pulmonary circulation disorders	2/407 (0.5%)	876/4848 (18.1%)	1925/7269 (26.5%)	1092/2050 (53.3%)	6/14574 (0%)
Peripheral vascular disorders	12/1294 (0.9%)	182/5532 (3.3%)	189/4947 (3.8%)	29/848 (3.4%)	0/12621 (0%)
Hypertension uncomplicated	826/29840 (2.8%)	35/68194 (0.1%)	243/45402 (0.5%)	10/6134 (0.2%)	5/149570 (0%)
Paralysis	12/1372 (0.9%)	539/1948 (27.7%)	557/2107 (26.4%)	114/616 (18.5%)	2/6043 (0%)
Other neurological disorders	13/4423 (0.3%)	1991/17280 (11.5%)	2283/14575 (15.7%)	325/2518 (12.9%)	3/38796 (0%)
Chronic pulmonary disease	180/18215 (1%)	1991/35117 (5.7%)	2548/28663 (8.9%)	234/3897 (6%)	17/85892 (0%)
Diabetes uncomplicated	14/11712 (0.1%)	3856/40047 (9.6%)	4775/31751 (15%)	97/4036 (2.4%)	4/87546 (0%)
Diabetes complicated	9/742 (1.2%)	811/7665 (10.6%)	757/6163 (12.3%)	12/1033 (1.2%)	1/15603 (0%)
Hypothyroidism	97/2720 (3.6%)	40/7622 (0.5%)	24/6104 (0.4%)	8/885 (0.9%)	2/17331 (0%)
Renal failure	64/3031 (2.1%)	1716/26141 (6.6%)	3041/23990 (12.7%)	368/3720 (9.9%)	5/56882 (0%)
Liver disease	23/3299 (0.7%)	965/5881 (16.4%)	1400/5664 (24.7%)	444/1647 (27%)	7/16491 (0%)
Peptic ulcer disease excluding bleeding	8/366 (2.2%)	21/787 (2.7%)	19/641 (3%)	3/114 (2.6%)	1/1908 (0.1%)
AIDS_HIV	0/198 (0%)	67/170 (39.4%)	32/142 (22.5%)	0/16 (0%)	0/526 (0%)
Lymphoma	11/121 (9.1%)	947/2643 (35.8%)	240/1207 (19.9%)	4/242 (1.7%)	4/4213 (0.1%)
Metastatic cancer	3/244 (1.2%)	8074/13652 (59.1%)	5154/11302 (45.6%)	196/1455 (13.5%)	5/26653 (0%)
Solid tumor without metastasis	2/199 (1%)	1792/6908 (25.9%)	970/5339 (18.2%)	21/666 (3.2%)	2/13112 (0%)
Rheumatoid arthritis/collagen vascular diseases	22/1790 (1.2%)	756/5678 (13.3%)	588/5236 (11.2%)	6/1029 (0.6%)	3/13733 (0%)
Coagulopathy	5/674 (0.7%)	564/3918 (14.4%)	576/4664 (12.3%)	38/1279 (3%)	0/10535 (0%)
Obesity	400/7684 (5.2%)	85/14268 (0.6%)	29/12289 (0.2%)	2/1745 (0.1%)	8/35986 (0%)
Weight loss	8/1148 (0.7%)	690/3585 (19.2%)	3224/9004 (35.8%)	749/1732 (43.2%)	2/15469 (0%)
Fluid and electrolyte disorders	18/5957 (0.3%)	3201/37382 (8.6%)	11473/49268 (23.3%)	3348/10100 (33.1%)	4/102707 (0%)
Blood loss anemia	1/227 (0.4%)	114/1364 (8.4%)	163/1107 (14.7%)	2/123 (1.6%)	0/2821 (0%)
Deficiency anemia	5/2229 (0.2%)	251/7788 (3.2%)	318/6925 (4.6%)	4/952 (0.4%)	0/17894 (0%)
Alcohol abuse	251/6554 (3.8%)	392/8103 (4.8%)	390/6531 (6%)	19/1355 (1.4%)	3/22543 (0%)
Drug abuse	4/1677 (0.2%)	51/831 (6.1%)	47/609 (7.7%)	4/139 (2.9%)	3/3256 (0.1%)
Psychoses	100/1155 (8.7%)	64/1622 (3.9%)	35/1189 (2.9%)	0/243 (0%)	1/4209 (0%)
Depression	170/6262 (2.7%)	57/9869 (0.6%)	34/7038 (0.5%)	15/1111 (1.4%)	5/24280 (0%)

Table 5. Number and percentage of episodes that changed their base APR-DRG or SOI level after removing comorbidities, MDC 5 (Diseases and Disorders of the Circulatory System)

Charlson comorbidities	SOI 1	SOI 2	SOI 3	SOI 4	Base APR-DRG
Myocardial infarction	846/13745 (6.2%)	1743/15052 (11.6%)	2369/8658 (27.4%)	554/2054 (27%)	1647/39509 (4.2%)
Congestive heart failure	2/4887 (0%)	26670/56463 (47.2%)	4325/24375 (17.7%)	230/4856 (4.7%)	15/90581 (0%)
Peripheral vascular disease	77/8136 (0.9%)	754/10498 (7.2%)	279/5175 (5.4%)	84/1358 (6.2%)	7/25167 (0%)
Cerebrovascular disease	32/4528 (0.7%)	1973/13169 (15%)	1983/9422 (21%)	532/2115 (25.2%)	10/29234 (0%)
Dementia	1/373 (0.3%)	570/4503 (12.7%)	339/3469 (9.8%)	8/414 (1.9%)	0/8759 (0%)
Chronic pulmonary disease	41/9750 (0.4%)	2351/27353 (8.6%)	848/15408 (5.5%)	39/2784 (1.4%)	7/55295 (0%)
Rheumatic disease	7/1163 (0.6%)	320/1846 (17.3%)	66/799 (8.3%)	0/134 (0%)	0/3942 (0%)
Peptic ulcer disease	13/677 (1.9%)	41/1065 (3.8%)	18/551 (3.3%)	2/152 (1.3%)	0/2445 (0%)
Mild liver disease	25/1138 (2.2%)	622/4233 (14.7%)	487/2939 (16.6%)	255/1259 (20.3%)	6/9569 (0.1%)
Diabetes without chronic complication	27/35833 (0.1%)	7220/44345 (16.3%)	2618/20240 (12.9%)	31/3408 (0.9%)	7/103826 (0%)
Diabetes with chronic complication	39/2517 (1.5%)	1680/10968 (15.3%)	761/6472 (11.8%)	19/1202 (1.6%)	5/21159 (0%)
Hemiplegia	1/236 (0.4%)	94/416 (22.6%)	49/638 (7.7%)	10/358 (2.8%)	0/1648 (0%)
Renal disease	284/21939 (1.3%)	4677/53230 (8.8%)	17437/41343 (42.2%)	4876/10140 (48.1%)	26/126652 (0%)
Any malignancy	5/352 (1.4%)	2302/6357 (36.2%)	917/3912 (23.4%)	62/583 (10.6%)	1/11204 (0%)
Moderate or severe liver disease	2/26 (7.7%)	109/554 (19.7%)	160/526 (30.4%)	97/218 (44.5%)	0/1324 (0%)
Metastatic solid tumor	2/26 (7.7%)	346/1151 (30.1%)	700/1460 (47.9%)	31/185 (16.8%)	2/2822 (0.1%)
AIDS/HIV	0/223 (0%)	57/264 (21.6%)	24/97 (24.7%)	0/19 (0%)	0/603 (0%)
Elixhauser comorbidities					
Congestive heart failure	2/4887 (0%)	26670/56463 (47.2%)	4325/24375 (17.7%)	230/4856 (4.7%)	15/90581 (0%)
Cardiac arrhythmias	52/27464 (0.2%)	11381/68691 (16.6%)	7134/37251 (19.2%)	396/6872 (5.8%)	37/140278 (0%)

Valvular disease	77/13554 (0.6%)	3284/35067 (9.4%)	1136/17390 (6.5%)	58/3507 (1.7%)	19/69518 (0%)
Pulmonary circulation disorders	3/1021 (0.3%)	1174/10218 (11.5%)	1029/6578 (15.6%)	348/1479 (23.5%)	5/19296 (0%)
Peripheral vascular disorders	77/8136 (0.9%)	754/10498 (7.2%)	279/5175 (5.4%)	84/1358 (6.2%)	7/25167 (0%)
Hypertension uncomplicated	679/97348 (0.7%)	120/62485 (0.2%)	135/23592 (0.6%)	14/4546 (0.3%)	12/187971 (0%)
Paralysis	1/236 (0.4%)	94/416 (22.6%)	49/638 (7.7%)	10/358 (2.8%)	0/1648 (0%)
Other neurological disorders	9/1869 (0.5%)	996/5533 (18%)	518/3854 (13.4%)	141/1291 (10.9%)	1/12547 (0%)
Chronic pulmonary disease	41/9750 (0.4%)	2351/27353 (8.6%)	848/15408 (5.5%)	39/2784 (1.4%)	7/55295 (0%)
Diabetes uncomplicated	27/35508 (0.1%)	6988/43114 (16.2%)	2589/19569 (13.2%)	23/3235 (0.7%)	7/101426 (0%)
Diabetes complicated	38/2830 (1.3%)	1934/11846 (16.3%)	788/6865 (11.5%)	30/1319 (2.3%)	5/22860 (0%)
Hypothyroidism	3/4336 (0.1%)	68/8755 (0.8%)	37/4609 (0.8%)	4/805 (0.5%)	3/18505 (0%)
Renal failure	31/7020 (0.4%)	3853/33684 (11.4%)	3676/22023 (16.7%)	226/3763 (6%)	14/66490 (0%)
Liver disease	32/1728 (1.9%)	772/4920 (15.7%)	642/3298 (19.5%)	352/1396 (25.2%)	6/11342 (0.1%)
Peptic ulcer disease excluding bleeding	5/595 (0.8%)	35/841 (4.2%)	3/360 (0.8%)	2/82 (2.4%)	0/1878 (0%)
AIDS_HIV	0/221 (0%)	57/264 (21.6%)	24/97 (24.7%)	0/19 (0%)	0/601 (0%)
Lymphoma	1/68 (1.5%)	289/915 (31.6%)	47/411 (11.4%)	2/70 (2.9%)	0/1464 (0%)
Metastatic cancer	2/26 (7.7%)	346/1151 (30.1%)	700/1460 (47.9%)	31/185 (16.8%)	2/2822 (0.1%)
Solid tumor without metastasis	1/128 (0.8%)	1024/3107 (33%)	321/1846 (17.4%)	12/259 (4.6%)	1/5340 (0%)
Rheumatoid arthritis/collagen vascular diseases	9/1553 (0.6%)	477/2826 (16.9%)	120/1718 (7%)	3/557 (0.5%)	0/6654 (0%)
Coagulopathy	2/806 (0.2%)	538/3698 (14.5%)	384/3029 (12.7%)	56/1144 (4.9%)	1/8677 (0%)
Obesity	556/21072 (2.6%)	178/21153 (0.8%)	19/10694 (0.2%)	5/2081 (0.2%)	3/55000 (0%)
Weight loss	7/220 (3.2%)	56/563 (9.9%)	356/1165 (30.6%)	55/262 (21%)	0/2210 (0%)
Fluid and electrolyte disorders	5/2624 (0.2%)	1194/14458 (8.3%)	5204/19252 (27%)	1864/5645 (33%)	7/41979 (0%)
Blood loss anemia	1/252 (0.4%)	132/1133 (11.7%)	81/689 (11.8%)	0/148 (0%)	0/2222 (0%)
Deficiency anemia	4/1384 (0.3%)	310/6561 (4.7%)	98/4052 (2.4%)	10/694 (1.4%)	1/12691 (0%)
Alcohol abuse	232/5347 (4.3%)	441/6960 (6.3%)	165/3077 (5.4%)	4/891 (0.4%)	1/16275 (0%)
Drug abuse	6/693 (0.9%)	16/350 (4.6%)	20/156 (12.8%)	4/61 (6.6%)	0/1260 (0%)
Psychoses	24/478 (5%)	10/538 (1.9%)	11/349 (3.2%)	0/98 (0%)	0/1463 (0%)
Depression	39/6294 (0.6%)	50/6369 (0.8%)	6/3219 (0.2%)	0/584 (0%)	1/16466 (0%)

Table 6 - Overview of evaluation metrics obtained with SVM for base APR-DRG and SOI classification

MDC 4 Classification (Diseases and Disorders of the Respiratory System)				
Base APR-DRG Assignment				
APR-DRG	Precision	Recall	% Correctly Classified	% Correctly Classified (2016 unseen data)
144 - Respiratory System Signs, Symptoms & Other Diagnoses	0.999	0.998	99.8	99.7
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0.997	0.997	99.7	94.1
142 - Interstitial Lung Disease	0.993	0.999	99.9	72.2
141 - Asthma	0.999	1.000	100.0	99.1
140 - Chronic Obstructive Pulmonary Disease	0.999	1.000	100.0	100.0
139 - Other Pneumonia	0.998	0.999	99.9	99.9
138 - Bronchiolitis & RSV Pneumonia	0.987	1.000	100.0	100
137 - Major Respiratory Infections & Inflammations	0.989	0.998	99.8	99.8
136 - Respiratory Malignancy	0.997	0.999	99.9	99.9
135 - Major Chest & Respiratory Trauma	0.995	0.996	99.6	99.9
134 - Pulmonary Embolism	0.994	1.000	100	100.0
133 - Pulmonary Edema & Respiratory Failure	0.990	0.998	99.8	99.9
132 - BPD & Oth Chronic Respiratory Dis Arising In Perinatal Period	0.967	1.000	100	100.0
131 - Cystic Fibrosis - Pulmonary Disease	0.985	1.000	100	100.0
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0.963	0.845	84.5	99.6
121 - Other Respiratory & Chest Procedures	1.000	0.955	95.5	99.6
120 - Major Respiratory & Chest Procedures	1.000	0.992	99.2	99.7
Severity of Illness (SOI) subclass Assignment				
Severity of Illness (SOI)	Precision	Recall	% Correctly Classified	% Correctly Classified (2016 unseen data)
1 (Minor)	0.918	0.922	92.2	92.1

2 (Moderate)	0.870	0.867	86.7	85.3
3 (Major)	0.878	0.882	88.2	89.2
4 (Extreme)	0.903	0.879	87.9	88.4
MDC 5 Classification (Diseases and Disorders of the Circulatory System)				
Base APR-DRG Assignment				
APR-DRG	Precision	Recall	% Correctly Classified	% Correctly Classified (2016 unseen data)
199 - Hypertension	0.992	0.999	99.9	91.5
198 - Angina Pectoris & Coronary Atherosclerosis	0.997	0.999	99.9	98.1
197 - Peripheral & Other Vascular Disorders	0.993	1.000	100.0	98.1
196 - Cardiac Arrest	0.980	0.990	99.0	99.8
194 - Heart Failure	0.999	1.000	100.0	96.9
193 - Acute & Subacute Endocarditis	0.960	1.000	100.0	100
192 - Cardiac Catheterization for Ischemic Heart Disease	0.998	1.000	100.0	95.8
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0.996	0.998	99.8	95.9
190 - Acute Myocardial Infarction	0.997	1.000	100.0	97.5
180 - Other Circulatory System Procedures	0.998	0.989	98.9	100
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0.991	0.983	98.3	99.2
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0.988	0.989	98.9	99.9
175 - Percutaneous Cardiovascular Procedures w/o AMI	0.999	1.000	100.0	99.8
174 - Percutaneous Cardiovascular Procedures w/ AMI	0.999	1.000	100.0	98.7
173 - Other Vascular Procedures	0.998	0.992	99.2	97.4
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0.992	0.999	99.9	97.8
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0.963	0.973	97.3	99.9
207 - Other Circulatory System Diagnoses	0.997	0.992	99.2	99.6

206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0.979	0.994	99.4	99.9
205 - Cardiomyopathy	0.997	0.994	99.4	100
204 - Syncope & Collapse	0.995	0.998	99.8	100
203 - Chest Pain	0.997	1.000	100.0	99.5
169 - Major Thoracic & Abdominal Vascular Procedures	0.990	0.960	96.0	99.9
201 - Cardiac Arrhythmia & Conduction Disorders	0.998	0.995	99.5	100
200 - Cardiac Congenital & Valvular Disorders	0.993	0.996	99.6	100
167 - Other Cardiothoracic Procedures	0.980	0.949	94.9	99.4
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0.995	0.999	99.9	98.7
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0.994	0.978	97.8	100
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0.999	0.997	99.7	100
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0.981	0.972	97.2	99.6
161 - Cardiac Defibrillator & Heart Assist Anomaly	0.999	0.977	97.7	100
160 - Major Cardiothoracic Repair of Heart Anomaly	1.000	0.929	92.9	99.2
Severity of Illness (SOI) subclass Assignment				
Severity of Illness (SOI)	Precision	Recall	% Correctly Classified	% Correctly Classified (2016 unseen data)
1 (Minor)	0.923	0.945	94.5	94.2
2 (Moderate)	0.855	0.839	83.9	84.3
3 (Major)	0.822	0.813	81.3	83.8
4 (Extreme)	0.902	0.819	81.9	81.2

Table 7 - Number and percentage of episodes that changed their base APR-DRG or SOI level after removing comorbidities, by APR-DRG, MDC 4 (Diseases and Disorders of the Respiratory System)

Charlson comorbidities					
	SOI 1	SOI 2	SOI 3	SOI 4	Base APR-DRG
Myocardial infarction					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	0/369 (0%)	8/1112 (0.7%)	131/817 (16%)	57/122 (46.7%)	0/2420 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/70 (0%)	0/85 (0%)	6/59 (10.2%)	4/7 (57.1%)	0/221 (0%)
142 - Interstitial Lung Disease	1/17 (5.9%)	1/41 (2.4%)	3/29 (10.3%)	1/6 (16.7%)	0/93 (0%)
141 - Asthma	0/21 (0%)	0/13 (0%)	9/30 (30%)	3/6 (50%)	0/70 (0%)
140 - Chronic Obstructive Pulmonary Disease	1/171 (0.6%)	4/533 (0.8%)	64/591 (10.8%)	52/143 (36.4%)	0/1438 (0%)
139 - Other Pneumonia	5/352 (1.4%)	19/2510 (0.8%)	530/2581 (20.5%)	287/724 (39.6%)	0/6167 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/3 (0%)	0/6 (0%)	2/6 (33.3%)	0/0 (-)	0/15 (0%)
137 - Major Respiratory Infections & Inflammations	1/44 (2.3%)	1/328 (0.3%)	56/340 (16.5%)	38/102 (37.3%)	0/814 (0%)
136 - Respiratory Malignancy	0/130 (0%)	1/261 (0.4%)	16/247 (6.5%)	4/51 (7.8%)	0/689 (0%)
135 - Major Chest & Respiratory Trauma	0/77 (0%)	0/44 (0%)	2/20 (10%)	2/3 (66.7%)	0/144 (0%)
134 - Pulmonary Embolism	1/78 (1.3%)	1/188 (0.5%)	33/138 (23.9%)	9/37 (24.3%)	0/441 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/65 (0%)	2/120 (1.7%)	28/187 (15%)	15/57 (26.3%)	0/429 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/14 (0%)	2/39 (5.1%)	26/121 (21.5%)	31/142 (21.8%)	2/316 (0.6%)
121 - Other Respiratory & Chest Procedures	0/74 (0%)	0/30 (0%)	2/19 (10.5%)	3/9 (33.3%)	0/132 (0%)
120 - Major Respiratory & Chest Procedures	0/83 (0%)	0/39 (0%)	0/4 (0%)	0/4 (0%)	0/130 (0%)
Congestive heart failure					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	0/115 (0%)	4115/12188 (33.8%)	1644/7871 (20.9%)	43/615 (7%)	1/20789 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/17 (0%)	190/479 (39.7%)	148/710 (20.8%)	1/52 (1.9%)	0/1258 (0%)

142 - Interstitial Lung Disease	0/4 (0%)	52/307 (16.9%)	47/368 (12.8%)	2/46 (4.3%)	0/725 (0%)
141 - Asthma	0/16 (0%)	295/481 (61.3%)	60/286 (21%)	1/30 (3.3%)	0/813 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/90 (0%)	3558/8535 (41.7%)	1084/7394 (14.7%)	39/835 (4.7%)	0/16854 (0%)
139 - Other Pneumonia	0/88 (0%)	3088/25345 (12.2%)	3965/22195 (17.9%)	163/3259 (5%)	1/50887 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/6 (0%)	23/112 (20.5%)	15/47 (31.9%)	1/3 (33.3%)	0/168 (0%)
137 - Major Respiratory Infections & Inflammations	0/23 (0%)	321/3445 (9.3%)	487/3246 (15%)	18/569 (3.2%)	1/7283 (0%)
136 - Respiratory Malignancy	0/21 (0%)	268/803 (33.4%)	163/967 (16.9%)	4/104 (3.8%)	1/1895 (0.1%)
135 - Major Chest & Respiratory Trauma	0/16 (0%)	199/328 (60.7%)	27/128 (21.1%)	0/33 (0%)	0/505 (0%)
134 - Pulmonary Embolism	0/35 (0%)	493/1803 (27.3%)	241/1151 (20.9%)	8/160 (5%)	1/3149 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/22 (0%)	148/965 (15.3%)	283/1557 (18.2%)	3/112 (2.7%)	0/2656 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/0 (-)	0/1 (0%)	0/2 (0%)	0/0 (-)	0/3 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/29 (0%)	145/379 (38.3%)	116/629 (18.4%)	8/584 (1.4%)	2/1621 (0.1%)
121 - Other Respiratory & Chest Procedures	0/33 (0%)	67/114 (58.8%)	20/95 (21.1%)	2/28 (7.1%)	0/270 (0%)
120 - Major Respiratory & Chest Procedures	0/27 (0%)	56/84 (66.7%)	3/12 (25%)	0/18 (0%)	0/141 (0%)
Peripheral vascular disease					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	2/265 (0.8%)	39/1031 (3.8%)	33/703 (4.7%)	3/68 (4.4%)	0/2067 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/44 (0%)	9/106 (8.5%)	6/79 (7.6%)	0/13 (0%)	0/242 (0%)
142 - Interstitial Lung Disease	0/13 (0%)	1/49 (2%)	0/29 (0%)	0/4 (0%)	0/95 (0%)
141 - Asthma	0/12 (0%)	1/13 (7.7%)	2/13 (15.4%)	0/1 (0%)	0/39 (0%)
140 - Chronic Obstructive Pulmonary Disease	2/216 (0.9%)	15/548 (2.7%)	28/621 (4.5%)	2/80 (2.5%)	0/1465 (0%)
139 - Other Pneumonia	4/275 (1.5%)	72/2545 (2.8%)	77/2262 (3.4%)	12/412 (2.9%)	0/5494 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/2 (0%)	0/7 (0%)	0/2 (0%)	0/0 (-)	0/11 (0%)
137 - Major Respiratory Infections & Inflammations	2/49 (4.1%)	5/437 (1.1%)	12/434 (2.8%)	5/86 (5.8%)	0/1006 (0%)
136 - Respiratory Malignancy	1/124 (0.8%)	15/333 (4.5%)	12/355 (3.4%)	2/41 (4.9%)	0/853 (0%)
135 - Major Chest & Respiratory Trauma	0/60 (0%)	1/40 (2.5%)	2/22 (9.1%)	0/6 (0%)	0/128 (0%)

134 - Pulmonary Embolism	1/66 (1.5%)	11/223 (4.9%)	9/167 (5.4%)	4/21 (19%)	0/477 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/21 (0%)	3/93 (3.2%)	3/135 (2.2%)	0/26 (0%)	0/275 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/1 (0%)	0/2 (0%)	0/0 (-)	0/0 (-)	0/3 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/9 (0%)	5/31 (16.1%)	4/85 (4.7%)	1/73 (1.4%)	0/198 (0%)
121 - Other Respiratory & Chest Procedures	0/66 (0%)	4/38 (10.5%)	1/29 (3.4%)	0/8 (0%)	0/141 (0%)
120 - Major Respiratory & Chest Procedures	0/71 (0%)	1/36 (2.8%)	0/11 (0%)	0/9 (0%)	0/127 (0%)
Cerebrovascular disease					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	2/821 (0.2%)	1288/6259 (20.6%)	922/4712 (19.6%)	81/358 (22.6%)	0/12150 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/61 (0%)	45/264 (17%)	51/279 (18.3%)	9/34 (26.5%)	0/638 (0%)
142 - Interstitial Lung Disease	0/10 (0%)	4/68 (5.9%)	6/47 (12.8%)	3/12 (25%)	0/137 (0%)
141 - Asthma	2/45 (4.4%)	12/62 (19.4%)	4/43 (9.3%)	3/6 (50%)	0/156 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/193 (0%)	235/1387 (16.9%)	194/1348 (14.4%)	44/230 (19.1%)	0/3158 (0%)
139 - Other Pneumonia	1/372 (0.3%)	1187/12548 (9.5%)	2120/12202 (17.4%)	423/1876 (22.5%)	0/26998 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/4 (0%)	2/25 (8%)	4/27 (14.8%)	1/3 (33.3%)	0/59 (0%)
137 - Major Respiratory Infections & Inflammations	2/89 (2.2%)	147/3550 (4.1%)	673/3580 (18.8%)	157/632 (24.8%)	2/7851 (0%)
136 - Respiratory Malignancy	0/95 (0%)	61/414 (14.7%)	122/532 (22.9%)	40/119 (33.6%)	0/1160 (0%)
135 - Major Chest & Respiratory Trauma	1/105 (1%)	39/115 (33.9%)	14/51 (27.5%)	1/12 (8.3%)	0/283 (0%)
134 - Pulmonary Embolism	1/52 (1.9%)	79/560 (14.1%)	134/457 (29.3%)	50/99 (50.5%)	0/1168 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/17 (0%)	30/219 (13.7%)	45/375 (12%)	16/72 (22.2%)	0/683 (0%)
132 - BPD & Oth Chronic Respiratory Dis Arising In Perinatal Period	0/0 (-)	0/0 (-)	1/1 (100%)	0/0 (-)	0/1 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/15 (0%)	8/75 (10.7%)	40/165 (24.2%)	37/195 (19%)	1/450 (0.2%)
121 - Other Respiratory & Chest Procedures	0/45 (0%)	4/40 (10%)	6/41 (14.6%)	7/26 (26.9%)	1/152 (0.7%)
120 - Major Respiratory & Chest Procedures	0/40 (0%)	1/16 (6.2%)	1/12 (8.3%)	0/12 (0%)	0/80 (0%)

Dementia					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	0/295 (0%)	822/4208 (19.5%)	422/2882 (14.6%)	0/221 (0%)	0/7606 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/6 (0%)	29/133 (21.8%)	24/139 (17.3%)	0/17 (0%)	0/295 (0%)
142 - Interstitial Lung Disease	0/1 (0%)	2/42 (4.8%)	3/23 (13%)	0/2 (0%)	0/68 (0%)
141 - Asthma	0/11 (0%)	7/22 (31.8%)	5/16 (31.2%)	0/2 (0%)	0/51 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/47 (0%)	139/791 (17.6%)	73/700 (10.4%)	0/86 (0%)	0/1624 (0%)
139 - Other Pneumonia	1/54 (1.9%)	632/8753 (7.2%)	1022/8156 (12.5%)	5/1053 (0.5%)	0/18016 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/0 (-)	0/33 (0%)	2/22 (9.1%)	0/5 (0%)	0/60 (0%)
137 - Major Respiratory Infections & Inflammations	1/20 (5%)	98/2508 (3.9%)	260/2178 (11.9%)	2/328 (0.6%)	0/5034 (0%)
136 - Respiratory Malignancy	0/12 (0%)	24/87 (27.6%)	16/109 (14.7%)	0/12 (0%)	0/220 (0%)
135 - Major Chest & Respiratory Trauma	0/18 (0%)	14/55 (25.5%)	0/13 (0%)	0/2 (0%)	0/88 (0%)
134 - Pulmonary Embolism	0/7 (0%)	57/398 (14.3%)	32/260 (12.3%)	0/34 (0%)	0/699 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/1 (0%)	10/102 (9.8%)	19/156 (12.2%)	0/14 (0%)	0/273 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/1 (0%)	0/29 (0%)	3/39 (7.7%)	0/43 (0%)	0/112 (0%)
121 - Other Respiratory & Chest Procedures	0/6 (0%)	0/11 (0%)	2/14 (14.3%)	0/1 (0%)	0/32 (0%)
120 - Major Respiratory & Chest Procedures	0/4 (0%)	0/1 (0%)	0/0 (-)	0/0 (-)	0/5 (0%)
Chronic pulmonary disease					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	32/3418 (0.9%)	271/5431 (5%)	359/3560 (10.1%)	23/269 (8.6%)	2/12678 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	6/1111 (0.5%)	63/665 (9.5%)	74/569 (13%)	3/64 (4.7%)	1/2409 (0%)
142 - Interstitial Lung Disease	2/186 (1.1%)	16/450 (3.6%)	33/372 (8.9%)	1/38 (2.6%)	0/1046 (0%)
141 - Asthma	1/282 (0.4%)	32/170 (18.8%)	19/207 (9.2%)	0/10 (0%)	0/669 (0%)
140 - Chronic Obstructive Pulmonary Disease	25/1567 (1.6%)	405/2942 (13.8%)	411/3847 (10.7%)	127/487 (26.1%)	0/8843 (0%)
139 - Other Pneumonia	67/5489 (1.2%)	642/17504 (3.7%)	1017/13314 (7.6%)	41/1755 (2.3%)	1/38062 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/167 (0%)	3/62 (4.8%)	4/34 (11.8%)	0/4 (0%)	0/267 (0%)
137 - Major Respiratory Infections & Inflammations	13/907 (1.4%)	68/2417 (2.8%)	139/2045 (6.8%)	13/321 (4%)	1/5690 (0%)

136 - Respiratory Malignancy	8/1184 (0.7%)	99/1920 (5.2%)	111/1715 (6.5%)	7/226 (3.1%)	1/5045 (0%)
135 - Major Chest & Respiratory Trauma	5/384 (1.3%)	20/202 (9.9%)	12/97 (12.4%)	0/12 (0%)	2/695 (0.3%)
134 - Pulmonary Embolism	3/490 (0.6%)	190/1266 (15%)	118/794 (14.9%)	4/109 (3.7%)	0/2659 (0%)
133 - Pulmonary Edema & Respiratory Failure	7/351 (2%)	90/1155 (7.8%)	155/1265 (12.3%)	2/107 (1.9%)	0/2878 (0%)
132 - BPD & Oth Chronic Respiratory Dis Arising In Perinatal Period	0/1 (0%)	0/1 (0%)	1/3 (33.3%)	0/0 (-)	0/5 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/69 (0%)	21/77 (27.3%)	6/86 (7%)	0/1 (0%)	0/233 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	3/139 (2.2%)	24/303 (7.9%)	49/512 (9.6%)	11/421 (2.6%)	7/1375 (0.5%)
121 - Other Respiratory & Chest Procedures	3/1166 (0.3%)	24/232 (10.3%)	27/168 (16.1%)	1/40 (2.5%)	1/1606 (0.1%)
120 - Major Respiratory & Chest Procedures	5/1304 (0.4%)	23/320 (7.2%)	13/75 (17.3%)	1/33 (3%)	1/1732 (0.1%)
Rheumatic disease					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	0/253 (0%)	74/484 (15.3%)	34/273 (12.5%)	0/10 (0%)	0/1020 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	1/53 (1.9%)	12/37 (32.4%)	6/32 (18.8%)	0/5 (0%)	0/127 (0%)
142 - Interstitial Lung Disease	0/33 (0%)	6/59 (10.2%)	1/48 (2.1%)	0/8 (0%)	0/148 (0%)
141 - Asthma	0/28 (0%)	4/24 (16.7%)	6/24 (25%)	0/3 (0%)	0/79 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/113 (0%)	15/193 (7.8%)	15/197 (7.6%)	0/8 (0%)	0/511 (0%)
139 - Other Pneumonia	6/335 (1.8%)	133/1181 (11.3%)	83/845 (9.8%)	2/135 (1.5%)	1/2496 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/0 (-)	1/5 (20%)	0/2 (0%)	0/0 (-)	0/7 (0%)
137 - Major Respiratory Infections & Inflammations	1/63 (1.6%)	9/162 (5.6%)	13/121 (10.7%)	0/25 (0%)	0/371 (0%)
136 - Respiratory Malignancy	0/29 (0%)	10/75 (13.3%)	5/64 (7.8%)	0/6 (0%)	0/174 (0%)
135 - Major Chest & Respiratory Trauma	0/39 (0%)	5/13 (38.5%)	1/2 (50%)	0/1 (0%)	0/55 (0%)
134 - Pulmonary Embolism	0/92 (0%)	19/148 (12.8%)	11/67 (16.4%)	0/6 (0%)	0/313 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/11 (0%)	2/44 (4.5%)	7/67 (10.4%)	0/6 (0%)	0/128 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/0 (-)	0/0 (-)	1/2 (50%)	0/0 (-)	0/2 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	1/7 (14.3%)	2/28 (7.1%)	1/33 (3%)	0/46 (0%)	0/114 (0%)
121 - Other Respiratory & Chest Procedures	0/60 (0%)	2/12 (16.7%)	6/12 (50%)	0/4 (0%)	0/88 (0%)

120 - Major Respiratory & Chest Procedures	0/35 (0%)	0/8 (0%)	0/4 (0%)	0/0 (-)	0/47 (0%)
Peptic ulcer disease					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	0/72 (0%)	7/195 (3.6%)	2/121 (1.7%)	1/8 (12.5%)	0/396 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	1/23 (4.3%)	2/19 (10.5%)	0/14 (0%)	0/3 (0%)	0/59 (0%)
142 - Interstitial Lung Disease	0/4 (0%)	0/5 (0%)	0/1 (0%)	0/3 (0%)	0/13 (0%)
141 - Asthma	2/12 (16.7%)	0/6 (0%)	0/4 (0%)	0/0 (-)	0/22 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/46 (0%)	4/86 (4.7%)	4/100 (4%)	2/25 (8%)	0/257 (0%)
139 - Other Pneumonia	8/101 (7.9%)	10/437 (2.3%)	9/375 (2.4%)	0/70 (0%)	0/983 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/0 (-)	0/1 (0%)	0/1 (0%)	0/0 (-)	0/2 (0%)
137 - Major Respiratory Infections & Inflammations	1/23 (4.3%)	5/92 (5.4%)	5/84 (6%)	0/21 (0%)	0/220 (0%)
136 - Respiratory Malignancy	0/34 (0%)	3/95 (3.2%)	4/58 (6.9%)	0/12 (0%)	0/199 (0%)
135 - Major Chest & Respiratory Trauma	0/17 (0%)	0/6 (0%)	0/2 (0%)	0/1 (0%)	0/26 (0%)
134 - Pulmonary Embolism	1/21 (4.8%)	0/34 (0%)	0/22 (0%)	0/0 (-)	0/77 (0%)
133 - Pulmonary Edema & Respiratory Failure	1/2 (50%)	0/12 (0%)	1/31 (3.2%)	0/4 (0%)	0/49 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/1 (0%)	0/6 (0%)	2/22 (9.1%)	0/32 (0%)	1/61 (1.6%)
121 - Other Respiratory & Chest Procedures	0/31 (0%)	0/7 (0%)	0/5 (0%)	0/4 (0%)	0/47 (0%)
120 - Major Respiratory & Chest Procedures	0/33 (0%)	0/4 (0%)	0/4 (0%)	0/1 (0%)	0/42 (0%)
Mild liver disease					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	2/365 (0.5%)	128/826 (15.5%)	155/742 (20.9%)	29/112 (25.9%)	0/2045 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	1/128 (0.8%)	46/201 (22.9%)	18/136 (13.2%)	5/23 (21.7%)	0/488 (0%)
142 - Interstitial Lung Disease	0/35 (0%)	12/53 (22.6%)	7/51 (13.7%)	2/11 (18.2%)	0/150 (0%)
141 - Asthma	0/40 (0%)	8/27 (29.6%)	4/31 (12.9%)	0/2 (0%)	0/100 (0%)
140 - Chronic Obstructive Pulmonary Disease	2/224 (0.9%)	78/472 (16.5%)	79/613 (12.9%)	19/104 (18.3%)	0/1413 (0%)
139 - Other Pneumonia	13/823 (1.6%)	301/2241 (13.4%)	375/2104 (17.8%)	125/633 (19.7%)	0/5801 (0%)

138 - Bronchiolitis & RSV Pneumonia	0/11 (0%)	2/9 (22.2%)	0/4 (0%)	1/2 (50%)	0/26 (0%)
137 - Major Respiratory Infections & Inflammations	2/288 (0.7%)	52/489 (10.6%)	129/510 (25.3%)	35/180 (19.4%)	1/1467 (0.1%)
136 - Respiratory Malignancy	1/112 (0.9%)	23/263 (8.7%)	47/303 (15.5%)	27/86 (31.4%)	1/764 (0.1%)
135 - Major Chest & Respiratory Trauma	0/111 (0%)	18/61 (29.5%)	5/42 (11.9%)	0/9 (0%)	0/223 (0%)
134 - Pulmonary Embolism	0/114 (0%)	39/247 (15.8%)	32/163 (19.6%)	13/45 (28.9%)	0/569 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/20 (0%)	7/52 (13.5%)	16/105 (15.2%)	11/42 (26.2%)	0/219 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/12 (0%)	2/10 (20%)	2/15 (13.3%)	0/0 (-)	1/37 (2.7%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/17 (0%)	11/56 (19.6%)	19/123 (15.4%)	33/232 (14.2%)	4/428 (0.9%)
121 - Other Respiratory & Chest Procedures	0/68 (0%)	9/37 (24.3%)	7/40 (17.5%)	3/18 (16.7%)	0/163 (0%)
120 - Major Respiratory & Chest Procedures	0/35 (0%)	8/22 (36.4%)	2/5 (40%)	1/4 (25%)	0/66 (0%)
Diabetes without chronic complication					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	2/2576 (0.1%)	958/8271 (11.6%)	958/5598 (17.1%)	7/379 (1.8%)	0/16824 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/436 (0%)	109/664 (16.4%)	128/608 (21.1%)	0/43 (0%)	0/1751 (0%)
142 - Interstitial Lung Disease	0/108 (0%)	26/338 (7.7%)	37/256 (14.5%)	1/25 (4%)	0/727 (0%)
141 - Asthma	2/461 (0.4%)	37/314 (11.8%)	45/292 (15.4%)	0/18 (0%)	0/1085 (0%)
140 - Chronic Obstructive Pulmonary Disease	1/1596 (0.1%)	432/4064 (10.6%)	469/3956 (11.9%)	8/350 (2.3%)	0/9966 (0%)
139 - Other Pneumonia	3/2937 (0.1%)	1752/19860 (8.8%)	2352/15397 (15.3%)	52/2089 (2.5%)	0/40283 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/10 (0%)	8/86 (9.3%)	7/43 (16.3%)	0/5 (0%)	0/144 (0%)
137 - Major Respiratory Infections & Inflammations	1/581 (0.2%)	198/3567 (5.6%)	382/2916 (13.1%)	15/488 (3.1%)	0/7552 (0%)
136 - Respiratory Malignancy	0/746 (0%)	150/1545 (9.7%)	201/1399 (14.4%)	9/180 (5%)	0/3870 (0%)
135 - Major Chest & Respiratory Trauma	3/721 (0.4%)	75/316 (23.7%)	21/119 (17.6%)	0/20 (0%)	0/1176 (0%)
134 - Pulmonary Embolism	0/411 (0%)	153/1214 (12.6%)	118/716 (16.5%)	2/90 (2.2%)	0/2431 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/206 (0%)	90/767 (11.7%)	125/943 (13.3%)	1/99 (1%)	0/2015 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/40 (0%)	1/25 (4%)	5/30 (16.7%)	0/1 (0%)	0/96 (0%)

130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	1/81 (1.2%)	24/228 (10.5%)	51/396 (12.9%)	3/375 (0.8%)	2/1080 (0.2%)
121 - Other Respiratory & Chest Procedures	1/480 (0.2%)	25/181 (13.8%)	17/115 (14.8%)	0/22 (0%)	2/798 (0.3%)
120 - Major Respiratory & Chest Procedures	0/482 (0%)	20/181 (11%)	7/21 (33.3%)	0/12 (0%)	0/696 (0%)
Diabetes with chronic complication					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	3/178 (1.7%)	181/1455 (12.4%)	129/962 (13.4%)	0/82 (0%)	0/2677 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	1/25 (4%)	19/103 (18.4%)	6/86 (7%)	0/13 (0%)	0/227 (0%)
142 - Interstitial Lung Disease	0/7 (0%)	3/29 (10.3%)	1/19 (5.3%)	1/1 (100%)	0/56 (0%)
141 - Asthma	0/23 (0%)	10/31 (32.3%)	5/33 (15.2%)	0/1 (0%)	0/88 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/56 (0%)	53/522 (10.2%)	53/548 (9.7%)	0/70 (0%)	0/1196 (0%)
139 - Other Pneumonia	4/145 (2.8%)	253/3217 (7.9%)	302/2676 (11.3%)	4/465 (0.9%)	0/6503 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/0 (-)	2/24 (8.3%)	0/15 (0%)	0/1 (0%)	0/40 (0%)
137 - Major Respiratory Infections & Inflammations	1/23 (4.3%)	25/478 (5.2%)	47/441 (10.7%)	3/101 (3%)	0/1043 (0%)
136 - Respiratory Malignancy	0/15 (0%)	7/99 (7.1%)	10/100 (10%)	0/14 (0%)	0/228 (0%)
135 - Major Chest & Respiratory Trauma	0/38 (0%)	10/37 (27%)	2/12 (16.7%)	0/3 (0%)	0/90 (0%)
134 - Pulmonary Embolism	0/12 (0%)	18/127 (14.2%)	9/111 (8.1%)	2/11 (18.2%)	0/261 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/15 (0%)	10/96 (10.4%)	27/181 (14.9%)	0/25 (0%)	0/317 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	1/17 (5.9%)	3/50 (6%)	11/81 (13.6%)	1/103 (1%)	1/251 (0.4%)
121 - Other Respiratory & Chest Procedures	0/17 (0%)	1/24 (4.2%)	3/17 (17.6%)	0/6 (0%)	0/64 (0%)
120 - Major Respiratory & Chest Procedures	0/14 (0%)	6/22 (27.3%)	2/6 (33.3%)	0/3 (0%)	0/45 (0%)
Hemiplegia					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	2/460 (0.4%)	181/429 (42.2%)	112/360 (31.1%)	20/61 (32.8%)	0/1310 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/33 (0%)	15/36 (41.7%)	11/36 (30.6%)	1/8 (12.5%)	0/113 (0%)
142 - Interstitial Lung Disease	0/2 (0%)	2/3 (66.7%)	0/9 (0%)	0/1 (0%)	0/15 (0%)

141 - Asthma	0/31 (0%)	4/10 (40%)	1/5 (20%)	0/2 (0%)	0/48 (0%)
140 - Chronic Obstructive Pulmonary Disease	1/42 (2.4%)	10/50 (20%)	19/99 (19.2%)	7/25 (28%)	0/216 (0%)
139 - Other Pneumonia	6/627 (1%)	225/761 (29.6%)	257/899 (28.6%)	52/275 (18.9%)	1/2562 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/32 (0%)	9/18 (50%)	3/7 (42.9%)	0/0 (-)	0/57 (0%)
137 - Major Respiratory Infections & Inflammations	1/66 (1.5%)	42/271 (15.5%)	77/292 (26.4%)	16/88 (18.2%)	0/717 (0%)
136 - Respiratory Malignancy	0/13 (0%)	7/256 (2.7%)	40/244 (16.4%)	5/44 (11.4%)	0/557 (0%)
135 - Major Chest & Respiratory Trauma	0/8 (0%)	0/1 (0%)	0/3 (0%)	0/3 (0%)	0/15 (0%)
134 - Pulmonary Embolism	2/15 (13.3%)	3/33 (9.1%)	6/37 (16.2%)	2/14 (14.3%)	0/99 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/14 (0%)	27/51 (52.9%)	12/53 (22.6%)	4/20 (20%)	0/138 (0%)
132 - BPD & Oth Chronic Respiratory Dis Arising In Perinatal Period	0/2 (0%)	1/1 (100%)	1/1 (100%)	0/0 (-)	0/4 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/10 (0%)	9/17 (52.9%)	15/45 (33.3%)	5/63 (7.9%)	1/135 (0.7%)
121 - Other Respiratory & Chest Procedures	0/7 (0%)	1/3 (33.3%)	3/13 (23.1%)	2/10 (20%)	0/33 (0%)
120 - Major Respiratory & Chest Procedures	0/10 (0%)	3/8 (37.5%)	0/4 (0%)	0/2 (0%)	0/24 (0%)
144 - Respiratory System Signs, Symptoms & Other Diagnoses	56/6331 (0.9%)	3064/13366 (22.9%)	7968/12884 (61.8%)	937/1276 (73.4%)	2/33857 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	11/2336 (0.5%)	435/1811 (24%)	804/1678 (47.9%)	124/209 (59.3%)	1/6034 (0%)
142 - Interstitial Lung Disease	2/506 (0.4%)	217/1065 (20.4%)	830/1023 (81.1%)	80/116 (69%)	0/2710 (0%)
141 - Asthma	8/2945 (0.3%)	545/1057 (51.6%)	1004/1169 (85.9%)	51/75 (68%)	0/5246 (0%)
140 - Chronic Obstructive Pulmonary Disease	29/4284 (0.7%)	2918/9507 (30.7%)	10640/14531 (73.2%)	1350/1639 (82.4%)	0/29961 (0%)
139 - Other Pneumonia	150/12531 (1.2%)	6615/37228 (17.8%)	25940/41505 (62.5%)	5034/7626 (66%)	2/98890 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/2994 (0%)	610/791 (77.1%)	198/242 (81.8%)	19/21 (90.5%)	0/4048 (0%)
137 - Major Respiratory Infections & Inflammations	16/2235 (0.7%)	817/6627 (12.3%)	4482/8203 (54.6%)	1102/1865 (59.1%)	2/18930 (0%)
136 - Respiratory Malignancy	12/2654 (0.5%)	687/5407 (12.7%)	2556/5655 (45.2%)	549/870 (63.1%)	3/14586 (0%)
135 - Major Chest & Respiratory Trauma	6/1295 (0.5%)	127/594 (21.4%)	153/330 (46.4%)	50/88 (56.8%)	1/2307 (0%)
134 - Pulmonary Embolism	18/1505 (1.2%)	447/3060 (14.6%)	1212/2369 (51.2%)	250/389 (64.3%)	1/7323 (0%)
133 - Pulmonary Edema & Respiratory Failure	19/610 (3.1%)	90/1720 (5.2%)	351/2116 (16.6%)	79/273 (28.9%)	1/4719 (0%)

132 - BPD & Oth Chronic Respiratory Dis Arising In Perinatal Period	0/29 (0%)	15/23 (65.2%)	12/12 (100%)	0/0 (-)	0/64 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/148 (0%)	98/166 (59%)	158/189 (83.6%)	3/3 (100%)	1/506 (0.2%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	6/580 (1%)	584/1006 (58.1%)	1103/1543 (71.5%)	673/1604 (42%)	44/4733 (0.9%)
121 - Other Respiratory & Chest Procedures	5/1710 (0.3%)	186/648 (28.7%)	354/602 (58.8%)	89/155 (57.4%)	5/3115 (0.2%)
120 - Major Respiratory & Chest Procedures	4/2004 (0.2%)	129/558 (23.1%)	93/141 (66%)	44/95 (46.3%)	4/2798 (0.1%)
Any malignancy					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	5/132 (3.8%)	1483/3638 (40.8%)	630/2010 (31.3%)	21/170 (12.4%)	0/5950 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/46 (0%)	623/1148 (54.3%)	205/590 (34.7%)	11/39 (28.2%)	1/1823 (0.1%)
142 - Interstitial Lung Disease	0/8 (0%)	28/87 (32.2%)	17/72 (23.6%)	0/6 (0%)	0/173 (0%)
141 - Asthma	0/4 (0%)	37/65 (56.9%)	2/21 (9.5%)	0/0 (-)	0/90 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/20 (0%)	427/1037 (41.2%)	218/1099 (19.8%)	7/96 (7.3%)	0/2252 (0%)
139 - Other Pneumonia	7/137 (5.1%)	1876/7379 (25.4%)	1660/6319 (26.3%)	111/941 (11.8%)	0/14776 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/6 (0%)	8/26 (30.8%)	3/10 (30%)	0/1 (0%)	0/43 (0%)
137 - Major Respiratory Infections & Inflammations	2/27 (7.4%)	321/1321 (24.3%)	299/1130 (26.5%)	28/212 (13.2%)	0/2690 (0%)
136 - Respiratory Malignancy	2/71 (2.8%)	523/1132 (46.2%)	207/657 (31.5%)	14/74 (18.9%)	0/1934 (0%)
135 - Major Chest & Respiratory Trauma	0/3 (0%)	38/73 (52.1%)	8/23 (34.8%)	2/4 (50%)	0/103 (0%)
134 - Pulmonary Embolism	0/20 (0%)	301/871 (34.6%)	217/615 (35.3%)	15/74 (20.3%)	0/1580 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/5 (0%)	56/217 (25.8%)	109/404 (27%)	2/42 (4.8%)	0/668 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/0 (-)	0/0 (-)	0/2 (0%)	0/0 (-)	0/2 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	1/8 (12.5%)	31/76 (40.8%)	27/121 (22.3%)	3/139 (2.2%)	5/344 (1.5%)
121 - Other Respiratory & Chest Procedures	1/68 (1.5%)	185/304 (60.9%)	59/153 (38.6%)	1/21 (4.8%)	1/546 (0.2%)
120 - Major Respiratory & Chest Procedures	0/75 (0%)	126/190 (66.3%)	6/10 (60%)	0/6 (0%)	0/281 (0%)
Moderate or severe liver disease					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	0/10 (0%)	41/136 (30.1%)	110/216 (50.9%)	19/30 (63.3%)	0/392 (0%)

143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/2 (0%)	17/58 (29.3%)	23/57 (40.4%)	4/7 (57.1%)	0/124 (0%)
142 - Interstitial Lung Disease	0/1 (0%)	1/7 (14.3%)	5/11 (45.5%)	0/1 (0%)	0/20 (0%)
141 - Asthma	0/2 (0%)	2/2 (100%)	2/2 (100%)	0/0 (-)	0/6 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/0 (-)	17/38 (44.7%)	21/78 (26.9%)	6/13 (46.2%)	0/129 (0%)
139 - Other Pneumonia	0/6 (0%)	47/228 (20.6%)	230/482 (47.7%)	74/134 (55.2%)	0/850 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/1 (0%)	1/2 (50%)	0/1 (0%)	0/0 (-)	0/4 (0%)
137 - Major Respiratory Infections & Inflammations	0/0 (-)	14/55 (25.5%)	66/117 (56.4%)	16/41 (39%)	0/213 (0%)
136 - Respiratory Malignancy	0/1 (0%)	9/30 (30%)	21/65 (32.3%)	13/22 (59.1%)	0/118 (0%)
135 - Major Chest & Respiratory Trauma	0/0 (-)	4/10 (40%)	7/11 (63.6%)	1/1 (100%)	0/22 (0%)
134 - Pulmonary Embolism	0/1 (0%)	1/13 (7.7%)	13/30 (43.3%)	1/4 (25%)	0/48 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/1 (0%)	0/3 (0%)	5/24 (20.8%)	2/4 (50%)	0/32 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/0 (-)	4/4 (100%)	2/3 (66.7%)	0/0 (-)	0/7 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/0 (-)	3/5 (60%)	5/23 (21.7%)	8/37 (21.6%)	1/65 (1.5%)
121 - Other Respiratory & Chest Procedures	0/2 (0%)	6/7 (85.7%)	4/8 (50%)	2/5 (40%)	0/22 (0%)
120 - Major Respiratory & Chest Procedures	0/2 (0%)	4/7 (57.1%)	0/0 (-)	0/0 (-)	0/9 (0%)
Metastatic solid tumor					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	1/9 (11.1%)	307/1138 (27%)	469/979 (47.9%)	11/81 (13.6%)	0/2207 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/2 (0%)	242/611 (39.6%)	244/474 (51.5%)	7/32 (21.9%)	0/1119 (0%)
142 - Interstitial Lung Disease	0/0 (-)	7/15 (46.7%)	9/25 (36%)	1/2 (50%)	0/42 (0%)
141 - Asthma	0/0 (-)	0/3 (0%)	3/7 (42.9%)	0/0 (-)	0/10 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/1 (0%)	31/140 (22.1%)	83/242 (34.3%)	0/17 (0%)	0/400 (0%)
139 - Other Pneumonia	0/0 (-)	283/1816 (15.6%)	1024/2713 (37.7%)	48/372 (12.9%)	0/4901 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/0 (-)	1/3 (33.3%)	2/4 (50%)	0/0 (-)	0/7 (0%)
137 - Major Respiratory Infections & Inflammations	0/1 (0%)	74/371 (19.9%)	176/478 (36.8%)	7/64 (10.9%)	0/914 (0%)
136 - Respiratory Malignancy	2/30 (6.7%)	6119/7989 (76.6%)	2650/5367 (49.4%)	106/737 (14.4%)	2/14123 (0%)

135 - Major Chest & Respiratory Trauma	0/0 (-)	3/9 (33.3%)	7/13 (53.8%)	0/1 (0%)	0/23 (0%)
134 - Pulmonary Embolism	0/0 (-)	97/384 (25.3%)	205/408 (50.2%)	5/42 (11.9%)	0/834 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/0 (-)	14/67 (20.9%)	100/210 (47.6%)	2/18 (11.1%)	0/295 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/0 (-)	10/20 (50%)	15/50 (30%)	0/31 (0%)	0/101 (0%)
121 - Other Respiratory & Chest Procedures	0/126 (0%)	319/435 (73.3%)	146/296 (49.3%)	6/46 (13%)	3/903 (0.3%)
120 - Major Respiratory & Chest Procedures	0/75 (0%)	567/651 (87.1%)	21/36 (58.3%)	3/12 (25%)	0/774 (0%)
AIDS/HIV					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	0/91 (0%)	28/64 (43.8%)	9/26 (34.6%)	0/3 (0%)	0/184 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/4 (0%)	4/7 (57.1%)	1/2 (50%)	0/0 (-)	0/13 (0%)
142 - Interstitial Lung Disease	0/3 (0%)	1/1 (100%)	0/1 (0%)	0/0 (-)	0/5 (0%)
141 - Asthma	0/6 (0%)	3/5 (60%)	1/2 (50%)	0/0 (-)	0/13 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/39 (0%)	13/22 (59.1%)	7/52 (13.5%)	0/3 (0%)	0/116 (0%)
139 - Other Pneumonia	0/11 (0%)	0/0 (-)	0/3 (0%)	0/1 (0%)	0/15 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/1 (0%)	0/1 (0%)	0/0 (-)	0/0 (-)	0/2 (0%)
137 - Major Respiratory Infections & Inflammations	0/5 (0%)	2/6 (33.3%)	2/7 (28.6%)	0/2 (0%)	0/20 (0%)
136 - Respiratory Malignancy	0/18 (0%)	2/38 (5.3%)	8/43 (18.6%)	0/3 (0%)	0/102 (0%)
135 - Major Chest & Respiratory Trauma	0/8 (0%)	3/5 (60%)	0/0 (-)	0/0 (-)	0/13 (0%)
134 - Pulmonary Embolism	0/3 (0%)	8/14 (57.1%)	2/6 (33.3%)	0/0 (-)	0/23 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/1 (0%)	0/0 (-)	0/0 (-)	0/0 (-)	0/1 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/3 (0%)	0/0 (-)	2/6 (33.3%)	0/3 (0%)	0/12 (0%)
121 - Other Respiratory & Chest Procedures	0/6 (0%)	1/2 (50%)	0/1 (0%)	0/0 (-)	0/9 (0%)
120 - Major Respiratory & Chest Procedures	0/6 (0%)	3/7 (42.9%)	0/0 (-)	0/2 (0%)	0/15 (0%)
Elixhauser comorbidities					
	SOI 1	SOI 2	SOI 3	SOI 4	Base APR-DRG

Congestive heart failure					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	0/115 (0%)	4115/12188 (33.8%)	1644/7871 (20.9%)	43/615 (7%)	1/20789 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/17 (0%)	190/479 (39.7%)	148/710 (20.8%)	1/52 (1.9%)	0/1258 (0%)
142 - Interstitial Lung Disease	0/4 (0%)	52/307 (16.9%)	47/368 (12.8%)	2/46 (4.3%)	0/725 (0%)
141 - Asthma	0/16 (0%)	295/481 (61.3%)	60/286 (21%)	1/30 (3.3%)	0/813 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/90 (0%)	3558/8535 (41.7%)	1084/7394 (14.7%)	39/835 (4.7%)	0/16854 (0%)
139 - Other Pneumonia	0/88 (0%)	3088/25345 (12.2%)	3965/22195 (17.9%)	163/3259 (5%)	1/50887 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/6 (0%)	23/112 (20.5%)	15/47 (31.9%)	1/3 (33.3%)	0/168 (0%)
137 - Major Respiratory Infections & Inflammations	0/23 (0%)	321/3445 (9.3%)	487/3246 (15%)	18/569 (3.2%)	1/7283 (0%)
136 - Respiratory Malignancy	0/21 (0%)	268/803 (33.4%)	163/967 (16.9%)	4/104 (3.8%)	1/1895 (0.1%)
135 - Major Chest & Respiratory Trauma	0/16 (0%)	199/328 (60.7%)	27/128 (21.1%)	0/33 (0%)	0/505 (0%)
134 - Pulmonary Embolism	0/35 (0%)	493/1803 (27.3%)	241/1151 (20.9%)	8/160 (5%)	1/3149 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/22 (0%)	148/965 (15.3%)	283/1557 (18.2%)	3/112 (2.7%)	0/2656 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/0 (-)	0/1 (0%)	0/2 (0%)	0/0 (-)	0/3 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/29 (0%)	145/379 (38.3%)	116/629 (18.4%)	8/584 (1.4%)	2/1621 (0.1%)
121 - Other Respiratory & Chest Procedures	0/33 (0%)	67/114 (58.8%)	20/95 (21.1%)	2/28 (7.1%)	0/270 (0%)
120 - Major Respiratory & Chest Procedures	0/27 (0%)	56/84 (66.7%)	3/12 (25%)	0/18 (0%)	0/141 (0%)
Cardiac arrhythmias					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	4/1321 (0.3%)	1115/10115 (11%)	1062/6944 (15.3%)	12/551 (2.2%)	0/18931 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	1/246 (0.4%)	169/695 (24.3%)	117/661 (17.7%)	1/69 (1.4%)	1/1671 (0.1%)
142 - Interstitial Lung Disease	0/37 (0%)	18/261 (6.9%)	18/258 (7%)	1/32 (3.1%)	0/588 (0%)
141 - Asthma	0/224 (0%)	48/294 (16.3%)	37/223 (16.6%)	0/27 (0%)	0/768 (0%)
140 - Chronic Obstructive Pulmonary Disease	2/834 (0.2%)	591/5239 (11.3%)	584/5230 (11.2%)	11/594 (1.9%)	0/11897 (0%)
139 - Other Pneumonia	6/1026 (0.6%)	1639/23823 (6.9%)	2599/20903 (12.4%)	43/3126 (1.4%)	0/48878 (0%)

138 - Bronchiolitis & RSV Pneumonia	0/72 (0%)	9/91 (9.9%)	4/49 (8.2%)	0/3 (0%)	0/215 (0%)
137 - Major Respiratory Infections & Inflammations	1/212 (0.5%)	181/3916 (4.6%)	389/3755 (10.4%)	17/672 (2.5%)	0/8555 (0%)
136 - Respiratory Malignancy	0/279 (0%)	161/1127 (14.3%)	178/1303 (13.7%)	3/187 (1.6%)	0/2896 (0%)
135 - Major Chest & Respiratory Trauma	0/331 (0%)	90/345 (26.1%)	20/152 (13.2%)	1/45 (2.2%)	0/873 (0%)
134 - Pulmonary Embolism	3/316 (0.9%)	248/1713 (14.5%)	184/1055 (17.4%)	5/179 (2.8%)	0/3263 (0%)
133 - Pulmonary Edema & Respiratory Failure	2/108 (1.9%)	123/789 (15.6%)	142/1221 (11.6%)	4/163 (2.5%)	0/2281 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/1 (0%)	1/1 (100%)	0/7 (0%)	0/0 (-)	0/9 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	1/63 (1.6%)	29/278 (10.4%)	64/594 (10.8%)	9/603 (1.5%)	5/1538 (0.3%)
121 - Other Respiratory & Chest Procedures	1/254 (0.4%)	39/171 (22.8%)	14/138 (10.1%)	2/44 (4.5%)	1/607 (0.2%)
120 - Major Respiratory & Chest Procedures	1/233 (0.4%)	38/189 (20.1%)	12/41 (29.3%)	1/27 (3.7%)	1/490 (0.2%)
Valvular disease					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	16/407 (3.9%)	109/2440 (4.5%)	78/1525 (5.1%)	2/146 (1.4%)	0/4518 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	4/148 (2.7%)	21/181 (11.6%)	9/168 (5.4%)	0/24 (0%)	0/521 (0%)
142 - Interstitial Lung Disease	3/23 (13%)	7/117 (6%)	1/97 (1%)	0/14 (0%)	0/251 (0%)
141 - Asthma	1/73 (1.4%)	9/90 (10%)	3/77 (3.9%)	0/7 (0%)	0/247 (0%)
140 - Chronic Obstructive Pulmonary Disease	8/189 (4.2%)	58/1338 (4.3%)	46/1365 (3.4%)	2/239 (0.8%)	0/3131 (0%)
139 - Other Pneumonia	30/479 (6.3%)	149/5210 (2.9%)	171/4258 (4%)	5/691 (0.7%)	1/10638 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/18 (0%)	0/14 (0%)	0/7 (0%)	0/1 (0%)	0/40 (0%)
137 - Major Respiratory Infections & Inflammations	6/90 (6.7%)	17/615 (2.8%)	20/590 (3.4%)	0/119 (0%)	0/1414 (0%)
136 - Respiratory Malignancy	1/52 (1.9%)	16/222 (7.2%)	19/237 (8%)	2/35 (5.7%)	1/546 (0.2%)
135 - Major Chest & Respiratory Trauma	1/61 (1.6%)	8/63 (12.7%)	2/40 (5%)	0/5 (0%)	0/169 (0%)
134 - Pulmonary Embolism	10/289 (3.5%)	44/795 (5.5%)	18/449 (4%)	0/63 (0%)	0/1596 (0%)
133 - Pulmonary Edema & Respiratory Failure	2/72 (2.8%)	32/315 (10.2%)	10/451 (2.2%)	0/52 (0%)	0/890 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/1 (0%)	0/3 (0%)	0/3 (0%)	0/0 (-)	0/7 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/22 (0%)	4/70 (5.7%)	7/194 (3.6%)	0/179 (0%)	0/465 (0%)

121 - Other Respiratory & Chest Procedures	0/77 (0%)	6/42 (14.3%)	2/30 (6.7%)	0/18 (0%)	0/167 (0%)
120 - Major Respiratory & Chest Procedures	0/75 (0%)	2/31 (6.5%)	0/9 (0%)	0/7 (0%)	0/122 (0%)
Pulmonary circulation disorders					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	0/58 (0%)	116/749 (15.5%)	245/903 (27.1%)	86/156 (55.1%)	0/1866 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/13 (0%)	19/80 (23.8%)	44/135 (32.6%)	26/40 (65%)	1/268 (0.4%)
142 - Interstitial Lung Disease	0/4 (0%)	13/155 (8.4%)	32/231 (13.9%)	19/35 (54.3%)	0/425 (0%)
141 - Asthma	0/8 (0%)	13/40 (32.5%)	21/72 (29.2%)	6/10 (60%)	0/130 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/86 (0%)	287/1109 (25.9%)	348/1864 (18.7%)	194/386 (50.3%)	0/3445 (0%)
139 - Other Pneumonia	0/47 (0%)	112/1491 (7.5%)	660/2333 (28.3%)	411/772 (53.2%)	0/4643 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/5 (0%)	4/10 (40%)	2/8 (25%)	1/2 (50%)	0/25 (0%)
137 - Major Respiratory Infections & Inflammations	0/11 (0%)	11/153 (7.2%)	95/324 (29.3%)	70/122 (57.4%)	1/610 (0.2%)
136 - Respiratory Malignancy	0/10 (0%)	26/96 (27.1%)	174/302 (57.6%)	185/224 (82.6%)	0/632 (0%)
135 - Major Chest & Respiratory Trauma	0/2 (0%)	3/14 (21.4%)	8/24 (33.3%)	3/7 (42.9%)	1/47 (2.1%)
134 - Pulmonary Embolism	1/113 (0.9%)	192/641 (30%)	121/419 (28.9%)	9/57 (15.8%)	0/1230 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/12 (0%)	49/213 (23%)	118/447 (26.4%)	21/49 (42.9%)	0/721 (0%)
132 - BPD & Oth Chronic Respiratory Dis Arising In Perinatal Period	0/0 (-)	0/1 (0%)	1/1 (100%)	0/0 (-)	0/2 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/0 (-)	2/6 (33.3%)	1/7 (14.3%)	0/0 (-)	0/13 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/11 (0%)	17/57 (29.8%)	33/148 (22.3%)	36/149 (24.2%)	3/365 (0.8%)
121 - Other Respiratory & Chest Procedures	1/19 (5.3%)	8/19 (42.1%)	16/42 (38.1%)	17/27 (63%)	0/107 (0%)
120 - Major Respiratory & Chest Procedures	0/8 (0%)	4/14 (28.6%)	6/9 (66.7%)	8/14 (57.1%)	0/45 (0%)
Peripheral vascular disorders					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	2/265 (0.8%)	39/1031 (3.8%)	33/703 (4.7%)	3/68 (4.4%)	0/2067 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/44 (0%)	9/106 (8.5%)	6/79 (7.6%)	0/13 (0%)	0/242 (0%)
142 - Interstitial Lung Disease	0/13 (0%)	1/49 (2%)	0/29 (0%)	0/4 (0%)	0/95 (0%)

141 - Asthma	0/12 (0%)	1/13 (7.7%)	2/13 (15.4%)	0/1 (0%)	0/39 (0%)
140 - Chronic Obstructive Pulmonary Disease	2/216 (0.9%)	15/548 (2.7%)	28/621 (4.5%)	2/80 (2.5%)	0/1465 (0%)
139 - Other Pneumonia	4/275 (1.5%)	72/2545 (2.8%)	77/2262 (3.4%)	12/412 (2.9%)	0/5494 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/2 (0%)	0/7 (0%)	0/2 (0%)	0/0 (-)	0/11 (0%)
137 - Major Respiratory Infections & Inflammations	2/49 (4.1%)	5/437 (1.1%)	12/434 (2.8%)	5/86 (5.8%)	0/1006 (0%)
136 - Respiratory Malignancy	1/124 (0.8%)	15/333 (4.5%)	12/355 (3.4%)	2/41 (4.9%)	0/853 (0%)
135 - Major Chest & Respiratory Trauma	0/60 (0%)	1/40 (2.5%)	2/22 (9.1%)	0/6 (0%)	0/128 (0%)
134 - Pulmonary Embolism	1/66 (1.5%)	11/223 (4.9%)	9/167 (5.4%)	4/21 (19%)	0/477 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/21 (0%)	3/93 (3.2%)	3/135 (2.2%)	0/26 (0%)	0/275 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/1 (0%)	0/2 (0%)	0/0 (-)	0/0 (-)	0/3 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/9 (0%)	5/31 (16.1%)	4/85 (4.7%)	1/73 (1.4%)	0/198 (0%)
121 - Other Respiratory & Chest Procedures	0/66 (0%)	4/38 (10.5%)	1/29 (3.4%)	0/8 (0%)	0/141 (0%)
120 - Major Respiratory & Chest Procedures	0/71 (0%)	1/36 (2.8%)	0/11 (0%)	0/9 (0%)	0/127 (0%)
Hypertension uncomplicated					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	171/5917 (2.9%)	5/12687 (0%)	48/7160 (0.7%)	1/579 (0.2%)	0/26343 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	17/1157 (1.5%)	1/1204 (0.1%)	3/821 (0.4%)	0/78 (0%)	0/3260 (0%)
142 - Interstitial Lung Disease	5/254 (2%)	0/586 (0%)	0/400 (0%)	0/27 (0%)	0/1267 (0%)
141 - Asthma	13/1104 (1.2%)	1/563 (0.2%)	1/488 (0.2%)	0/28 (0%)	0/2183 (0%)
140 - Chronic Obstructive Pulmonary Disease	86/3955 (2.2%)	3/6517 (0%)	25/6119 (0.4%)	0/587 (0%)	0/17178 (0%)
139 - Other Pneumonia	360/7517 (4.8%)	2/31701 (0%)	111/20516 (0.5%)	3/2855 (0.1%)	0/62589 (0%)
138 - Bronchiolitis & RSV Pneumonia	1/22 (4.5%)	0/127 (0%)	1/57 (1.8%)	0/4 (0%)	0/210 (0%)
137 - Major Respiratory Infections & Inflammations	33/1057 (3.1%)	20/5758 (0.3%)	25/4088 (0.6%)	5/715 (0.7%)	4/11618 (0%)
136 - Respiratory Malignancy	28/1695 (1.7%)	1/3025 (0%)	11/2238 (0.5%)	0/313 (0%)	0/7271 (0%)
135 - Major Chest & Respiratory Trauma	22/2031 (1.1%)	0/630 (0%)	2/189 (1.1%)	0/38 (0%)	0/2888 (0%)
134 - Pulmonary Embolism	55/1773 (3.1%)	0/2895 (0%)	3/1284 (0.2%)	0/166 (0%)	0/6118 (0%)

133 - Pulmonary Edema & Respiratory Failure	16/480 (3.3%)	2/1297 (0.2%)	6/1220 (0.5%)	0/148 (0%)	0/3145 (0%)
132 - BPD & Oth Chronic Respiratory Dis Arising In Perinatal Period	0/0 (-)	0/1 (0%)	0/0 (-)	0/0 (-)	0/1 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/2 (0%)	0/4 (0%)	0/4 (0%)	0/0 (-)	0/10 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	6/169 (3.6%)	0/376 (0%)	3/534 (0.6%)	1/507 (0.2%)	1/1586 (0.1%)
121 - Other Respiratory & Chest Procedures	5/1340 (0.4%)	0/386 (0%)	4/231 (1.7%)	0/51 (0%)	0/2008 (0%)
120 - Major Respiratory & Chest Procedures	8/1367 (0.6%)	0/437 (0%)	0/53 (0%)	0/38 (0%)	0/1895 (0%)
Paralysis					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	2/460 (0.4%)	181/429 (42.2%)	112/360 (31.1%)	20/61 (32.8%)	0/1310 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/33 (0%)	15/36 (41.7%)	11/36 (30.6%)	1/8 (12.5%)	0/113 (0%)
142 - Interstitial Lung Disease	0/2 (0%)	2/3 (66.7%)	0/9 (0%)	0/1 (0%)	0/15 (0%)
141 - Asthma	0/31 (0%)	4/10 (40%)	1/5 (20%)	0/2 (0%)	0/48 (0%)
140 - Chronic Obstructive Pulmonary Disease	1/42 (2.4%)	10/50 (20%)	19/99 (19.2%)	7/25 (28%)	0/216 (0%)
139 - Other Pneumonia	6/627 (1%)	225/761 (29.6%)	257/899 (28.6%)	52/275 (18.9%)	1/2562 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/32 (0%)	9/18 (50%)	3/7 (42.9%)	0/0 (-)	0/57 (0%)
137 - Major Respiratory Infections & Inflammations	1/66 (1.5%)	42/271 (15.5%)	77/292 (26.4%)	16/88 (18.2%)	0/717 (0%)
136 - Respiratory Malignancy	0/13 (0%)	7/256 (2.7%)	40/244 (16.4%)	5/44 (11.4%)	0/557 (0%)
135 - Major Chest & Respiratory Trauma	0/8 (0%)	0/1 (0%)	0/3 (0%)	0/3 (0%)	0/15 (0%)
134 - Pulmonary Embolism	2/15 (13.3%)	3/33 (9.1%)	6/37 (16.2%)	2/14 (14.3%)	0/99 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/14 (0%)	27/51 (52.9%)	12/53 (22.6%)	4/20 (20%)	0/138 (0%)
132 - BPD & Oth Chronic Respiratory Dis Arising In Perinatal Period	0/2 (0%)	1/1 (100%)	1/1 (100%)	0/0 (-)	0/4 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/10 (0%)	9/17 (52.9%)	15/45 (33.3%)	5/63 (7.9%)	1/135 (0.7%)
121 - Other Respiratory & Chest Procedures	0/7 (0%)	1/3 (33.3%)	3/13 (23.1%)	2/10 (20%)	0/33 (0%)
120 - Major Respiratory & Chest Procedures	0/10 (0%)	3/8 (37.5%)	0/4 (0%)	0/2 (0%)	0/24 (0%)
Other neurological disorders					

144 - Respiratory System Signs, Symptoms & Other Diagnoses	3/1309 (0.2%)	643/3867 (16.6%)	472/2661 (17.7%)	51/239 (21.3%)	0/8076 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/104 (0%)	36/166 (21.7%)	38/190 (20%)	3/28 (10.7%)	0/488 (0%)
142 - Interstitial Lung Disease	0/22 (0%)	6/51 (11.8%)	4/34 (11.8%)	2/8 (25%)	0/115 (0%)
141 - Asthma	0/131 (0%)	18/57 (31.6%)	8/34 (23.5%)	2/6 (33.3%)	0/228 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/238 (0%)	152/894 (17%)	108/893 (12.1%)	18/137 (13.1%)	0/2162 (0%)
139 - Other Pneumonia	7/1614 (0.4%)	804/8393 (9.6%)	1068/7226 (14.8%)	170/1232 (13.8%)	1/18465 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/178 (0%)	10/55 (18.2%)	7/17 (41.2%)	0/0 (-)	0/250 (0%)
137 - Major Respiratory Infections & Inflammations	1/255 (0.4%)	105/2529 (4.2%)	349/2268 (15.4%)	47/422 (11.1%)	0/5474 (0%)
136 - Respiratory Malignancy	1/80 (1.2%)	47/434 (10.8%)	39/361 (10.8%)	3/73 (4.1%)	0/948 (0%)
135 - Major Chest & Respiratory Trauma	0/187 (0%)	36/108 (33.3%)	8/43 (18.6%)	1/12 (8.3%)	0/350 (0%)
134 - Pulmonary Embolism	0/74 (0%)	54/375 (14.4%)	62/290 (21.4%)	6/54 (11.1%)	0/793 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/42 (0%)	34/165 (20.6%)	73/313 (23.3%)	5/73 (6.8%)	0/593 (0%)
132 - BPD & Oth Chronic Respiratory Dis Arising In Perinatal Period	0/2 (0%)	0/2 (0%)	0/2 (0%)	0/0 (-)	0/6 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/6 (0%)	2/6 (33.3%)	1/4 (25%)	0/0 (-)	0/16 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	1/57 (1.8%)	31/128 (24.2%)	42/198 (21.2%)	14/203 (6.9%)	1/586 (0.2%)
121 - Other Respiratory & Chest Procedures	0/75 (0%)	7/32 (21.9%)	3/33 (9.1%)	3/25 (12%)	1/165 (0.6%)
120 - Major Respiratory & Chest Procedures	0/49 (0%)	6/18 (33.3%)	1/8 (12.5%)	0/6 (0%)	0/81 (0%)
144 - Respiratory System Signs, Symptoms & Other Diagnoses	32/3418 (0.9%)	271/5431 (5%)	359/3560 (10.1%)	23/269 (8.6%)	2/12678 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	6/1111 (0.5%)	63/665 (9.5%)	74/569 (13%)	3/64 (4.7%)	1/2409 (0%)
142 - Interstitial Lung Disease	2/186 (1.1%)	16/450 (3.6%)	33/372 (8.9%)	1/38 (2.6%)	0/1046 (0%)
141 - Asthma	1/282 (0.4%)	32/170 (18.8%)	19/207 (9.2%)	0/10 (0%)	0/669 (0%)
140 - Chronic Obstructive Pulmonary Disease	25/1567 (1.6%)	405/2942 (13.8%)	411/3847 (10.7%)	127/487 (26.1%)	0/8843 (0%)
139 - Other Pneumonia	67/5489 (1.2%)	642/17504 (3.7%)	1017/13314 (7.6%)	41/1755 (2.3%)	1/38062 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/167 (0%)	3/62 (4.8%)	4/34 (11.8%)	0/4 (0%)	0/267 (0%)
137 - Major Respiratory Infections & Inflammations	13/907 (1.4%)	68/2417 (2.8%)	139/2045 (6.8%)	13/321 (4%)	1/5690 (0%)
136 - Respiratory Malignancy	8/1184 (0.7%)	99/1920 (5.2%)	111/1715 (6.5%)	7/226 (3.1%)	1/5045 (0%)

135 - Major Chest & Respiratory Trauma	5/384 (1.3%)	20/202 (9.9%)	12/97 (12.4%)	0/12 (0%)	2/695 (0.3%)
134 - Pulmonary Embolism	3/490 (0.6%)	190/1266 (15%)	118/794 (14.9%)	4/109 (3.7%)	0/2659 (0%)
133 - Pulmonary Edema & Respiratory Failure	7/351 (2%)	90/1155 (7.8%)	155/1265 (12.3%)	2/107 (1.9%)	0/2878 (0%)
132 - BPD & Oth Chronic Respiratory Dis Arising In Perinatal Period	0/1 (0%)	0/1 (0%)	1/3 (33.3%)	0/0 (-)	0/5 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/69 (0%)	21/77 (27.3%)	6/86 (7%)	0/1 (0%)	0/233 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	3/139 (2.2%)	24/303 (7.9%)	49/512 (9.6%)	11/421 (2.6%)	7/1375 (0.5%)
121 - Other Respiratory & Chest Procedures	3/1166 (0.3%)	24/232 (10.3%)	27/168 (16.1%)	1/40 (2.5%)	1/1606 (0.1%)
120 - Major Respiratory & Chest Procedures	5/1304 (0.4%)	23/320 (7.2%)	13/75 (17.3%)	1/33 (3%)	1/1732 (0.1%)
Diabetes uncomplicated					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	2/2531 (0.1%)	911/8008 (11.4%)	937/5416 (17.3%)	6/362 (1.7%)	0/16317 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/432 (0%)	102/645 (15.8%)	127/595 (21.3%)	0/41 (0%)	0/1713 (0%)
142 - Interstitial Lung Disease	0/106 (0%)	26/333 (7.8%)	36/251 (14.3%)	1/25 (4%)	0/715 (0%)
141 - Asthma	2/456 (0.4%)	36/310 (11.6%)	45/290 (15.5%)	0/18 (0%)	0/1074 (0%)
140 - Chronic Obstructive Pulmonary Disease	1/1579 (0.1%)	414/3964 (10.4%)	454/3869 (11.7%)	8/336 (2.4%)	0/9748 (0%)
139 - Other Pneumonia	3/2881 (0.1%)	1644/18931 (8.7%)	2269/14856 (15.3%)	52/2018 (2.6%)	0/38686 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/10 (0%)	7/82 (8.5%)	7/41 (17.1%)	0/5 (0%)	0/138 (0%)
137 - Major Respiratory Infections & Inflammations	1/570 (0.2%)	186/3419 (5.4%)	372/2788 (13.3%)	15/466 (3.2%)	0/7243 (0%)
136 - Respiratory Malignancy	0/739 (0%)	148/1509 (9.8%)	194/1360 (14.3%)	9/172 (5.2%)	0/3780 (0%)
135 - Major Chest & Respiratory Trauma	3/717 (0.4%)	75/313 (24%)	21/118 (17.8%)	0/18 (0%)	0/1166 (0%)
134 - Pulmonary Embolism	0/407 (0%)	151/1188 (12.7%)	113/700 (16.1%)	2/89 (2.2%)	0/2384 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/206 (0%)	87/748 (11.6%)	122/918 (13.3%)	1/95 (1.1%)	0/1967 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/39 (0%)	1/22 (4.5%)	5/30 (16.7%)	0/1 (0%)	0/92 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	1/80 (1.2%)	24/218 (11%)	49/386 (12.7%)	3/357 (0.8%)	2/1041 (0.2%)
121 - Other Respiratory & Chest Procedures	1/478 (0.2%)	25/179 (14%)	17/112 (15.2%)	0/22 (0%)	2/791 (0.3%)

120 - Major Respiratory & Chest Procedures	0/481 (0%)	19/178 (10.7%)	7/21 (33.3%)	0/11 (0%)	0/691 (0%)
Diabetes complicated					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	3/221 (1.4%)	229/1669 (13.7%)	148/1108 (13.4%)	1/98 (1%)	0/3096 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	1/29 (3.4%)	28/116 (24.1%)	7/95 (7.4%)	0/15 (0%)	0/255 (0%)
142 - Interstitial Lung Disease	0/9 (0%)	3/32 (9.4%)	2/24 (8.3%)	1/1 (100%)	0/66 (0%)
141 - Asthma	0/28 (0%)	11/33 (33.3%)	5/34 (14.7%)	0/1 (0%)	0/96 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/73 (0%)	71/613 (11.6%)	72/616 (11.7%)	0/78 (0%)	0/1380 (0%)
139 - Other Pneumonia	3/200 (1.5%)	366/4020 (9.1%)	384/3138 (12.2%)	4/524 (0.8%)	0/7882 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/0 (-)	3/27 (11.1%)	0/17 (0%)	0/1 (0%)	0/45 (0%)
137 - Major Respiratory Infections & Inflammations	1/34 (2.9%)	37/609 (6.1%)	58/546 (10.6%)	3/122 (2.5%)	0/1311 (0%)
136 - Respiratory Malignancy	0/22 (0%)	11/131 (8.4%)	17/133 (12.8%)	0/22 (0%)	0/308 (0%)
135 - Major Chest & Respiratory Trauma	0/43 (0%)	10/40 (25%)	2/13 (15.4%)	0/4 (0%)	0/100 (0%)
134 - Pulmonary Embolism	0/16 (0%)	19/151 (12.6%)	14/127 (11%)	2/12 (16.7%)	0/306 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/15 (0%)	13/113 (11.5%)	31/196 (15.8%)	0/29 (0%)	0/353 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/1 (0%)	0/3 (0%)	0/0 (-)	0/0 (-)	0/4 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	1/19 (5.3%)	3/59 (5.1%)	12/89 (13.5%)	1/116 (0.9%)	1/283 (0.4%)
121 - Other Respiratory & Chest Procedures	0/18 (0%)	1/26 (3.8%)	3/20 (15%)	0/6 (0%)	0/70 (0%)
120 - Major Respiratory & Chest Procedures	0/14 (0%)	6/23 (26.1%)	2/7 (28.6%)	0/4 (0%)	0/48 (0%)
Hypothyroidism					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	19/522 (3.6%)	12/1598 (0.8%)	5/1050 (0.5%)	1/80 (1.2%)	0/3250 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	4/125 (3.2%)	1/136 (0.7%)	1/126 (0.8%)	0/12 (0%)	0/399 (0%)
142 - Interstitial Lung Disease	1/32 (3.1%)	0/63 (0%)	0/60 (0%)	0/6 (0%)	0/161 (0%)
141 - Asthma	5/177 (2.8%)	0/90 (0%)	0/67 (0%)	0/6 (0%)	0/340 (0%)
140 - Chronic Obstructive Pulmonary Disease	10/274 (3.6%)	4/683 (0.6%)	3/756 (0.4%)	0/78 (0%)	0/1791 (0%)

139 - Other Pneumonia	40/778 (5.1%)	18/3566 (0.5%)	13/2787 (0.5%)	2/438 (0.5%)	0/7569 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/32 (0%)	0/13 (0%)	0/3 (0%)	0/2 (0%)	0/50 (0%)
137 - Major Respiratory Infections & Inflammations	4/108 (3.7%)	1/591 (0.2%)	2/503 (0.4%)	1/80 (1.2%)	0/1282 (0%)
136 - Respiratory Malignancy	3/92 (3.3%)	2/228 (0.9%)	0/167 (0%)	1/30 (3.3%)	0/517 (0%)
135 - Major Chest & Respiratory Trauma	0/70 (0%)	0/27 (0%)	0/14 (0%)	0/3 (0%)	0/114 (0%)
134 - Pulmonary Embolism	7/243 (2.9%)	0/321 (0%)	0/197 (0%)	1/22 (4.5%)	0/783 (0%)
133 - Pulmonary Edema & Respiratory Failure	1/31 (3.2%)	1/180 (0.6%)	0/242 (0%)	1/19 (5.3%)	0/472 (0%)
132 - BPD & Oth Chronic Respiratory Dis Arising In Perinatal Period	0/3 (0%)	0/2 (0%)	0/0 (-)	0/0 (-)	0/5 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/1 (0%)	0/1 (0%)	0/1 (0%)	0/0 (-)	0/3 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	3/30 (10%)	0/59 (0%)	0/91 (0%)	1/95 (1.1%)	1/275 (0.4%)
121 - Other Respiratory & Chest Procedures	0/117 (0%)	1/40 (2.5%)	0/39 (0%)	0/7 (0%)	1/203 (0.5%)
120 - Major Respiratory & Chest Procedures	0/85 (0%)	0/24 (0%)	0/1 (0%)	0/7 (0%)	0/117 (0%)
Renal failure					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	9/913 (1%)	535/5734 (9.3%)	641/4172 (15.4%)	35/341 (10.3%)	1/11160 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/128 (0%)	67/360 (18.6%)	68/422 (16.1%)	5/37 (13.5%)	1/947 (0.1%)
142 - Interstitial Lung Disease	0/17 (0%)	12/106 (11.3%)	10/96 (10.4%)	1/16 (6.2%)	0/235 (0%)
141 - Asthma	0/39 (0%)	9/96 (9.4%)	16/89 (18%)	0/8 (0%)	0/232 (0%)
140 - Chronic Obstructive Pulmonary Disease	2/354 (0.6%)	197/2264 (8.7%)	246/2441 (10.1%)	44/328 (13.4%)	0/5387 (0%)
139 - Other Pneumonia	38/890 (4.3%)	617/13556 (4.6%)	1557/12541 (12.4%)	219/2080 (10.5%)	0/29067 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/6 (0%)	8/68 (11.8%)	15/41 (36.6%)	2/6 (33.3%)	0/121 (0%)
137 - Major Respiratory Infections & Inflammations	2/137 (1.5%)	90/2059 (4.4%)	231/2005 (11.5%)	29/379 (7.7%)	0/4580 (0%)
136 - Respiratory Malignancy	4/130 (3.1%)	40/449 (8.9%)	82/508 (16.1%)	13/78 (16.7%)	0/1165 (0%)
135 - Major Chest & Respiratory Trauma	1/71 (1.4%)	18/94 (19.1%)	7/51 (13.7%)	0/10 (0%)	0/226 (0%)
134 - Pulmonary Embolism	2/95 (2.1%)	52/677 (7.7%)	71/545 (13%)	8/72 (11.1%)	1/1389 (0.1%)
133 - Pulmonary Edema & Respiratory Failure	3/72 (4.2%)	36/421 (8.6%)	65/757 (8.6%)	5/79 (6.3%)	0/1329 (0%)

131 - Cystic Fibrosis - Pulmonary Disease	0/4 (0%)	0/0 (-)	0/3 (0%)	0/0 (-)	0/7 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	3/43 (7%)	15/146 (10.3%)	19/251 (7.6%)	7/257 (2.7%)	2/697 (0.3%)
121 - Other Respiratory & Chest Procedures	0/76 (0%)	11/69 (15.9%)	11/57 (19.3%)	0/16 (0%)	0/218 (0%)
120 - Major Respiratory & Chest Procedures	0/56 (0%)	9/42 (21.4%)	2/11 (18.2%)	0/13 (0%)	0/122 (0%)
Liver disease					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	2/487 (0.4%)	175/958 (18.3%)	255/823 (31%)	48/125 (38.4%)	0/2393 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	1/177 (0.6%)	71/228 (31.1%)	46/155 (29.7%)	8/25 (32%)	0/585 (0%)
142 - Interstitial Lung Disease	0/45 (0%)	13/67 (19.4%)	10/59 (16.9%)	2/14 (14.3%)	0/185 (0%)
141 - Asthma	0/67 (0%)	10/37 (27%)	6/41 (14.6%)	0/3 (0%)	0/148 (0%)
140 - Chronic Obstructive Pulmonary Disease	2/312 (0.6%)	102/567 (18%)	103/722 (14.3%)	25/116 (21.6%)	0/1717 (0%)
139 - Other Pneumonia	15/1085 (1.4%)	378/2537 (14.9%)	601/2334 (25.7%)	195/692 (28.2%)	0/6648 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/13 (0%)	4/11 (36.4%)	0/5 (0%)	1/2 (50%)	0/31 (0%)
137 - Major Respiratory Infections & Inflammations	2/451 (0.4%)	67/582 (11.5%)	189/568 (33.3%)	50/190 (26.3%)	1/1791 (0.1%)
136 - Respiratory Malignancy	1/160 (0.6%)	33/353 (9.3%)	70/377 (18.6%)	40/105 (38.1%)	1/995 (0.1%)
135 - Major Chest & Respiratory Trauma	0/135 (0%)	23/62 (37.1%)	12/44 (27.3%)	1/9 (11.1%)	0/250 (0%)
134 - Pulmonary Embolism	0/136 (0%)	41/258 (15.9%)	44/187 (23.5%)	14/45 (31.1%)	0/626 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/26 (0%)	7/63 (11.1%)	20/126 (15.9%)	13/42 (31%)	0/257 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/12 (0%)	5/10 (50%)	4/16 (25%)	0/0 (-)	1/38 (2.6%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/24 (0%)	15/67 (22.4%)	28/152 (18.4%)	41/252 (16.3%)	4/495 (0.8%)
121 - Other Respiratory & Chest Procedures	0/101 (0%)	12/48 (25%)	10/49 (20.4%)	5/20 (25%)	0/218 (0%)
120 - Major Respiratory & Chest Procedures	0/68 (0%)	9/33 (27.3%)	2/6 (33.3%)	1/7 (14.3%)	0/114 (0%)
Peptic ulcer disease excluding bleeding					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	0/67 (0%)	5/157 (3.2%)	1/94 (1.1%)	1/5 (20%)	0/323 (0%)

143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/18 (0%)	2/17 (11.8%)	0/13 (0%)	0/2 (0%)	0/50 (0%)
142 - Interstitial Lung Disease	0/4 (0%)	0/5 (0%)	0/1 (0%)	0/1 (0%)	0/11 (0%)
141 - Asthma	2/12 (16.7%)	0/6 (0%)	0/3 (0%)	0/0 (-)	0/21 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/42 (0%)	2/72 (2.8%)	4/83 (4.8%)	2/19 (10.5%)	0/216 (0%)
139 - Other Pneumonia	5/80 (6.2%)	8/332 (2.4%)	7/284 (2.5%)	0/48 (0%)	0/744 (0%)
137 - Major Respiratory Infections & Inflammations	0/19 (0%)	2/60 (3.3%)	2/53 (3.8%)	0/12 (0%)	0/144 (0%)
136 - Respiratory Malignancy	0/30 (0%)	2/85 (2.4%)	3/47 (6.4%)	0/10 (0%)	0/172 (0%)
135 - Major Chest & Respiratory Trauma	0/16 (0%)	0/6 (0%)	0/2 (0%)	0/1 (0%)	0/25 (0%)
134 - Pulmonary Embolism	0/18 (0%)	0/26 (0%)	0/16 (0%)	0/0 (-)	0/60 (0%)
133 - Pulmonary Edema & Respiratory Failure	1/1 (100%)	0/8 (0%)	1/26 (3.8%)	0/2 (0%)	0/37 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/1 (0%)	0/2 (0%)	1/13 (7.7%)	0/11 (0%)	1/27 (3.7%)
121 - Other Respiratory & Chest Procedures	0/30 (0%)	0/7 (0%)	0/4 (0%)	0/2 (0%)	0/43 (0%)
120 - Major Respiratory & Chest Procedures	0/28 (0%)	0/4 (0%)	0/2 (0%)	0/1 (0%)	0/35 (0%)
AIDS_HIV					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	0/91 (0%)	28/64 (43.8%)	9/26 (34.6%)	0/3 (0%)	0/184 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/3 (0%)	4/7 (57.1%)	1/2 (50%)	0/0 (-)	0/12 (0%)
142 - Interstitial Lung Disease	0/3 (0%)	1/1 (100%)	0/1 (0%)	0/0 (-)	0/5 (0%)
141 - Asthma	0/6 (0%)	3/5 (60%)	1/1 (100%)	0/0 (-)	0/12 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/39 (0%)	13/22 (59.1%)	7/48 (14.6%)	0/3 (0%)	0/112 (0%)
139 - Other Pneumonia	0/10 (0%)	0/0 (-)	0/1 (0%)	0/1 (0%)	0/12 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/1 (0%)	0/1 (0%)	0/0 (-)	0/0 (-)	0/2 (0%)
137 - Major Respiratory Infections & Inflammations	0/2 (0%)	2/5 (40%)	2/7 (28.6%)	0/2 (0%)	0/16 (0%)
136 - Respiratory Malignancy	0/18 (0%)	2/38 (5.3%)	8/43 (18.6%)	0/3 (0%)	0/102 (0%)
135 - Major Chest & Respiratory Trauma	0/8 (0%)	3/5 (60%)	0/0 (-)	0/0 (-)	0/13 (0%)
134 - Pulmonary Embolism	0/3 (0%)	8/14 (57.1%)	2/6 (33.3%)	0/0 (-)	0/23 (0%)

133 - Pulmonary Edema & Respiratory Failure	0/1 (0%)	0/0 (-)	0/0 (-)	0/0 (-)	0/1 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/2 (0%)	0/0 (-)	2/6 (33.3%)	0/3 (0%)	0/11 (0%)
121 - Other Respiratory & Chest Procedures	0/6 (0%)	1/2 (50%)	0/1 (0%)	0/0 (-)	0/9 (0%)
120 - Major Respiratory & Chest Procedures	0/5 (0%)	2/6 (33.3%)	0/0 (-)	0/1 (0%)	0/12 (0%)
Lymphoma					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	1/26 (3.8%)	253/589 (43%)	36/177 (20.3%)	0/16 (0%)	0/808 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/10 (0%)	51/79 (64.6%)	8/29 (27.6%)	0/0 (-)	0/118 (0%)
142 - Interstitial Lung Disease	0/2 (0%)	9/21 (42.9%)	5/14 (35.7%)	0/4 (0%)	0/41 (0%)
141 - Asthma	0/1 (0%)	6/9 (66.7%)	0/4 (0%)	0/0 (-)	0/14 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/8 (0%)	45/106 (42.5%)	12/56 (21.4%)	1/8 (12.5%)	0/178 (0%)
139 - Other Pneumonia	7/31 (22.6%)	442/1406 (31.4%)	141/694 (20.3%)	1/132 (0.8%)	0/2263 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/0 (-)	4/8 (50%)	0/0 (-)	0/0 (-)	0/8 (0%)
137 - Major Respiratory Infections & Inflammations	1/6 (16.7%)	49/207 (23.7%)	17/99 (17.2%)	0/30 (0%)	0/342 (0%)
136 - Respiratory Malignancy	0/4 (0%)	19/47 (40.4%)	4/24 (16.7%)	0/1 (0%)	0/76 (0%)
135 - Major Chest & Respiratory Trauma	0/1 (0%)	3/8 (37.5%)	1/2 (50%)	0/0 (-)	0/11 (0%)
134 - Pulmonary Embolism	0/1 (0%)	33/87 (37.9%)	8/43 (18.6%)	0/2 (0%)	0/133 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/1 (0%)	6/25 (24%)	4/40 (10%)	0/5 (0%)	0/71 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/0 (-)	0/0 (-)	0/1 (0%)	0/0 (-)	0/1 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	1/1 (100%)	10/21 (47.6%)	1/18 (5.6%)	2/43 (4.7%)	3/83 (3.6%)
121 - Other Respiratory & Chest Procedures	1/25 (4%)	10/18 (55.6%)	2/5 (40%)	0/1 (0%)	1/49 (2%)
120 - Major Respiratory & Chest Procedures	0/4 (0%)	7/12 (58.3%)	1/1 (100%)	0/0 (-)	0/17 (0%)
Metastatic cancer					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	1/9 (11.1%)	307/1138 (27%)	469/979 (47.9%)	11/81 (13.6%)	0/2207 (0%)

143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/2 (0%)	242/611 (39.6%)	244/474 (51.5%)	7/32 (21.9%)	0/1119 (0%)
142 - Interstitial Lung Disease	0/0 (-)	7/15 (46.7%)	9/25 (36%)	1/2 (50%)	0/42 (0%)
141 - Asthma	0/0 (-)	0/3 (0%)	3/7 (42.9%)	0/0 (-)	0/10 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/1 (0%)	31/140 (22.1%)	83/242 (34.3%)	0/17 (0%)	0/400 (0%)
139 - Other Pneumonia	0/0 (-)	283/1816 (15.6%)	1024/2713 (37.7%)	48/372 (12.9%)	0/4901 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/0 (-)	1/3 (33.3%)	2/4 (50%)	0/0 (-)	0/7 (0%)
137 - Major Respiratory Infections & Inflammations	0/1 (0%)	74/371 (19.9%)	176/478 (36.8%)	7/64 (10.9%)	0/914 (0%)
136 - Respiratory Malignancy	2/30 (6.7%)	6119/7989 (76.6%)	2650/5367 (49.4%)	106/737 (14.4%)	2/14123 (0%)
135 - Major Chest & Respiratory Trauma	0/0 (-)	3/9 (33.3%)	7/13 (53.8%)	0/1 (0%)	0/23 (0%)
134 - Pulmonary Embolism	0/0 (-)	97/384 (25.3%)	205/408 (50.2%)	5/42 (11.9%)	0/834 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/0 (-)	14/67 (20.9%)	100/210 (47.6%)	2/18 (11.1%)	0/295 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/0 (-)	10/20 (50%)	15/50 (30%)	0/31 (0%)	0/101 (0%)
121 - Other Respiratory & Chest Procedures	0/126 (0%)	319/435 (73.3%)	146/296 (49.3%)	6/46 (13%)	3/903 (0.3%)
120 - Major Respiratory & Chest Procedures	0/75 (0%)	567/651 (87.1%)	21/36 (58.3%)	3/12 (25%)	0/774 (0%)
Solid tumor without metastasis					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	0/46 (0%)	435/1345 (32.3%)	181/839 (21.6%)	4/69 (5.8%)	0/2299 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/11 (0%)	156/391 (39.9%)	46/226 (20.4%)	3/13 (23.1%)	0/641 (0%)
142 - Interstitial Lung Disease	0/1 (0%)	8/30 (26.7%)	3/26 (11.5%)	0/1 (0%)	0/58 (0%)
141 - Asthma	0/0 (-)	12/27 (44.4%)	1/8 (12.5%)	0/0 (-)	0/35 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/2 (0%)	143/481 (29.7%)	65/506 (12.8%)	0/41 (0%)	0/1030 (0%)
139 - Other Pneumonia	0/15 (0%)	447/2770 (16.1%)	420/2522 (16.7%)	9/344 (2.6%)	0/5651 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/3 (0%)	3/7 (42.9%)	3/5 (60%)	0/1 (0%)	0/16 (0%)
137 - Major Respiratory Infections & Inflammations	0/3 (0%)	70/499 (14%)	87/454 (19.2%)	1/74 (1.4%)	0/1030 (0%)
136 - Respiratory Malignancy	2/52 (3.8%)	245/620 (39.5%)	71/325 (21.8%)	1/34 (2.9%)	0/1031 (0%)
135 - Major Chest & Respiratory Trauma	0/0 (-)	20/40 (50%)	1/6 (16.7%)	0/2 (0%)	0/48 (0%)

134 - Pulmonary Embolism	0/11 (0%)	127/406 (31.3%)	43/195 (22.1%)	2/29 (6.9%)	0/641 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/2 (0%)	18/86 (20.9%)	30/140 (21.4%)	0/14 (0%)	0/242 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/0 (-)	0/0 (-)	0/1 (0%)	0/0 (-)	0/1 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/3 (0%)	8/28 (28.6%)	6/33 (18.2%)	1/35 (2.9%)	2/99 (2%)
121 - Other Respiratory & Chest Procedures	0/19 (0%)	52/105 (49.5%)	11/51 (21.6%)	0/6 (0%)	0/181 (0%)
120 - Major Respiratory & Chest Procedures	0/31 (0%)	48/73 (65.8%)	2/2 (100%)	0/3 (0%)	0/109 (0%)
Rheumatoid arthritis/collagen vascular diseases					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	7/446 (1.6%)	252/1303 (19.3%)	116/939 (12.4%)	0/91 (0%)	0/2779 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	1/70 (1.4%)	14/55 (25.5%)	8/62 (12.9%)	0/9 (0%)	0/196 (0%)
142 - Interstitial Lung Disease	0/41 (0%)	10/77 (13%)	2/55 (3.6%)	0/10 (0%)	0/183 (0%)
141 - Asthma	0/47 (0%)	7/35 (20%)	7/33 (21.2%)	0/3 (0%)	0/118 (0%)
140 - Chronic Obstructive Pulmonary Disease	1/155 (0.6%)	45/335 (13.4%)	38/349 (10.9%)	0/40 (0%)	0/879 (0%)
139 - Other Pneumonia	10/513 (1.9%)	306/2826 (10.8%)	304/2787 (10.9%)	4/521 (0.8%)	1/6647 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/6 (0%)	2/26 (7.7%)	3/17 (17.6%)	0/1 (0%)	0/50 (0%)
137 - Major Respiratory Infections & Inflammations	2/105 (1.9%)	30/459 (6.5%)	48/456 (10.5%)	0/143 (0%)	0/1163 (0%)
136 - Respiratory Malignancy	0/42 (0%)	14/105 (13.3%)	12/109 (11%)	0/10 (0%)	1/266 (0.4%)
135 - Major Chest & Respiratory Trauma	0/83 (0%)	31/88 (35.2%)	6/41 (14.6%)	0/11 (0%)	0/223 (0%)
134 - Pulmonary Embolism	0/120 (0%)	24/216 (11.1%)	20/144 (13.9%)	0/19 (0%)	0/499 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/14 (0%)	6/67 (9%)	11/121 (9.1%)	1/23 (4.3%)	0/225 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/0 (-)	0/0 (-)	1/2 (50%)	0/0 (-)	0/2 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	1/19 (5.3%)	11/57 (19.3%)	6/93 (6.5%)	1/134 (0.7%)	1/303 (0.3%)
121 - Other Respiratory & Chest Procedures	0/75 (0%)	4/19 (21.1%)	6/19 (31.6%)	0/11 (0%)	0/124 (0%)
120 - Major Respiratory & Chest Procedures	0/54 (0%)	0/10 (0%)	0/9 (0%)	0/3 (0%)	0/76 (0%)
Coagulopathy					

144 - Respiratory System Signs, Symptoms & Other Diagnoses	0/151 (0%)	145/820 (17.7%)	129/710 (18.2%)	3/105 (2.9%)	0/1786 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/24 (0%)	22/65 (33.8%)	10/83 (12%)	0/13 (0%)	0/185 (0%)
142 - Interstitial Lung Disease	0/5 (0%)	1/29 (3.4%)	5/35 (14.3%)	1/9 (11.1%)	0/78 (0%)
141 - Asthma	0/23 (0%)	7/21 (33.3%)	2/16 (12.5%)	0/0 (-)	0/60 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/51 (0%)	42/280 (15%)	47/406 (11.6%)	0/75 (0%)	0/812 (0%)
139 - Other Pneumonia	4/215 (1.9%)	185/1786 (10.4%)	263/2225 (11.8%)	13/521 (2.5%)	0/4747 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/10 (0%)	0/5 (0%)	1/4 (25%)	0/0 (-)	0/19 (0%)
137 - Major Respiratory Infections & Inflammations	0/46 (0%)	38/322 (11.8%)	35/415 (8.4%)	5/125 (4%)	0/908 (0%)
136 - Respiratory Malignancy	0/30 (0%)	32/223 (14.3%)	32/298 (10.7%)	2/63 (3.2%)	0/614 (0%)
135 - Major Chest & Respiratory Trauma	0/23 (0%)	16/52 (30.8%)	3/39 (7.7%)	1/11 (9.1%)	0/125 (0%)
134 - Pulmonary Embolism	0/50 (0%)	39/194 (20.1%)	29/172 (16.9%)	2/39 (5.1%)	0/455 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/1 (0%)	8/30 (26.7%)	6/115 (5.2%)	1/37 (2.7%)	0/183 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/0 (-)	0/1 (0%)	0/2 (0%)	0/1 (0%)	0/4 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/7 (0%)	7/41 (17.1%)	8/113 (7.1%)	8/255 (3.1%)	0/416 (0%)
121 - Other Respiratory & Chest Procedures	0/26 (0%)	15/31 (48.4%)	6/27 (22.2%)	2/17 (11.8%)	0/101 (0%)
120 - Major Respiratory & Chest Procedures	1/12 (8.3%)	7/18 (38.9%)	0/4 (0%)	0/8 (0%)	0/42 (0%)
Obesity					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	61/1188 (5.1%)	16/2777 (0.6%)	2/2056 (0.1%)	0/186 (0%)	0/6207 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	7/241 (2.9%)	4/253 (1.6%)	0/255 (0%)	0/33 (0%)	1/782 (0.1%)
142 - Interstitial Lung Disease	1/74 (1.4%)	0/140 (0%)	0/101 (0%)	0/8 (0%)	0/323 (0%)
141 - Asthma	13/664 (2%)	1/282 (0.4%)	2/272 (0.7%)	0/16 (0%)	0/1234 (0%)
140 - Chronic Obstructive Pulmonary Disease	57/1138 (5%)	20/2454 (0.8%)	8/2862 (0.3%)	0/293 (0%)	0/6747 (0%)
139 - Other Pneumonia	155/2123 (7.3%)	19/5548 (0.3%)	7/4291 (0.2%)	0/668 (0%)	0/12630 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/15 (0%)	0/24 (0%)	1/10 (10%)	0/0 (-)	0/49 (0%)
137 - Major Respiratory Infections & Inflammations	15/214 (7%)	2/643 (0.3%)	4/535 (0.7%)	1/118 (0.8%)	2/1510 (0.1%)

136 - Respiratory Malignancy	5/172 (2.9%)	0/268 (0%)	1/285 (0.4%)	0/39 (0%)	0/764 (0%)
135 - Major Chest & Respiratory Trauma	5/180 (2.8%)	0/83 (0%)	0/49 (0%)	0/11 (0%)	0/323 (0%)
134 - Pulmonary Embolism	40/843 (4.7%)	7/779 (0.9%)	1/406 (0.2%)	0/62 (0%)	1/2090 (0%)
133 - Pulmonary Edema & Respiratory Failure	29/241 (12%)	13/742 (1.8%)	1/849 (0.1%)	0/66 (0%)	0/1898 (0%)
132 - BPD & Oth Chronic Respiratory Dis Arising In Perinatal Period	0/1 (0%)	0/0 (-)	0/0 (-)	0/0 (-)	0/1 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/1 (0%)	0/0 (-)	0/1 (0%)	0/0 (-)	0/2 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	8/101 (7.9%)	3/160 (1.9%)	1/267 (0.4%)	1/223 (0.4%)	4/751 (0.5%)
121 - Other Respiratory & Chest Procedures	3/267 (1.1%)	0/63 (0%)	1/40 (2.5%)	0/14 (0%)	0/384 (0%)
120 - Major Respiratory & Chest Procedures	1/221 (0.5%)	0/52 (0%)	0/10 (0%)	0/8 (0%)	0/291 (0%)
Weight loss					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	2/189 (1.1%)	118/566 (20.8%)	461/1259 (36.6%)	79/140 (56.4%)	0/2154 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/56 (0%)	21/84 (25%)	46/128 (35.9%)	4/18 (22.2%)	0/286 (0%)
142 - Interstitial Lung Disease	0/24 (0%)	5/41 (12.2%)	13/46 (28.3%)	3/12 (25%)	0/123 (0%)
141 - Asthma	0/14 (0%)	1/2 (50%)	1/5 (20%)	0/0 (-)	0/21 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/110 (0%)	60/222 (27%)	180/516 (34.9%)	89/151 (58.9%)	0/999 (0%)
139 - Other Pneumonia	5/219 (2.3%)	162/1305 (12.4%)	1390/4011 (34.7%)	335/785 (42.7%)	0/6320 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/42 (0%)	1/4 (25%)	2/9 (22.2%)	1/1 (100%)	0/56 (0%)
137 - Major Respiratory Infections & Inflammations	1/243 (0.4%)	128/616 (20.8%)	582/1537 (37.9%)	142/328 (43.3%)	1/2724 (0%)
136 - Respiratory Malignancy	0/145 (0%)	164/587 (27.9%)	450/1061 (42.4%)	71/156 (45.5%)	0/1949 (0%)
135 - Major Chest & Respiratory Trauma	0/4 (0%)	2/3 (66.7%)	2/9 (22.2%)	0/1 (0%)	0/17 (0%)
134 - Pulmonary Embolism	0/13 (0%)	5/36 (13.9%)	17/83 (20.5%)	5/15 (33.3%)	0/147 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/5 (0%)	4/20 (20%)	41/130 (31.5%)	2/16 (12.5%)	0/171 (0%)
132 - BPD & Oth Chronic Respiratory Dis Arising In Perinatal Period	0/0 (-)	1/4 (25%)	1/2 (50%)	0/0 (-)	0/6 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/26 (0%)	1/42 (2.4%)	3/70 (4.3%)	0/0 (-)	0/138 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/5 (0%)	6/22 (27.3%)	19/75 (25.3%)	9/80 (11.2%)	0/182 (0%)

121 - Other Respiratory & Chest Procedures	0/39 (0%)	8/23 (34.8%)	15/53 (28.3%)	7/15 (46.7%)	0/130 (0%)
120 - Major Respiratory & Chest Procedures	0/14 (0%)	3/8 (37.5%)	1/10 (10%)	2/14 (14.3%)	1/46 (2.2%)
Fluid and electrolyte disorders					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	5/1538 (0.3%)	886/8182 (10.8%)	2132/8260 (25.8%)	384/952 (40.3%)	1/18932 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	1/102 (1%)	49/337 (14.5%)	156/623 (25%)	33/90 (36.7%)	0/1152 (0%)
142 - Interstitial Lung Disease	0/22 (0%)	11/125 (8.8%)	35/214 (16.4%)	24/53 (45.3%)	0/414 (0%)
141 - Asthma	0/197 (0%)	179/316 (56.6%)	81/278 (29.1%)	25/52 (48.1%)	0/843 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/610 (0%)	486/2585 (18.8%)	1320/5097 (25.9%)	690/1135 (60.8%)	0/9427 (0%)
139 - Other Pneumonia	9/2174 (0.4%)	985/18730 (5.3%)	5317/24117 (22%)	1549/4889 (31.7%)	1/49910 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/114 (0%)	99/183 (54.1%)	36/88 (40.9%)	4/13 (30.8%)	0/398 (0%)
137 - Major Respiratory Infections & Inflammations	0/495 (0%)	121/4036 (3%)	1145/5356 (21.4%)	327/1226 (26.7%)	0/11113 (0%)
136 - Respiratory Malignancy	0/312 (0%)	68/1282 (5.3%)	258/1878 (13.7%)	75/357 (21%)	0/3829 (0%)
135 - Major Chest & Respiratory Trauma	0/63 (0%)	29/109 (26.6%)	23/108 (21.3%)	11/38 (28.9%)	1/318 (0.3%)
134 - Pulmonary Embolism	2/89 (2.2%)	100/729 (13.7%)	146/831 (17.6%)	59/205 (28.8%)	0/1854 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/48 (0%)	74/387 (19.1%)	593/1548 (38.3%)	61/233 (26.2%)	0/2216 (0%)
132 - BPD & Oth Chronic Respiratory Dis Arising In Perinatal Period	0/2 (0%)	1/1 (100%)	0/0 (-)	0/0 (-)	0/3 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/6 (0%)	4/10 (40%)	1/12 (8.3%)	0/1 (0%)	0/29 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	1/63 (1.6%)	75/246 (30.5%)	208/685 (30.4%)	95/765 (12.4%)	1/1759 (0.1%)
121 - Other Respiratory & Chest Procedures	0/81 (0%)	19/84 (22.6%)	14/146 (9.6%)	8/59 (13.6%)	0/370 (0%)
120 - Major Respiratory & Chest Procedures	0/41 (0%)	15/40 (37.5%)	8/27 (29.6%)	3/32 (9.4%)	0/140 (0%)
Blood loss anemia					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	1/49 (2%)	31/286 (10.8%)	28/170 (16.5%)	0/8 (0%)	0/513 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/13 (0%)	4/27 (14.8%)	4/15 (26.7%)	0/1 (0%)	0/56 (0%)
142 - Interstitial Lung Disease	0/1 (0%)	0/7 (0%)	0/6 (0%)	0/0 (-)	0/14 (0%)

141 - Asthma	0/3 (0%)	1/4 (25%)	0/3 (0%)	0/1 (0%)	0/11 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/26 (0%)	4/73 (5.5%)	8/77 (10.4%)	0/6 (0%)	0/182 (0%)
139 - Other Pneumonia	0/60 (0%)	51/685 (7.4%)	90/585 (15.4%)	1/71 (1.4%)	0/1401 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/6 (0%)	0/0 (-)	0/0 (-)	0/0 (-)	0/6 (0%)
137 - Major Respiratory Infections & Inflammations	0/21 (0%)	6/155 (3.9%)	25/136 (18.4%)	0/16 (0%)	0/328 (0%)
136 - Respiratory Malignancy	0/17 (0%)	11/65 (16.9%)	3/49 (6.1%)	0/1 (0%)	0/132 (0%)
135 - Major Chest & Respiratory Trauma	0/5 (0%)	1/10 (10%)	0/4 (0%)	0/1 (0%)	0/20 (0%)
134 - Pulmonary Embolism	0/14 (0%)	2/25 (8%)	3/27 (11.1%)	0/1 (0%)	0/67 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/0 (-)	2/14 (14.3%)	2/21 (9.5%)	0/4 (0%)	0/39 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/4 (0%)	1/7 (14.3%)	0/8 (0%)	1/12 (8.3%)	0/31 (0%)
121 - Other Respiratory & Chest Procedures	0/4 (0%)	0/4 (0%)	0/4 (0%)	0/0 (-)	0/12 (0%)
120 - Major Respiratory & Chest Procedures	0/4 (0%)	0/2 (0%)	0/2 (0%)	0/1 (0%)	0/9 (0%)
Deficiency anemia					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	1/444 (0.2%)	69/1628 (4.2%)	65/1165 (5.6%)	0/93 (0%)	0/3330 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/52 (0%)	7/112 (6.2%)	4/98 (4.1%)	0/12 (0%)	0/274 (0%)
142 - Interstitial Lung Disease	0/25 (0%)	0/38 (0%)	1/29 (3.4%)	0/4 (0%)	0/96 (0%)
141 - Asthma	0/68 (0%)	4/34 (11.8%)	0/22 (0%)	0/1 (0%)	0/125 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/179 (0%)	17/574 (3%)	24/658 (3.6%)	0/96 (0%)	0/1507 (0%)
139 - Other Pneumonia	4/827 (0.5%)	110/4042 (2.7%)	168/3572 (4.7%)	2/502 (0.4%)	0/8943 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/121 (0%)	0/15 (0%)	1/6 (16.7%)	0/0 (-)	0/142 (0%)
137 - Major Respiratory Infections & Inflammations	0/236 (0%)	16/736 (2.2%)	28/718 (3.9%)	2/111 (1.8%)	0/1801 (0%)
136 - Respiratory Malignancy	0/60 (0%)	6/167 (3.6%)	6/196 (3.1%)	0/31 (0%)	0/454 (0%)
135 - Major Chest & Respiratory Trauma	0/18 (0%)	1/22 (4.5%)	0/12 (0%)	0/2 (0%)	0/54 (0%)
134 - Pulmonary Embolism	0/133 (0%)	15/275 (5.5%)	12/145 (8.3%)	0/16 (0%)	0/569 (0%)
133 - Pulmonary Edema & Respiratory Failure	0/9 (0%)	2/89 (2.2%)	5/191 (2.6%)	0/11 (0%)	0/300 (0%)

131 - Cystic Fibrosis - Pulmonary Disease	0/4 (0%)	0/4 (0%)	0/12 (0%)	0/0 (-)	0/20 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/10 (0%)	3/32 (9.4%)	4/69 (5.8%)	0/61 (0%)	0/172 (0%)
121 - Other Respiratory & Chest Procedures	0/31 (0%)	1/18 (5.6%)	0/29 (0%)	0/8 (0%)	0/86 (0%)
120 - Major Respiratory & Chest Procedures	0/12 (0%)	0/2 (0%)	0/3 (0%)	0/4 (0%)	0/21 (0%)
Alcohol abuse					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	33/980 (3.4%)	64/1211 (5.3%)	64/749 (8.5%)	1/86 (1.2%)	0/3026 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	4/280 (1.4%)	25/194 (12.9%)	8/121 (6.6%)	1/22 (4.5%)	0/617 (0%)
142 - Interstitial Lung Disease	2/32 (6.2%)	3/53 (5.7%)	4/32 (12.5%)	1/7 (14.3%)	1/124 (0.8%)
141 - Asthma	1/72 (1.4%)	3/26 (11.5%)	1/22 (4.5%)	0/4 (0%)	0/124 (0%)
140 - Chronic Obstructive Pulmonary Disease	30/912 (3.3%)	54/1077 (5%)	48/1235 (3.9%)	4/179 (2.2%)	0/3403 (0%)
139 - Other Pneumonia	108/1939 (5.6%)	154/3264 (4.7%)	165/2506 (6.6%)	7/509 (1.4%)	0/8218 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/5 (0%)	1/9 (11.1%)	0/5 (0%)	0/0 (-)	0/19 (0%)
137 - Major Respiratory Infections & Inflammations	28/912 (3.1%)	27/875 (3.1%)	51/665 (7.7%)	2/156 (1.3%)	0/2608 (0%)
136 - Respiratory Malignancy	18/359 (5%)	25/718 (3.5%)	18/560 (3.2%)	1/80 (1.2%)	0/1717 (0%)
135 - Major Chest & Respiratory Trauma	5/380 (1.3%)	5/104 (4.8%)	4/63 (6.3%)	0/12 (0%)	0/559 (0%)
134 - Pulmonary Embolism	11/176 (6.2%)	5/199 (2.5%)	10/131 (7.6%)	1/24 (4.2%)	0/530 (0%)
133 - Pulmonary Edema & Respiratory Failure	6/65 (9.2%)	8/128 (6.2%)	9/152 (5.9%)	0/25 (0%)	0/370 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	2/85 (2.4%)	11/130 (8.5%)	4/225 (1.8%)	1/218 (0.5%)	2/658 (0.3%)
121 - Other Respiratory & Chest Procedures	1/193 (0.5%)	2/60 (3.3%)	4/52 (7.7%)	0/20 (0%)	0/325 (0%)
120 - Major Respiratory & Chest Procedures	2/164 (1.2%)	5/55 (9.1%)	0/13 (0%)	0/13 (0%)	0/245 (0%)
Drug abuse					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	1/184 (0.5%)	7/73 (9.6%)	4/41 (9.8%)	1/7 (14.3%)	0/305 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/189 (0%)	2/23 (8.7%)	2/21 (9.5%)	0/1 (0%)	0/234 (0%)

142 - Interstitial Lung Disease	0/11 (0%)	1/9 (11.1%)	0/3 (0%)	0/1 (0%)	0/24 (0%)
141 - Asthma	2/73 (2.7%)	3/14 (21.4%)	4/20 (20%)	0/2 (0%)	0/109 (0%)
140 - Chronic Obstructive Pulmonary Disease	0/196 (0%)	9/123 (7.3%)	6/146 (4.1%)	0/15 (0%)	0/480 (0%)
139 - Other Pneumonia	0/389 (0%)	6/231 (2.6%)	9/141 (6.4%)	2/27 (7.4%)	0/788 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/1 (0%)	0/0 (-)	0/0 (-)	0/1 (0%)	0/2 (0%)
137 - Major Respiratory Infections & Inflammations	1/306 (0.3%)	6/113 (5.3%)	3/62 (4.8%)	0/24 (0%)	0/505 (0%)
136 - Respiratory Malignancy	0/70 (0%)	2/157 (1.3%)	8/89 (9%)	0/11 (0%)	0/327 (0%)
135 - Major Chest & Respiratory Trauma	0/62 (0%)	2/8 (25%)	0/4 (0%)	0/2 (0%)	0/76 (0%)
134 - Pulmonary Embolism	0/28 (0%)	4/17 (23.5%)	0/11 (0%)	0/1 (0%)	1/57 (1.8%)
133 - Pulmonary Edema & Respiratory Failure	0/23 (0%)	3/20 (15%)	2/13 (15.4%)	0/3 (0%)	0/59 (0%)
132 - BPD & Oth Chronic Respiratory Dis Arising In Perinatal Period	0/0 (-)	0/1 (0%)	0/0 (-)	0/0 (-)	0/1 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0/35 (0%)	5/23 (21.7%)	8/43 (18.6%)	1/38 (2.6%)	2/139 (1.4%)
121 - Other Respiratory & Chest Procedures	0/68 (0%)	1/12 (8.3%)	0/9 (0%)	0/2 (0%)	0/91 (0%)
120 - Major Respiratory & Chest Procedures	0/42 (0%)	0/7 (0%)	1/6 (16.7%)	0/4 (0%)	0/59 (0%)
Psychoses					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	17/253 (6.7%)	9/297 (3%)	4/157 (2.5%)	0/12 (0%)	0/719 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0/32 (0%)	2/26 (7.7%)	1/15 (6.7%)	0/1 (0%)	0/74 (0%)
142 - Interstitial Lung Disease	0/1 (0%)	0/6 (0%)	0/9 (0%)	0/3 (0%)	0/19 (0%)
141 - Asthma	1/37 (2.7%)	1/13 (7.7%)	1/17 (5.9%)	0/1 (0%)	0/68 (0%)
140 - Chronic Obstructive Pulmonary Disease	12/131 (9.2%)	4/142 (2.8%)	5/176 (2.8%)	0/25 (0%)	0/474 (0%)
139 - Other Pneumonia	52/408 (12.7%)	31/686 (4.5%)	11/480 (2.3%)	0/91 (0%)	0/1665 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/3 (0%)	0/2 (0%)	0/4 (0%)	0/0 (-)	0/9 (0%)
137 - Major Respiratory Infections & Inflammations	7/94 (7.4%)	2/205 (1%)	3/113 (2.7%)	0/38 (0%)	0/450 (0%)
136 - Respiratory Malignancy	2/45 (4.4%)	11/143 (7.7%)	6/106 (5.7%)	0/21 (0%)	0/315 (0%)
135 - Major Chest & Respiratory Trauma	0/33 (0%)	0/7 (0%)	0/7 (0%)	0/1 (0%)	0/48 (0%)

134 - Pulmonary Embolism	5/54 (9.3%)	1/37 (2.7%)	0/25 (0%)	0/6 (0%)	0/122 (0%)
133 - Pulmonary Edema & Respiratory Failure	2/12 (16.7%)	2/26 (7.7%)	1/42 (2.4%)	0/1 (0%)	0/81 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	2/19 (10.5%)	1/26 (3.8%)	3/33 (9.1%)	0/40 (0%)	1/118 (0.8%)
121 - Other Respiratory & Chest Procedures	0/13 (0%)	0/2 (0%)	0/4 (0%)	0/1 (0%)	0/20 (0%)
120 - Major Respiratory & Chest Procedures	0/20 (0%)	0/4 (0%)	0/1 (0%)	0/2 (0%)	0/27 (0%)
Depression					
144 - Respiratory System Signs, Symptoms & Other Diagnoses	28/1069 (2.6%)	10/1806 (0.6%)	3/1004 (0.3%)	1/81 (1.2%)	0/3960 (0%)
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	1/232 (0.4%)	1/196 (0.5%)	1/128 (0.8%)	0/18 (0%)	0/574 (0%)
142 - Interstitial Lung Disease	3/116 (2.6%)	0/120 (0%)	0/100 (0%)	0/11 (0%)	0/347 (0%)
141 - Asthma	5/408 (1.2%)	3/141 (2.1%)	2/141 (1.4%)	0/12 (0%)	0/702 (0%)
140 - Chronic Obstructive Pulmonary Disease	19/680 (2.8%)	9/1045 (0.9%)	4/1063 (0.4%)	3/118 (2.5%)	0/2906 (0%)
139 - Other Pneumonia	74/1675 (4.4%)	23/4179 (0.6%)	8/2812 (0.3%)	4/439 (0.9%)	0/9105 (0%)
138 - Bronchiolitis & RSV Pneumonia	0/4 (0%)	0/13 (0%)	0/3 (0%)	0/1 (0%)	0/21 (0%)
137 - Major Respiratory Infections & Inflammations	14/293 (4.8%)	2/683 (0.3%)	3/495 (0.6%)	2/116 (1.7%)	0/1587 (0%)
136 - Respiratory Malignancy	3/294 (1%)	4/676 (0.6%)	6/557 (1.1%)	3/98 (3.1%)	0/1625 (0%)
135 - Major Chest & Respiratory Trauma	0/286 (0%)	0/64 (0%)	0/33 (0%)	0/5 (0%)	0/388 (0%)
134 - Pulmonary Embolism	16/564 (2.8%)	1/559 (0.2%)	2/300 (0.7%)	0/29 (0%)	1/1452 (0.1%)
133 - Pulmonary Edema & Respiratory Failure	3/76 (3.9%)	2/195 (1%)	1/199 (0.5%)	0/25 (0%)	0/495 (0%)
131 - Cystic Fibrosis - Pulmonary Disease	0/15 (0%)	0/2 (0%)	0/10 (0%)	0/0 (-)	0/27 (0%)
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	2/52 (3.8%)	2/74 (2.7%)	4/124 (3.2%)	1/128 (0.8%)	3/378 (0.8%)
121 - Other Respiratory & Chest Procedures	2/277 (0.7%)	0/53 (0%)	0/58 (0%)	1/18 (5.6%)	1/406 (0.2%)
120 - Major Respiratory & Chest Procedures	0/221 (0%)	0/63 (0%)	0/11 (0%)	0/12 (0%)	0/307 (0%)

Table 8. Number and percentage of episodes that changed their base APR-DRG or SOI level after removing comorbidities, by APR-DRG, MDC 5 (Diseases and Disorders of the Circulatory System)

Charlson comorbidities					
	SOI 1	SOI 2	SOI 3	SOI 4	Base APR-DRG
Myocardial infarction					
199 - Hypertension	0/53 (0%)	4/64 (6.2%)	9/33 (27.3%)	1/2 (50%)	0/152 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	85/1293 (6.6%)	46/1086 (4.2%)	10/246 (4.1%)	0/37 (0%)	88/2662 (3.3%)
197 - Peripheral & Other Vascular Disorders	5/410 (1.2%)	2/311 (0.6%)	29/175 (16.6%)	8/50 (16%)	2/946 (0.2%)
196 - Cardiac Arrest	0/6 (0%)	1/12 (8.3%)	14/39 (35.9%)	7/57 (12.3%)	0/114 (0%)
194 - Heart Failure	30/766 (3.9%)	37/4720 (0.8%)	478/3352 (14.3%)	208/773 (26.9%)	0/9611 (0%)
193 - Acute & Subacute Endocarditis	0/9 (0%)	3/16 (18.8%)	6/19 (31.6%)	5/13 (38.5%)	0/57 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	9/1653 (0.5%)	16/582 (2.7%)	0/78 (0%)	1/8 (12.5%)	0/2321 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	5/325 (1.5%)	36/276 (13%)	152/341 (44.6%)	30/105 (28.6%)	0/1047 (0%)
190 - Acute Myocardial Infarction	670/1605 (41.7%)	545/1928 (28.3%)	356/1486 (24%)	50/220 (22.7%)	1550/5239 (29.6%)
180 - Other Circulatory System Procedures	0/111 (0%)	2/41 (4.9%)	2/28 (7.1%)	1/17 (5.9%)	0/197 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/48 (0%)	0/51 (0%)	1/9 (11.1%)	0/3 (0%)	0/111 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	1/86 (1.2%)	0/82 (0%)	2/13 (15.4%)	1/5 (20%)	0/186 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	12/2372 (0.5%)	486/945 (51.4%)	685/894 (76.6%)	93/189 (49.2%)	1/4400 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	2/1053 (0.2%)	10/842 (1.2%)	42/203 (20.7%)	11/103 (10.7%)	0/2201 (0%)
173 - Other Vascular Procedures	3/610 (0.5%)	8/504 (1.6%)	35/135 (25.9%)	16/91 (17.6%)	0/1340 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	5/536 (0.9%)	17/390 (4.4%)	44/108 (40.7%)	14/35 (40%)	1/1069 (0.1%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/14 (0%)	1/35 (2.9%)	1/22 (4.5%)	0/7 (0%)	1/78 (1.3%)
207 - Other Circulatory System Diagnoses	0/74 (0%)	4/83 (4.8%)	10/43 (23.3%)	4/10 (40%)	0/210 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	1/54 (1.9%)	4/63 (6.3%)	9/29 (31%)	3/11 (27.3%)	0/157 (0%)

205 - Cardiomyopathy	0/21 (0%)	1/63 (1.6%)	7/24 (29.2%)	0/4 (0%)	0/112 (0%)
204 - Syncope & Collapse	0/71 (0%)	1/77 (1.3%)	5/25 (20%)	2/3 (66.7%)	0/176 (0%)
203 - Chest Pain	0/5 (0%)	0/3 (0%)	0/1 (0%)	0/0 (-)	0/9 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/120 (0%)	4/72 (5.6%)	7/34 (20.6%)	6/64 (9.4%)	0/290 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	6/564 (1.1%)	46/784 (5.9%)	116/599 (19.4%)	17/62 (27.4%)	1/2009 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/30 (0%)	6/98 (6.1%)	48/83 (57.8%)	6/13 (46.2%)	0/224 (0%)
167 - Other Cardiothoracic Procedures	0/30 (0%)	5/35 (14.3%)	3/20 (15%)	7/14 (50%)	1/99 (1%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	5/945 (0.5%)	356/729 (48.8%)	181/266 (68%)	22/47 (46.8%)	1/1987 (0.1%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/185 (0%)	78/234 (33.3%)	25/100 (25%)	8/17 (47.1%)	0/536 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	3/80 (3.8%)	16/397 (4%)	49/132 (37.1%)	16/42 (38.1%)	0/651 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/8 (0%)	5/85 (5.9%)	32/65 (49.2%)	12/33 (36.4%)	1/191 (0.5%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	4/608 (0.7%)	3/441 (0.7%)	11/56 (19.6%)	4/18 (22.2%)	0/1123 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/0 (-)	0/3 (0%)	0/0 (-)	1/1 (100%)	0/4 (0%)
Congestive heart failure					
199 - Hypertension	0/24 (0%)	160/398 (40.2%)	35/172 (20.3%)	0/15 (0%)	0/609 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/264 (0%)	1583/3149 (50.3%)	155/840 (18.5%)	11/154 (7.1%)	0/4407 (0%)
197 - Peripheral & Other Vascular Disorders	1/74 (1.4%)	538/1296 (41.5%)	126/635 (19.8%)	6/133 (4.5%)	1/2138 (0%)
196 - Cardiac Arrest	0/9 (0%)	40/93 (43%)	14/111 (12.6%)	3/130 (2.3%)	0/343 (0%)
194 - Heart Failure	0/656 (0%)	2948/14286 (20.6%)	1192/9503 (12.5%)	73/1616 (4.5%)	0/26061 (0%)
193 - Acute & Subacute Endocarditis	0/7 (0%)	80/183 (43.7%)	27/155 (17.4%)	2/89 (2.2%)	0/434 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/269 (0%)	996/1414 (70.4%)	48/149 (32.2%)	2/27 (7.4%)	0/1859 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/438 (0%)	2243/3090 (72.6%)	158/779 (20.3%)	4/201 (2%)	2/4508 (0%)
190 - Acute Myocardial Infarction	0/160 (0%)	1235/3503 (35.3%)	1159/4644 (25%)	41/749 (5.5%)	2/9056 (0%)
180 - Other Circulatory System Procedures	0/30 (0%)	131/228 (57.5%)	20/93 (21.5%)	2/47 (4.3%)	2/398 (0.5%)

177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/70 (0%)	203/291 (69.8%)	13/42 (31%)	1/13 (7.7%)	0/416 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/153 (0%)	532/628 (84.7%)	39/111 (35.1%)	2/10 (20%)	1/902 (0.1%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/319 (0%)	1114/1572 (70.9%)	95/536 (17.7%)	7/141 (5%)	0/2568 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/203 (0%)	1026/2462 (41.7%)	136/621 (21.9%)	31/372 (8.3%)	0/3658 (0%)
173 - Other Vascular Procedures	0/66 (0%)	582/1190 (48.9%)	57/287 (19.9%)	4/140 (2.9%)	0/1683 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/449 (0%)	2072/3206 (64.6%)	85/400 (21.2%)	5/101 (5%)	0/4156 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/33 (0%)	41/112 (36.6%)	16/81 (19.8%)	0/18 (0%)	0/244 (0%)
207 - Other Circulatory System Diagnoses	0/56 (0%)	357/884 (40.4%)	45/372 (12.1%)	4/80 (5%)	0/1392 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/39 (0%)	143/289 (49.5%)	29/118 (24.6%)	3/48 (6.2%)	0/494 (0%)
205 - Cardiomyopathy	0/35 (0%)	639/1058 (60.4%)	45/238 (18.9%)	0/44 (0%)	0/1375 (0%)
204 - Syncope & Collapse	0/34 (0%)	129/367 (35.1%)	12/72 (16.7%)	0/2 (0%)	0/475 (0%)
203 - Chest Pain	0/29 (0%)	66/112 (58.9%)	5/13 (38.5%)	0/0 (-)	0/154 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/23 (0%)	119/196 (60.7%)	14/77 (18.2%)	1/99 (1%)	0/395 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/662 (0%)	5003/8125 (61.6%)	511/2847 (17.9%)	14/241 (5.8%)	1/11875 (0%)
200 - Cardiac Congenital & Valvular Disorders	1/37 (2.7%)	1032/1770 (58.3%)	98/432 (22.7%)	3/90 (3.3%)	2/2329 (0.1%)
167 - Other Cardiothoracic Procedures	0/101 (0%)	190/315 (60.3%)	18/85 (21.2%)	0/17 (0%)	1/518 (0.2%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/33 (0%)	557/758 (73.5%)	30/114 (26.3%)	0/23 (0%)	0/928 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/4 (0%)	78/202 (38.6%)	5/64 (7.8%)	2/19 (10.5%)	0/289 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/78 (0%)	1622/3415 (47.5%)	83/506 (16.4%)	4/148 (2.7%)	1/4147 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/3 (0%)	84/326 (25.8%)	19/146 (13%)	3/46 (6.5%)	2/521 (0.4%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/502 (0%)	1088/1472 (73.9%)	28/103 (27.2%)	2/38 (5.3%)	0/2115 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/27 (0%)	39/73 (53.4%)	8/29 (27.6%)	0/5 (0%)	0/134 (0%)
Peripheral vascular disease					
199 - Hypertension	0/67 (0%)	6/70 (8.6%)	1/39 (2.6%)	0/1 (0%)	0/177 (0%)

198 - Angina Pectoris & Coronary Atherosclerosis	3/400 (0.8%)	34/445 (7.6%)	6/127 (4.7%)	5/30 (16.7%)	0/1002 (0%)
197 - Peripheral & Other Vascular Disorders	11/1482 (0.7%)	52/1013 (5.1%)	20/401 (5%)	13/108 (12%)	1/3004 (0%)
196 - Cardiac Arrest	0/2 (0%)	0/5 (0%)	0/11 (0%)	0/20 (0%)	0/38 (0%)
194 - Heart Failure	8/187 (4.3%)	78/2819 (2.8%)	67/2076 (3.2%)	14/351 (4%)	0/5433 (0%)
193 - Acute & Subacute Endocarditis	0/9 (0%)	1/24 (4.2%)	1/22 (4.5%)	0/10 (0%)	0/65 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	1/409 (0.2%)	24/239 (10%)	9/34 (26.5%)	1/11 (9.1%)	0/693 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	2/263 (0.8%)	32/264 (12.1%)	6/125 (4.8%)	7/38 (18.4%)	0/690 (0%)
190 - Acute Myocardial Infarction	14/463 (3%)	108/896 (12.1%)	35/869 (4%)	9/145 (6.2%)	0/2373 (0%)
180 - Other Circulatory System Procedures	0/106 (0%)	7/105 (6.7%)	2/61 (3.3%)	2/33 (6.1%)	2/305 (0.7%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/12 (0%)	1/18 (5.6%)	0/9 (0%)	0/0 (-)	0/39 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/11 (0%)	1/17 (5.9%)	0/4 (0%)	0/2 (0%)	0/34 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	1/587 (0.2%)	32/285 (11.2%)	13/153 (8.5%)	5/34 (14.7%)	0/1059 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/350 (0%)	11/394 (2.8%)	12/146 (8.2%)	6/89 (6.7%)	0/979 (0%)
173 - Other Vascular Procedures	20/1842 (1.1%)	85/1208 (7%)	27/249 (10.8%)	11/176 (6.2%)	2/3475 (0.1%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/215 (0%)	32/252 (12.7%)	3/54 (5.6%)	0/17 (0%)	0/538 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/1 (0%)	1/20 (5%)	1/14 (7.1%)	0/8 (0%)	1/43 (2.3%)
207 - Other Circulatory System Diagnoses	1/40 (2.5%)	6/70 (8.6%)	4/39 (10.3%)	1/5 (20%)	0/154 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	2/203 (1%)	8/96 (8.3%)	4/39 (10.3%)	0/11 (0%)	0/349 (0%)
205 - Cardiomyopathy	0/8 (0%)	1/37 (2.7%)	0/9 (0%)	0/0 (-)	0/54 (0%)
204 - Syncope & Collapse	0/39 (0%)	8/74 (10.8%)	2/14 (14.3%)	0/1 (0%)	0/128 (0%)
203 - Chest Pain	0/17 (0%)	1/14 (7.1%)	1/2 (50%)	0/0 (-)	0/33 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	5/363 (1.4%)	6/133 (4.5%)	8/81 (9.9%)	4/120 (3.3%)	0/697 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	2/145 (1.4%)	26/397 (6.5%)	15/231 (6.5%)	1/36 (2.8%)	0/809 (0%)
200 - Cardiac Congenital & Valvular Disorders	1/55 (1.8%)	10/101 (9.9%)	3/32 (9.4%)	0/6 (0%)	0/194 (0%)
167 - Other Cardiothoracic Procedures	1/14 (7.1%)	4/38 (10.5%)	7/28 (25%)	1/13 (7.7%)	1/93 (1.1%)

166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/241 (0%)	12/157 (7.6%)	1/46 (2.2%)	0/17 (0%)	0/461 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/49 (0%)	2/107 (1.9%)	3/37 (8.1%)	1/13 (7.7%)	0/206 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	5/486 (1%)	151/1032 (14.6%)	20/166 (12%)	2/41 (4.9%)	0/1725 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/23 (0%)	6/81 (7.4%)	7/45 (15.6%)	1/17 (5.9%)	0/166 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/46 (0%)	8/86 (9.3%)	1/11 (9.1%)	0/4 (0%)	0/147 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/1 (0%)	0/1 (0%)	0/1 (0%)	0/1 (0%)	0/4 (0%)
Cerebrovascular disease					
199 - Hypertension	1/142 (0.7%)	57/170 (33.5%)	24/71 (33.8%)	1/7 (14.3%)	0/390 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	1/208 (0.5%)	90/610 (14.8%)	73/275 (26.5%)	29/69 (42%)	1/1162 (0.1%)
197 - Peripheral & Other Vascular Disorders	0/332 (0%)	157/645 (24.3%)	98/433 (22.6%)	22/94 (23.4%)	1/1504 (0.1%)
196 - Cardiac Arrest	0/3 (0%)	2/14 (14.3%)	6/30 (20%)	2/46 (4.3%)	0/93 (0%)
194 - Heart Failure	4/129 (3.1%)	295/4965 (5.9%)	608/4459 (13.6%)	154/732 (21%)	0/10285 (0%)
193 - Acute & Subacute Endocarditis	0/8 (0%)	11/43 (25.6%)	59/103 (57.3%)	27/71 (38%)	0/225 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	4/318 (1.3%)	47/216 (21.8%)	19/42 (45.2%)	4/11 (36.4%)	0/587 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	1/228 (0.4%)	42/286 (14.7%)	38/154 (24.7%)	16/60 (26.7%)	0/728 (0%)
190 - Acute Myocardial Infarction	5/229 (2.2%)	162/912 (17.8%)	343/1507 (22.8%)	95/297 (32%)	0/2945 (0%)
180 - Other Circulatory System Procedures	0/43 (0%)	14/44 (31.8%)	6/24 (25%)	5/17 (29.4%)	3/128 (2.3%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/13 (0%)	9/33 (27.3%)	7/19 (36.8%)	1/6 (16.7%)	0/71 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/29 (0%)	13/28 (46.4%)	5/23 (21.7%)	1/3 (33.3%)	0/83 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	1/327 (0.3%)	57/233 (24.5%)	30/120 (25%)	15/45 (33.3%)	0/725 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/242 (0%)	66/430 (15.3%)	107/203 (52.7%)	42/140 (30%)	0/1015 (0%)
173 - Other Vascular Procedures	3/314 (1%)	116/522 (22.2%)	66/190 (34.7%)	14/88 (15.9%)	2/1114 (0.2%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	2/452 (0.4%)	238/746 (31.9%)	73/170 (42.9%)	12/52 (23.1%)	0/1420 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/4 (0%)	6/27 (22.2%)	2/27 (7.4%)	2/6 (33.3%)	0/64 (0%)

207 - Other Circulatory System Diagnoses	0/74 (0%)	42/182 (23.1%)	14/68 (20.6%)	5/20 (25%)	0/344 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/21 (0%)	9/51 (17.6%)	18/54 (33.3%)	4/27 (14.8%)	0/153 (0%)
205 - Cardiomyopathy	0/8 (0%)	6/48 (12.5%)	4/26 (15.4%)	1/8 (12.5%)	0/90 (0%)
204 - Syncope & Collapse	3/170 (1.8%)	117/363 (32.2%)	24/75 (32%)	2/3 (66.7%)	0/611 (0%)
203 - Chest Pain	0/14 (0%)	7/27 (25.9%)	4/7 (57.1%)	0/0 (-)	0/48 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	1/82 (1.2%)	11/59 (18.6%)	12/41 (29.3%)	9/52 (17.3%)	1/234 (0.4%)
201 - Cardiac Arrhythmia & Conduction Disorders	4/472 (0.8%)	313/1413 (22.2%)	195/803 (24.3%)	33/104 (31.7%)	0/2792 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/44 (0%)	13/160 (8.1%)	32/103 (31.1%)	10/30 (33.3%)	0/337 (0%)
167 - Other Cardiothoracic Procedures	0/25 (0%)	5/30 (16.7%)	9/26 (34.6%)	1/6 (16.7%)	0/87 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	1/327 (0.3%)	19/182 (10.4%)	20/80 (25%)	2/20 (10%)	0/609 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/58 (0%)	8/134 (6%)	5/62 (8.1%)	1/13 (7.7%)	0/267 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	1/178 (0.6%)	31/463 (6.7%)	65/162 (40.1%)	16/56 (28.6%)	1/859 (0.1%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/7 (0%)	4/88 (4.5%)	11/49 (22.4%)	4/24 (16.7%)	1/168 (0.6%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/26 (0%)	6/42 (14.3%)	6/16 (37.5%)	1/6 (16.7%)	0/90 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/1 (0%)	0/3 (0%)	0/0 (-)	1/2 (50%)	0/6 (0%)
Dementia					
199 - Hypertension	1/21 (4.8%)	17/68 (25%)	3/29 (10.3%)	0/0 (-)	0/118 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/18 (0%)	39/303 (12.9%)	19/143 (13.3%)	0/23 (0%)	0/487 (0%)
197 - Peripheral & Other Vascular Disorders	0/52 (0%)	66/242 (27.3%)	27/188 (14.4%)	0/23 (0%)	0/505 (0%)
196 - Cardiac Arrest	0/1 (0%)	1/6 (16.7%)	1/5 (20%)	0/7 (0%)	0/19 (0%)
194 - Heart Failure	0/17 (0%)	118/2358 (5%)	160/2014 (7.9%)	5/223 (2.2%)	0/4612 (0%)
193 - Acute & Subacute Endocarditis	0/0 (-)	0/7 (0%)	2/14 (14.3%)	0/3 (0%)	0/24 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/5 (0%)	5/15 (33.3%)	0/3 (0%)	0/0 (-)	0/23 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/2 (0%)	4/26 (15.4%)	6/19 (31.6%)	0/0 (-)	0/47 (0%)

190 - Acute Myocardial Infarction	0/3 (0%)	32/193 (16.6%)	75/510 (14.7%)	3/48 (6.2%)	0/754 (0%)
180 - Other Circulatory System Procedures	0/5 (0%)	1/8 (12.5%)	1/8 (12.5%)	0/3 (0%)	0/24 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/2 (0%)	0/6 (0%)	0/5 (0%)	0/0 (-)	0/13 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/2 (0%)	3/13 (23.1%)	1/5 (20%)	0/1 (0%)	0/21 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/3 (0%)	4/21 (19%)	0/10 (0%)	0/5 (0%)	0/39 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/6 (0%)	11/41 (26.8%)	1/16 (6.2%)	0/7 (0%)	0/70 (0%)
173 - Other Vascular Procedures	0/11 (0%)	11/53 (20.8%)	2/18 (11.1%)	0/10 (0%)	0/92 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/91 (0%)	69/237 (29.1%)	3/53 (5.7%)	0/7 (0%)	0/388 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	2/7 (28.6%)	0/4 (0%)	0/1 (0%)	0/12 (0%)
207 - Other Circulatory System Diagnoses	0/5 (0%)	7/38 (18.4%)	2/26 (7.7%)	0/7 (0%)	0/76 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/2 (0%)	8/27 (29.6%)	1/16 (6.2%)	0/3 (0%)	0/48 (0%)
205 - Cardiomyopathy	0/1 (0%)	4/17 (23.5%)	0/4 (0%)	0/4 (0%)	0/26 (0%)
204 - Syncope & Collapse	0/23 (0%)	29/105 (27.6%)	3/17 (17.6%)	0/0 (-)	0/145 (0%)
203 - Chest Pain	0/1 (0%)	1/10 (10%)	1/2 (50%)	0/0 (-)	0/13 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/0 (-)	1/6 (16.7%)	0/2 (0%)	0/6 (0%)	0/14 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/87 (0%)	126/624 (20.2%)	28/326 (8.6%)	0/30 (0%)	0/1067 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/9 (0%)	9/59 (15.3%)	3/29 (10.3%)	0/2 (0%)	0/99 (0%)
167 - Other Cardiothoracic Procedures	0/0 (-)	1/2 (50%)	0/0 (-)	0/0 (-)	0/2 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/2 (0%)	0/2 (0%)	0/0 (-)	0/0 (-)	0/4 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/4 (0%)	1/8 (12.5%)	0/2 (0%)	0/0 (-)	0/14 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/0 (-)	0/0 (-)	0/1 (0%)	0/1 (0%)	0/2 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/0 (-)	0/1 (0%)	0/0 (-)	0/0 (-)	0/1 (0%)
Chronic pulmonary disease					
199 - Hypertension	0/107 (0%)	18/158 (11.4%)	6/95 (6.3%)	0/7 (0%)	0/367 (0%)

198 - Angina Pectoris & Coronary Atherosclerosis	1/338 (0.3%)	56/727 (7.7%)	16/218 (7.3%)	1/44 (2.3%)	0/1327 (0%)
197 - Peripheral & Other Vascular Disorders	1/533 (0.2%)	70/607 (11.5%)	19/271 (7%)	1/65 (1.5%)	0/1476 (0%)
196 - Cardiac Arrest	0/7 (0%)	3/25 (12%)	3/47 (6.4%)	0/52 (0%)	0/131 (0%)
194 - Heart Failure	12/1157 (1%)	753/14524 (5.2%)	470/10161 (4.6%)	27/1477 (1.8%)	0/27319 (0%)
193 - Acute & Subacute Endocarditis	0/23 (0%)	3/66 (4.5%)	4/46 (8.7%)	0/30 (0%)	0/165 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	1/538 (0.2%)	78/344 (22.7%)	5/66 (7.6%)	0/13 (0%)	0/961 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	2/850 (0.2%)	255/1191 (21.4%)	30/412 (7.3%)	1/97 (1%)	0/2550 (0%)
190 - Acute Myocardial Infarction	8/394 (2%)	105/1032 (10.2%)	114/1256 (9.1%)	2/220 (0.9%)	0/2902 (0%)
180 - Other Circulatory System Procedures	1/579 (0.2%)	9/95 (9.5%)	4/60 (6.7%)	0/30 (0%)	1/764 (0.1%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/25 (0%)	7/52 (13.5%)	1/19 (5.3%)	0/4 (0%)	0/100 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	2/68 (2.9%)	9/47 (19.1%)	2/14 (14.3%)	0/5 (0%)	0/134 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	1/673 (0.1%)	56/461 (12.1%)	14/172 (8.1%)	0/42 (0%)	1/1348 (0.1%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/574 (0%)	51/643 (7.9%)	20/192 (10.4%)	1/79 (1.3%)	0/1488 (0%)
173 - Other Vascular Procedures	0/607 (0%)	88/672 (13.1%)	5/137 (3.6%)	1/140 (0.7%)	0/1556 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	3/762 (0.4%)	135/884 (15.3%)	15/178 (8.4%)	1/37 (2.7%)	0/1861 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/14 (0%)	3/56 (5.4%)	5/47 (10.6%)	0/7 (0%)	0/124 (0%)
207 - Other Circulatory System Diagnoses	3/203 (1.5%)	28/388 (7.2%)	10/197 (5.1%)	0/36 (0%)	1/824 (0.1%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/38 (0%)	19/107 (17.8%)	2/56 (3.6%)	0/31 (0%)	0/232 (0%)
205 - Cardiomyopathy	0/47 (0%)	16/278 (5.8%)	2/86 (2.3%)	0/14 (0%)	0/425 (0%)
204 - Syncope & Collapse	0/83 (0%)	14/158 (8.9%)	1/36 (2.8%)	0/2 (0%)	0/279 (0%)
203 - Chest Pain	0/80 (0%)	3/30 (10%)	0/7 (0%)	0/0 (-)	0/117 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/133 (0%)	13/128 (10.2%)	5/63 (7.9%)	0/83 (0%)	0/407 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	4/931 (0.4%)	216/2014 (10.7%)	59/867 (6.8%)	3/93 (3.2%)	0/3905 (0%)
200 - Cardiac Congenital & Valvular Disorders	1/128 (0.8%)	69/612 (11.3%)	9/177 (5.1%)	0/33 (0%)	1/950 (0.1%)
167 - Other Cardiothoracic Procedures	0/130 (0%)	24/130 (18.5%)	1/43 (2.3%)	0/12 (0%)	0/315 (0%)

166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/217 (0%)	34/167 (20.4%)	3/51 (5.9%)	0/13 (0%)	0/448 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/36 (0%)	2/78 (2.6%)	0/37 (0%)	0/14 (0%)	0/165 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	1/356 (0.3%)	179/1288 (13.9%)	14/261 (5.4%)	1/72 (1.4%)	0/1977 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/15 (0%)	14/180 (7.8%)	7/82 (8.5%)	0/21 (0%)	3/298 (1%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/80 (0%)	20/178 (11.2%)	1/30 (3.3%)	0/7 (0%)	0/295 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/24 (0%)	1/33 (3%)	1/24 (4.2%)	0/4 (0%)	0/85 (0%)
Rheumatic disease					
199 - Hypertension	0/20 (0%)	6/12 (50%)	1/5 (20%)	0/0 (-)	0/37 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/45 (0%)	9/65 (13.8%)	2/12 (16.7%)	0/4 (0%)	0/126 (0%)
197 - Peripheral & Other Vascular Disorders	0/146 (0%)	25/111 (22.5%)	3/36 (8.3%)	0/12 (0%)	0/305 (0%)
196 - Cardiac Arrest	0/0 (-)	0/1 (0%)	0/4 (0%)	0/4 (0%)	0/9 (0%)
194 - Heart Failure	2/35 (5.7%)	62/659 (9.4%)	23/410 (5.6%)	0/48 (0%)	0/1152 (0%)
193 - Acute & Subacute Endocarditis	0/2 (0%)	1/7 (14.3%)	2/9 (22.2%)	0/3 (0%)	0/21 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/73 (0%)	7/28 (25%)	0/3 (0%)	0/1 (0%)	0/105 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/70 (0%)	19/74 (25.7%)	2/12 (16.7%)	0/2 (0%)	0/158 (0%)
190 - Acute Myocardial Infarction	3/52 (5.8%)	38/123 (30.9%)	9/108 (8.3%)	0/19 (0%)	0/302 (0%)
180 - Other Circulatory System Procedures	0/88 (0%)	8/19 (42.1%)	1/7 (14.3%)	0/4 (0%)	0/118 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/3 (0%)	1/3 (33.3%)	0/1 (0%)	0/2 (0%)	0/9 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/8 (0%)	0/3 (0%)	0/0 (-)	0/0 (-)	0/11 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/81 (0%)	10/37 (27%)	0/17 (0%)	0/1 (0%)	0/136 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/100 (0%)	11/92 (12%)	2/14 (14.3%)	0/6 (0%)	0/212 (0%)
173 - Other Vascular Procedures	0/72 (0%)	14/74 (18.9%)	2/13 (15.4%)	0/9 (0%)	0/168 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/78 (0%)	19/65 (29.2%)	4/12 (33.3%)	0/1 (0%)	0/156 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/3 (0%)	0/3 (0%)	0/1 (0%)	0/7 (0%)

207 - Other Circulatory System Diagnoses	1/35 (2.9%)	16/83 (19.3%)	1/14 (7.1%)	0/5 (0%)	0/137 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	1/11 (9.1%)	5/24 (20.8%)	0/6 (0%)	0/1 (0%)	0/42 (0%)
205 - Cardiomyopathy	0/1 (0%)	1/1 (100%)	1/2 (50%)	0/1 (0%)	0/5 (0%)
204 - Syncope & Collapse	0/18 (0%)	3/24 (12.5%)	0/5 (0%)	0/0 (-)	0/47 (0%)
203 - Chest Pain	0/12 (0%)	2/7 (28.6%)	1/1 (100%)	0/0 (-)	0/20 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/7 (0%)	2/5 (40%)	0/2 (0%)	0/3 (0%)	0/17 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/124 (0%)	24/148 (16.2%)	6/69 (8.7%)	0/4 (0%)	0/345 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/8 (0%)	4/31 (12.9%)	1/9 (11.1%)	0/0 (-)	0/48 (0%)
167 - Other Cardiothoracic Procedures	0/8 (0%)	2/7 (28.6%)	0/4 (0%)	0/0 (-)	0/19 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/20 (0%)	8/20 (40%)	2/5 (40%)	0/0 (-)	0/45 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/5 (0%)	1/13 (7.7%)	0/2 (0%)	0/0 (-)	0/20 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/33 (0%)	17/84 (20.2%)	1/11 (9.1%)	0/0 (-)	0/128 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/2 (0%)	2/9 (22.2%)	1/2 (50%)	0/1 (0%)	0/14 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/6 (0%)	3/13 (23.1%)	1/1 (100%)	0/1 (0%)	0/21 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/0 (-)	0/1 (0%)	0/0 (-)	0/1 (0%)	0/2 (0%)
Peptic ulcer disease					
199 - Hypertension	0/7 (0%)	1/9 (11.1%)	0/4 (0%)	0/1 (0%)	0/21 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/39 (0%)	1/44 (2.3%)	0/19 (0%)	0/6 (0%)	0/108 (0%)
197 - Peripheral & Other Vascular Disorders	2/45 (4.4%)	2/37 (5.4%)	1/24 (4.2%)	0/7 (0%)	0/113 (0%)
196 - Cardiac Arrest	0/0 (-)	0/1 (0%)	0/3 (0%)	0/0 (-)	0/4 (0%)
194 - Heart Failure	2/31 (6.5%)	10/404 (2.5%)	7/272 (2.6%)	1/49 (2%)	0/756 (0%)
193 - Acute & Subacute Endocarditis	0/2 (0%)	0/12 (0%)	1/3 (33.3%)	0/6 (0%)	0/23 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/56 (0%)	2/14 (14.3%)	0/2 (0%)	0/1 (0%)	0/73 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	1/23 (4.3%)	3/30 (10%)	1/14 (7.1%)	0/7 (0%)	0/74 (0%)

190 - Acute Myocardial Infarction	1/56 (1.8%)	9/98 (9.2%)	3/92 (3.3%)	1/13 (7.7%)	0/259 (0%)
180 - Other Circulatory System Procedures	0/31 (0%)	0/3 (0%)	0/5 (0%)	0/2 (0%)	0/41 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/2 (0%)	0/6 (0%)	0/0 (-)	0/0 (-)	0/8 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/5 (0%)	0/3 (0%)	0/0 (-)	0/0 (-)	0/8 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	1/49 (2%)	3/17 (17.6%)	0/4 (0%)	0/3 (0%)	0/73 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/56 (0%)	0/50 (0%)	1/13 (7.7%)	0/9 (0%)	0/128 (0%)
173 - Other Vascular Procedures	0/45 (0%)	0/51 (0%)	0/10 (0%)	0/17 (0%)	0/123 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/33 (0%)	2/42 (4.8%)	0/8 (0%)	0/5 (0%)	0/88 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/5 (0%)	0/2 (0%)	0/0 (-)	0/7 (0%)
207 - Other Circulatory System Diagnoses	1/17 (5.9%)	1/12 (8.3%)	0/4 (0%)	0/2 (0%)	0/35 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	1/12 (8.3%)	0/2 (0%)	0/4 (0%)	0/0 (-)	0/18 (0%)
205 - Cardiomyopathy	0/0 (-)	1/14 (7.1%)	0/5 (0%)	0/0 (-)	0/19 (0%)
204 - Syncope & Collapse	0/13 (0%)	1/8 (12.5%)	0/1 (0%)	0/1 (0%)	0/23 (0%)
203 - Chest Pain	0/10 (0%)	0/3 (0%)	0/0 (-)	0/0 (-)	0/13 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/15 (0%)	0/6 (0%)	0/4 (0%)	0/11 (0%)	0/36 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	2/48 (4.2%)	4/89 (4.5%)	1/36 (2.8%)	0/2 (0%)	0/175 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/7 (0%)	0/13 (0%)	2/5 (40%)	0/1 (0%)	0/26 (0%)
167 - Other Cardiothoracic Procedures	1/4 (25%)	0/3 (0%)	1/2 (50%)	0/0 (-)	0/9 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/31 (0%)	0/15 (0%)	0/3 (0%)	0/1 (0%)	0/50 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/2 (0%)	0/8 (0%)	0/1 (0%)	0/1 (0%)	0/12 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	1/38 (2.6%)	1/53 (1.9%)	0/7 (0%)	0/4 (0%)	0/102 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/0 (-)	0/6 (0%)	0/1 (0%)	0/3 (0%)	0/10 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/0 (-)	0/7 (0%)	0/3 (0%)	0/0 (-)	0/10 (0%)
Mild liver disease					

199 - Hypertension	1/41 (2.4%)	9/42 (21.4%)	3/23 (13%)	1/4 (25%)	0/110 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/32 (0%)	23/106 (21.7%)	14/55 (25.5%)	8/31 (25.8%)	0/224 (0%)
197 - Peripheral & Other Vascular Disorders	0/139 (0%)	45/195 (23.1%)	11/108 (10.2%)	3/33 (9.1%)	0/475 (0%)
196 - Cardiac Arrest	0/0 (-)	1/7 (14.3%)	5/19 (26.3%)	10/45 (22.2%)	0/71 (0%)
194 - Heart Failure	13/104 (12.5%)	240/2296 (10.5%)	294/1744 (16.9%)	114/482 (23.7%)	0/4626 (0%)
193 - Acute & Subacute Endocarditis	0/11 (0%)	7/36 (19.4%)	7/41 (17.1%)	3/33 (9.1%)	0/121 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/47 (0%)	15/44 (34.1%)	0/4 (0%)	1/5 (20%)	0/100 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	1/53 (1.9%)	23/137 (16.8%)	16/80 (20%)	10/43 (23.3%)	2/313 (0.6%)
190 - Acute Myocardial Infarction	3/45 (6.7%)	27/129 (20.9%)	23/230 (10%)	26/109 (23.9%)	0/513 (0%)
180 - Other Circulatory System Procedures	2/49 (4.1%)	3/22 (13.6%)	1/23 (4.3%)	0/20 (0%)	0/114 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/12 (0%)	1/5 (20%)	1/4 (25%)	1/8 (12.5%)	0/29 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/31 (0%)	1/4 (25%)	0/2 (0%)	0/2 (0%)	0/39 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	1/40 (2.5%)	21/58 (36.2%)	4/23 (17.4%)	1/9 (11.1%)	0/130 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/51 (0%)	19/92 (20.7%)	10/34 (29.4%)	3/71 (4.2%)	1/248 (0.4%)
173 - Other Vascular Procedures	1/59 (1.7%)	27/105 (25.7%)	6/36 (16.7%)	3/47 (6.4%)	0/247 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	1/87 (1.1%)	29/121 (24%)	6/31 (19.4%)	4/22 (18.2%)	0/261 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/10 (0%)	4/7 (57.1%)	2/6 (33.3%)	1/23 (4.3%)
207 - Other Circulatory System Diagnoses	0/54 (0%)	21/109 (19.3%)	11/63 (17.5%)	6/27 (22.2%)	1/253 (0.4%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/14 (0%)	5/28 (17.9%)	2/23 (8.7%)	2/14 (14.3%)	0/79 (0%)
205 - Cardiomyopathy	1/17 (5.9%)	5/78 (6.4%)	4/34 (11.8%)	5/24 (20.8%)	0/153 (0%)
204 - Syncope & Collapse	0/32 (0%)	14/54 (25.9%)	5/14 (35.7%)	0/0 (-)	0/100 (0%)
203 - Chest Pain	0/13 (0%)	3/10 (30%)	3/5 (60%)	0/0 (-)	0/28 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/10 (0%)	1/13 (7.7%)	3/21 (14.3%)	2/47 (4.3%)	0/91 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/130 (0%)	63/353 (17.8%)	39/212 (18.4%)	35/95 (36.8%)	0/790 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/11 (0%)	8/49 (16.3%)	3/25 (12%)	4/16 (25%)	0/101 (0%)

167 - Other Cardiothoracic Procedures	0/3 (0%)	1/14 (7.1%)	0/4 (0%)	2/4 (50%)	0/25 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/14 (0%)	3/9 (33.3%)	1/5 (20%)	2/4 (50%)	0/32 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	1/7 (14.3%)	0/15 (0%)	0/6 (0%)	0/3 (0%)	0/31 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/22 (0%)	5/63 (7.9%)	8/34 (23.5%)	5/31 (16.1%)	0/150 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/0 (-)	0/11 (0%)	0/11 (0%)	2/16 (12.5%)	1/38 (2.6%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/6 (0%)	2/17 (11.8%)	3/13 (23.1%)	0/6 (0%)	0/42 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/4 (0%)	0/1 (0%)	0/5 (0%)	0/2 (0%)	0/12 (0%)
Diabetes without chronic complication					
199 - Hypertension	0/390 (0%)	79/311 (25.4%)	17/107 (15.9%)	0/11 (0%)	0/819 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	2/1669 (0.1%)	289/1748 (16.5%)	87/474 (18.4%)	1/82 (1.2%)	0/3973 (0%)
197 - Peripheral & Other Vascular Disorders	3/1776 (0.2%)	269/1347 (20%)	87/485 (17.9%)	0/81 (0%)	0/3689 (0%)
196 - Cardiac Arrest	0/14 (0%)	8/56 (14.3%)	7/81 (8.6%)	1/90 (1.1%)	0/241 (0%)
194 - Heart Failure	12/1437 (0.8%)	2172/17822 (12.2%)	1126/10605 (10.6%)	15/1409 (1.1%)	1/31273 (0%)
193 - Acute & Subacute Endocarditis	0/33 (0%)	14/90 (15.6%)	9/84 (10.7%)	1/49 (2%)	0/256 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	1/3891 (0%)	282/960 (29.4%)	22/97 (22.7%)	0/14 (0%)	1/4962 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	1/1998 (0.1%)	259/1262 (20.5%)	55/507 (10.8%)	2/126 (1.6%)	0/3893 (0%)
190 - Acute Myocardial Infarction	3/2160 (0.1%)	1007/3917 (25.7%)	531/2992 (17.7%)	2/465 (0.4%)	1/9534 (0%)
180 - Other Circulatory System Procedures	0/1083 (0%)	32/153 (20.9%)	2/51 (3.9%)	0/25 (0%)	0/1312 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/132 (0%)	24/116 (20.7%)	6/38 (15.8%)	0/8 (0%)	0/294 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	1/302 (0.3%)	33/181 (18.2%)	16/59 (27.1%)	0/5 (0%)	0/547 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/5664 (0%)	329/1256 (26.2%)	66/505 (13.1%)	0/98 (0%)	1/7523 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/3519 (0%)	336/2841 (11.8%)	91/576 (15.8%)	4/300 (1.3%)	0/7236 (0%)
173 - Other Vascular Procedures	0/1760 (0%)	230/1632 (14.1%)	23/216 (10.6%)	0/126 (0%)	0/3734 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	1/3562 (0%)	478/1898 (25.2%)	48/311 (15.4%)	1/58 (1.7%)	0/5829 (0%)

170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/22 (0%)	19/120 (15.8%)	12/75 (16%)	0/9 (0%)	1/226 (0.4%)
207 - Other Circulatory System Diagnoses	0/289 (0%)	72/431 (16.7%)	25/218 (11.5%)	0/25 (0%)	0/963 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/151 (0%)	47/181 (26%)	6/61 (9.8%)	1/14 (7.1%)	0/407 (0%)
205 - Cardiomyopathy	0/47 (0%)	19/240 (7.9%)	14/83 (16.9%)	0/15 (0%)	0/385 (0%)
204 - Syncope & Collapse	0/245 (0%)	71/321 (22.1%)	10/60 (16.7%)	0/2 (0%)	0/628 (0%)
203 - Chest Pain	0/182 (0%)	21/69 (30.4%)	2/6 (33.3%)	0/0 (-)	0/257 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/278 (0%)	45/192 (23.4%)	5/50 (10%)	1/80 (1.2%)	0/600 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/2284 (0%)	523/3287 (15.9%)	215/1585 (13.6%)	0/127 (0%)	0/7283 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/161 (0%)	58/465 (12.5%)	19/154 (12.3%)	0/30 (0%)	0/810 (0%)
167 - Other Cardiothoracic Procedures	0/97 (0%)	9/82 (11%)	5/37 (13.5%)	0/9 (0%)	0/225 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	1/1386 (0.1%)	163/704 (23.2%)	47/187 (25.1%)	1/25 (4%)	2/2302 (0.1%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/227 (0%)	36/356 (10.1%)	9/97 (9.3%)	0/17 (0%)	0/697 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/646 (0%)	214/1683 (12.7%)	34/305 (11.1%)	1/70 (1.4%)	0/2704 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/32 (0%)	13/161 (8.1%)	12/84 (14.3%)	0/22 (0%)	0/299 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	2/393 (0.5%)	69/459 (15%)	10/50 (20%)	0/16 (0%)	0/918 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/3 (0%)	0/4 (0%)	0/0 (-)	0/0 (-)	0/7 (0%)
Diabetes with chronic complication					
199 - Hypertension	0/22 (0%)	25/121 (20.7%)	8/51 (15.7%)	0/1 (0%)	0/195 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	2/80 (2.5%)	67/399 (16.8%)	22/157 (14%)	0/32 (0%)	0/668 (0%)
197 - Peripheral & Other Vascular Disorders	7/501 (1.4%)	237/851 (27.8%)	53/285 (18.6%)	0/47 (0%)	0/1684 (0%)
196 - Cardiac Arrest	0/1 (0%)	2/10 (20%)	0/13 (0%)	0/18 (0%)	0/42 (0%)
194 - Heart Failure	15/173 (8.7%)	439/4863 (9%)	380/3705 (10.3%)	11/572 (1.9%)	0/9313 (0%)
193 - Acute & Subacute Endocarditis	0/4 (0%)	7/42 (16.7%)	4/28 (14.3%)	1/17 (5.9%)	0/91 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/178 (0%)	55/230 (23.9%)	11/41 (26.8%)	0/10 (0%)	0/459 (0%)

191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/58 (0%)	42/213 (19.7%)	9/81 (11.1%)	1/28 (3.6%)	0/380 (0%)
190 - Acute Myocardial Infarction	3/90 (3.3%)	100/627 (15.9%)	123/898 (13.7%)	1/154 (0.6%)	0/1769 (0%)
180 - Other Circulatory System Procedures	1/51 (2%)	28/113 (24.8%)	14/64 (21.9%)	1/17 (5.9%)	3/245 (1.2%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/7 (0%)	4/21 (19%)	3/10 (30%)	1/5 (20%)	1/43 (2.3%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/8 (0%)	6/22 (27.3%)	1/5 (20%)	0/1 (0%)	0/36 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	1/239 (0.4%)	83/287 (28.9%)	15/123 (12.2%)	0/25 (0%)	0/674 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/131 (0%)	66/363 (18.2%)	25/135 (18.5%)	1/72 (1.4%)	0/701 (0%)
173 - Other Vascular Procedures	5/477 (1%)	190/1146 (16.6%)	30/203 (14.8%)	0/57 (0%)	0/1883 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	1/128 (0.8%)	91/389 (23.4%)	10/67 (14.9%)	0/21 (0%)	0/605 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/1 (0%)	5/26 (19.2%)	0/23 (0%)	0/6 (0%)	0/56 (0%)
207 - Other Circulatory System Diagnoses	0/15 (0%)	19/97 (19.6%)	0/38 (0%)	0/7 (0%)	0/157 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/25 (0%)	22/86 (25.6%)	8/46 (17.4%)	1/20 (5%)	0/177 (0%)
205 - Cardiomyopathy	0/0 (-)	6/50 (12%)	0/13 (0%)	0/3 (0%)	0/66 (0%)
204 - Syncope & Collapse	0/12 (0%)	13/58 (22.4%)	2/13 (15.4%)	0/1 (0%)	0/84 (0%)
203 - Chest Pain	0/6 (0%)	4/16 (25%)	1/1 (100%)	0/0 (-)	0/23 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/42 (0%)	6/29 (20.7%)	0/13 (0%)	1/17 (5.9%)	0/101 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	2/108 (1.9%)	91/507 (17.9%)	27/296 (9.1%)	0/33 (0%)	1/944 (0.1%)
200 - Cardiac Congenital & Valvular Disorders	1/7 (14.3%)	3/53 (5.7%)	1/29 (3.4%)	0/6 (0%)	0/95 (0%)
167 - Other Cardiothoracic Procedures	0/2 (0%)	6/14 (42.9%)	1/5 (20%)	0/1 (0%)	0/22 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	1/88 (1.1%)	27/100 (27%)	9/39 (23.1%)	0/5 (0%)	0/232 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/13 (0%)	4/52 (7.7%)	0/27 (0%)	0/5 (0%)	0/97 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/36 (0%)	24/116 (20.7%)	3/42 (7.1%)	0/14 (0%)	0/208 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/0 (-)	1/17 (5.9%)	0/12 (0%)	0/1 (0%)	0/30 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/14 (0%)	7/48 (14.6%)	1/9 (11.1%)	0/4 (0%)	0/75 (0%)

160 - Major Cardiothoracic Repair of Heart Anomaly	0/0 (-)	0/2 (0%)	0/0 (-)	0/2 (0%)	0/4 (0%)
Hemiplegia					
199 - Hypertension	0/11 (0%)	1/12 (8.3%)	3/10 (30%)	0/2 (0%)	0/35 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/8 (0%)	7/16 (43.8%)	3/16 (18.8%)	1/11 (9.1%)	0/51 (0%)
197 - Peripheral & Other Vascular Disorders	1/44 (2.3%)	12/38 (31.6%)	5/30 (16.7%)	0/8 (0%)	0/120 (0%)
196 - Cardiac Arrest	0/2 (0%)	0/0 (-)	1/3 (33.3%)	0/10 (0%)	0/15 (0%)
194 - Heart Failure	0/13 (0%)	9/101 (8.9%)	20/204 (9.8%)	4/89 (4.5%)	0/407 (0%)
193 - Acute & Subacute Endocarditis	0/2 (0%)	0/4 (0%)	0/22 (0%)	0/16 (0%)	0/44 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/8 (0%)	2/4 (50%)	1/4 (25%)	0/1 (0%)	0/17 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/3 (0%)	1/3 (33.3%)	0/11 (0%)	1/12 (8.3%)	0/29 (0%)
190 - Acute Myocardial Infarction	0/7 (0%)	7/17 (41.2%)	6/80 (7.5%)	1/46 (2.2%)	0/150 (0%)
180 - Other Circulatory System Procedures	0/1 (0%)	4/7 (57.1%)	1/3 (33.3%)	0/4 (0%)	0/15 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/0 (-)	0/0 (-)	0/0 (-)	0/1 (0%)	0/1 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/0 (-)	0/0 (-)	0/0 (-)	0/1 (0%)	0/1 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/4 (0%)	3/12 (25%)	0/6 (0%)	0/6 (0%)	0/28 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/16 (0%)	2/18 (11.1%)	0/38 (0%)	2/35 (5.7%)	0/107 (0%)
173 - Other Vascular Procedures	0/14 (0%)	6/30 (20%)	0/24 (0%)	0/21 (0%)	0/89 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/10 (0%)	8/22 (36.4%)	0/13 (0%)	0/11 (0%)	0/56 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/0 (-)	0/1 (0%)	0/0 (-)	0/1 (0%)
207 - Other Circulatory System Diagnoses	0/12 (0%)	5/12 (41.7%)	2/7 (28.6%)	0/4 (0%)	0/35 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/3 (0%)	2/7 (28.6%)	0/6 (0%)	0/4 (0%)	0/20 (0%)
205 - Cardiomyopathy	0/0 (-)	1/5 (20%)	0/2 (0%)	0/3 (0%)	0/10 (0%)
204 - Syncope & Collapse	0/17 (0%)	5/10 (50%)	0/3 (0%)	0/0 (-)	0/30 (0%)
203 - Chest Pain	0/2 (0%)	1/1 (100%)	0/0 (-)	0/0 (-)	0/3 (0%)

169 - Major Thoracic & Abdominal Vascular Procedures	0/7 (0%)	0/4 (0%)	0/9 (0%)	0/19 (0%)	0/39 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/22 (0%)	13/45 (28.9%)	3/54 (5.6%)	0/17 (0%)	0/138 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/1 (0%)	0/3 (0%)	0/11 (0%)	0/2 (0%)	0/17 (0%)
167 - Other Cardiothoracic Procedures	0/5 (0%)	1/1 (100%)	0/3 (0%)	0/0 (-)	0/9 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/4 (0%)	1/8 (12.5%)	0/11 (0%)	0/8 (0%)	0/31 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/2 (0%)	0/1 (0%)	0/5 (0%)	1/1 (100%)	0/9 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/13 (0%)	3/30 (10%)	1/41 (2.4%)	0/19 (0%)	0/103 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/1 (0%)	0/4 (0%)	1/15 (6.7%)	0/5 (0%)	0/25 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/2 (0%)	0/0 (-)	1/3 (33.3%)	0/0 (-)	0/5 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/2 (0%)	0/1 (0%)	1/3 (33.3%)	0/2 (0%)	0/8 (0%)
199 - Hypertension	2/389 (0.5%)	51/394 (12.9%)	79/238 (33.2%)	13/23 (56.5%)	0/1044 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	8/870 (0.9%)	155/1560 (9.9%)	318/759 (41.9%)	92/194 (47.4%)	0/3383 (0%)
197 - Peripheral & Other Vascular Disorders	16/1634 (1%)	170/1477 (11.5%)	230/1001 (23%)	86/303 (28.4%)	0/4415 (0%)
196 - Cardiac Arrest	0/17 (0%)	6/65 (9.2%)	53/156 (34%)	72/231 (31.2%)	0/469 (0%)
194 - Heart Failure	102/2515 (4.1%)	2280/30319 (7.5%)	12903/26512 (48.7%)	3012/4514 (66.7%)	2/63860 (0%)
193 - Acute & Subacute Endocarditis	2/108 (1.9%)	21/195 (10.8%)	60/200 (30%)	42/151 (27.8%)	1/654 (0.2%)
192 - Cardiac Catheterization for Ischemic Heart Disease	5/1003 (0.5%)	58/448 (12.9%)	37/114 (32.5%)	16/35 (45.7%)	0/1600 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	15/1088 (1.4%)	139/1252 (11.1%)	258/751 (34.4%)	131/341 (38.4%)	2/3432 (0.1%)
190 - Acute Myocardial Infarction	32/1094 (2.9%)	170/2376 (7.2%)	836/3965 (21.1%)	492/1064 (46.2%)	0/8499 (0%)
180 - Other Circulatory System Procedures	4/1348 (0.3%)	37/226 (16.4%)	65/187 (34.8%)	25/98 (25.5%)	7/1859 (0.4%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	1/48 (2.1%)	5/69 (7.2%)	9/41 (22%)	7/20 (35%)	0/178 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	4/92 (4.3%)	7/60 (11.7%)	14/36 (38.9%)	4/15 (26.7%)	0/203 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	10/1183 (0.8%)	79/646 (12.2%)	85/386 (22%)	37/169 (21.9%)	0/2384 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	5/1340 (0.4%)	130/1567 (8.3%)	257/671 (38.3%)	216/657 (32.9%)	0/4235 (0%)
173 - Other Vascular Procedures	7/1127 (0.6%)	122/1033 (11.8%)	163/429 (38%)	76/451 (16.9%)	3/3040 (0.1%)

171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	11/1584 (0.7%)	172/1418 (12.1%)	183/487 (37.6%)	57/140 (40.7%)	0/3629 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/17 (0%)	6/109 (5.5%)	33/121 (27.3%)	14/36 (38.9%)	3/283 (1.1%)
207 - Other Circulatory System Diagnoses	9/817 (1.1%)	174/1003 (17.3%)	273/577 (47.3%)	58/139 (41.7%)	1/2536 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	3/142 (2.1%)	27/203 (13.3%)	51/162 (31.5%)	16/74 (21.6%)	0/581 (0%)
205 - Cardiomyopathy	1/100 (1%)	24/401 (6%)	99/209 (47.4%)	23/57 (40.4%)	0/767 (0%)
204 - Syncope & Collapse	4/364 (1.1%)	82/456 (18%)	50/121 (41.3%)	3/5 (60%)	0/946 (0%)
203 - Chest Pain	1/199 (0.5%)	11/68 (16.2%)	10/22 (45.5%)	0/1 (0%)	0/290 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	3/354 (0.8%)	52/240 (21.7%)	91/212 (42.9%)	49/417 (11.8%)	2/1223 (0.2%)
201 - Cardiac Arrhythmia & Conduction Disorders	18/2397 (0.8%)	390/4009 (9.7%)	758/2338 (32.4%)	160/375 (42.7%)	1/9119 (0%)
200 - Cardiac Congenital & Valvular Disorders	8/281 (2.8%)	48/736 (6.5%)	147/357 (41.2%)	48/118 (40.7%)	1/1492 (0.1%)
167 - Other Cardiothoracic Procedures	3/187 (1.6%)	16/139 (11.5%)	21/78 (26.9%)	10/38 (26.3%)	1/442 (0.2%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	2/560 (0.4%)	58/351 (16.5%)	52/178 (29.2%)	12/59 (20.3%)	0/1148 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	1/109 (0.9%)	15/258 (5.8%)	35/134 (26.1%)	12/41 (29.3%)	0/542 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	6/741 (0.8%)	137/1595 (8.6%)	177/604 (29.3%)	58/231 (25.1%)	0/3171 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/34 (0%)	7/282 (2.5%)	37/166 (22.3%)	20/85 (23.5%)	2/567 (0.4%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/137 (0%)	20/229 (8.7%)	33/80 (41.2%)	15/49 (30.6%)	0/495 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	1/60 (1.7%)	8/46 (17.4%)	20/51 (39.2%)	0/9 (0%)	0/166 (0%)
Any malignancy					
199 - Hypertension	0/2 (0%)	29/68 (42.6%)	7/25 (28%)	0/1 (0%)	0/96 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/10 (0%)	90/250 (36%)	31/105 (29.5%)	4/14 (28.6%)	0/379 (0%)
197 - Peripheral & Other Vascular Disorders	1/95 (1.1%)	445/824 (54%)	124/334 (37.1%)	7/35 (20%)	0/1288 (0%)
196 - Cardiac Arrest	1/4 (25%)	5/16 (31.2%)	5/14 (35.7%)	1/16 (6.2%)	0/50 (0%)
194 - Heart Failure	1/15 (6.7%)	225/2216 (10.2%)	366/2039 (17.9%)	30/268 (11.2%)	0/4538 (0%)
193 - Acute & Subacute Endocarditis	0/1 (0%)	13/38 (34.2%)	7/25 (28%)	1/10 (10%)	0/74 (0%)

192 - Cardiac Catheterization for Ischemic Heart Disease	0/4 (0%)	80/114 (70.2%)	9/18 (50%)	0/0 (-)	0/136 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/10 (0%)	65/118 (55.1%)	5/35 (14.3%)	0/13 (0%)	0/176 (0%)
190 - Acute Myocardial Infarction	1/8 (12.5%)	82/266 (30.8%)	143/564 (25.4%)	8/62 (12.9%)	0/900 (0%)
180 - Other Circulatory System Procedures	0/9 (0%)	36/64 (56.2%)	9/24 (37.5%)	0/7 (0%)	0/104 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/0 (-)	6/13 (46.2%)	1/3 (33.3%)	0/1 (0%)	0/17 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/1 (0%)	9/16 (56.2%)	3/5 (60%)	0/0 (-)	0/22 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/7 (0%)	86/137 (62.8%)	9/34 (26.5%)	1/9 (11.1%)	0/187 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/10 (0%)	97/215 (45.1%)	11/41 (26.8%)	1/15 (6.7%)	0/281 (0%)
173 - Other Vascular Procedures	0/23 (0%)	148/253 (58.5%)	19/59 (32.2%)	1/30 (3.3%)	0/365 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/25 (0%)	214/332 (64.5%)	19/47 (40.4%)	0/5 (0%)	0/409 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/4 (0%)	2/7 (28.6%)	0/2 (0%)	0/13 (0%)
207 - Other Circulatory System Diagnoses	0/17 (0%)	88/174 (50.6%)	14/53 (26.4%)	2/11 (18.2%)	0/255 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/35 (0%)	107/175 (61.1%)	13/43 (30.2%)	0/12 (0%)	0/265 (0%)
205 - Cardiomyopathy	0/0 (-)	4/23 (17.4%)	1/3 (33.3%)	0/2 (0%)	0/28 (0%)
204 - Syncope & Collapse	0/14 (0%)	58/116 (50%)	11/24 (45.8%)	0/1 (0%)	0/155 (0%)
203 - Chest Pain	0/2 (0%)	16/33 (48.5%)	0/4 (0%)	0/0 (-)	0/39 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/9 (0%)	29/44 (65.9%)	2/10 (20%)	0/21 (0%)	0/84 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	1/42 (2.4%)	296/664 (44.6%)	85/329 (25.8%)	5/28 (17.9%)	0/1063 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/1 (0%)	12/45 (26.7%)	7/19 (36.8%)	0/2 (0%)	0/67 (0%)
167 - Other Cardiothoracic Procedures	0/2 (0%)	6/9 (66.7%)	2/7 (28.6%)	0/3 (0%)	1/21 (4.8%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/4 (0%)	20/29 (69%)	2/6 (33.3%)	0/1 (0%)	0/40 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/0 (-)	3/13 (23.1%)	2/6 (33.3%)	0/2 (0%)	0/21 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/1 (0%)	24/70 (34.3%)	4/16 (25%)	1/11 (9.1%)	0/98 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/0 (-)	3/4 (75%)	3/12 (25%)	0/1 (0%)	0/17 (0%)

161 - Cardiac Defibrillator & Heart Assist Anomaly	0/1 (0%)	6/13 (46.2%)	1/1 (100%)	0/0 (-)	0/15 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/0 (-)	0/1 (0%)	0/0 (-)	0/0 (-)	0/1 (0%)
Moderate or severe liver disease					
199 - Hypertension	0/0 (-)	1/5 (20%)	0/2 (0%)	1/2 (50%)	0/9 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/1 (0%)	5/20 (25%)	2/9 (22.2%)	2/5 (40%)	0/35 (0%)
197 - Peripheral & Other Vascular Disorders	0/8 (0%)	25/54 (46.3%)	13/38 (34.2%)	4/15 (26.7%)	0/115 (0%)
196 - Cardiac Arrest	0/0 (-)	0/1 (0%)	0/1 (0%)	1/7 (14.3%)	0/9 (0%)
194 - Heart Failure	2/3 (66.7%)	16/264 (6.1%)	92/307 (30%)	61/110 (55.5%)	0/684 (0%)
193 - Acute & Subacute Endocarditis	0/0 (-)	2/11 (18.2%)	4/11 (36.4%)	1/8 (12.5%)	0/30 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/0 (-)	3/4 (75%)	1/1 (100%)	0/0 (-)	0/5 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/1 (0%)	8/17 (47.1%)	7/12 (58.3%)	1/6 (16.7%)	0/36 (0%)
190 - Acute Myocardial Infarction	0/0 (-)	1/14 (7.1%)	10/43 (23.3%)	4/14 (28.6%)	0/71 (0%)
180 - Other Circulatory System Procedures	0/1 (0%)	2/3 (66.7%)	2/6 (33.3%)	1/1 (100%)	0/11 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/0 (-)	0/0 (-)	0/0 (-)	1/3 (33.3%)	0/3 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/0 (-)	0/1 (0%)	0/0 (-)	0/0 (-)	0/1 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/2 (0%)	8/12 (66.7%)	0/5 (0%)	1/3 (33.3%)	0/22 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/0 (-)	3/7 (42.9%)	2/3 (66.7%)	0/1 (0%)	0/11 (0%)
173 - Other Vascular Procedures	0/1 (0%)	6/17 (35.3%)	1/5 (20%)	1/7 (14.3%)	0/30 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/2 (0%)	6/16 (37.5%)	5/11 (45.5%)	0/0 (-)	0/29 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/0 (-)	1/1 (100%)	0/0 (-)	0/1 (0%)
207 - Other Circulatory System Diagnoses	0/1 (0%)	5/16 (31.2%)	7/20 (35%)	1/2 (50%)	0/39 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/0 (-)	0/7 (0%)	1/6 (16.7%)	0/3 (0%)	0/16 (0%)
205 - Cardiomyopathy	0/0 (-)	1/10 (10%)	1/3 (33.3%)	2/3 (66.7%)	0/16 (0%)
204 - Syncope & Collapse	0/0 (-)	2/4 (50%)	0/0 (-)	0/0 (-)	0/4 (0%)

203 - Chest Pain	0/1 (0%)	0/2 (0%)	0/0 (-)	0/0 (-)	0/3 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/0 (-)	1/1 (100%)	0/0 (-)	1/2 (50%)	0/3 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/3 (0%)	9/39 (23.1%)	6/24 (25%)	2/7 (28.6%)	0/73 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/2 (0%)	1/10 (10%)	3/8 (37.5%)	6/6 (100%)	0/26 (0%)
167 - Other Cardiothoracic Procedures	0/0 (-)	2/4 (50%)	1/1 (100%)	1/2 (50%)	0/7 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/0 (-)	1/1 (100%)	1/2 (50%)	1/1 (100%)	0/4 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/0 (-)	0/3 (0%)	0/0 (-)	0/0 (-)	0/3 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/0 (-)	1/6 (16.7%)	0/5 (0%)	4/10 (40%)	0/21 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/0 (-)	0/2 (0%)	0/0 (-)	0/0 (-)	0/2 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/0 (-)	0/3 (0%)	0/2 (0%)	0/0 (-)	0/5 (0%)
Metastatic solid tumor					
199 - Hypertension	0/1 (0%)	2/7 (28.6%)	8/9 (88.9%)	0/0 (-)	0/17 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/1 (0%)	13/41 (31.7%)	25/47 (53.2%)	1/4 (25%)	0/93 (0%)
197 - Peripheral & Other Vascular Disorders	1/11 (9.1%)	121/319 (37.9%)	129/234 (55.1%)	6/24 (25%)	0/588 (0%)
196 - Cardiac Arrest	1/1 (100%)	1/5 (20%)	6/6 (100%)	0/4 (0%)	0/16 (0%)
194 - Heart Failure	0/0 (-)	27/275 (9.8%)	284/662 (42.9%)	12/81 (14.8%)	0/1018 (0%)
193 - Acute & Subacute Endocarditis	0/0 (-)	1/7 (14.3%)	3/11 (27.3%)	0/2 (0%)	0/20 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/0 (-)	3/6 (50%)	8/8 (100%)	0/0 (-)	0/14 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/0 (-)	2/10 (20%)	1/1 (100%)	1/2 (50%)	0/13 (0%)
190 - Acute Myocardial Infarction	0/0 (-)	11/26 (42.3%)	60/165 (36.4%)	1/23 (4.3%)	0/214 (0%)
180 - Other Circulatory System Procedures	0/3 (0%)	12/23 (52.2%)	14/23 (60.9%)	1/4 (25%)	1/53 (1.9%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/0 (-)	0/2 (0%)	0/0 (-)	0/0 (-)	0/2 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/0 (-)	2/2 (100%)	0/0 (-)	0/0 (-)	0/2 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/0 (-)	5/15 (33.3%)	5/8 (62.5%)	0/2 (0%)	0/25 (0%)

174 - Percutaneous Cardiovascular Procedures w/ AMI	0/1 (0%)	6/22 (27.3%)	5/9 (55.6%)	2/6 (33.3%)	0/38 (0%)
173 - Other Vascular Procedures	0/2 (0%)	14/35 (40%)	10/19 (52.6%)	1/6 (16.7%)	0/62 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/0 (-)	7/25 (28%)	5/12 (41.7%)	0/0 (-)	0/37 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/0 (-)	0/1 (0%)	0/0 (-)	0/1 (0%)
207 - Other Circulatory System Diagnoses	0/1 (0%)	29/68 (42.6%)	28/46 (60.9%)	2/5 (40%)	1/120 (0.8%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/1 (0%)	37/81 (45.7%)	12/24 (50%)	1/3 (33.3%)	0/109 (0%)
205 - Cardiomyopathy	0/0 (-)	0/4 (0%)	1/2 (50%)	0/1 (0%)	0/7 (0%)
204 - Syncope & Collapse	0/1 (0%)	8/22 (36.4%)	14/15 (93.3%)	0/0 (-)	0/38 (0%)
203 - Chest Pain	0/0 (-)	1/6 (16.7%)	4/5 (80%)	1/1 (100%)	0/12 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/1 (0%)	2/3 (66.7%)	1/3 (33.3%)	0/4 (0%)	0/11 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/2 (0%)	38/132 (28.8%)	72/138 (52.2%)	1/8 (12.5%)	0/280 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/0 (-)	0/6 (0%)	4/7 (57.1%)	1/2 (50%)	0/15 (0%)
167 - Other Cardiothoracic Procedures	0/0 (-)	3/3 (100%)	0/1 (0%)	0/1 (0%)	0/5 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/0 (-)	1/3 (33.3%)	0/0 (-)	0/0 (-)	0/3 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/0 (-)	0/0 (-)	1/3 (33.3%)	0/0 (-)	0/3 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/0 (-)	0/3 (0%)	0/1 (0%)	0/2 (0%)	0/6 (0%)
AIDS/HIV					
199 - Hypertension	0/6 (0%)	1/2 (50%)	0/0 (-)	0/0 (-)	0/8 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/5 (0%)	2/6 (33.3%)	1/1 (100%)	0/0 (-)	0/12 (0%)
197 - Peripheral & Other Vascular Disorders	0/26 (0%)	4/22 (18.2%)	2/8 (25%)	0/0 (-)	0/56 (0%)
196 - Cardiac Arrest	0/0 (-)	0/0 (-)	1/1 (100%)	0/1 (0%)	0/2 (0%)
194 - Heart Failure	0/12 (0%)	13/47 (27.7%)	7/38 (18.4%)	0/4 (0%)	0/101 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/9 (0%)	2/5 (40%)	0/0 (-)	0/0 (-)	0/14 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/11 (0%)	1/7 (14.3%)	3/6 (50%)	0/1 (0%)	0/25 (0%)

190 - Acute Myocardial Infarction	0/16 (0%)	7/20 (35%)	1/5 (20%)	0/3 (0%)	0/44 (0%)
180 - Other Circulatory System Procedures	0/11 (0%)	0/4 (0%)	0/2 (0%)	0/0 (-)	0/17 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/0 (-)	0/1 (0%)	0/0 (-)	0/0 (-)	0/1 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/0 (-)	0/0 (-)	0/1 (0%)	0/0 (-)	0/1 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/18 (0%)	0/3 (0%)	0/4 (0%)	0/1 (0%)	0/26 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/36 (0%)	4/45 (8.9%)	1/4 (25%)	0/2 (0%)	0/87 (0%)
173 - Other Vascular Procedures	0/36 (0%)	7/34 (20.6%)	3/4 (75%)	0/4 (0%)	0/78 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/11 (0%)	2/4 (50%)	0/1 (0%)	0/0 (-)	0/16 (0%)
207 - Other Circulatory System Diagnoses	0/5 (0%)	1/8 (12.5%)	1/2 (50%)	0/1 (0%)	0/16 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/5 (0%)	1/3 (33.3%)	2/6 (33.3%)	0/1 (0%)	0/15 (0%)
205 - Cardiomyopathy	0/0 (-)	1/5 (20%)	1/2 (50%)	0/0 (-)	0/7 (0%)
204 - Syncope & Collapse	0/4 (0%)	1/4 (25%)	0/1 (0%)	0/0 (-)	0/9 (0%)
203 - Chest Pain	0/1 (0%)	0/1 (0%)	0/0 (-)	0/0 (-)	0/2 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/3 (0%)	3/7 (42.9%)	0/0 (-)	0/1 (0%)	0/11 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/2 (0%)	6/17 (35.3%)	0/4 (0%)	0/0 (-)	0/23 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/0 (-)	0/3 (0%)	0/0 (-)	0/0 (-)	0/3 (0%)
167 - Other Cardiothoracic Procedures	0/0 (-)	0/1 (0%)	0/0 (-)	0/0 (-)	0/1 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/2 (0%)	1/5 (20%)	0/1 (0%)	0/0 (-)	0/8 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/0 (-)	0/2 (0%)	0/0 (-)	0/0 (-)	0/2 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/2 (0%)	0/4 (0%)	0/5 (0%)	0/0 (-)	0/11 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/2 (0%)	0/3 (0%)	1/1 (100%)	0/0 (-)	0/6 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/0 (-)	0/1 (0%)	0/0 (-)	0/0 (-)	0/1 (0%)
Elixhauser comorbidities					
	SOI 1	SOI 2	SOI 3	SOI 3	Base APR-DRG

Congestive heart failure					
199 - Hypertension	0/24 (0%)	160/398 (40.2%)	35/172 (20.3%)	0/15 (0%)	0/609 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/264 (0%)	1583/3149 (50.3%)	155/840 (18.5%)	11/154 (7.1%)	0/4407 (0%)
197 - Peripheral & Other Vascular Disorders	1/74 (1.4%)	538/1296 (41.5%)	126/635 (19.8%)	6/133 (4.5%)	1/2138 (0%)
196 - Cardiac Arrest	0/9 (0%)	40/93 (43%)	14/111 (12.6%)	3/130 (2.3%)	0/343 (0%)
194 - Heart Failure	0/656 (0%)	2948/14286 (20.6%)	1192/9503 (12.5%)	73/1616 (4.5%)	0/26061 (0%)
193 - Acute & Subacute Endocarditis	0/7 (0%)	80/183 (43.7%)	27/155 (17.4%)	2/89 (2.2%)	0/434 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/269 (0%)	996/1414 (70.4%)	48/149 (32.2%)	2/27 (7.4%)	0/1859 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/438 (0%)	2243/3090 (72.6%)	158/779 (20.3%)	4/201 (2%)	2/4508 (0%)
190 - Acute Myocardial Infarction	0/160 (0%)	1235/3503 (35.3%)	1159/4644 (25%)	41/749 (5.5%)	2/9056 (0%)
180 - Other Circulatory System Procedures	0/30 (0%)	131/228 (57.5%)	20/93 (21.5%)	2/47 (4.3%)	2/398 (0.5%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/70 (0%)	203/291 (69.8%)	13/42 (31%)	1/13 (7.7%)	0/416 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/153 (0%)	532/628 (84.7%)	39/111 (35.1%)	2/10 (20%)	1/902 (0.1%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/319 (0%)	1114/1572 (70.9%)	95/536 (17.7%)	7/141 (5%)	0/2568 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/203 (0%)	1026/2462 (41.7%)	136/621 (21.9%)	31/372 (8.3%)	0/3658 (0%)
173 - Other Vascular Procedures	0/66 (0%)	582/1190 (48.9%)	57/287 (19.9%)	4/140 (2.9%)	0/1683 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/449 (0%)	2072/3206 (64.6%)	85/400 (21.2%)	5/101 (5%)	0/4156 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/33 (0%)	41/112 (36.6%)	16/81 (19.8%)	0/18 (0%)	0/244 (0%)
207 - Other Circulatory System Diagnoses	0/56 (0%)	357/884 (40.4%)	45/372 (12.1%)	4/80 (5%)	0/1392 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/39 (0%)	143/289 (49.5%)	29/118 (24.6%)	3/48 (6.2%)	0/494 (0%)
205 - Cardiomyopathy	0/35 (0%)	639/1058 (60.4%)	45/238 (18.9%)	0/44 (0%)	0/1375 (0%)
204 - Syncope & Collapse	0/34 (0%)	129/367 (35.1%)	12/72 (16.7%)	0/2 (0%)	0/475 (0%)
203 - Chest Pain	0/29 (0%)	66/112 (58.9%)	5/13 (38.5%)	0/0 (-)	0/154 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/23 (0%)	119/196 (60.7%)	14/77 (18.2%)	1/99 (1%)	0/395 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/662 (0%)	5003/8125 (61.6%)	511/2847 (17.9%)	14/241 (5.8%)	1/11875 (0%)

200 - Cardiac Congenital & Valvular Disorders	1/37 (2.7%)	1032/1770 (58.3%)	98/432 (22.7%)	3/90 (3.3%)	2/2329 (0.1%)
167 - Other Cardiothoracic Procedures	0/101 (0%)	190/315 (60.3%)	18/85 (21.2%)	0/17 (0%)	1/518 (0.2%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/33 (0%)	557/758 (73.5%)	30/114 (26.3%)	0/23 (0%)	0/928 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/4 (0%)	78/202 (38.6%)	5/64 (7.8%)	2/19 (10.5%)	0/289 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/78 (0%)	1622/3415 (47.5%)	83/506 (16.4%)	4/148 (2.7%)	1/4147 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/3 (0%)	84/326 (25.8%)	19/146 (13%)	3/46 (6.5%)	2/521 (0.4%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/502 (0%)	1088/1472 (73.9%)	28/103 (27.2%)	2/38 (5.3%)	0/2115 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/27 (0%)	39/73 (53.4%)	8/29 (27.6%)	0/5 (0%)	0/134 (0%)
Cardiac arrhythmias					
199 - Hypertension	0/238 (0%)	86/438 (19.6%)	37/215 (17.2%)	0/17 (0%)	0/908 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	2/944 (0.2%)	301/2149 (14%)	124/652 (19%)	10/127 (7.9%)	0/3872 (0%)
197 - Peripheral & Other Vascular Disorders	7/705 (1%)	219/1336 (16.4%)	140/794 (17.6%)	3/169 (1.8%)	0/3004 (0%)
196 - Cardiac Arrest	1/36 (2.8%)	17/99 (17.2%)	22/130 (16.9%)	6/145 (4.1%)	0/410 (0%)
194 - Heart Failure	11/2251 (0.5%)	4157/34777 (12%)	2760/21443 (12.9%)	103/3096 (3.3%)	2/61567 (0%)
193 - Acute & Subacute Endocarditis	0/60 (0%)	24/168 (14.3%)	20/153 (13.1%)	1/84 (1.2%)	0/465 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/1450 (0%)	240/898 (26.7%)	57/131 (43.5%)	2/21 (9.5%)	0/2500 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	4/1951 (0.2%)	479/2075 (23.1%)	235/931 (25.2%)	16/275 (5.8%)	3/5232 (0.1%)
190 - Acute Myocardial Infarction	2/1069 (0.2%)	705/3467 (20.3%)	1218/4327 (28.1%)	68/749 (9.1%)	0/9612 (0%)
180 - Other Circulatory System Procedures	0/407 (0%)	38/204 (18.6%)	14/103 (13.6%)	1/57 (1.8%)	2/771 (0.3%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/634 (0%)	127/380 (33.4%)	69/106 (65.1%)	2/25 (8%)	0/1145 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	5/1437 (0.3%)	253/720 (35.1%)	184/231 (79.7%)	5/19 (26.3%)	4/2407 (0.2%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/1991 (0%)	338/1170 (28.9%)	171/686 (24.9%)	19/164 (11.6%)	1/4011 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	4/1785 (0.2%)	715/2814 (25.4%)	465/1007 (46.2%)	72/571 (12.6%)	0/6177 (0%)
173 - Other Vascular Procedures	1/1341 (0.1%)	294/1472 (20%)	63/365 (17.3%)	2/213 (0.9%)	0/3391 (0%)

171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	2/4134 (0%)	1069/3161 (33.8%)	217/513 (42.3%)	21/109 (19.3%)	2/7917 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/85 (0%)	81/321 (25.2%)	125/227 (55.1%)	9/41 (22%)	11/674 (1.6%)
207 - Other Circulatory System Diagnoses	2/477 (0.4%)	140/868 (16.1%)	55/372 (14.8%)	4/85 (4.7%)	0/1802 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	2/304 (0.7%)	63/340 (18.5%)	58/162 (35.8%)	1/66 (1.5%)	0/872 (0%)
205 - Cardiomyopathy	0/224 (0%)	88/752 (11.7%)	49/221 (22.2%)	1/50 (2%)	0/1247 (0%)
204 - Syncope & Collapse	0/422 (0%)	123/615 (20%)	30/125 (24%)	0/6 (0%)	1/1168 (0.1%)
203 - Chest Pain	0/151 (0%)	20/94 (21.3%)	6/16 (37.5%)	0/1 (0%)	0/262 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/195 (0%)	76/244 (31.1%)	23/115 (20%)	2/160 (1.2%)	2/714 (0.3%)
201 - Cardiac Arrhythmia & Conduction Disorders	1/2058 (0%)	577/3253 (17.7%)	304/2338 (13%)	15/176 (8.5%)	0/7825 (0%)
200 - Cardiac Congenital & Valvular Disorders	2/295 (0.7%)	115/1011 (11.4%)	57/306 (18.6%)	2/65 (3.1%)	2/1677 (0.1%)
167 - Other Cardiothoracic Procedures	1/196 (0.5%)	30/200 (15%)	37/94 (39.4%)	4/26 (15.4%)	0/516 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	1/671 (0.1%)	150/514 (29.2%)	58/188 (30.9%)	2/42 (4.8%)	0/1415 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/112 (0%)	41/336 (12.2%)	32/128 (25%)	2/26 (7.7%)	1/602 (0.2%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	1/1243 (0.1%)	526/3496 (15%)	354/809 (43.8%)	8/175 (4.6%)	0/5723 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	1/44 (2.3%)	31/414 (7.5%)	68/198 (34.3%)	6/68 (8.8%)	3/724 (0.4%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	1/523 (0.2%)	257/883 (29.1%)	76/144 (52.8%)	9/39 (23.1%)	3/1589 (0.2%)
160 - Major Cardiothoracic Repair of Heart Anomaly	1/31 (3.2%)	1/22 (4.5%)	6/21 (28.6%)	0/5 (0%)	0/79 (0%)
Valvular disease					
199 - Hypertension	1/141 (0.7%)	30/158 (19%)	1/53 (1.9%)	0/6 (0%)	0/358 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	1/557 (0.2%)	113/1113 (10.2%)	21/310 (6.8%)	0/43 (0%)	0/2023 (0%)
197 - Peripheral & Other Vascular Disorders	0/176 (0%)	45/329 (13.7%)	18/224 (8%)	0/63 (0%)	1/792 (0.1%)
196 - Cardiac Arrest	0/7 (0%)	6/27 (22.2%)	2/57 (3.5%)	2/57 (3.5%)	0/148 (0%)
194 - Heart Failure	23/996 (2.3%)	900/15333 (5.9%)	494/9202 (5.4%)	32/1468 (2.2%)	1/26999 (0%)
193 - Acute & Subacute Endocarditis	0/179 (0%)	36/244 (14.8%)	11/193 (5.7%)	0/108 (0%)	1/724 (0.1%)

192 - Cardiac Catheterization for Ischemic Heart Disease	5/1091 (0.5%)	183/879 (20.8%)	12/76 (15.8%)	0/15 (0%)	0/2061 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	7/1317 (0.5%)	247/1587 (15.6%)	50/620 (8.1%)	3/267 (1.1%)	2/3791 (0.1%)
190 - Acute Myocardial Infarction	6/872 (0.7%)	400/2622 (15.3%)	291/2644 (11%)	6/390 (1.5%)	0/6528 (0%)
180 - Other Circulatory System Procedures	0/114 (0%)	6/65 (9.2%)	0/44 (0%)	0/32 (0%)	1/255 (0.4%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/49 (0%)	11/81 (13.6%)	2/24 (8.3%)	1/9 (11.1%)	1/163 (0.6%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/133 (0%)	14/98 (14.3%)	6/33 (18.2%)	1/7 (14.3%)	0/271 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	3/909 (0.3%)	172/705 (24.4%)	10/259 (3.9%)	0/89 (0%)	1/1962 (0.1%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	2/962 (0.2%)	152/1507 (10.1%)	25/378 (6.6%)	3/198 (1.5%)	0/3045 (0%)
173 - Other Vascular Procedures	1/289 (0.3%)	65/454 (14.3%)	8/107 (7.5%)	1/93 (1.1%)	1/943 (0.1%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	3/1522 (0.2%)	255/1553 (16.4%)	15/281 (5.3%)	1/62 (1.6%)	0/3418 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/18 (0%)	12/115 (10.4%)	4/88 (4.5%)	0/19 (0%)	1/240 (0.4%)
207 - Other Circulatory System Diagnoses	3/408 (0.7%)	54/463 (11.7%)	11/175 (6.3%)	0/43 (0%)	0/1089 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	1/112 (0.9%)	15/178 (8.4%)	6/105 (5.7%)	0/44 (0%)	0/439 (0%)
205 - Cardiomyopathy	0/55 (0%)	23/345 (6.7%)	4/107 (3.7%)	1/21 (4.8%)	0/528 (0%)
204 - Syncope & Collapse	3/157 (1.9%)	29/279 (10.4%)	5/51 (9.8%)	0/1 (0%)	1/488 (0.2%)
203 - Chest Pain	0/90 (0%)	10/51 (19.6%)	2/6 (33.3%)	0/1 (0%)	0/148 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/122 (0%)	14/112 (12.5%)	4/60 (6.7%)	2/65 (3.1%)	1/359 (0.3%)
201 - Cardiac Arrhythmia & Conduction Disorders	10/1697 (0.6%)	297/2828 (10.5%)	71/1210 (5.9%)	0/94 (0%)	1/5829 (0%)
200 - Cardiac Congenital & Valvular Disorders	2/202 (1%)	22/476 (4.6%)	8/135 (5.9%)	1/41 (2.4%)	0/854 (0%)
167 - Other Cardiothoracic Procedures	1/169 (0.6%)	13/132 (9.8%)	3/54 (5.6%)	1/14 (7.1%)	0/369 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	1/228 (0.4%)	30/225 (13.3%)	11/84 (13.1%)	0/15 (0%)	0/552 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/55 (0%)	12/162 (7.4%)	3/63 (4.8%)	0/14 (0%)	0/294 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	4/706 (0.6%)	83/2243 (3.7%)	21/515 (4.1%)	2/150 (1.3%)	1/3614 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/41 (0%)	10/347 (2.9%)	8/145 (5.5%)	1/55 (1.8%)	5/588 (0.9%)

161 - Cardiac Defibrillator & Heart Assist Anomaly	0/143 (0%)	22/335 (6.6%)	3/55 (5.5%)	0/19 (0%)	0/552 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/37 (0%)	3/21 (14.3%)	6/32 (18.8%)	0/4 (0%)	0/94 (0%)
Pulmonary circulation disorders					
199 - Hypertension	0/4 (0%)	9/49 (18.4%)	6/32 (18.8%)	2/5 (40%)	0/90 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/12 (0%)	17/234 (7.3%)	19/79 (24.1%)	12/25 (48%)	0/350 (0%)
197 - Peripheral & Other Vascular Disorders	0/18 (0%)	13/94 (13.8%)	217/276 (78.6%)	52/78 (66.7%)	1/466 (0.2%)
196 - Cardiac Arrest	0/0 (-)	1/5 (20%)	1/15 (6.7%)	5/24 (20.8%)	0/44 (0%)
194 - Heart Failure	0/99 (0%)	331/5328 (6.2%)	390/4091 (9.5%)	157/781 (20.1%)	0/10299 (0%)
193 - Acute & Subacute Endocarditis	0/8 (0%)	2/32 (6.2%)	20/42 (47.6%)	7/21 (33.3%)	0/103 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/27 (0%)	30/128 (23.4%)	9/22 (40.9%)	1/6 (16.7%)	0/183 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/343 (0%)	210/797 (26.3%)	65/289 (22.5%)	9/50 (18%)	0/1479 (0%)
190 - Acute Myocardial Infarction	0/5 (0%)	27/206 (13.1%)	58/424 (13.7%)	19/91 (20.9%)	0/726 (0%)
180 - Other Circulatory System Procedures	0/8 (0%)	3/22 (13.6%)	6/21 (28.6%)	1/16 (6.2%)	0/67 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/0 (-)	2/21 (9.5%)	1/6 (16.7%)	3/5 (60%)	0/32 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/3 (0%)	3/16 (18.8%)	5/8 (62.5%)	1/3 (33.3%)	0/30 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/32 (0%)	32/171 (18.7%)	10/54 (18.5%)	4/20 (20%)	1/277 (0.4%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/16 (0%)	17/100 (17%)	16/53 (30.2%)	6/29 (20.7%)	0/198 (0%)
173 - Other Vascular Procedures	1/19 (5.3%)	16/172 (9.3%)	14/57 (24.6%)	6/35 (17.1%)	0/283 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/52 (0%)	62/305 (20.3%)	25/71 (35.2%)	6/25 (24%)	0/453 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/1 (0%)	2/24 (8.3%)	2/26 (7.7%)	3/9 (33.3%)	0/60 (0%)
207 - Other Circulatory System Diagnoses	0/19 (0%)	20/111 (18%)	33/93 (35.5%)	8/27 (29.6%)	0/250 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	1/3 (33.3%)	10/35 (28.6%)	5/27 (18.5%)	5/23 (21.7%)	0/88 (0%)
205 - Cardiomyopathy	0/12 (0%)	11/134 (8.2%)	7/48 (14.6%)	2/11 (18.2%)	0/205 (0%)
204 - Syncope & Collapse	0/1 (0%)	3/41 (7.3%)	2/9 (22.2%)	0/0 (-)	0/51 (0%)

203 - Chest Pain	0/3 (0%)	1/7 (14.3%)	0/0 (-)	0/0 (-)	0/10 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/6 (0%)	5/26 (19.2%)	3/21 (14.3%)	3/22 (13.6%)	0/75 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/83 (0%)	119/675 (17.6%)	66/360 (18.3%)	22/65 (33.8%)	0/1183 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/47 (0%)	58/403 (14.4%)	16/121 (13.2%)	4/24 (16.7%)	1/595 (0.2%)
167 - Other Cardiothoracic Procedures	0/88 (0%)	23/97 (23.7%)	6/30 (20%)	3/8 (37.5%)	1/223 (0.4%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/9 (0%)	8/25 (32%)	4/11 (36.4%)	0/1 (0%)	0/46 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/2 (0%)	0/4 (0%)	1/7 (14.3%)	0/6 (0%)	0/19 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/72 (0%)	116/732 (15.8%)	14/185 (7.6%)	5/49 (10.2%)	0/1038 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/5 (0%)	12/133 (9%)	4/63 (6.3%)	1/15 (6.7%)	1/216 (0.5%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	1/6 (16.7%)	10/59 (16.9%)	3/13 (23.1%)	0/1 (0%)	0/79 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/18 (0%)	1/32 (3.1%)	1/24 (4.2%)	1/4 (25%)	0/78 (0%)
Peripheral vascular disorders					
199 - Hypertension	0/67 (0%)	6/70 (8.6%)	1/39 (2.6%)	0/1 (0%)	0/177 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	3/400 (0.8%)	34/445 (7.6%)	6/127 (4.7%)	5/30 (16.7%)	0/1002 (0%)
197 - Peripheral & Other Vascular Disorders	11/1482 (0.7%)	52/1013 (5.1%)	20/401 (5%)	13/108 (12%)	1/3004 (0%)
196 - Cardiac Arrest	0/2 (0%)	0/5 (0%)	0/11 (0%)	0/20 (0%)	0/38 (0%)
194 - Heart Failure	8/187 (4.3%)	78/2819 (2.8%)	67/2076 (3.2%)	14/351 (4%)	0/5433 (0%)
193 - Acute & Subacute Endocarditis	0/9 (0%)	1/24 (4.2%)	1/22 (4.5%)	0/10 (0%)	0/65 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	1/409 (0.2%)	24/239 (10%)	9/34 (26.5%)	1/11 (9.1%)	0/693 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	2/263 (0.8%)	32/264 (12.1%)	6/125 (4.8%)	7/38 (18.4%)	0/690 (0%)
190 - Acute Myocardial Infarction	14/463 (3%)	108/896 (12.1%)	35/869 (4%)	9/145 (6.2%)	0/2373 (0%)
180 - Other Circulatory System Procedures	0/106 (0%)	7/105 (6.7%)	2/61 (3.3%)	2/33 (6.1%)	2/305 (0.7%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/12 (0%)	1/18 (5.6%)	0/9 (0%)	0/0 (-)	0/39 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/11 (0%)	1/17 (5.9%)	0/4 (0%)	0/2 (0%)	0/34 (0%)

175 - Percutaneous Cardiovascular Procedures w/o AMI	1/587 (0.2%)	32/285 (11.2%)	13/153 (8.5%)	5/34 (14.7%)	0/1059 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/350 (0%)	11/394 (2.8%)	12/146 (8.2%)	6/89 (6.7%)	0/979 (0%)
173 - Other Vascular Procedures	20/1842 (1.1%)	85/1208 (7%)	27/249 (10.8%)	11/176 (6.2%)	2/3475 (0.1%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/215 (0%)	32/252 (12.7%)	3/54 (5.6%)	0/17 (0%)	0/538 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/1 (0%)	1/20 (5%)	1/14 (7.1%)	0/8 (0%)	1/43 (2.3%)
207 - Other Circulatory System Diagnoses	1/40 (2.5%)	6/70 (8.6%)	4/39 (10.3%)	1/5 (20%)	0/154 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	2/203 (1%)	8/96 (8.3%)	4/39 (10.3%)	0/11 (0%)	0/349 (0%)
205 - Cardiomyopathy	0/8 (0%)	1/37 (2.7%)	0/9 (0%)	0/0 (-)	0/54 (0%)
204 - Syncope & Collapse	0/39 (0%)	8/74 (10.8%)	2/14 (14.3%)	0/1 (0%)	0/128 (0%)
203 - Chest Pain	0/17 (0%)	1/14 (7.1%)	1/2 (50%)	0/0 (-)	0/33 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	5/363 (1.4%)	6/133 (4.5%)	8/81 (9.9%)	4/120 (3.3%)	0/697 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	2/145 (1.4%)	26/397 (6.5%)	15/231 (6.5%)	1/36 (2.8%)	0/809 (0%)
200 - Cardiac Congenital & Valvular Disorders	1/55 (1.8%)	10/101 (9.9%)	3/32 (9.4%)	0/6 (0%)	0/194 (0%)
167 - Other Cardiothoracic Procedures	1/14 (7.1%)	4/38 (10.5%)	7/28 (25%)	1/13 (7.7%)	1/93 (1.1%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/241 (0%)	12/157 (7.6%)	1/46 (2.2%)	0/17 (0%)	0/461 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/49 (0%)	2/107 (1.9%)	3/37 (8.1%)	1/13 (7.7%)	0/206 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	5/486 (1%)	151/1032 (14.6%)	20/166 (12%)	2/41 (4.9%)	0/1725 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/23 (0%)	6/81 (7.4%)	7/45 (15.6%)	1/17 (5.9%)	0/166 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/46 (0%)	8/86 (9.3%)	1/11 (9.1%)	0/4 (0%)	0/147 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/1 (0%)	0/1 (0%)	0/1 (0%)	0/1 (0%)	0/4 (0%)
Hypertension uncomplicated					
199 - Hypertension	1/33 (3%)	0/46 (0%)	0/17 (0%)	0/1 (0%)	0/97 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	21/3992 (0.5%)	7/1954 (0.4%)	3/456 (0.7%)	0/75 (0%)	0/6477 (0%)
197 - Peripheral & Other Vascular Disorders	33/5556 (0.6%)	5/2631 (0.2%)	5/988 (0.5%)	0/221 (0%)	0/9396 (0%)

196 - Cardiac Arrest	0/25 (0%)	1/67 (1.5%)	1/73 (1.4%)	0/92 (0%)	0/257 (0%)
194 - Heart Failure	146/2995 (4.9%)	30/18438 (0.2%)	53/10246 (0.5%)	5/1329 (0.4%)	0/33008 (0%)
193 - Acute & Subacute Endocarditis	0/98 (0%)	0/140 (0%)	0/110 (0%)	0/61 (0%)	0/409 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	23/9185 (0.3%)	1/1319 (0.1%)	0/115 (0%)	0/23 (0%)	1/10642 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	28/5593 (0.5%)	0/1933 (0%)	4/732 (0.5%)	0/265 (0%)	0/8523 (0%)
190 - Acute Myocardial Infarction	106/6237 (1.7%)	38/6167 (0.6%)	18/3499 (0.5%)	4/554 (0.7%)	0/16457 (0%)
180 - Other Circulatory System Procedures	2/3887 (0.1%)	0/247 (0%)	2/64 (3.1%)	0/49 (0%)	2/4247 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	2/357 (0.6%)	1/188 (0.5%)	1/59 (1.7%)	1/5 (20%)	2/609 (0.3%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	3/967 (0.3%)	6/356 (1.7%)	0/89 (0%)	0/8 (0%)	0/1420 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	40/13292 (0.3%)	4/1753 (0.2%)	2/773 (0.3%)	0/143 (0%)	0/15961 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	28/8933 (0.3%)	1/5525 (0%)	6/827 (0.7%)	0/415 (0%)	0/15700 (0%)
173 - Other Vascular Procedures	33/5603 (0.6%)	1/2730 (0%)	1/358 (0.3%)	1/370 (0.3%)	1/9061 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	58/10739 (0.5%)	7/3302 (0.2%)	5/486 (1%)	0/66 (0%)	3/14593 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	1/61 (1.6%)	1/161 (0.6%)	2/103 (1.9%)	0/15 (0%)	1/340 (0.3%)
207 - Other Circulatory System Diagnoses	12/1022 (1.2%)	3/692 (0.4%)	2/292 (0.7%)	0/41 (0%)	0/2047 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	7/387 (1.8%)	0/236 (0%)	1/83 (1.2%)	0/21 (0%)	0/727 (0%)
205 - Cardiomyopathy	0/165 (0%)	1/313 (0.3%)	0/88 (0%)	0/15 (0%)	0/581 (0%)
204 - Syncope & Collapse	2/890 (0.2%)	0/574 (0%)	1/94 (1.1%)	0/3 (0%)	0/1561 (0%)
203 - Chest Pain	3/787 (0.4%)	0/106 (0%)	0/18 (0%)	0/1 (0%)	0/912 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	8/1226 (0.7%)	1/493 (0.2%)	3/186 (1.6%)	0/287 (0%)	0/2192 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	60/7634 (0.8%)	6/5073 (0.1%)	14/2264 (0.6%)	1/162 (0.6%)	0/15133 (0%)
200 - Cardiac Congenital & Valvular Disorders	4/476 (0.8%)	4/725 (0.6%)	0/198 (0%)	0/36 (0%)	0/1435 (0%)
167 - Other Cardiothoracic Procedures	2/364 (0.5%)	0/154 (0%)	1/64 (1.6%)	0/27 (0%)	0/609 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	22/2950 (0.7%)	0/1277 (0%)	4/287 (1.4%)	0/44 (0%)	1/4558 (0%)

165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	6/516 (1.2%)	0/600 (0%)	0/186 (0%)	1/24 (4.2%)	0/1326 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	21/2461 (0.9%)	2/4236 (0%)	5/628 (0.8%)	1/122 (0.8%)	1/7447 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/89 (0%)	0/367 (0%)	1/143 (0.7%)	0/52 (0%)	0/651 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	7/814 (0.9%)	0/668 (0%)	0/64 (0%)	0/19 (0%)	0/1565 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/14 (0%)	0/14 (0%)	0/2 (0%)	0/0 (-)	0/30 (0%)
Paralysis					
199 - Hypertension	0/11 (0%)	1/12 (8.3%)	3/10 (30%)	0/2 (0%)	0/35 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/8 (0%)	7/16 (43.8%)	3/16 (18.8%)	1/11 (9.1%)	0/51 (0%)
197 - Peripheral & Other Vascular Disorders	1/44 (2.3%)	12/38 (31.6%)	5/30 (16.7%)	0/8 (0%)	0/120 (0%)
196 - Cardiac Arrest	0/2 (0%)	0/0 (-)	1/3 (33.3%)	0/10 (0%)	0/15 (0%)
194 - Heart Failure	0/13 (0%)	9/101 (8.9%)	20/204 (9.8%)	4/89 (4.5%)	0/407 (0%)
193 - Acute & Subacute Endocarditis	0/2 (0%)	0/4 (0%)	0/22 (0%)	0/16 (0%)	0/44 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/8 (0%)	2/4 (50%)	1/4 (25%)	0/1 (0%)	0/17 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/3 (0%)	1/3 (33.3%)	0/11 (0%)	1/12 (8.3%)	0/29 (0%)
190 - Acute Myocardial Infarction	0/7 (0%)	7/17 (41.2%)	6/80 (7.5%)	1/46 (2.2%)	0/150 (0%)
180 - Other Circulatory System Procedures	0/1 (0%)	4/7 (57.1%)	1/3 (33.3%)	0/4 (0%)	0/15 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/0 (-)	0/0 (-)	0/0 (-)	0/1 (0%)	0/1 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/0 (-)	0/0 (-)	0/0 (-)	0/1 (0%)	0/1 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/4 (0%)	3/12 (25%)	0/6 (0%)	0/6 (0%)	0/28 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/16 (0%)	2/18 (11.1%)	0/38 (0%)	2/35 (5.7%)	0/107 (0%)
173 - Other Vascular Procedures	0/14 (0%)	6/30 (20%)	0/24 (0%)	0/21 (0%)	0/89 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/10 (0%)	8/22 (36.4%)	0/13 (0%)	0/11 (0%)	0/56 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/0 (-)	0/1 (0%)	0/0 (-)	0/1 (0%)
207 - Other Circulatory System Diagnoses	0/12 (0%)	5/12 (41.7%)	2/7 (28.6%)	0/4 (0%)	0/35 (0%)

206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/3 (0%)	2/7 (28.6%)	0/6 (0%)	0/4 (0%)	0/20 (0%)
205 - Cardiomyopathy	0/0 (-)	1/5 (20%)	0/2 (0%)	0/3 (0%)	0/10 (0%)
204 - Syncope & Collapse	0/17 (0%)	5/10 (50%)	0/3 (0%)	0/0 (-)	0/30 (0%)
203 - Chest Pain	0/2 (0%)	1/1 (100%)	0/0 (-)	0/0 (-)	0/3 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/7 (0%)	0/4 (0%)	0/9 (0%)	0/19 (0%)	0/39 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/22 (0%)	13/45 (28.9%)	3/54 (5.6%)	0/17 (0%)	0/138 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/1 (0%)	0/3 (0%)	0/11 (0%)	0/2 (0%)	0/17 (0%)
167 - Other Cardiothoracic Procedures	0/5 (0%)	1/1 (100%)	0/3 (0%)	0/0 (-)	0/9 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/4 (0%)	1/8 (12.5%)	0/11 (0%)	0/8 (0%)	0/31 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/2 (0%)	0/1 (0%)	0/5 (0%)	1/1 (100%)	0/9 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/13 (0%)	3/30 (10%)	1/41 (2.4%)	0/19 (0%)	0/103 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/1 (0%)	0/4 (0%)	1/15 (6.7%)	0/5 (0%)	0/25 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/2 (0%)	0/0 (-)	1/3 (33.3%)	0/0 (-)	0/5 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/2 (0%)	0/1 (0%)	1/3 (33.3%)	0/2 (0%)	0/8 (0%)
Other neurological disorders					
199 - Hypertension	0/46 (0%)	26/80 (32.5%)	8/30 (26.7%)	0/3 (0%)	0/159 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/72 (0%)	58/233 (24.9%)	20/109 (18.3%)	6/29 (20.7%)	0/443 (0%)
197 - Peripheral & Other Vascular Disorders	0/178 (0%)	71/280 (25.4%)	21/167 (12.6%)	5/40 (12.5%)	0/665 (0%)
196 - Cardiac Arrest	0/8 (0%)	9/26 (34.6%)	11/45 (24.4%)	33/130 (25.4%)	0/209 (0%)
194 - Heart Failure	3/67 (4.5%)	155/2130 (7.3%)	211/1865 (11.3%)	32/375 (8.5%)	0/4437 (0%)
193 - Acute & Subacute Endocarditis	0/6 (0%)	7/29 (24.1%)	0/23 (0%)	2/22 (9.1%)	0/80 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/96 (0%)	14/44 (31.8%)	4/16 (25%)	1/4 (25%)	0/160 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/96 (0%)	32/102 (31.4%)	12/52 (23.1%)	7/54 (13%)	0/304 (0%)
190 - Acute Myocardial Infarction	1/65 (1.5%)	73/340 (21.5%)	74/541 (13.7%)	20/183 (10.9%)	0/1129 (0%)

180 - Other Circulatory System Procedures	0/103 (0%)	6/29 (20.7%)	0/18 (0%)	1/10 (10%)	0/160 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/9 (0%)	6/23 (26.1%)	4/9 (44.4%)	0/1 (0%)	0/42 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	1/9 (11.1%)	7/17 (41.2%)	3/7 (42.9%)	1/2 (50%)	0/35 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/74 (0%)	31/75 (41.3%)	8/40 (20%)	1/26 (3.8%)	0/215 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/98 (0%)	42/192 (21.9%)	16/78 (20.5%)	12/111 (10.8%)	0/479 (0%)
173 - Other Vascular Procedures	0/76 (0%)	35/156 (22.4%)	7/61 (11.5%)	1/36 (2.8%)	0/329 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	1/262 (0.4%)	128/429 (29.8%)	12/86 (14%)	0/32 (0%)	0/809 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/12 (0%)	3/16 (18.8%)	0/4 (0%)	0/32 (0%)
207 - Other Circulatory System Diagnoses	0/65 (0%)	23/97 (23.7%)	8/37 (21.6%)	2/21 (9.5%)	0/220 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/10 (0%)	5/33 (15.2%)	4/21 (19%)	1/7 (14.3%)	0/71 (0%)
205 - Cardiomyopathy	0/3 (0%)	5/16 (31.2%)	3/10 (30%)	1/13 (7.7%)	0/42 (0%)
204 - Syncope & Collapse	2/118 (1.7%)	52/179 (29.1%)	9/32 (28.1%)	0/0 (-)	0/329 (0%)
203 - Chest Pain	0/25 (0%)	0/14 (0%)	0/1 (0%)	0/1 (0%)	0/41 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/13 (0%)	6/20 (30%)	0/10 (0%)	1/37 (2.7%)	1/80 (1.2%)
201 - Cardiac Arrhythmia & Conduction Disorders	1/240 (0.4%)	155/654 (23.7%)	53/408 (13%)	10/71 (14.1%)	0/1373 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/19 (0%)	6/52 (11.5%)	3/34 (8.8%)	1/10 (10%)	0/115 (0%)
167 - Other Cardiothoracic Procedures	0/17 (0%)	1/11 (9.1%)	2/11 (18.2%)	0/5 (0%)	0/44 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/31 (0%)	7/26 (26.9%)	2/19 (10.5%)	0/7 (0%)	0/83 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/2 (0%)	1/22 (4.5%)	1/11 (9.1%)	0/3 (0%)	0/38 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/41 (0%)	31/165 (18.8%)	12/60 (20%)	3/33 (9.1%)	0/299 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/1 (0%)	0/29 (0%)	2/21 (9.5%)	0/11 (0%)	0/62 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/15 (0%)	3/14 (21.4%)	2/9 (22.2%)	0/9 (0%)	0/47 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/4 (0%)	1/4 (25%)	3/7 (42.9%)	0/1 (0%)	0/16 (0%)
199 - Hypertension	0/107 (0%)	18/158 (11.4%)	6/95 (6.3%)	0/7 (0%)	0/367 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	1/338 (0.3%)	56/727 (7.7%)	16/218 (7.3%)	1/44 (2.3%)	0/1327 (0%)

197 - Peripheral & Other Vascular Disorders	1/533 (0.2%)	70/607 (11.5%)	19/271 (7%)	1/65 (1.5%)	0/1476 (0%)
196 - Cardiac Arrest	0/7 (0%)	3/25 (12%)	3/47 (6.4%)	0/52 (0%)	0/131 (0%)
194 - Heart Failure	12/1157 (1%)	753/14524 (5.2%)	470/10161 (4.6%)	27/1477 (1.8%)	0/27319 (0%)
193 - Acute & Subacute Endocarditis	0/23 (0%)	3/66 (4.5%)	4/46 (8.7%)	0/30 (0%)	0/165 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	1/538 (0.2%)	78/344 (22.7%)	5/66 (7.6%)	0/13 (0%)	0/961 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	2/850 (0.2%)	255/1191 (21.4%)	30/412 (7.3%)	1/97 (1%)	0/2550 (0%)
190 - Acute Myocardial Infarction	8/394 (2%)	105/1032 (10.2%)	114/1256 (9.1%)	2/220 (0.9%)	0/2902 (0%)
180 - Other Circulatory System Procedures	1/579 (0.2%)	9/95 (9.5%)	4/60 (6.7%)	0/30 (0%)	1/764 (0.1%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/25 (0%)	7/52 (13.5%)	1/19 (5.3%)	0/4 (0%)	0/100 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	2/68 (2.9%)	9/47 (19.1%)	2/14 (14.3%)	0/5 (0%)	0/134 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	1/673 (0.1%)	56/461 (12.1%)	14/172 (8.1%)	0/42 (0%)	1/1348 (0.1%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/574 (0%)	51/643 (7.9%)	20/192 (10.4%)	1/79 (1.3%)	0/1488 (0%)
173 - Other Vascular Procedures	0/607 (0%)	88/672 (13.1%)	5/137 (3.6%)	1/140 (0.7%)	0/1556 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	3/762 (0.4%)	135/884 (15.3%)	15/178 (8.4%)	1/37 (2.7%)	0/1861 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/14 (0%)	3/56 (5.4%)	5/47 (10.6%)	0/7 (0%)	0/124 (0%)
207 - Other Circulatory System Diagnoses	3/203 (1.5%)	28/388 (7.2%)	10/197 (5.1%)	0/36 (0%)	1/824 (0.1%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/38 (0%)	19/107 (17.8%)	2/56 (3.6%)	0/31 (0%)	0/232 (0%)
205 - Cardiomyopathy	0/47 (0%)	16/278 (5.8%)	2/86 (2.3%)	0/14 (0%)	0/425 (0%)
204 - Syncope & Collapse	0/83 (0%)	14/158 (8.9%)	1/36 (2.8%)	0/2 (0%)	0/279 (0%)
203 - Chest Pain	0/80 (0%)	3/30 (10%)	0/7 (0%)	0/0 (-)	0/117 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/133 (0%)	13/128 (10.2%)	5/63 (7.9%)	0/83 (0%)	0/407 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	4/931 (0.4%)	216/2014 (10.7%)	59/867 (6.8%)	3/93 (3.2%)	0/3905 (0%)
200 - Cardiac Congenital & Valvular Disorders	1/128 (0.8%)	69/612 (11.3%)	9/177 (5.1%)	0/33 (0%)	1/950 (0.1%)
167 - Other Cardiothoracic Procedures	0/130 (0%)	24/130 (18.5%)	1/43 (2.3%)	0/12 (0%)	0/315 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/217 (0%)	34/167 (20.4%)	3/51 (5.9%)	0/13 (0%)	0/448 (0%)

165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/36 (0%)	2/78 (2.6%)	0/37 (0%)	0/14 (0%)	0/165 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	1/356 (0.3%)	179/1288 (13.9%)	14/261 (5.4%)	1/72 (1.4%)	0/1977 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/15 (0%)	14/180 (7.8%)	7/82 (8.5%)	0/21 (0%)	3/298 (1%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/80 (0%)	20/178 (11.2%)	1/30 (3.3%)	0/7 (0%)	0/295 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/24 (0%)	1/33 (3%)	1/24 (4.2%)	0/4 (0%)	0/85 (0%)
Diabetes uncomplicated					
199 - Hypertension	0/382 (0%)	77/299 (25.8%)	16/102 (15.7%)	0/11 (0%)	0/794 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	2/1652 (0.1%)	281/1706 (16.5%)	86/464 (18.5%)	1/80 (1.2%)	0/3902 (0%)
197 - Peripheral & Other Vascular Disorders	3/1730 (0.2%)	230/1225 (18.8%)	86/446 (19.3%)	0/75 (0%)	0/3476 (0%)
196 - Cardiac Arrest	0/13 (0%)	8/54 (14.8%)	7/77 (9.1%)	1/85 (1.2%)	0/229 (0%)
194 - Heart Failure	12/1422 (0.8%)	2093/17184 (12.2%)	1111/10245 (10.8%)	11/1334 (0.8%)	1/30185 (0%)
193 - Acute & Subacute Endocarditis	0/32 (0%)	14/89 (15.7%)	9/79 (11.4%)	1/44 (2.3%)	0/244 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	1/3870 (0%)	277/944 (29.3%)	22/96 (22.9%)	0/14 (0%)	1/4924 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	1/1981 (0.1%)	252/1249 (20.2%)	55/498 (11%)	1/124 (0.8%)	0/3852 (0%)
190 - Acute Myocardial Infarction	3/2134 (0.1%)	993/3834 (25.9%)	527/2889 (18.2%)	1/431 (0.2%)	1/9288 (0%)
180 - Other Circulatory System Procedures	0/1076 (0%)	28/142 (19.7%)	2/47 (4.3%)	0/23 (0%)	0/1288 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/130 (0%)	24/116 (20.7%)	6/38 (15.8%)	0/7 (0%)	0/291 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	1/297 (0.3%)	33/180 (18.3%)	16/58 (27.6%)	0/5 (0%)	0/540 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/5636 (0%)	324/1238 (26.2%)	65/493 (13.2%)	0/96 (0%)	1/7463 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/3496 (0%)	330/2815 (11.7%)	91/568 (16%)	4/293 (1.4%)	0/7172 (0%)
173 - Other Vascular Procedures	0/1739 (0%)	210/1549 (13.6%)	23/191 (12%)	0/120 (0%)	0/3599 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	1/3535 (0%)	469/1869 (25.1%)	46/307 (15%)	0/55 (0%)	0/5766 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/22 (0%)	19/118 (16.1%)	12/71 (16.9%)	0/9 (0%)	1/220 (0.5%)
207 - Other Circulatory System Diagnoses	0/286 (0%)	72/418 (17.2%)	25/214 (11.7%)	0/23 (0%)	0/941 (0%)

206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/147 (0%)	45/174 (25.9%)	6/58 (10.3%)	1/13 (7.7%)	0/392 (0%)
205 - Cardiomyopathy	0/46 (0%)	19/239 (7.9%)	13/79 (16.5%)	0/13 (0%)	0/377 (0%)
204 - Syncope & Collapse	0/242 (0%)	70/318 (22%)	10/58 (17.2%)	0/2 (0%)	0/620 (0%)
203 - Chest Pain	0/181 (0%)	20/68 (29.4%)	2/6 (33.3%)	0/0 (-)	0/255 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/273 (0%)	42/186 (22.6%)	5/50 (10%)	1/79 (1.3%)	0/588 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/2251 (0%)	507/3225 (15.7%)	212/1548 (13.7%)	0/120 (0%)	0/7144 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/159 (0%)	57/460 (12.4%)	19/152 (12.5%)	0/29 (0%)	0/800 (0%)
167 - Other Cardiothoracic Procedures	0/96 (0%)	9/82 (11%)	5/37 (13.5%)	0/9 (0%)	0/224 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	1/1382 (0.1%)	155/690 (22.5%)	47/179 (26.3%)	1/24 (4.2%)	2/2275 (0.1%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/225 (0%)	36/351 (10.3%)	9/92 (9.8%)	0/16 (0%)	0/684 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/646 (0%)	213/1672 (12.7%)	34/297 (11.4%)	0/64 (0%)	0/2679 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/32 (0%)	13/159 (8.2%)	12/83 (14.5%)	0/21 (0%)	0/295 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	2/392 (0.5%)	68/457 (14.9%)	10/47 (21.3%)	0/16 (0%)	0/912 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/3 (0%)	0/4 (0%)	0/0 (-)	0/0 (-)	0/7 (0%)
Diabetes complicated					
199 - Hypertension	0/30 (0%)	27/130 (20.8%)	9/55 (16.4%)	0/1 (0%)	0/216 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	2/97 (2.1%)	77/425 (18.1%)	23/165 (13.9%)	0/32 (0%)	0/719 (0%)
197 - Peripheral & Other Vascular Disorders	7/541 (1.3%)	285/937 (30.4%)	54/310 (17.4%)	0/51 (0%)	0/1839 (0%)
196 - Cardiac Arrest	0/2 (0%)	2/12 (16.7%)	0/16 (0%)	0/21 (0%)	0/51 (0%)
194 - Heart Failure	15/188 (8%)	524/5337 (9.8%)	395/3923 (10.1%)	16/625 (2.6%)	0/10073 (0%)
193 - Acute & Subacute Endocarditis	0/5 (0%)	7/42 (16.7%)	4/29 (13.8%)	1/20 (5%)	0/96 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/199 (0%)	60/239 (25.1%)	11/42 (26.2%)	0/10 (0%)	0/490 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/75 (0%)	50/224 (22.3%)	9/87 (10.3%)	2/29 (6.9%)	0/415 (0%)
190 - Acute Myocardial Infarction	3/116 (2.6%)	117/694 (16.9%)	128/949 (13.5%)	3/178 (1.7%)	0/1937 (0%)

180 - Other Circulatory System Procedures	1/58 (1.7%)	32/121 (26.4%)	14/65 (21.5%)	1/18 (5.6%)	3/262 (1.1%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/9 (0%)	4/21 (19%)	3/10 (30%)	1/6 (16.7%)	1/46 (2.2%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/13 (0%)	6/23 (26.1%)	1/6 (16.7%)	0/1 (0%)	0/43 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	1/266 (0.4%)	88/302 (29.1%)	16/131 (12.2%)	0/27 (0%)	0/726 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/154 (0%)	74/383 (19.3%)	25/138 (18.1%)	1/78 (1.3%)	0/753 (0%)
173 - Other Vascular Procedures	4/495 (0.8%)	212/1184 (17.9%)	28/209 (13.4%)	0/60 (0%)	0/1948 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	1/154 (0.6%)	100/411 (24.3%)	11/68 (16.2%)	1/23 (4.3%)	0/656 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/1 (0%)	5/28 (17.9%)	0/27 (0%)	0/6 (0%)	0/62 (0%)
207 - Other Circulatory System Diagnoses	0/18 (0%)	19/105 (18.1%)	0/39 (0%)	0/8 (0%)	0/170 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/29 (0%)	24/91 (26.4%)	8/48 (16.7%)	1/20 (5%)	0/188 (0%)
205 - Cardiomyopathy	0/1 (0%)	6/51 (11.8%)	1/15 (6.7%)	0/4 (0%)	0/71 (0%)
204 - Syncope & Collapse	0/15 (0%)	14/59 (23.7%)	2/15 (13.3%)	0/1 (0%)	0/90 (0%)
203 - Chest Pain	0/7 (0%)	5/17 (29.4%)	1/1 (100%)	0/0 (-)	0/25 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/47 (0%)	8/31 (25.8%)	0/13 (0%)	1/18 (5.6%)	0/109 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	2/141 (1.4%)	108/552 (19.6%)	30/326 (9.2%)	1/36 (2.8%)	1/1055 (0.1%)
200 - Cardiac Congenital & Valvular Disorders	1/9 (11.1%)	4/57 (7%)	1/31 (3.2%)	0/7 (0%)	0/104 (0%)
167 - Other Cardiothoracic Procedures	0/3 (0%)	6/14 (42.9%)	1/5 (20%)	0/1 (0%)	0/23 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	1/91 (1.1%)	31/107 (29%)	9/43 (20.9%)	0/6 (0%)	0/247 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/15 (0%)	5/53 (9.4%)	0/29 (0%)	0/5 (0%)	0/102 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/36 (0%)	25/125 (20%)	3/46 (6.5%)	1/19 (5.3%)	0/226 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/0 (-)	1/19 (5.3%)	0/12 (0%)	0/2 (0%)	0/33 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/15 (0%)	8/50 (16%)	1/12 (8.3%)	0/4 (0%)	0/81 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/0 (-)	0/2 (0%)	0/0 (-)	0/2 (0%)	0/4 (0%)
Hypothyroidism					

199 - Hypertension	0/84 (0%)	0/68 (0%)	1/31 (3.2%)	0/4 (0%)	0/187 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/173 (0%)	1/315 (0.3%)	1/90 (1.1%)	0/10 (0%)	0/588 (0%)
197 - Peripheral & Other Vascular Disorders	0/230 (0%)	0/191 (0%)	1/93 (1.1%)	0/16 (0%)	0/530 (0%)
196 - Cardiac Arrest	0/2 (0%)	0/13 (0%)	0/14 (0%)	0/16 (0%)	0/45 (0%)
194 - Heart Failure	1/370 (0.3%)	29/4609 (0.6%)	23/2899 (0.8%)	2/441 (0.5%)	0/8319 (0%)
193 - Acute & Subacute Endocarditis	0/9 (0%)	0/21 (0%)	0/14 (0%)	0/7 (0%)	0/51 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/227 (0%)	3/83 (3.6%)	0/15 (0%)	0/1 (0%)	0/326 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/256 (0%)	1/233 (0.4%)	0/103 (0%)	1/32 (3.1%)	1/624 (0.2%)
190 - Acute Myocardial Infarction	1/200 (0.5%)	4/350 (1.1%)	5/400 (1.2%)	1/63 (1.6%)	1/1013 (0.1%)
180 - Other Circulatory System Procedures	1/260 (0.4%)	0/27 (0%)	0/15 (0%)	0/5 (0%)	1/307 (0.3%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/18 (0%)	0/22 (0%)	0/4 (0%)	0/2 (0%)	0/46 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/31 (0%)	0/18 (0%)	0/4 (0%)	0/2 (0%)	0/55 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/267 (0%)	1/112 (0.9%)	0/65 (0%)	0/17 (0%)	0/461 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/215 (0%)	1/229 (0.4%)	0/37 (0%)	0/26 (0%)	0/507 (0%)
173 - Other Vascular Procedures	0/128 (0%)	2/131 (1.5%)	1/38 (2.6%)	0/18 (0%)	0/315 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/458 (0%)	4/305 (1.3%)	0/48 (0%)	0/15 (0%)	0/826 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/2 (0%)	0/24 (0%)	0/10 (0%)	0/4 (0%)	0/40 (0%)
207 - Other Circulatory System Diagnoses	0/82 (0%)	1/132 (0.8%)	0/72 (0%)	0/8 (0%)	0/294 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/32 (0%)	1/52 (1.9%)	0/17 (0%)	0/10 (0%)	0/111 (0%)
205 - Cardiomyopathy	0/20 (0%)	1/105 (1%)	0/32 (0%)	0/4 (0%)	0/161 (0%)
204 - Syncope & Collapse	0/81 (0%)	1/84 (1.2%)	1/7 (14.3%)	0/0 (-)	0/172 (0%)
203 - Chest Pain	0/28 (0%)	0/12 (0%)	0/2 (0%)	0/0 (-)	0/42 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/22 (0%)	3/18 (16.7%)	0/10 (0%)	0/10 (0%)	0/60 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/849 (0%)	6/1076 (0.6%)	2/441 (0.5%)	0/51 (0%)	0/2417 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/41 (0%)	3/126 (2.4%)	2/44 (4.5%)	0/11 (0%)	0/222 (0%)

167 - Other Cardiothoracic Procedures	0/32 (0%)	1/22 (4.5%)	0/9 (0%)	0/2 (0%)	0/65 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/58 (0%)	1/34 (2.9%)	0/3 (0%)	0/1 (0%)	0/96 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/9 (0%)	0/17 (0%)	0/9 (0%)	0/1 (0%)	0/36 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/117 (0%)	4/263 (1.5%)	0/51 (0%)	0/20 (0%)	0/451 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/5 (0%)	0/15 (0%)	0/15 (0%)	0/5 (0%)	0/40 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/27 (0%)	0/43 (0%)	0/12 (0%)	0/3 (0%)	0/85 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/3 (0%)	0/5 (0%)	0/5 (0%)	0/0 (-)	0/13 (0%)
Renal failure					
199 - Hypertension	0/107 (0%)	38/355 (10.7%)	43/224 (19.2%)	2/15 (13.3%)	0/701 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	2/322 (0.6%)	227/1400 (16.2%)	127/524 (24.2%)	2/82 (2.4%)	1/2328 (0%)
197 - Peripheral & Other Vascular Disorders	2/486 (0.4%)	263/1209 (21.8%)	142/599 (23.7%)	9/129 (7%)	1/2423 (0%)
196 - Cardiac Arrest	0/8 (0%)	4/31 (12.9%)	4/62 (6.5%)	2/53 (3.8%)	0/154 (0%)
194 - Heart Failure	7/866 (0.8%)	594/17050 (3.5%)	2063/13198 (15.6%)	148/1956 (7.6%)	3/33070 (0%)
193 - Acute & Subacute Endocarditis	0/25 (0%)	18/103 (17.5%)	13/87 (14.9%)	3/44 (6.8%)	0/259 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	2/442 (0.5%)	260/673 (38.6%)	44/93 (47.3%)	0/13 (0%)	0/1221 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/306 (0%)	205/793 (25.9%)	82/357 (23%)	2/94 (2.1%)	1/1550 (0.1%)
190 - Acute Myocardial Infarction	3/329 (0.9%)	158/1775 (8.9%)	389/2678 (14.5%)	19/396 (4.8%)	0/5178 (0%)
180 - Other Circulatory System Procedures	1/138 (0.7%)	110/259 (42.5%)	43/127 (33.9%)	1/42 (2.4%)	5/566 (0.9%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/21 (0%)	15/93 (16.1%)	12/32 (37.5%)	1/12 (8.3%)	0/158 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/52 (0%)	16/94 (17%)	6/38 (15.8%)	0/5 (0%)	0/189 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	1/702 (0.1%)	317/759 (41.8%)	78/344 (22.7%)	1/68 (1.5%)	0/1873 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/410 (0%)	235/995 (23.6%)	76/373 (20.4%)	7/152 (4.6%)	0/1930 (0%)
173 - Other Vascular Procedures	4/530 (0.8%)	416/1459 (28.5%)	79/298 (26.5%)	4/138 (2.9%)	2/2425 (0.1%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	1/718 (0.1%)	245/1305 (18.8%)	71/300 (23.7%)	6/69 (8.7%)	0/2392 (0%)

170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/11 (0%)	0/83 (0%)	9/84 (10.7%)	0/16 (0%)	0/194 (0%)
207 - Other Circulatory System Diagnoses	0/103 (0%)	74/381 (19.4%)	25/169 (14.8%)	1/35 (2.9%)	0/688 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	2/157 (1.3%)	58/265 (21.9%)	27/179 (15.1%)	2/50 (4%)	0/651 (0%)
205 - Cardiomyopathy	0/25 (0%)	11/244 (4.5%)	15/94 (16%)	2/16 (12.5%)	0/379 (0%)
204 - Syncope & Collapse	0/74 (0%)	35/252 (13.9%)	26/66 (39.4%)	0/2 (0%)	0/394 (0%)
203 - Chest Pain	0/21 (0%)	15/55 (27.3%)	3/7 (42.9%)	0/0 (-)	0/83 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/63 (0%)	27/95 (28.4%)	7/45 (15.6%)	2/90 (2.2%)	0/293 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	3/630 (0.5%)	372/2469 (15.1%)	211/1491 (14.2%)	7/135 (5.2%)	0/4725 (0%)
200 - Cardiac Congenital & Valvular Disorders	1/60 (1.7%)	27/369 (7.3%)	35/169 (20.7%)	2/32 (6.2%)	1/630 (0.2%)
167 - Other Cardiothoracic Procedures	0/19 (0%)	6/63 (9.5%)	4/34 (11.8%)	0/8 (0%)	0/124 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/149 (0%)	41/186 (22%)	5/73 (6.8%)	0/15 (0%)	0/423 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/28 (0%)	8/87 (9.2%)	5/39 (12.8%)	1/17 (5.9%)	0/171 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	2/135 (1.5%)	31/490 (6.3%)	16/154 (10.4%)	1/58 (1.7%)	0/837 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/10 (0%)	5/82 (6.1%)	5/43 (11.6%)	1/14 (7.1%)	0/149 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/72 (0%)	21/208 (10.1%)	11/42 (26.2%)	0/6 (0%)	0/328 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/1 (0%)	1/2 (50%)	0/0 (-)	0/1 (0%)	0/4 (0%)
Liver disease					
199 - Hypertension	1/51 (2%)	11/47 (23.4%)	3/26 (11.5%)	2/4 (50%)	0/128 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/56 (0%)	32/128 (25%)	16/63 (25.4%)	10/33 (30.3%)	0/280 (0%)
197 - Peripheral & Other Vascular Disorders	0/227 (0%)	70/239 (29.3%)	23/127 (18.1%)	8/41 (19.5%)	0/634 (0%)
196 - Cardiac Arrest	0/0 (-)	1/8 (12.5%)	5/22 (22.7%)	10/47 (21.3%)	0/77 (0%)
194 - Heart Failure	20/150 (13.3%)	271/2580 (10.5%)	389/1923 (20.2%)	174/534 (32.6%)	0/5187 (0%)
193 - Acute & Subacute Endocarditis	0/23 (0%)	13/51 (25.5%)	10/50 (20%)	4/44 (9.1%)	0/168 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/69 (0%)	17/56 (30.4%)	1/9 (11.1%)	1/6 (16.7%)	0/140 (0%)

191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	1/82 (1.2%)	33/162 (20.4%)	20/89 (22.5%)	11/47 (23.4%)	2/380 (0.5%)
190 - Acute Myocardial Infarction	3/73 (4.1%)	33/169 (19.5%)	32/264 (12.1%)	31/125 (24.8%)	0/631 (0%)
180 - Other Circulatory System Procedures	1/99 (1%)	5/32 (15.6%)	3/27 (11.1%)	1/23 (4.3%)	0/181 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/13 (0%)	1/5 (20%)	1/5 (20%)	2/8 (25%)	0/31 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/31 (0%)	1/5 (20%)	0/3 (0%)	0/2 (0%)	0/41 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	2/68 (2.9%)	30/76 (39.5%)	4/33 (12.1%)	2/11 (18.2%)	0/188 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/99 (0%)	20/127 (15.7%)	12/39 (30.8%)	3/73 (4.1%)	1/338 (0.3%)
173 - Other Vascular Procedures	1/99 (1%)	31/136 (22.8%)	7/42 (16.7%)	4/57 (7%)	0/334 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	1/105 (1%)	37/135 (27.4%)	11/39 (28.2%)	4/23 (17.4%)	0/302 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/10 (0%)	4/7 (57.1%)	2/6 (33.3%)	1/23 (4.3%)
207 - Other Circulatory System Diagnoses	0/70 (0%)	26/122 (21.3%)	17/69 (24.6%)	6/29 (20.7%)	1/290 (0.3%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/24 (0%)	6/37 (16.2%)	3/26 (11.5%)	2/17 (11.8%)	0/104 (0%)
205 - Cardiomyopathy	1/19 (5.3%)	8/84 (9.5%)	5/36 (13.9%)	7/24 (29.2%)	0/163 (0%)
204 - Syncope & Collapse	0/38 (0%)	16/58 (27.6%)	5/14 (35.7%)	0/0 (-)	0/110 (0%)
203 - Chest Pain	0/17 (0%)	4/11 (36.4%)	3/5 (60%)	0/0 (-)	0/33 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/23 (0%)	2/16 (12.5%)	3/22 (13.6%)	3/50 (6%)	0/111 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/173 (0%)	75/387 (19.4%)	43/232 (18.5%)	37/96 (38.5%)	0/888 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/16 (0%)	10/62 (16.1%)	8/28 (28.6%)	10/19 (52.6%)	0/125 (0%)
167 - Other Cardiothoracic Procedures	0/9 (0%)	3/17 (17.6%)	1/6 (16.7%)	3/6 (50%)	0/38 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/24 (0%)	4/11 (36.4%)	1/8 (12.5%)	3/6 (50%)	0/49 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	1/10 (10%)	0/19 (0%)	0/6 (0%)	0/3 (0%)	0/38 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/41 (0%)	10/90 (11.1%)	9/45 (20%)	10/37 (27%)	0/213 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/0 (-)	0/17 (0%)	0/12 (0%)	2/17 (11.8%)	1/46 (2.2%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/15 (0%)	2/22 (9.1%)	3/16 (18.8%)	0/6 (0%)	0/59 (0%)

160 - Major Cardiothoracic Repair of Heart Anomaly	0/4 (0%)	0/1 (0%)	0/5 (0%)	0/2 (0%)	0/12 (0%)
Peptic ulcer disease excluding bleeding					
199 - Hypertension	0/5 (0%)	0/8 (0%)	0/1 (0%)	0/1 (0%)	0/15 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/29 (0%)	1/34 (2.9%)	0/7 (0%)	0/3 (0%)	0/73 (0%)
197 - Peripheral & Other Vascular Disorders	1/34 (2.9%)	2/29 (6.9%)	0/17 (0%)	0/4 (0%)	0/84 (0%)
196 - Cardiac Arrest	0/0 (-)	0/0 (-)	0/1 (0%)	0/0 (-)	0/1 (0%)
194 - Heart Failure	0/21 (0%)	10/309 (3.2%)	2/189 (1.1%)	1/32 (3.1%)	0/551 (0%)
193 - Acute & Subacute Endocarditis	0/2 (0%)	0/10 (0%)	0/2 (0%)	0/1 (0%)	0/15 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/55 (0%)	2/11 (18.2%)	0/1 (0%)	0/1 (0%)	0/68 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/19 (0%)	2/23 (8.7%)	1/11 (9.1%)	0/5 (0%)	0/58 (0%)
190 - Acute Myocardial Infarction	0/49 (0%)	9/76 (11.8%)	0/55 (0%)	1/6 (16.7%)	0/186 (0%)
180 - Other Circulatory System Procedures	0/30 (0%)	0/3 (0%)	0/3 (0%)	0/1 (0%)	0/37 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/2 (0%)	0/5 (0%)	0/0 (-)	0/0 (-)	0/7 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/5 (0%)	0/3 (0%)	0/0 (-)	0/0 (-)	0/8 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/42 (0%)	2/15 (13.3%)	0/4 (0%)	0/2 (0%)	0/63 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/54 (0%)	0/39 (0%)	0/9 (0%)	0/2 (0%)	0/104 (0%)
173 - Other Vascular Procedures	0/41 (0%)	0/39 (0%)	0/4 (0%)	0/10 (0%)	0/94 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/29 (0%)	1/35 (2.9%)	0/7 (0%)	0/3 (0%)	0/74 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/3 (0%)	0/2 (0%)	0/0 (-)	0/5 (0%)
207 - Other Circulatory System Diagnoses	1/15 (6.7%)	1/10 (10%)	0/2 (0%)	0/2 (0%)	0/29 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/9 (0%)	0/0 (-)	0/3 (0%)	0/0 (-)	0/12 (0%)
205 - Cardiomyopathy	0/0 (-)	1/12 (8.3%)	0/3 (0%)	0/0 (-)	0/15 (0%)
204 - Syncope & Collapse	0/11 (0%)	1/8 (12.5%)	0/0 (-)	0/1 (0%)	0/20 (0%)
203 - Chest Pain	0/10 (0%)	0/3 (0%)	0/0 (-)	0/0 (-)	0/13 (0%)

169 - Major Thoracic & Abdominal Vascular Procedures	0/15 (0%)	0/5 (0%)	0/2 (0%)	0/4 (0%)	0/26 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	1/39 (2.6%)	3/71 (4.2%)	0/24 (0%)	0/1 (0%)	0/135 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/5 (0%)	0/6 (0%)	0/3 (0%)	0/0 (-)	0/14 (0%)
167 - Other Cardiothoracic Procedures	1/4 (25%)	0/3 (0%)	0/0 (-)	0/0 (-)	0/7 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/31 (0%)	0/15 (0%)	0/1 (0%)	0/0 (-)	0/47 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/2 (0%)	0/7 (0%)	0/1 (0%)	0/0 (-)	0/10 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	1/37 (2.7%)	0/46 (0%)	0/6 (0%)	0/2 (0%)	0/91 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/0 (-)	0/6 (0%)	0/0 (-)	0/1 (0%)	0/7 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/0 (-)	0/7 (0%)	0/2 (0%)	0/0 (-)	0/9 (0%)
AIDS_HIV					
199 - Hypertension	0/6 (0%)	1/2 (50%)	0/0 (-)	0/0 (-)	0/8 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/5 (0%)	2/6 (33.3%)	1/1 (100%)	0/0 (-)	0/12 (0%)
197 - Peripheral & Other Vascular Disorders	0/26 (0%)	4/22 (18.2%)	2/8 (25%)	0/0 (-)	0/56 (0%)
196 - Cardiac Arrest	0/0 (-)	0/0 (-)	1/1 (100%)	0/1 (0%)	0/2 (0%)
194 - Heart Failure	0/11 (0%)	13/47 (27.7%)	7/38 (18.4%)	0/4 (0%)	0/100 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/9 (0%)	2/5 (40%)	0/0 (-)	0/0 (-)	0/14 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/10 (0%)	1/7 (14.3%)	3/6 (50%)	0/1 (0%)	0/24 (0%)
190 - Acute Myocardial Infarction	0/16 (0%)	7/20 (35%)	1/5 (20%)	0/3 (0%)	0/44 (0%)
180 - Other Circulatory System Procedures	0/11 (0%)	0/4 (0%)	0/2 (0%)	0/0 (-)	0/17 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/0 (-)	0/1 (0%)	0/0 (-)	0/0 (-)	0/1 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/0 (-)	0/0 (-)	0/1 (0%)	0/0 (-)	0/1 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/18 (0%)	0/3 (0%)	0/4 (0%)	0/1 (0%)	0/26 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/36 (0%)	4/45 (8.9%)	1/4 (25%)	0/2 (0%)	0/87 (0%)
173 - Other Vascular Procedures	0/36 (0%)	7/34 (20.6%)	3/4 (75%)	0/4 (0%)	0/78 (0%)

171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/11 (0%)	2/4 (50%)	0/1 (0%)	0/0 (-)	0/16 (0%)
207 - Other Circulatory System Diagnoses	0/5 (0%)	1/8 (12.5%)	1/2 (50%)	0/1 (0%)	0/16 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/5 (0%)	1/3 (33.3%)	2/6 (33.3%)	0/1 (0%)	0/15 (0%)
205 - Cardiomyopathy	0/0 (-)	1/5 (20%)	1/2 (50%)	0/0 (-)	0/7 (0%)
204 - Syncope & Collapse	0/4 (0%)	1/4 (25%)	0/1 (0%)	0/0 (-)	0/9 (0%)
203 - Chest Pain	0/1 (0%)	0/1 (0%)	0/0 (-)	0/0 (-)	0/2 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/3 (0%)	3/7 (42.9%)	0/0 (-)	0/1 (0%)	0/11 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/2 (0%)	6/17 (35.3%)	0/4 (0%)	0/0 (-)	0/23 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/0 (-)	0/3 (0%)	0/0 (-)	0/0 (-)	0/3 (0%)
167 - Other Cardiothoracic Procedures	0/0 (-)	0/1 (0%)	0/0 (-)	0/0 (-)	0/1 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/2 (0%)	1/5 (20%)	0/1 (0%)	0/0 (-)	0/8 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/0 (-)	0/2 (0%)	0/0 (-)	0/0 (-)	0/2 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/2 (0%)	0/4 (0%)	0/5 (0%)	0/0 (-)	0/11 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/2 (0%)	0/3 (0%)	1/1 (100%)	0/0 (-)	0/6 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/0 (-)	0/1 (0%)	0/0 (-)	0/0 (-)	0/1 (0%)
Lymphoma					
199 - Hypertension	0/1 (0%)	3/8 (37.5%)	1/3 (33.3%)	0/0 (-)	0/12 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/5 (0%)	7/31 (22.6%)	0/9 (0%)	0/3 (0%)	0/48 (0%)
197 - Peripheral & Other Vascular Disorders	0/13 (0%)	53/85 (62.4%)	2/15 (13.3%)	0/1 (0%)	0/114 (0%)
196 - Cardiac Arrest	0/0 (-)	1/2 (50%)	1/2 (50%)	0/0 (-)	0/4 (0%)
194 - Heart Failure	0/7 (0%)	48/420 (11.4%)	22/242 (9.1%)	1/34 (2.9%)	0/703 (0%)
193 - Acute & Subacute Endocarditis	0/0 (-)	0/3 (0%)	2/6 (33.3%)	0/1 (0%)	0/10 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/1 (0%)	5/13 (38.5%)	0/0 (-)	0/0 (-)	0/14 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/1 (0%)	9/16 (56.2%)	0/4 (0%)	0/0 (-)	0/21 (0%)

190 - Acute Myocardial Infarction	1/2 (50%)	14/31 (45.2%)	7/40 (17.5%)	1/7 (14.3%)	0/80 (0%)
180 - Other Circulatory System Procedures	0/2 (0%)	7/12 (58.3%)	0/3 (0%)	0/2 (0%)	0/19 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/0 (-)	0/1 (0%)	0/0 (-)	0/1 (0%)	0/2 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/1 (0%)	2/3 (66.7%)	1/1 (100%)	0/0 (-)	0/5 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/3 (0%)	6/14 (42.9%)	2/5 (40%)	0/0 (-)	0/22 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/2 (0%)	8/16 (50%)	0/5 (0%)	0/1 (0%)	0/24 (0%)
173 - Other Vascular Procedures	0/3 (0%)	15/34 (44.1%)	0/5 (0%)	0/1 (0%)	0/43 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/4 (0%)	27/41 (65.9%)	1/4 (25%)	0/1 (0%)	0/50 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/1 (0%)	0/1 (0%)	0/1 (0%)	0/3 (0%)
207 - Other Circulatory System Diagnoses	0/3 (0%)	6/24 (25%)	0/7 (0%)	0/1 (0%)	0/35 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/9 (0%)	13/19 (68.4%)	1/7 (14.3%)	0/5 (0%)	0/40 (0%)
205 - Cardiomyopathy	0/0 (-)	3/6 (50%)	0/0 (-)	0/1 (0%)	0/7 (0%)
204 - Syncope & Collapse	0/1 (0%)	5/14 (35.7%)	0/4 (0%)	0/1 (0%)	0/20 (0%)
203 - Chest Pain	0/0 (-)	1/4 (25%)	0/0 (-)	0/0 (-)	0/4 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/2 (0%)	6/7 (85.7%)	0/0 (-)	0/0 (-)	0/9 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/8 (0%)	47/89 (52.8%)	6/41 (14.6%)	0/4 (0%)	0/142 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/0 (-)	0/3 (0%)	0/4 (0%)	0/1 (0%)	0/8 (0%)
167 - Other Cardiothoracic Procedures	0/0 (-)	0/0 (-)	0/0 (-)	0/1 (0%)	0/1 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/0 (-)	1/3 (33.3%)	0/1 (0%)	0/1 (0%)	0/5 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/0 (-)	0/3 (0%)	0/0 (-)	0/0 (-)	0/3 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/0 (-)	2/8 (25%)	0/0 (-)	0/2 (0%)	0/10 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/0 (-)	0/0 (-)	1/2 (50%)	0/0 (-)	0/2 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/0 (-)	0/4 (0%)	0/0 (-)	0/0 (-)	0/4 (0%)
Metastatic cancer					

199 - Hypertension	0/1 (0%)	2/7 (28.6%)	8/9 (88.9%)	0/0 (-)	0/17 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/1 (0%)	13/41 (31.7%)	25/47 (53.2%)	1/4 (25%)	0/93 (0%)
197 - Peripheral & Other Vascular Disorders	1/11 (9.1%)	121/319 (37.9%)	129/234 (55.1%)	6/24 (25%)	0/588 (0%)
196 - Cardiac Arrest	1/1 (100%)	1/5 (20%)	6/6 (100%)	0/4 (0%)	0/16 (0%)
194 - Heart Failure	0/0 (-)	27/275 (9.8%)	284/662 (42.9%)	12/81 (14.8%)	0/1018 (0%)
193 - Acute & Subacute Endocarditis	0/0 (-)	1/7 (14.3%)	3/11 (27.3%)	0/2 (0%)	0/20 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/0 (-)	3/6 (50%)	8/8 (100%)	0/0 (-)	0/14 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/0 (-)	2/10 (20%)	1/1 (100%)	1/2 (50%)	0/13 (0%)
190 - Acute Myocardial Infarction	0/0 (-)	11/26 (42.3%)	60/165 (36.4%)	1/23 (4.3%)	0/214 (0%)
180 - Other Circulatory System Procedures	0/3 (0%)	12/23 (52.2%)	14/23 (60.9%)	1/4 (25%)	1/53 (1.9%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/0 (-)	0/2 (0%)	0/0 (-)	0/0 (-)	0/2 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/0 (-)	2/2 (100%)	0/0 (-)	0/0 (-)	0/2 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/0 (-)	5/15 (33.3%)	5/8 (62.5%)	0/2 (0%)	0/25 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/1 (0%)	6/22 (27.3%)	5/9 (55.6%)	2/6 (33.3%)	0/38 (0%)
173 - Other Vascular Procedures	0/2 (0%)	14/35 (40%)	10/19 (52.6%)	1/6 (16.7%)	0/62 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/0 (-)	7/25 (28%)	5/12 (41.7%)	0/0 (-)	0/37 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/0 (-)	0/1 (0%)	0/0 (-)	0/1 (0%)
207 - Other Circulatory System Diagnoses	0/1 (0%)	29/68 (42.6%)	28/46 (60.9%)	2/5 (40%)	1/120 (0.8%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/1 (0%)	37/81 (45.7%)	12/24 (50%)	1/3 (33.3%)	0/109 (0%)
205 - Cardiomyopathy	0/0 (-)	0/4 (0%)	1/2 (50%)	0/1 (0%)	0/7 (0%)
204 - Syncope & Collapse	0/1 (0%)	8/22 (36.4%)	14/15 (93.3%)	0/0 (-)	0/38 (0%)
203 - Chest Pain	0/0 (-)	1/6 (16.7%)	4/5 (80%)	1/1 (100%)	0/12 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/1 (0%)	2/3 (66.7%)	1/3 (33.3%)	0/4 (0%)	0/11 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/2 (0%)	38/132 (28.8%)	72/138 (52.2%)	1/8 (12.5%)	0/280 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/0 (-)	0/6 (0%)	4/7 (57.1%)	1/2 (50%)	0/15 (0%)

167 - Other Cardiothoracic Procedures	0/0 (-)	3/3 (100%)	0/1 (0%)	0/1 (0%)	0/5 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/0 (-)	1/3 (33.3%)	0/0 (-)	0/0 (-)	0/3 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/0 (-)	0/0 (-)	1/3 (33.3%)	0/0 (-)	0/3 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/0 (-)	0/3 (0%)	0/1 (0%)	0/2 (0%)	0/6 (0%)
Solid tumor without metastasis					
199 - Hypertension	0/1 (0%)	19/43 (44.2%)	4/15 (26.7%)	0/1 (0%)	0/60 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/3 (0%)	45/128 (35.2%)	10/39 (25.6%)	0/5 (0%)	0/175 (0%)
197 - Peripheral & Other Vascular Disorders	0/48 (0%)	168/320 (52.5%)	24/99 (24.2%)	2/14 (14.3%)	0/481 (0%)
196 - Cardiac Arrest	1/1 (100%)	1/5 (20%)	3/8 (37.5%)	0/10 (0%)	0/24 (0%)
194 - Heart Failure	0/5 (0%)	81/1139 (7.1%)	130/1054 (12.3%)	6/129 (4.7%)	0/2327 (0%)
193 - Acute & Subacute Endocarditis	0/0 (-)	2/16 (12.5%)	1/7 (14.3%)	1/5 (20%)	0/28 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/1 (0%)	50/67 (74.6%)	5/12 (41.7%)	0/0 (-)	0/80 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/4 (0%)	27/58 (46.6%)	1/19 (5.3%)	0/7 (0%)	0/88 (0%)
190 - Acute Myocardial Infarction	0/1 (0%)	38/128 (29.7%)	64/271 (23.6%)	1/29 (3.4%)	0/429 (0%)
180 - Other Circulatory System Procedures	0/3 (0%)	13/23 (56.5%)	1/5 (20%)	0/2 (0%)	0/33 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/0 (-)	3/7 (42.9%)	1/2 (50%)	0/0 (-)	0/9 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/0 (-)	4/7 (57.1%)	2/3 (66.7%)	0/0 (-)	0/10 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/2 (0%)	44/74 (59.5%)	3/13 (23.1%)	1/5 (20%)	0/94 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/2 (0%)	53/120 (44.2%)	5/16 (31.2%)	0/7 (0%)	0/145 (0%)
173 - Other Vascular Procedures	0/9 (0%)	54/109 (49.5%)	4/20 (20%)	0/11 (0%)	0/149 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/9 (0%)	124/197 (62.9%)	8/27 (29.6%)	0/2 (0%)	0/235 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/2 (0%)	0/3 (0%)	0/1 (0%)	0/6 (0%)
207 - Other Circulatory System Diagnoses	0/2 (0%)	35/70 (50%)	3/18 (16.7%)	0/4 (0%)	0/94 (0%)

206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/12 (0%)	28/44 (63.6%)	4/18 (22.2%)	0/0 (-)	0/74 (0%)
205 - Cardiomyopathy	0/0 (-)	0/14 (0%)	0/2 (0%)	0/0 (-)	0/16 (0%)
204 - Syncope & Collapse	0/3 (0%)	34/66 (51.5%)	7/14 (50%)	0/0 (-)	0/83 (0%)
203 - Chest Pain	0/2 (0%)	11/19 (57.9%)	0/2 (0%)	0/0 (-)	0/23 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/4 (0%)	12/19 (63.2%)	1/5 (20%)	0/13 (0%)	0/41 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/12 (0%)	139/343 (40.5%)	29/144 (20.1%)	1/7 (14.3%)	0/506 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/1 (0%)	9/23 (39.1%)	5/12 (41.7%)	0/1 (0%)	0/37 (0%)
167 - Other Cardiothoracic Procedures	0/1 (0%)	1/4 (25%)	1/4 (25%)	0/2 (0%)	1/11 (9.1%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/2 (0%)	14/20 (70%)	0/0 (-)	0/0 (-)	0/22 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/0 (-)	0/3 (0%)	1/2 (50%)	0/2 (0%)	0/7 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/0 (-)	11/32 (34.4%)	2/8 (25%)	0/2 (0%)	0/42 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/0 (-)	0/1 (0%)	1/3 (33.3%)	0/0 (-)	0/4 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/0 (-)	4/6 (66.7%)	1/1 (100%)	0/0 (-)	0/7 (0%)
Rheumatoid arthritis/collagen vascular diseases					
199 - Hypertension	0/34 (0%)	11/38 (28.9%)	2/15 (13.3%)	0/1 (0%)	0/88 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/63 (0%)	20/113 (17.7%)	4/37 (10.8%)	0/14 (0%)	0/227 (0%)
197 - Peripheral & Other Vascular Disorders	0/182 (0%)	39/171 (22.8%)	6/92 (6.5%)	0/46 (0%)	0/491 (0%)
196 - Cardiac Arrest	0/0 (-)	0/1 (0%)	0/18 (0%)	0/14 (0%)	0/33 (0%)
194 - Heart Failure	3/54 (5.6%)	98/1031 (9.5%)	46/794 (5.8%)	1/134 (0.7%)	0/2013 (0%)
193 - Acute & Subacute Endocarditis	0/10 (0%)	3/18 (16.7%)	2/23 (8.7%)	0/7 (0%)	0/58 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/91 (0%)	9/33 (27.3%)	0/5 (0%)	0/2 (0%)	0/131 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/94 (0%)	21/93 (22.6%)	3/24 (12.5%)	0/11 (0%)	0/222 (0%)
190 - Acute Myocardial Infarction	3/67 (4.5%)	50/173 (28.9%)	15/234 (6.4%)	0/66 (0%)	0/540 (0%)
180 - Other Circulatory System Procedures	0/105 (0%)	9/23 (39.1%)	2/10 (20%)	0/8 (0%)	0/146 (0%)

177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/3 (0%)	1/5 (20%)	0/3 (0%)	0/2 (0%)	0/13 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/8 (0%)	0/5 (0%)	0/1 (0%)	0/2 (0%)	0/16 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/103 (0%)	10/42 (23.8%)	1/23 (4.3%)	0/3 (0%)	0/171 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/111 (0%)	12/111 (10.8%)	4/32 (12.5%)	0/53 (0%)	0/307 (0%)
173 - Other Vascular Procedures	1/103 (1%)	28/144 (19.4%)	7/73 (9.6%)	1/65 (1.5%)	0/385 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/94 (0%)	25/96 (26%)	4/26 (15.4%)	0/14 (0%)	0/230 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/3 (0%)	0/3 (0%)	0/4 (0%)	0/10 (0%)
207 - Other Circulatory System Diagnoses	1/57 (1.8%)	19/100 (19%)	3/24 (12.5%)	1/10 (10%)	0/191 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	1/14 (7.1%)	7/32 (21.9%)	0/9 (0%)	0/7 (0%)	0/62 (0%)
205 - Cardiomyopathy	0/2 (0%)	1/7 (14.3%)	1/6 (16.7%)	0/1 (0%)	0/16 (0%)
204 - Syncope & Collapse	0/47 (0%)	21/94 (22.3%)	0/21 (0%)	0/0 (-)	0/162 (0%)
203 - Chest Pain	0/23 (0%)	3/8 (37.5%)	1/3 (33.3%)	0/0 (-)	0/34 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/15 (0%)	7/22 (31.8%)	1/22 (4.5%)	0/55 (0%)	0/114 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/166 (0%)	43/262 (16.4%)	10/171 (5.8%)	0/17 (0%)	0/616 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/11 (0%)	4/40 (10%)	2/15 (13.3%)	0/1 (0%)	0/67 (0%)
167 - Other Cardiothoracic Procedures	0/8 (0%)	2/7 (28.6%)	0/4 (0%)	0/1 (0%)	0/20 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/30 (0%)	8/21 (38.1%)	2/5 (40%)	0/1 (0%)	0/57 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/6 (0%)	2/17 (11.8%)	0/3 (0%)	0/5 (0%)	0/31 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/41 (0%)	18/90 (20%)	2/17 (11.8%)	0/4 (0%)	0/152 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/2 (0%)	2/11 (18.2%)	1/3 (33.3%)	0/4 (0%)	0/20 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/8 (0%)	4/14 (28.6%)	1/2 (50%)	0/4 (0%)	0/28 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/1 (0%)	0/1 (0%)	0/0 (-)	0/1 (0%)	0/3 (0%)
Coagulopathy					
199 - Hypertension	0/8 (0%)	7/28 (25%)	5/21 (23.8%)	0/4 (0%)	0/61 (0%)

198 - Angina Pectoris & Coronary Atherosclerosis	0/33 (0%)	27/116 (23.3%)	5/57 (8.8%)	1/18 (5.6%)	0/224 (0%)
197 - Peripheral & Other Vascular Disorders	1/102 (1%)	39/144 (27.1%)	19/107 (17.8%)	4/40 (10%)	0/393 (0%)
196 - Cardiac Arrest	0/0 (-)	1/3 (33.3%)	5/22 (22.7%)	1/47 (2.1%)	0/72 (0%)
194 - Heart Failure	0/17 (0%)	66/1551 (4.3%)	176/1674 (10.5%)	23/343 (6.7%)	0/3585 (0%)
193 - Acute & Subacute Endocarditis	0/8 (0%)	2/25 (8%)	3/28 (10.7%)	1/39 (2.6%)	0/100 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/36 (0%)	16/43 (37.2%)	2/9 (22.2%)	0/1 (0%)	0/89 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	1/31 (3.2%)	18/99 (18.2%)	11/62 (17.7%)	0/34 (0%)	0/226 (0%)
190 - Acute Myocardial Infarction	0/30 (0%)	33/129 (25.6%)	41/286 (14.3%)	1/68 (1.5%)	1/513 (0.2%)
180 - Other Circulatory System Procedures	0/68 (0%)	4/19 (21.1%)	2/7 (28.6%)	2/12 (16.7%)	0/106 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/2 (0%)	2/10 (20%)	1/4 (25%)	1/6 (16.7%)	0/22 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/4 (0%)	0/3 (0%)	1/6 (16.7%)	0/1 (0%)	0/14 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/39 (0%)	14/62 (22.6%)	1/34 (2.9%)	2/16 (12.5%)	0/151 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/62 (0%)	28/130 (21.5%)	4/25 (16%)	0/65 (0%)	0/282 (0%)
173 - Other Vascular Procedures	0/40 (0%)	26/98 (26.5%)	13/47 (27.7%)	5/86 (5.8%)	0/271 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/59 (0%)	52/169 (30.8%)	13/50 (26%)	0/20 (0%)	0/298 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/7 (0%)	3/10 (30%)	0/3 (0%)	0/20 (0%)
207 - Other Circulatory System Diagnoses	0/47 (0%)	22/101 (21.8%)	6/42 (14.3%)	1/27 (3.7%)	0/217 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/9 (0%)	3/29 (10.3%)	5/22 (22.7%)	0/21 (0%)	0/81 (0%)
205 - Cardiomyopathy	0/2 (0%)	5/55 (9.1%)	4/27 (14.8%)	1/11 (9.1%)	0/95 (0%)
204 - Syncope & Collapse	0/12 (0%)	15/52 (28.8%)	3/13 (23.1%)	0/0 (-)	0/77 (0%)
203 - Chest Pain	0/6 (0%)	3/10 (30%)	0/0 (-)	0/0 (-)	0/16 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/13 (0%)	6/23 (26.1%)	3/31 (9.7%)	2/114 (1.8%)	0/181 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/100 (0%)	82/422 (19.4%)	33/244 (13.5%)	2/45 (4.4%)	0/811 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/16 (0%)	13/82 (15.9%)	4/34 (11.8%)	1/17 (5.9%)	0/149 (0%)
167 - Other Cardiothoracic Procedures	0/7 (0%)	2/23 (8.7%)	4/23 (17.4%)	1/10 (10%)	0/63 (0%)

166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/17 (0%)	8/21 (38.1%)	3/8 (37.5%)	0/7 (0%)	0/53 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/2 (0%)	0/16 (0%)	1/8 (12.5%)	0/7 (0%)	0/33 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/23 (0%)	37/183 (20.2%)	10/84 (11.9%)	4/46 (8.7%)	0/336 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/0 (-)	1/18 (5.6%)	1/23 (4.3%)	2/22 (9.1%)	0/63 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/9 (0%)	6/19 (31.6%)	1/7 (14.3%)	0/9 (0%)	0/44 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/4 (0%)	0/8 (0%)	1/14 (7.1%)	1/5 (20%)	0/31 (0%)
Obesity					
199 - Hypertension	2/360 (0.6%)	2/147 (1.4%)	0/73 (0%)	0/6 (0%)	0/586 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	21/844 (2.5%)	3/576 (0.5%)	0/153 (0%)	0/25 (0%)	0/1598 (0%)
197 - Peripheral & Other Vascular Disorders	13/867 (1.5%)	3/441 (0.7%)	0/193 (0%)	0/57 (0%)	1/1558 (0.1%)
196 - Cardiac Arrest	0/4 (0%)	0/16 (0%)	0/29 (0%)	0/33 (0%)	0/82 (0%)
194 - Heart Failure	209/1555 (13.4%)	89/9358 (1%)	11/6720 (0.2%)	4/1033 (0.4%)	1/18666 (0%)
193 - Acute & Subacute Endocarditis	0/22 (0%)	0/24 (0%)	0/36 (0%)	0/14 (0%)	0/96 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	25/1682 (1.5%)	0/387 (0%)	0/44 (0%)	0/12 (0%)	0/2125 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	16/1348 (1.2%)	5/655 (0.8%)	2/275 (0.7%)	0/99 (0%)	0/2377 (0%)
190 - Acute Myocardial Infarction	76/1825 (4.2%)	28/1690 (1.7%)	2/1044 (0.2%)	0/188 (0%)	0/4747 (0%)
180 - Other Circulatory System Procedures	4/1216 (0.3%)	0/70 (0%)	0/32 (0%)	0/23 (0%)	0/1341 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	1/49 (2%)	0/33 (0%)	0/21 (0%)	0/4 (0%)	0/107 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	1/79 (1.3%)	0/40 (0%)	0/13 (0%)	0/3 (0%)	0/135 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	34/2529 (1.3%)	3/492 (0.6%)	0/287 (0%)	0/41 (0%)	0/3349 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	23/2399 (1%)	7/1594 (0.4%)	1/245 (0.4%)	0/166 (0%)	0/4404 (0%)
173 - Other Vascular Procedures	9/482 (1.9%)	0/381 (0%)	0/75 (0%)	0/79 (0%)	0/1017 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	25/1347 (1.9%)	4/708 (0.6%)	0/127 (0%)	0/32 (0%)	0/2214 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/18 (0%)	0/48 (0%)	0/46 (0%)	1/7 (14.3%)	1/119 (0.8%)

207 - Other Circulatory System Diagnoses	1/327 (0.3%)	5/248 (2%)	0/130 (0%)	0/20 (0%)	0/725 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	1/54 (1.9%)	0/67 (0%)	0/26 (0%)	0/10 (0%)	0/157 (0%)
205 - Cardiomyopathy	0/50 (0%)	2/135 (1.5%)	0/30 (0%)	0/8 (0%)	0/223 (0%)
204 - Syncope & Collapse	3/110 (2.7%)	0/110 (0%)	0/21 (0%)	0/1 (0%)	0/242 (0%)
203 - Chest Pain	1/144 (0.7%)	0/25 (0%)	0/5 (0%)	0/0 (-)	0/174 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	2/110 (1.8%)	1/79 (1.3%)	2/36 (5.6%)	0/57 (0%)	0/282 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	33/1493 (2.2%)	14/1437 (1%)	0/536 (0%)	0/61 (0%)	0/3527 (0%)
200 - Cardiac Congenital & Valvular Disorders	5/103 (4.9%)	1/207 (0.5%)	0/50 (0%)	0/10 (0%)	0/370 (0%)
167 - Other Cardiothoracic Procedures	1/91 (1.1%)	1/72 (1.4%)	0/29 (0%)	0/7 (0%)	0/199 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	20/912 (2.2%)	3/374 (0.8%)	0/82 (0%)	0/13 (0%)	0/1381 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	8/184 (4.3%)	2/233 (0.9%)	0/74 (0%)	0/12 (0%)	0/503 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	14/696 (2%)	4/1205 (0.3%)	0/183 (0%)	0/40 (0%)	0/2124 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/15 (0%)	1/119 (0.8%)	0/54 (0%)	0/14 (0%)	0/202 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	7/155 (4.5%)	0/181 (0%)	1/23 (4.3%)	0/6 (0%)	0/365 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	1/2 (50%)	0/1 (0%)	0/2 (0%)	0/0 (-)	0/5 (0%)
Weight loss					
199 - Hypertension	0/7 (0%)	1/11 (9.1%)	0/5 (0%)	0/0 (-)	0/23 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/5 (0%)	2/21 (9.5%)	9/26 (34.6%)	1/5 (20%)	0/57 (0%)
197 - Peripheral & Other Vascular Disorders	0/23 (0%)	15/47 (31.9%)	41/126 (32.5%)	3/16 (18.8%)	0/212 (0%)
196 - Cardiac Arrest	0/0 (-)	2/4 (50%)	2/4 (50%)	0/4 (0%)	0/12 (0%)
194 - Heart Failure	1/17 (5.9%)	12/251 (4.8%)	210/673 (31.2%)	36/120 (30%)	0/1061 (0%)
193 - Acute & Subacute Endocarditis	0/8 (0%)	2/8 (25%)	7/17 (41.2%)	1/8 (12.5%)	0/41 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/1 (0%)	0/0 (-)	0/3 (0%)	0/0 (-)	0/4 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/21 (0%)	0/15 (0%)	7/21 (33.3%)	0/5 (0%)	0/62 (0%)

190 - Acute Myocardial Infarction	1/10 (10%)	1/25 (4%)	16/88 (18.2%)	5/23 (21.7%)	0/146 (0%)
180 - Other Circulatory System Procedures	0/4 (0%)	1/4 (25%)	1/4 (25%)	0/1 (0%)	0/13 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/1 (0%)	0/1 (0%)	0/1 (0%)	0/1 (0%)	0/4 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/0 (-)	0/0 (-)	1/1 (100%)	0/1 (0%)	0/2 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/2 (0%)	1/4 (25%)	1/3 (33.3%)	0/3 (0%)	0/12 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/3 (0%)	1/4 (25%)	3/7 (42.9%)	0/4 (0%)	0/18 (0%)
173 - Other Vascular Procedures	1/13 (7.7%)	3/24 (12.5%)	12/27 (44.4%)	1/13 (7.7%)	0/77 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/1 (0%)	0/10 (0%)	2/5 (40%)	1/5 (20%)	0/21 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/1 (0%)	0/2 (0%)	0/0 (-)	0/3 (0%)
207 - Other Circulatory System Diagnoses	2/13 (15.4%)	4/28 (14.3%)	9/21 (42.9%)	0/5 (0%)	0/67 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/3 (0%)	2/9 (22.2%)	5/11 (45.5%)	1/5 (20%)	0/28 (0%)
205 - Cardiomyopathy	0/1 (0%)	2/7 (28.6%)	3/11 (27.3%)	0/2 (0%)	0/21 (0%)
204 - Syncope & Collapse	0/9 (0%)	2/11 (18.2%)	2/9 (22.2%)	0/0 (-)	0/29 (0%)
203 - Chest Pain	0/3 (0%)	0/1 (0%)	0/1 (0%)	0/0 (-)	0/5 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/11 (0%)	1/3 (33.3%)	1/6 (16.7%)	0/6 (0%)	0/26 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	2/25 (8%)	2/33 (6.1%)	16/55 (29.1%)	6/17 (35.3%)	0/130 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/13 (0%)	1/8 (12.5%)	5/12 (41.7%)	0/6 (0%)	0/39 (0%)
167 - Other Cardiothoracic Procedures	0/11 (0%)	1/5 (20%)	0/1 (0%)	0/3 (0%)	0/20 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/0 (-)	0/1 (0%)	0/0 (-)	0/1 (0%)	0/2 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/1 (0%)	0/3 (0%)	1/5 (20%)	0/1 (0%)	0/10 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/5 (0%)	0/11 (0%)	2/13 (15.4%)	0/1 (0%)	0/30 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/0 (-)	0/4 (0%)	0/3 (0%)	0/4 (0%)	0/11 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/0 (-)	0/1 (0%)	0/1 (0%)	0/0 (-)	0/2 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/9 (0%)	0/8 (0%)	0/3 (0%)	0/2 (0%)	0/22 (0%)

Fluid and electrolyte disorders					
199 - Hypertension	0/150 (0%)	31/211 (14.7%)	73/172 (42.4%)	7/17 (41.2%)	0/550 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	1/93 (1.1%)	31/396 (7.8%)	141/400 (35.2%)	19/78 (24.4%)	0/967 (0%)
197 - Peripheral & Other Vascular Disorders	1/118 (0.8%)	63/368 (17.1%)	157/584 (26.9%)	39/164 (23.8%)	0/1234 (0%)
196 - Cardiac Arrest	0/13 (0%)	7/43 (16.3%)	33/92 (35.9%)	25/132 (18.9%)	0/280 (0%)
194 - Heart Failure	1/391 (0.3%)	362/8446 (4.3%)	3470/12246 (28.3%)	1338/2945 (45.4%)	2/24028 (0%)
193 - Acute & Subacute Endocarditis	0/21 (0%)	3/56 (5.4%)	31/98 (31.6%)	4/65 (6.2%)	0/240 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/55 (0%)	12/75 (16%)	12/37 (32.4%)	3/15 (20%)	0/182 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/84 (0%)	17/196 (8.7%)	48/262 (18.3%)	31/163 (19%)	0/705 (0%)
190 - Acute Myocardial Infarction	0/95 (0%)	41/463 (8.9%)	318/1805 (17.6%)	147/567 (25.9%)	0/2930 (0%)
180 - Other Circulatory System Procedures	0/14 (0%)	5/31 (16.1%)	9/66 (13.6%)	9/44 (20.5%)	0/155 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/6 (0%)	1/12 (8.3%)	4/19 (21.1%)	4/8 (50%)	1/45 (2.2%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	1/4 (25%)	2/15 (13.3%)	2/11 (18.2%)	2/7 (28.6%)	1/37 (2.7%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/53 (0%)	5/88 (5.7%)	11/103 (10.7%)	5/72 (6.9%)	0/316 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/127 (0%)	20/265 (7.5%)	43/215 (20%)	30/256 (11.7%)	0/863 (0%)
173 - Other Vascular Procedures	0/53 (0%)	21/141 (14.9%)	45/169 (26.6%)	21/188 (11.2%)	0/551 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	1/203 (0.5%)	78/495 (15.8%)	92/265 (34.7%)	20/93 (21.5%)	0/1056 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/1 (0%)	2/31 (6.5%)	8/43 (18.6%)	4/17 (23.5%)	0/92 (0%)
207 - Other Circulatory System Diagnoses	0/87 (0%)	24/218 (11%)	58/181 (32%)	27/77 (35.1%)	0/563 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/20 (0%)	9/60 (15%)	8/55 (14.5%)	5/39 (12.8%)	0/174 (0%)
205 - Cardiomyopathy	0/22 (0%)	6/101 (5.9%)	14/77 (18.2%)	5/31 (16.1%)	0/231 (0%)
204 - Syncope & Collapse	0/90 (0%)	49/223 (22%)	47/90 (52.2%)	3/5 (60%)	0/408 (0%)
203 - Chest Pain	0/21 (0%)	8/25 (32%)	8/12 (66.7%)	0/2 (0%)	0/60 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/35 (0%)	11/54 (20.4%)	15/56 (26.8%)	9/161 (5.6%)	1/306 (0.3%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/632 (0%)	286/1811 (15.8%)	455/1744 (26.1%)	75/259 (29%)	0/4446 (0%)

200 - Cardiac Congenital & Valvular Disorders	0/30 (0%)	10/126 (7.9%)	31/112 (27.7%)	9/53 (17%)	1/321 (0.3%)
167 - Other Cardiothoracic Procedures	0/11 (0%)	7/21 (33.3%)	3/21 (14.3%)	2/13 (15.4%)	0/66 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/70 (0%)	17/51 (33.3%)	9/34 (26.5%)	3/18 (16.7%)	0/173 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/10 (0%)	7/46 (15.2%)	5/28 (17.9%)	2/15 (13.3%)	0/99 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/94 (0%)	55/296 (18.6%)	40/155 (25.8%)	12/79 (15.2%)	1/624 (0.2%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/2 (0%)	1/46 (2.2%)	6/52 (11.5%)	2/37 (5.4%)	0/137 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/14 (0%)	3/36 (8.3%)	5/32 (15.6%)	2/21 (9.5%)	0/103 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/5 (0%)	0/12 (0%)	3/16 (18.8%)	0/4 (0%)	0/37 (0%)
Blood loss anemia					
199 - Hypertension	0/5 (0%)	2/8 (25%)	2/7 (28.6%)	0/0 (-)	0/20 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/14 (0%)	11/56 (19.6%)	3/23 (13%)	0/3 (0%)	0/96 (0%)
197 - Peripheral & Other Vascular Disorders	1/62 (1.6%)	7/49 (14.3%)	2/33 (6.1%)	0/8 (0%)	0/152 (0%)
196 - Cardiac Arrest	0/0 (-)	0/1 (0%)	0/1 (0%)	0/3 (0%)	0/5 (0%)
194 - Heart Failure	0/17 (0%)	48/611 (7.9%)	40/363 (11%)	0/57 (0%)	0/1048 (0%)
193 - Acute & Subacute Endocarditis	0/5 (0%)	0/7 (0%)	0/8 (0%)	0/2 (0%)	0/22 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/7 (0%)	1/9 (11.1%)	0/2 (0%)	0/0 (-)	0/18 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/14 (0%)	4/14 (28.6%)	1/8 (12.5%)	0/3 (0%)	0/39 (0%)
190 - Acute Myocardial Infarction	0/7 (0%)	19/82 (23.2%)	18/109 (16.5%)	0/14 (0%)	0/212 (0%)
180 - Other Circulatory System Procedures	0/5 (0%)	0/5 (0%)	1/6 (16.7%)	0/3 (0%)	0/19 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/0 (-)	1/3 (33.3%)	0/0 (-)	0/1 (0%)	0/4 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/0 (-)	0/0 (-)	0/1 (0%)	0/0 (-)	0/1 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/9 (0%)	2/14 (14.3%)	0/6 (0%)	0/5 (0%)	0/34 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/15 (0%)	6/34 (17.6%)	5/21 (23.8%)	0/11 (0%)	0/81 (0%)
173 - Other Vascular Procedures	0/9 (0%)	0/13 (0%)	1/3 (33.3%)	0/7 (0%)	0/32 (0%)

171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/26 (0%)	11/50 (22%)	1/12 (8.3%)	0/1 (0%)	0/89 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/1 (0%)	0/0 (-)	0/3 (0%)	0/2 (0%)	0/6 (0%)
207 - Other Circulatory System Diagnoses	0/14 (0%)	6/23 (26.1%)	1/6 (16.7%)	0/0 (-)	0/43 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/0 (-)	0/7 (0%)	1/4 (25%)	0/3 (0%)	0/14 (0%)
205 - Cardiomyopathy	0/0 (-)	0/4 (0%)	0/2 (0%)	0/1 (0%)	0/7 (0%)
204 - Syncope & Collapse	0/3 (0%)	2/8 (25%)	0/0 (-)	0/0 (-)	0/11 (0%)
203 - Chest Pain	0/0 (-)	1/5 (20%)	0/0 (-)	0/0 (-)	0/5 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/0 (-)	0/4 (0%)	0/3 (0%)	0/6 (0%)	0/13 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/30 (0%)	8/92 (8.7%)	3/39 (7.7%)	0/3 (0%)	0/164 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/3 (0%)	3/9 (33.3%)	0/9 (0%)	0/5 (0%)	0/26 (0%)
167 - Other Cardiothoracic Procedures	0/1 (0%)	0/1 (0%)	0/3 (0%)	0/0 (-)	0/5 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/0 (-)	0/1 (0%)	0/0 (-)	0/0 (-)	0/1 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/0 (-)	0/5 (0%)	0/0 (-)	0/1 (0%)	0/6 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/4 (0%)	0/13 (0%)	1/6 (16.7%)	0/5 (0%)	0/28 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/0 (-)	0/4 (0%)	1/9 (11.1%)	0/3 (0%)	0/16 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/1 (0%)	0/1 (0%)	0/2 (0%)	0/1 (0%)	0/5 (0%)
Deficiency anemia					
199 - Hypertension	0/42 (0%)	6/61 (9.8%)	2/30 (6.7%)	0/1 (0%)	0/134 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/88 (0%)	13/268 (4.9%)	1/102 (1%)	0/11 (0%)	0/469 (0%)
197 - Peripheral & Other Vascular Disorders	0/158 (0%)	12/151 (7.9%)	1/99 (1%)	0/18 (0%)	0/426 (0%)
196 - Cardiac Arrest	0/1 (0%)	1/7 (14.3%)	0/8 (0%)	0/16 (0%)	0/32 (0%)
194 - Heart Failure	3/207 (1.4%)	116/3930 (3%)	55/2597 (2.1%)	7/378 (1.9%)	0/7112 (0%)
193 - Acute & Subacute Endocarditis	0/12 (0%)	0/30 (0%)	2/25 (8%)	0/8 (0%)	0/75 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/51 (0%)	8/52 (15.4%)	0/8 (0%)	0/3 (0%)	0/114 (0%)

191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/67 (0%)	13/154 (8.4%)	0/69 (0%)	0/19 (0%)	1/309 (0.3%)
190 - Acute Myocardial Infarction	0/66 (0%)	33/358 (9.2%)	19/487 (3.9%)	1/64 (1.6%)	0/975 (0%)
180 - Other Circulatory System Procedures	1/19 (5.3%)	2/19 (10.5%)	0/10 (0%)	0/5 (0%)	0/53 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/1 (0%)	3/9 (33.3%)	1/7 (14.3%)	0/2 (0%)	0/19 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/3 (0%)	0/4 (0%)	0/3 (0%)	0/2 (0%)	0/12 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/60 (0%)	11/94 (11.7%)	2/35 (5.7%)	0/11 (0%)	0/200 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/65 (0%)	11/149 (7.4%)	1/43 (2.3%)	0/33 (0%)	0/290 (0%)
173 - Other Vascular Procedures	0/41 (0%)	6/69 (8.7%)	0/32 (0%)	0/17 (0%)	0/159 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/112 (0%)	14/185 (7.6%)	0/45 (0%)	0/13 (0%)	0/355 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/1 (0%)	0/17 (0%)	0/11 (0%)	0/2 (0%)	0/31 (0%)
207 - Other Circulatory System Diagnoses	0/55 (0%)	3/106 (2.8%)	1/45 (2.2%)	1/10 (10%)	0/216 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/7 (0%)	3/35 (8.6%)	1/14 (7.1%)	0/3 (0%)	0/59 (0%)
205 - Cardiomyopathy	0/9 (0%)	2/45 (4.4%)	0/6 (0%)	0/4 (0%)	0/64 (0%)
204 - Syncope & Collapse	0/49 (0%)	8/74 (10.8%)	0/12 (0%)	0/1 (0%)	0/136 (0%)
203 - Chest Pain	0/5 (0%)	1/10 (10%)	1/4 (25%)	0/0 (-)	0/19 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/3 (0%)	0/8 (0%)	0/7 (0%)	0/7 (0%)	0/25 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/188 (0%)	30/482 (6.2%)	8/240 (3.3%)	0/29 (0%)	0/939 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/26 (0%)	3/95 (3.2%)	2/38 (5.3%)	0/9 (0%)	0/168 (0%)
167 - Other Cardiothoracic Procedures	0/8 (0%)	1/16 (6.2%)	0/8 (0%)	0/0 (-)	0/32 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/10 (0%)	3/13 (23.1%)	0/3 (0%)	0/0 (-)	0/26 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/6 (0%)	0/11 (0%)	0/10 (0%)	1/4 (25%)	0/31 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/17 (0%)	5/75 (6.7%)	1/28 (3.6%)	0/10 (0%)	0/130 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/1 (0%)	0/24 (0%)	0/20 (0%)	0/12 (0%)	0/57 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/5 (0%)	2/8 (25%)	0/5 (0%)	0/1 (0%)	0/19 (0%)

160 - Major Cardiothoracic Repair of Heart Anomaly	0/1 (0%)	0/2 (0%)	0/1 (0%)	0/1 (0%)	0/5 (0%)
Alcohol abuse					
199 - Hypertension	1/94 (1.1%)	3/53 (5.7%)	1/20 (5%)	0/4 (0%)	0/171 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	3/212 (1.4%)	11/188 (5.9%)	2/57 (3.5%)	0/12 (0%)	0/469 (0%)
197 - Peripheral & Other Vascular Disorders	8/396 (2%)	18/205 (8.8%)	4/108 (3.7%)	0/23 (0%)	0/732 (0%)
196 - Cardiac Arrest	0/2 (0%)	1/16 (6.2%)	1/24 (4.2%)	1/35 (2.9%)	0/77 (0%)
194 - Heart Failure	97/726 (13.4%)	230/3182 (7.2%)	104/1557 (6.7%)	0/326 (0%)	0/5791 (0%)
193 - Acute & Subacute Endocarditis	0/24 (0%)	2/34 (5.9%)	4/53 (7.5%)	1/28 (3.6%)	0/139 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	4/251 (1.6%)	4/87 (4.6%)	0/14 (0%)	0/4 (0%)	0/356 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	19/322 (5.9%)	22/304 (7.2%)	8/132 (6.1%)	1/50 (2%)	1/808 (0.1%)
190 - Acute Myocardial Infarction	22/431 (5.1%)	22/412 (5.3%)	6/285 (2.1%)	0/70 (0%)	0/1198 (0%)
180 - Other Circulatory System Procedures	1/106 (0.9%)	1/20 (5%)	0/19 (0%)	0/7 (0%)	0/152 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	1/12 (8.3%)	2/14 (14.3%)	0/2 (0%)	0/3 (0%)	0/31 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/8 (0%)	1/14 (7.1%)	0/4 (0%)	0/1 (0%)	0/27 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	7/237 (3%)	9/108 (8.3%)	2/66 (3%)	0/17 (0%)	0/428 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	2/482 (0.4%)	4/328 (1.2%)	2/62 (3.2%)	0/68 (0%)	0/940 (0%)
173 - Other Vascular Procedures	10/277 (3.6%)	15/210 (7.1%)	2/39 (5.1%)	0/56 (0%)	0/582 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	7/207 (3.4%)	13/173 (7.5%)	4/43 (9.3%)	0/7 (0%)	0/430 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/4 (0%)	0/8 (0%)	1/13 (7.7%)	0/4 (0%)	0/29 (0%)
207 - Other Circulatory System Diagnoses	3/140 (2.1%)	7/95 (7.4%)	2/53 (3.8%)	1/23 (4.3%)	0/311 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	1/18 (5.6%)	4/24 (16.7%)	0/20 (0%)	0/5 (0%)	0/67 (0%)
205 - Cardiomyopathy	3/68 (4.4%)	6/230 (2.6%)	1/72 (1.4%)	0/18 (0%)	0/388 (0%)
204 - Syncope & Collapse	2/104 (1.9%)	7/64 (10.9%)	1/14 (7.1%)	0/2 (0%)	0/184 (0%)
203 - Chest Pain	1/38 (2.6%)	0/10 (0%)	0/2 (0%)	0/0 (-)	0/50 (0%)

169 - Major Thoracic & Abdominal Vascular Procedures	0/83 (0%)	0/37 (0%)	0/20 (0%)	0/36 (0%)	0/176 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	16/602 (2.7%)	43/595 (7.2%)	14/250 (5.6%)	0/32 (0%)	0/1479 (0%)
200 - Cardiac Congenital & Valvular Disorders	2/33 (6.1%)	5/52 (9.6%)	3/24 (12.5%)	0/7 (0%)	0/116 (0%)
167 - Other Cardiothoracic Procedures	0/17 (0%)	0/14 (0%)	0/5 (0%)	0/0 (-)	0/36 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	5/190 (2.6%)	1/78 (1.3%)	0/14 (0%)	0/5 (0%)	0/287 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/29 (0%)	0/63 (0%)	0/15 (0%)	0/8 (0%)	0/115 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	14/150 (9.3%)	9/232 (3.9%)	2/56 (3.6%)	0/21 (0%)	0/459 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/10 (0%)	1/23 (4.3%)	0/15 (0%)	0/10 (0%)	0/58 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	3/72 (4.2%)	0/86 (0%)	1/19 (5.3%)	0/9 (0%)	0/186 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/2 (0%)	0/1 (0%)	0/0 (-)	0/0 (-)	0/3 (0%)
Drug abuse					
199 - Hypertension	0/14 (0%)	1/3 (33.3%)	0/0 (-)	0/0 (-)	0/17 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	0/23 (0%)	0/10 (0%)	0/1 (0%)	0/1 (0%)	0/35 (0%)
197 - Peripheral & Other Vascular Disorders	0/112 (0%)	3/21 (14.3%)	2/8 (25%)	0/3 (0%)	0/144 (0%)
196 - Cardiac Arrest	0/1 (0%)	0/1 (0%)	0/3 (0%)	0/6 (0%)	0/11 (0%)
194 - Heart Failure	1/37 (2.7%)	5/86 (5.8%)	6/45 (13.3%)	0/6 (0%)	0/174 (0%)
193 - Acute & Subacute Endocarditis	0/21 (0%)	1/9 (11.1%)	4/12 (33.3%)	1/7 (14.3%)	0/49 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/20 (0%)	1/2 (50%)	0/0 (-)	0/0 (-)	0/22 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/28 (0%)	0/13 (0%)	0/9 (0%)	0/2 (0%)	0/52 (0%)
190 - Acute Myocardial Infarction	1/65 (1.5%)	0/39 (0%)	2/16 (12.5%)	1/4 (25%)	0/124 (0%)
180 - Other Circulatory System Procedures	0/39 (0%)	0/4 (0%)	1/3 (33.3%)	0/1 (0%)	0/47 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/0 (-)	0/0 (-)	0/1 (0%)	0/0 (-)	0/1 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/2 (0%)	0/1 (0%)	0/0 (-)	0/0 (-)	0/3 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	1/25 (4%)	2/6 (33.3%)	0/2 (0%)	0/2 (0%)	0/35 (0%)

174 - Percutaneous Cardiovascular Procedures w/ AMI	0/86 (0%)	0/64 (0%)	0/3 (0%)	0/5 (0%)	0/158 (0%)
173 - Other Vascular Procedures	1/66 (1.5%)	1/21 (4.8%)	0/9 (0%)	0/5 (0%)	0/101 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/4 (0%)	0/2 (0%)	0/0 (-)	0/0 (-)	0/6 (0%)
207 - Other Circulatory System Diagnoses	0/48 (0%)	0/5 (0%)	0/7 (0%)	1/4 (25%)	0/64 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/6 (0%)	0/1 (0%)	0/3 (0%)	0/2 (0%)	0/12 (0%)
205 - Cardiomyopathy	0/1 (0%)	0/7 (0%)	0/1 (0%)	1/3 (33.3%)	0/12 (0%)
204 - Syncope & Collapse	0/9 (0%)	0/6 (0%)	0/0 (-)	0/0 (-)	0/15 (0%)
203 - Chest Pain	1/3 (33.3%)	0/2 (0%)	0/0 (-)	0/0 (-)	0/5 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/11 (0%)	0/3 (0%)	0/6 (0%)	0/3 (0%)	0/23 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	0/29 (0%)	0/12 (0%)	3/6 (50%)	0/1 (0%)	0/48 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/10 (0%)	1/3 (33.3%)	0/1 (0%)	0/0 (-)	0/14 (0%)
167 - Other Cardiothoracic Procedures	0/2 (0%)	0/0 (-)	0/1 (0%)	0/0 (-)	0/3 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/5 (0%)	1/3 (33.3%)	0/1 (0%)	0/0 (-)	0/9 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/3 (0%)	0/4 (0%)	0/3 (0%)	0/0 (-)	0/10 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0/13 (0%)	0/16 (0%)	2/10 (20%)	0/4 (0%)	0/43 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/2 (0%)	0/4 (0%)	0/1 (0%)	0/0 (-)	0/7 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	1/8 (12.5%)	0/2 (0%)	0/2 (0%)	0/1 (0%)	0/13 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/0 (-)	0/0 (-)	0/2 (0%)	0/1 (0%)	0/3 (0%)
Psychoses					
199 - Hypertension	0/16 (0%)	0/2 (0%)	0/1 (0%)	0/0 (-)	0/19 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	1/16 (6.2%)	1/17 (5.9%)	0/9 (0%)	0/0 (-)	0/42 (0%)
197 - Peripheral & Other Vascular Disorders	2/65 (3.1%)	0/27 (0%)	0/10 (0%)	0/6 (0%)	0/108 (0%)
196 - Cardiac Arrest	0/1 (0%)	1/1 (100%)	0/2 (0%)	0/6 (0%)	0/10 (0%)
194 - Heart Failure	11/68 (16.2%)	4/227 (1.8%)	5/173 (2.9%)	0/34 (0%)	0/502 (0%)

193 - Acute & Subacute Endocarditis	0/0 (-)	0/1 (0%)	0/2 (0%)	0/3 (0%)	0/6 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	0/11 (0%)	1/6 (16.7%)	0/2 (0%)	0/0 (-)	0/19 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0/13 (0%)	0/7 (0%)	0/10 (0%)	0/4 (0%)	0/34 (0%)
190 - Acute Myocardial Infarction	1/27 (3.7%)	0/38 (0%)	2/44 (4.5%)	0/11 (0%)	0/120 (0%)
180 - Other Circulatory System Procedures	0/32 (0%)	0/5 (0%)	0/0 (-)	0/1 (0%)	0/38 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/4 (0%)	0/0 (-)	0/2 (0%)	0/0 (-)	0/6 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/1 (0%)	0/1 (0%)	0/1 (0%)	0/0 (-)	0/3 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/10 (0%)	0/9 (0%)	1/12 (8.3%)	0/1 (0%)	0/32 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	1/29 (3.4%)	1/48 (2.1%)	0/9 (0%)	0/9 (0%)	0/95 (0%)
173 - Other Vascular Procedures	3/29 (10.3%)	1/15 (6.7%)	0/6 (0%)	0/1 (0%)	0/51 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0/42 (0%)	0/18 (0%)	1/12 (8.3%)	0/2 (0%)	0/74 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/0 (-)	0/1 (0%)	0/0 (-)	0/0 (-)	0/1 (0%)
207 - Other Circulatory System Diagnoses	1/17 (5.9%)	0/10 (0%)	0/7 (0%)	0/0 (-)	0/34 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/3 (0%)	0/3 (0%)	1/2 (50%)	0/2 (0%)	0/10 (0%)
205 - Cardiomyopathy	0/1 (0%)	0/3 (0%)	0/0 (-)	0/0 (-)	0/4 (0%)
204 - Syncope & Collapse	0/15 (0%)	0/4 (0%)	0/2 (0%)	0/0 (-)	0/21 (0%)
203 - Chest Pain	0/6 (0%)	0/1 (0%)	0/0 (-)	0/0 (-)	0/7 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/4 (0%)	0/5 (0%)	0/1 (0%)	0/8 (0%)	0/18 (0%)
201 - Cardiac Arrhythmia & Conduction Disorders	2/49 (4.1%)	1/64 (1.6%)	0/34 (0%)	0/5 (0%)	0/152 (0%)
200 - Cardiac Congenital & Valvular Disorders	1/7 (14.3%)	0/3 (0%)	0/0 (-)	0/1 (0%)	0/11 (0%)
167 - Other Cardiothoracic Procedures	0/1 (0%)	0/1 (0%)	0/1 (0%)	0/0 (-)	0/3 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0/4 (0%)	0/3 (0%)	0/1 (0%)	0/0 (-)	0/8 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/0 (-)	0/4 (0%)	0/1 (0%)	0/2 (0%)	0/7 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	1/6 (16.7%)	0/11 (0%)	1/5 (20%)	0/1 (0%)	0/23 (0%)

162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/0 (-)	0/1 (0%)	0/0 (-)	0/1 (0%)	0/2 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/1 (0%)	0/2 (0%)	0/0 (-)	0/0 (-)	0/3 (0%)
Depression					
199 - Hypertension	0/201 (0%)	0/64 (0%)	0/15 (0%)	0/2 (0%)	0/282 (0%)
198 - Angina Pectoris & Coronary Atherosclerosis	2/302 (0.7%)	1/247 (0.4%)	0/69 (0%)	0/16 (0%)	0/634 (0%)
197 - Peripheral & Other Vascular Disorders	1/491 (0.2%)	1/248 (0.4%)	0/113 (0%)	0/21 (0%)	0/873 (0%)
196 - Cardiac Arrest	0/5 (0%)	0/4 (0%)	0/10 (0%)	0/16 (0%)	0/35 (0%)
194 - Heart Failure	6/395 (1.5%)	18/2811 (0.6%)	3/1803 (0.2%)	0/252 (0%)	0/5261 (0%)
193 - Acute & Subacute Endocarditis	0/15 (0%)	0/30 (0%)	0/21 (0%)	0/10 (0%)	0/76 (0%)
192 - Cardiac Catheterization for Ischemic Heart Disease	3/362 (0.8%)	0/89 (0%)	0/14 (0%)	0/3 (0%)	0/468 (0%)
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	4/340 (1.2%)	0/204 (0%)	0/89 (0%)	0/26 (0%)	0/659 (0%)
190 - Acute Myocardial Infarction	7/407 (1.7%)	12/405 (3%)	1/343 (0.3%)	0/67 (0%)	0/1222 (0%)
180 - Other Circulatory System Procedures	0/694 (0%)	0/35 (0%)	0/16 (0%)	0/3 (0%)	0/748 (0%)
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0/17 (0%)	0/16 (0%)	0/4 (0%)	0/2 (0%)	0/39 (0%)
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0/25 (0%)	0/10 (0%)	0/3 (0%)	0/2 (0%)	0/40 (0%)
175 - Percutaneous Cardiovascular Procedures w/o AMI	0/319 (0%)	2/93 (2.2%)	0/49 (0%)	0/12 (0%)	0/473 (0%)
174 - Percutaneous Cardiovascular Procedures w/ AMI	0/388 (0%)	4/293 (1.4%)	1/56 (1.8%)	0/35 (0%)	0/772 (0%)
173 - Other Vascular Procedures	2/195 (1%)	2/134 (1.5%)	0/43 (0%)	0/22 (0%)	0/394 (0%)
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	5/485 (1%)	0/213 (0%)	0/46 (0%)	0/15 (0%)	0/759 (0%)
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0/5 (0%)	0/15 (0%)	0/13 (0%)	0/2 (0%)	0/35 (0%)
207 - Other Circulatory System Diagnoses	0/195 (0%)	2/129 (1.6%)	0/59 (0%)	0/5 (0%)	0/388 (0%)
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0/24 (0%)	0/48 (0%)	0/22 (0%)	0/7 (0%)	0/101 (0%)
205 - Cardiomyopathy	0/22 (0%)	0/52 (0%)	0/16 (0%)	0/6 (0%)	0/96 (0%)
204 - Syncope & Collapse	1/191 (0.5%)	0/89 (0%)	0/15 (0%)	0/0 (-)	0/295 (0%)

203 - Chest Pain	0/81 (0%)	0/16 (0%)	0/5 (0%)	0/0 (-)	0/102 (0%)
169 - Major Thoracic & Abdominal Vascular Procedures	0/44 (0%)	1/20 (5%)	1/10 (10%)	0/14 (0%)	1/88 (1.1%)
201 - Cardiac Arrhythmia & Conduction Disorders	4/742 (0.5%)	4/650 (0.6%)	0/249 (0%)	0/24 (0%)	0/1665 (0%)
200 - Cardiac Congenital & Valvular Disorders	0/41 (0%)	1/88 (1.1%)	0/30 (0%)	0/4 (0%)	0/163 (0%)
167 - Other Cardiothoracic Procedures	0/37 (0%)	0/11 (0%)	0/5 (0%)	0/2 (0%)	0/55 (0%)
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	3/92 (3.3%)	1/44 (2.3%)	0/20 (0%)	0/2 (0%)	0/158 (0%)
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0/16 (0%)	0/47 (0%)	0/17 (0%)	0/1 (0%)	0/81 (0%)
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	1/125 (0.8%)	1/190 (0.5%)	0/45 (0%)	0/11 (0%)	0/371 (0%)
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0/7 (0%)	0/31 (0%)	0/12 (0%)	0/2 (0%)	0/52 (0%)
161 - Cardiac Defibrillator & Heart Assist Anomaly	0/30 (0%)	0/42 (0%)	0/6 (0%)	0/0 (-)	0/78 (0%)
160 - Major Cardiothoracic Repair of Heart Anomaly	0/1 (0%)	0/1 (0%)	0/1 (0%)	0/0 (-)	0/3 (0%)

How the APR-DRG system responds to
the different types of hospital
procedures?

6. How the APR-DRG system responds to the different types of hospital procedures?

In this third objective of the thesis, we aimed at providing information on coding of procedures to assist hospital stakeholders to improve the quality of administrative datasets and support the implementation or optimization of their DRG systems. To achieve this goal, we employed Support Vector Machine (SVM) models to acknowledge how the different types of procedures drive and modify APR-DRG grouping and hospital funding in the context of respiratory (MDC 4) and cardiovascular diseases (MDC 5). We assessed administrative data from Portugal and Brazil, which are, respectively, countries that has and has not implemented a DRG-based system. Even minor diagnostic and therapeutic procedures did considerably influence APR-DRG grouping. Procedures seem to mostly drive grouping into the base APR-DRG rather than SOI determination. Procedures from any category generally place the episodes in a higher-paying APR-DRG, except for Brazilian data regarding MDC 4, where minor procedures seemed to place episodes into lower-paying APR-DRGs. In Brazil, minor diagnostic procedures drove APR-DRG classification in a higher proportion of episodes when compared to major therapeutic in MDC 5. The results obtained with the SVM models were consistent with the APR-DRG grouping logics.

How different procedure codes drive APR-DRG classification and hospital funding for respiratory and circulatory system diseases? An approach using Support Vector Machine

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How different procedure codes drive APR-DRG classification and hospital funding for respiratory and circulatory system diseases? An approach using Support Vector Machine

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Summary

Background: Diagnosis-Related Groups (DRGs) have become the principal mean of hospital payments in several countries worldwide. As a case-mix-based funding model, an effective DRG system relies upon coded clinical data held in administrative databases. Proper coding of procedures, in particular, plays a major role on DRG allocation. The accuracy and completeness of reporting all hospital procedures can be particularly difficult to achieve as those considered irrelevant in terms of reimbursement, such as routine procedures, tend to be underreported in administrative datasets. In this context, acknowledging how the different types of hospital procedures drive DRG classification is critical to implement an effective DRG-based payment system and to assess the suitability of hospital administrative datasets for DRG grouping.

Objectives: In this study, the emphasis is to understand the impact of coding more and better procedures on DRG classification and hospital funding. We aimed at exploring the APR-DRG (All-Patient Refined Diagnosis-Related Groups) technical remuneration in order to understand and characterize how the different procedures drive and modify APR-DRG grouping and thereby hospital funding.

Methods: Using grouped coded clinical data of admissions due to respiratory and circulatory system diseases from a nationwide Portuguese hospitalization database, for the period 2011-2015, we built Support Vector Machine (SVM) models to simulate the APR-DRG system and assess their response to each procedure code from the ICD-9-CM (International Classification of Diseases, Ninth Revision, Clinical Modification) classification system. We also studied the individual effects of different types of

procedures based on categories defined by the Agency for Health Care Research and Quality (AHRQ). The SVM models were further employed in coded clinical data from a Brazilian inpatient database to perform the same analyses and to verify the applicability of the proposed method to non-DRG based systems.

Results: Overall, considering the Portuguese dataset, therapeutic procedures alone, either minor or major in terms of invasiveness, accounted, respectively, for more than 58 and 25 million euros in reimbursement for paying episodes of respiratory diseases. The financial effects of removing major therapeutic procedures for cardiovascular diseases was much higher when compared to respiratory diseases (more than 256 million euros), though omitting minor therapeutic procedures accounted for a lower yet elevated amount (over 58 million euros). Minor diagnostic procedures presented a very low impact on hospital payments for respiratory diseases, whereas accounted for over 33 million euros for circulatory system diseases. The opposite was observed for major diagnostic procedures, in which the higher effects on hospital payments was observed for respiratory system diseases (more than 4 million euros), while it was minimal for circulatory system diseases. Regarding Brazilian data, minor and major therapeutic procedures presented a much higher financial impact for circulatory diseases (over 1 and 13 million euros, respectively) in comparison with respiratory diseases, whereas minor and major diagnostic procedures influenced a minimal amount of reimbursement in both diagnosis areas. In both countries, as expected, major therapeutic procedures accounted for the highest percentage change in APR-DRG for both respiratory and circulatory system diseases. Minor diagnostic procedures caused the second highest percentage change in APR-DRGs of circulatory system diseases in Portugal and Brazil (34.9 and 60.9, respectively), though influenced less the APR-DRG assignment in respiratory diseases (around 1 percent of APR-DRG changes in both countries). Procedures mostly drove base

APR-DRG classification rather than SOI level assignment in both countries and for both diagnosis areas. In general, the results obtained with the SVM models were consistent with the APR-DRG grouping logics.

Conclusions: Our results indicate that procedures, even those considered minor diagnostic or therapeutic, can considerably influence APR-DRGs grouping in respiratory and circulatory system diseases, reinforcing thus the importance of a more complete reporting of all procedures performed during the patient stay. Our findings helped to understand and acknowledge how specific hospital procedures and categories of procedures drive and modify APR-DRG classification in respiratory and circulatory system diseases. Furthermore, we presented a generic and reproducible method that can be applied to different datasets, from different DRG systems and, thus, can be used to assess the suitability of hospital administrative datasets for DRG implementation and optimization.

Keywords: Respiratory System; Circulatory System; Inpatients; Diagnosis-Related Groups; International Classification of Diseases; Clinical Coding; Hospital Administration; Hospital Procedures; Machine Learning; Support Vector Machine; Hospitals; AHRQ

1. Introduction

1.1. Diagnosis Related Groups: concept and evolution

Coded clinical data abstracted from medical records are used for a variety of purposes, namely for determining the complexity of care, supporting clinical and health care services research, measuring health care activity and quality, as well as for hospital billing [1,2]. Regarding this latter purpose, in several countries, when a patient is admitted to a hospital, the facility is reimbursed according to a system based on Diagnosis Related Groups (DRGs) [2,3], in which inpatient and, in some cases, outpatient episodes are grouped into clinically and economically homogeneous clusters, the so-called DRGs, which in turn will be used to determine the reimbursement driven by that group of hospitalizations [4]. The main purpose of a DRG-based payment system is to provide an

insight regarding the provision of services within hospitals and incentive the efficient use of resources by paying hospitals on the basis of the number and type of cases treated [5,6].

The DRG system was first developed at the Yale School of Organization and Management in the late 1960s [5] and was first implemented in the United States in 1983 as part of a prospective payment system for Medicare [7]. The initial DRGs were later redesigned with the creation of MS-DRGs (Medicare Severity Diagnosis Related Groups), which stratified individual DRGs into three different complication levels (major complication and comorbidities, complications and comorbidities, and no complications and comorbidities) in order to obtain smaller and more clinically homogenous groups [8]. This adaptation was necessary because not all patients grouped into the same DRG are identical in terms of severity and resource use needs. As MS-DRGs were solely created for Medicare patients and thus did not accurately compass patients outside of this population, a new concept of patient stratification was introduced afterwards with the creation of the All-Patient Refined Diagnosis-Related Groups (APR-DRG) system with creation of a Severity of Illness (SOI) and Risk of Mortality (ROM) score combined with the base DRG [4].

The APR-DRG system, as the other DRG systems, is organized into 25 Major Diagnostic Categories (MDC), with each one representing mutually exclusive diagnosis areas. A patient is assigned to a MDC mostly according to the principal diagnosis and is later grouped into a base APR-DRG within that MDC [9]. A total of 314 base APR-DRGs (version 31) across the 25 MDCs were developed, each of which representing a group of patients with the same causes of hospitalization. Episodes are assigned to a base APR-DRG based upon the principal diagnosis, if it is a medical case, or the main operating room procedure, if it is a surgical case [9]. The base APR-DRG is further stratified according to a SOI and a ROM level, both ranging sequentially from 1 to 4 (1 - minor; 2

- moderate; 3 - major; 4 - extreme), representing increasing reimbursement needs [9]. While SOI refers to the degree of loss of function or physiologic decompensation of an organ system, ROM reflects the likelihood of death [9]. The determination of SOI and ROM combines principal and secondary diagnoses, age, operating and non-operating room procedures and multiple operating-room procedures [9]. The APR-DRG system is currently employed for reimbursement purposes in some European countries, such as Portugal, Belgium, Spain and Italy, some Arab countries and in over 30 states in the US [10].

1.2. Hospital procedures within the DRG structure

Regardless of the DRG system, the full process associated with the assignment to the different DRGs is highly dependent on the diagnoses and procedures presented in health records that are further translated into coded clinical data, typically after the discharge. Apart from properly recognizing the principal diagnosis as a crucial task, since it drives the MDC classification and many of the medical DRGs, considering the medical-surgical distinction of the DRG system is also essential as the presence of surgical procedures consistently affects hospital resources [11]. For this reason, the classic DRG structure was divided into medical and surgical DRGs following the MDC assignment, with the latter branch comprising DRGs that are mainly characterized by specific codes representing the main operating room procedures [11].

Moreover, since inpatients can present multiple procedures related or not with their principal diagnosis, a hierarchical order of surgical DRGs within each MDC was defined to address those situations in which certain procedures are more relevant than others for grouping purposes [11]. For instance, a patient who was submitted to a coronary bypass and an amputation due to a circulatory system disorder will be assigned to the

coronary bypass DRG because it is the higher surgical class in the DRG hierarchy within the MDC comprising circulatory system diagnoses [12]. Also, if a patient is submitted to a procedure that is not in the same MDC as the principal diagnosis and is not directly related to any presenting sign or symptom, then that procedure will not necessarily determine the DRG, which may affect hospital reimbursement. For instance, a patient with a principal diagnosis of gastrointestinal bleed who is later diagnosed with abdominal aortic aneurysm and thus submitted to a repair, will be placed in an unrelated surgical procedure DRG [4].

Another important aspect refers to non-operating room procedures, which are not routinely performed in an operating room but can often help to identify patients with higher resource consumption and costs [13]. For instance, the presence of flow-direct pulmonary artery catheter in patients with acute heart failure, combined with a secondary diagnosis of hypotension, which typically occurs in acute myocardial infarction patients, might indicate a more complicated episode among those grouped into the acute myocardial infarction DRG [13]. Furthermore, when hospital payment occurs based on DRG classification systems and if coders report mostly for reimbursement purposes, most procedures performed in hospitals other than operating room procedures may not be coded and therefore not be registered in inpatient databases [14]. There is an estimated of more than 1500 non-operating room procedures within ICD-9-CM, of which only about 116 determine DRG classification. Therefore, about a third of all listed procedures may be subject to underreporting, since they are not required to reimbursement via DRGs [14]. This issue is of concern not only for hospital authorities that aim to use administrative data for DRG grouping, but also for health services researchers and policy-makers that use these data sources to examine variations in procedure utilization, outcomes, treatment costs and adjusting for patient risk [14].

In this sense, understanding how the different procedures modify and determine DRG grouping should help the competent health entities to implement or optimize their existing DRG-based payment system. In this article, the emphasis is to understand and characterize the impact of a better and complete coding of procedures on DRG classification and hospital funding.

2. Methods

We used grouped coded clinical data from a Portuguese nationwide inpatient database to construct Support Vector Machine (SVM) models for APR-DRG prediction in order to simulate the response of the APR-DRG system to the different procedure codes. This machine learning-based approach was chosen as a way to provide and validate a reproducible method that can be applied to assess different DRG versions and to be used in data from countries that have not implemented a DRG-based system yet. We also assessed the effects of four distinct categories of procedures created by the Agency for Health Care Research and Quality (AHRQ) in the context of APR-DRG classification.

We focused on episodes assigned to MDC 4 (Diseases and Disorders of the Respiratory System) and MDC 5 (Diseases and Disorders of the Circulatory System), which are the two diagnosis areas with the highest number of hospitalizations among all MDCs in Portugal, accounting for over one million hospitalizations during the period comprised by our data, being thus two relevant areas for authorities due to this high hospitalization burden. To perform the same analyses in hospitals that have not implemented DRGs and show the applicability of a machine learning based approach, we employed the constructed SVM models in a sample of coded clinical data from a Brazilian inpatient database.

2.1. Clinical Data

Data used for this study was extracted from the Portuguese national DRG database, containing grouped coded clinical data from all public hospitals of the National Health System (NHS) in mainland Portugal. We selected all inpatient episodes grouped into MDCs 4 and 5 with a discharge date between 2011-2016 (i.e., the period in which APR-DRG data was available). A total of 1,107,867 episodes were retrieved. All patient characteristics required for APR-DRG grouping were retrieved, namely principal diagnosis, up to 30 secondary diagnoses, up to 30 procedures, discharge status, sex and age. Diagnoses and procedures were coded in the ICD-9-CM (International Classification of Diseases, 9th Revision, Clinical Modification) classification system. These hospitalizations comprised episodes grouped into a set of 17 respiratory system APR-DRGs (MDC 4) and 32 circulatory system APR-DRGs (MDC 5) and other 3 surgical DRGs that comprise procedures not related with the principal diagnosis (DRGs 950, 951 and 952).

Hospitalization data for Brazil was extracted from a regional administrative inpatient database which also contained a sample of coded clinical data of 407,255 inpatient episodes provided by public, private and charity hospitals located in São Paulo State, for the period 2011-2015. Data from 2015 onwards were not available. Each inpatient episode was also characterized by age, sex, discharge status, up to 5 diagnosis codes (including the principal diagnosis) and up to 3 procedure codes. Diagnoses were coded in ICD-10-WHO (International Statistical Classification of Diseases and Related Health Problems 10th Revision, World Health Organization version) and procedures were also coded in ICD-9-CM.

2.2. Data Standardization

As the SVM models were entirely built with ICD-9-CM data from Portugal, we used General Equivalence Mapping (GEM) files to map between ICD-10-WHO codes to ICD-9-CM. GEM files allowed the conversion between ICD-10-CM and ICD-9-CM [15]. Using the first four characters of ICD-10-WHO codes, we obtained the approximate ICD-10-CM codes and later used GEM files to convert them to their ICD-9-CM mapping codes. To diminish further bias, our final sample only included cases in which the four-digit approximation mapping between ICD-10-WHO to ICD-10-CM was possible. After the terminology conversion process, a total of 251,947 episodes were retrieved. From this number, a total of 115,575 episodes (% of the total) reported at least one procedure code. We further selected the cases with a principal diagnosis within MDCs 4 and 5 based on a principal diagnosis list constructed with the Portuguese data. The final sample contained 27,992 episodes for MDC 4 and 31,168 episodes for MDC 5.

2.2. Support Vector Machine (SVM) models for APR-DRG prediction

We used five years of Portuguese inpatient data (2011-2015) to build SVM models for APR-DRG prediction. The SVM algorithm finds a separating boundary between the different inpatient episodes, the so-called hyperplanes [16], in order to segregate the different APR-DRGs (classes) between the episodes. Apart from presenting a high performance in solving classification problems in bioinformatics [17], SVM algorithm may be suitable for dealing with the APR-DRG classification problem mainly because it handles high dimensionality issues [18]. As modeling APR-DRG grouping requires the combination of several patient attributes, like discharge status, a wide range of diagnosis and procedure codes and other patient features, such as age and sex, the SVM algorithm seemed to be adequate for this task.

For each MDC, we constructed two classification models: one model to classify episodes into a base APR-DRG and the other one to determine the SOI level. Thus, the target variables (classes) used to build the first and second models were, respectively, the base APR-DRG and the patient's SOI level. Since ROM is not used for payment and we were interested on assessing the effects of the different procedures on hospital funding, we did not consider ROM classification in our study.

Regarding the specification of variables, the first model (base APR-DRG prediction) included age as numeric attribute, sex and discharge status as categorical attributes and all ICD-9-CM diagnosis and procedure codes in the dataset. As SOI classification does not consider sex and discharge status, the second model (SOI prediction) only included age as numeric attribute, the base APR-DRG assigned by the first model as categorical attribute and all diagnosis and procedure codes. Each diagnosis and procedure code was treated as an individual binary variable (1 if the episode reported the code, 0 otherwise). We trained SVM models on two thirds of the inpatient data for the period 2011-2015 (training set) and evaluated their performance on the remaining third (testing set). As evaluation metrics, we estimated the percentage of correctly classified episodes, as well as recall and precision by each possible class. To add critical validation to the models and assess their capacity of generalization we tested the SVM models using 2016 data and estimated the percentage of correctly classified episodes in each class. The evaluation metrics of the SVM models are presented in supplementary table 1. Finally, we applied the previously constructed SVM models on Brazilian data to group inpatient episodes to an APR-DRG comprised by the MDCs associated with the studied conditions (MDCs 4 and 5).

2.3. Analysis

We firstly re-grouped all 2011-2015 episodes into APR-DRGs using the previously constructed SVM models. The goal was to use the classification results obtained with the complete dataset as baseline for further comparisons. To investigate how the different procedures drive APR-DRG classification, we individually removed each procedure code from the original dataset and analyzed classification changes. We also compared the classification changes in terms of types of procedures taking into account the four procedure categories created by the AHRQ: minor diagnostic, which consists of non-operating room procedures that are performed for diagnostic reasons; minor therapeutic, which also contains non-operating room procedures but that are for therapeutic reasons; major diagnostic, which comprises all operating-room procedures considered valid by the DRG grouper and that are performed for diagnostic reasons; and major therapeutic, which corresponds to all operating-room procedures considered valid by the DRG grouper and are performed for therapeutic reasons [19].

We estimated the percentage of episodes that changed their DRGs after removing each procedure code. Besides evaluating DRG modification, we also assessed changes in hospital payments by estimating the total amount to be reimbursed when considering the classification results obtained with the complete dataset (baseline results) and after removing each procedure code. For this latter analysis, we used official APR-DRG prices derived from the 2017 APR-DRG prices and weights table [20], which was defined for paying public hospitals within the Portuguese NHS. We further repeated the same analyzes using Brazilian hospitalization data, using the same APR-DRG weights and prices that were used for Portugal.

2.4.Ethical considerations

Since inpatient data used in this study was completely anonymized and only contained the discharge year, diagnosis and procedure codes, sex, age, discharge status and an arbitrary episode identification number, there was no need for ethical approval.

2.5. Software

Data processing, training and testing phases of SVM and all the presented analyses were performed using Java code in combination with a Weka open source library for Java [21], version 3.8.0

3. Results

Coded clinical data of 935,429 hospitalizations were used for training and testing the SVM models. This number corresponded to all Portuguese inpatient episodes assigned to a principal diagnosis within MDC 4 (487,156 episodes) and MDC 5 (448,273 episodes) in the period 2011-2015. We also tested the SVM models in hospitalization data from 2016 data (92,475 episodes from MDC 4 and 79,963 episodes from MDC 5) and verified a high capacity of generalization, with an overall proportion of correctly classified cases of 99.2% (MDC 4) and 99.3% (MDC 5) for base APR-DRG assignment and 89% (MDC 4) and 88.3% (MDC 5) for SOI determination (see supplementary table 1). When considering the combination of both, base APR-DRG and SOI, the SVM models correctly classified 88.4% and 87.8% of the episodes from the year of 2016 in MDCs 4 and 5, respectively (supplementary table 1).

Overall results for Portugal and Brazil, namely the percentage of episodes that changed their APR-DRG and differences in hospital payments resulted from the removal of procedures from each category can be seen in Tables 1 and 2, respectively. Considering only Portuguese data, the removal of procedure codes, regardless of the category they

belong to, resulted in decreases in hospital reimbursement (Table 1). The same was observed after analyzing Brazilian data, except for some results for MDC 4, in which the effects of minor procedures resulted in a small increase in hospital reimbursement (Table 2). For both countries, and as expected, major therapeutic procedures accounted for the highest percentage of APR-DRG changes in both MDCs. Nevertheless, in Portugal, minor therapeutic procedures accounted for the highest loss in hospital payments in MDC 4, reaching over than 58 million euros (Table 1). Moreover, minor diagnostic procedures accounted for the second highest percentage of APR-DRG changes in MDC 5 for both datasets, while their impact on APR-DRG assignment for MDC 4 was minimal (Tables 1 and 2).

Table 3 shows, for Portugal and Brazil, how the different categories of procedures modified the base APR-DRG and SOI levels in respiratory and circulatory system diseases. Overall, relatively small proportions of episodes had their SOI level affected by the removal of procedures. For MDC 4 and for both countries, major diagnostic and therapeutic procedures had a much higher impact on base APR-DRG classification when compared to the minor categories, though the influence of minor procedures on base APR-DRG grouping for MDC 5 was quite higher for both, Portuguese and Brazilian datasets (Table 3).

Supplementary tables 2 and 3 present for MDCs 4 and 5, respectively, a more detailed analysis using Portuguese data, showing a descending ranking of procedure codes according to the percentage change in APR-DRGs. Differences in hospital payments that could have been attributed to the presence of each procedure is also presented. In Portugal, major therapeutic procedures 31.79 (Other repair and plastic operations on trachea) and 38.15 (Endarterectomy, other thoracic vessels) accounted for the highest percentages of APR-DRG changes among MDC 4 episodes (100%) and both

procedures only occurred in episodes grouped into APR-DRG 120 (Major Respiratory and Chest Procedures) (supplementary table 2). Among MDC 5 episodes, major therapeutic procedures 05.25 (Periarterial sympathectomy), 35.06 (Transapical replacement of aortic valve), 37.62 (Insertion of temporary non-implantable extracorporeal circulatory assist device) and 37.96 (Implantation of automatic cardioverter/defibrillator pulse generator only) led to the highest percentage change of APR-DRGs and also changed the APR-DRG in all episodes they occurred (supplementary table 3). In terms of major diagnostic procedures, the most impacting was 34.21 (Transpleural thoracoscopy) in both MDCs, as it changed the APR-DRG in over 80% of the episodes it occurred in MDC 4, affecting mostly APR-DRG 121 (Other Respiratory & Chest Procedures), and over 70% of the MDC 5 episodes, changing mostly the APR-DRG 951 (Moderately Extensive Procedure Unrelated to Principal Diagnosis) (supplementary tables 2 and 3).

Considering the minor categories, in Portugal, minor therapeutic procedure 96.72 (Continuous invasive mechanical ventilation for 96 consecutive hours or more) changed the APR-DRG in more than 85% of the cases it was performed, being thus responsible for the highest percentage change of APR-DRGs among MDC 4 episodes. This code mostly affected APR-DRG 130 (Respiratory System Diagnosis with Ventilator Support 96+ Hours) by shifting most of these episodes to APR-DRG 137 (Major Respiratory Infections and Inflammations) (supplementary table 2). Procedure 42.29 (Other diagnostic procedures on esophagus) was the minor diagnostic procedure that most influenced APR-DRG grouping in MDC 4, causing an increase in the SOI level in episodes grouped into APR-DRG 136 (Respiratory Malignancy) and APR-DRG 139 (Other Pneumonia) (see supplementary table 2).

Among MDC 5 episodes, minor therapeutic procedures from the ICD-9-CM category 37.7 (Insertion, Revision, Replacement, and Removal of Pacemaker Leads; Insertion of Temporary Pacemaker System; or Revision of Pocket) caused most of the APR-DRG changes, namely codes 37.70, 37.71 and 37.72, which changed the APR-DRG in over 90% they were reported (supplementary table 3). These procedures clearly drove the classification into APR-DRGs 170 (Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock) and 171 (Permanent Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock) (see supplementary table 3). Procedure 37.28 (Intracardiac echocardiography) was the minor diagnostic procedure with the highest impact on APR-DRG classification in MDC 5, changing the DRG in more than 65% of the episodes it occurred, mostly shifting APR-DRG 162 (Cardiac Valve Procedures with Cardiac Catheterization) to 163 (Cardiac Valve Procedures without Cardiac Catheterization) (see supplementary table 3).

Supplementary tables 4 and 5 present the same analysis, but using Brazilian data, showing a descending ranking of procedure codes according to the percentage change in APR-DRGs differences in hospital payments in MDCs 4 and 5, respectively. Among MDC 4 cases, procedure 34.51 (Decortication of lung) was the most impacting major therapeutic procedure, affecting the APR-DRG assignment in all episodes it was performed, shifting the episodes from APR-DRG 120 mostly to a medical APR-DRG or to APR-DRG 121 (supplementary table 4). In MDC 5, the major therapeutic procedure 35.73 (Other and unspecified repair of endocardial cushion defect) caused the highest changes in APR-DRG (100%), exclusively affecting grouping into APR-DRG 160 (Major Cardiothoracic Repair of Heart Anomaly) (supplementary table 5). The impact of major diagnostic procedures in the Brazilian sample was quite limited in both MDCs. The only and most impacting one was procedure 34.21 (Transpleural thoracoscopy), which

shifted the APR-DRG in 77.8% of the episodes it was performed in MDC 4. Moreover, this procedure affected exclusively the classification into APR-DRG 121 (supplementary table 4).

The influence of minor procedures in Brazilian data was quite subtle among MDC 4 episodes, with minor therapeutic procedure 311 (Temporary tracheostomy) proportionally affecting more cases (6.2%) as it changed the SOI to a lower level among APR-DRGs 139 (Other Pneumonia) and 140 (Chronic Obstructive Pulmonary Disease) (supplementary table 4). The impact of minor procedures was higher among MDC 5 episodes, with minor diagnostic procedure 88.57 (Other and unspecified coronary arteriography) changing the APR-DRG in over 60% of the cases, and minor therapeutic procedure 39.61 (Extracorporeal circulation auxiliary to open heart surgery) placing more than 30% of the episodes in a different APR-DRG. The first procedure mostly impacted the classification into APR-DRG 174 (Percutaneous Cardiovascular Procedures with AMI), whereas the second one mainly affected APR-DRG 160 (Major Cardiothoracic Repair of Heart Anomaly) (see supplementary table 5).

4. Discussion

Hospital care comprises a large share of the total health expenditures in countries [22]. In order to increase efficiency in inpatient care and improve transparency in hospital services, DRG-based payment systems have been gradually introduced in many countries worldwide since its first implementation in 1983, in the United States [22]. However, the main concern prior to implement or optimize an existing DRG-based system should be ensuring the quality of administrative databases. Therefore, hospitals should find means to evaluate whether their data are suitable for DRG grouping, especially concerning accurate and complete medical coding. There are many types of coding errors that can

lead episodes to be placed erroneously in a higher or lower-resource intensity DRG, such as selecting the wrong principal diagnosis, omitting codes that should have been reported or using less specific codes [23]. Procedure guidelines, in particular, state that all significant diagnostic and therapeutic procedures should be coded, which includes those that are surgical in nature, carry a procedural or anesthetic risk and demand special facilities, equipment or training [23]. However, many routine procedures, namely non-OR procedures, tend to be underreported as they are not required for reimbursement via DRG classification. After assessing 1997 data from nonfederal hospital inpatient claims from Washington State, Dismuke (2005) found that ICD-9-CM procedure coding was considerably underreported and variable, concluding that the frequency of underreporting of the studied non-OR procedures was not random [14].

While DRGs may be difficult to be fully understood, they should be something that physicians and other professionals should be comfortable using in order to improve data quality and help assist in medical coding and subsequent hospital funding. Physicians and other hospital stakeholders should become facile with the whole process of DRG allocation to ensure accurate and complete report and coding of procedures and thus improve their administrative databases, optimize the performance of the DRG grouper and finally achieve fairer hospital funding. In this article, the emphasis was to understand the impact of better and comprehensive coding of procedures on the APR-DRG classification. We employed a machine learning-based approach based on SVM models to provide a method to assess the APR-DRG technical structure and acknowledge how this grouper responds to the different types of hospital procedures. Our main goal was to provide more detailed insights on the role of each procedure within the APR-DRG grouping logic by using a generic and reproducible method that can also be used to

investigate different DRG systems and to be used in data from hospitals that have not implemented DRGs.

Overall, in both Brazilian and Portuguese datasets, the removal of procedure codes from any category generally placed the episodes in a lower-paying APR-DRG, resulting in losses in hospital reimbursement. Although major categories were, as expected, where the types of procedures that mostly determined APR-DRG grouping, it is important to point that minor therapeutic and diagnostic procedures did considerably influence grouping and hospital funding in MDC 5 in both countries, accounting for a substantial percentage of APR-DRG changes in the episodes they occurred (Tables 1 and 2). In fact, the omission of procedures from minor categories would have cost over 70 million € during the studied period in Portugal (Tables 1 and 2). In MDC 4, however, the influence of minor categories on APR-DRG changes were much lower, though the financial impact of underreporting minor therapeutic procedures was considerably elevated in Portugal, accounting for over 58 million € during the studied period (Table 1). These findings reflect that the influence of the different types of procedures in the context of APR-DRG grouping is domain-specific, though underreporting minor categories, which comprise non-OR procedures, may have a very high financial impact on hospital funding, especially in the context of circulatory system diseases.

. We observed that the influence of procedures to determine the different SOI levels varied concerning the country, with SOI determination being slightly more sensitive to procedures among Brazilian cases (Table 3). Moreover, we observed that the impact of procedures, regardless of their category, is much higher on base APR-DRG classification than on SOI determination (Table 3). While in MDC 4 the influence of the minor categories on base APR-DRG assignment was minimal in Portugal and Brazil, in MDC 5, both minor diagnostic and therapeutic procedures drove base APR-DRG

classification in a considerable percentage of episodes they occurred in both countries (Table 3). Also, minor procedures alone did influence SOI levels in several cases, which is line with Hughes et al (1990), who concluded that non-operating room procedures can often work as DRG modifiers by helping to identify groups of more severely ill and costlier patients, being thus useful to improve the accuracy and fairness of the DRG system [13].

Overall, the results obtained with the SVM models were considerably consistent and in line with the APR-DRG grouping logic, reinforcing the validity of this method to study technical specificities of the DRG system. We thus presented a generic and reproducible method based on SVM models that can be employed in order to study different DRG systems and also to assess data from countries that have not used DRGs, such as the case of Brazil, providing options to acknowledge how the DRG system responds to their data and which information regarding hospital procedures would be crucial to implement an effective DRG-based system. Furthermore, the advantages of evaluating results from SVM models rather than directly employing the grouper, besides its use in different data sources from different DRG versions, include the feasibility to simulate different coding behaviors and assess the response of the DRG system to these behaviors, as well as the possibility to investigate the effects of specific diagnosis or procedures of interest.

As a limitation of this study, these results rely and are limited to the quality of coded clinical data. For instance, certain procedures might have had little to no significant impact on the sensitivity for APR-DRG classification because they might simply be under-reported and thus the SVM models, which were constructed through patterns learned from the data, will minimize their importance in terms of classification, being less sensitive to their removal. Another important limitation includes the utilization of results

obtained with SVM models (which artificially learned how episodes were grouped into APR-DRGs) as baseline to compare changes in sensitivity and hospital reimbursement. Therefore, existing errors associated with the original SVM models might have influenced or been replicated in our results. Another limitation includes the use of ICD-9-CM data to perform all analyses, as this classification system ceased to be updated in 2015. The transition to ICD-10-CM in Portugal was enacted in 2017 and it is still an ongoing process. Many of the available ICD-10-CM inpatient data was still incomplete, being thus not viable to perform this study. Also, it is important to take into account the inherent bias of using GEM files to map between ICD-9 and ICD-10 codes, considering that, in many cases, this method only finds approximate matches to a given code.

5. Conclusions

In summary, our findings showed how incomplete coding of procedures alone, including those considering non-OR procedures can directly affect proper APR-DRG assignment and hospital reimbursement. Also, it is important to keep in mind that poor and incomplete coding of procedures may also undermine other tasks related with clinical and health care services management and research, such as evaluating resource use, adjusting for patient risk, monitoring costs and quality, as well as utilization, outcome and policy studies [9, 14]. Additionally, as previous research found that hospitals, even with similar complexity, can differ on reporting non-operating room procedures [24], our findings were useful to demonstrate that even minor procedures, either for diagnostic or therapeutic reasons, might considerably influence base APR-DRG classification, especially in the context of circulatory system diseases, and thus should not be neglected. Furthermore, our results may help to better understand the role and impact of specific procedures in APR-DRG classification for respiratory and circulatory diseases as our

method allowed the identification of codes and categories of procedures that are more relevant for grouping specific APR-DRGs. Moreover, we presented a generic and reproducible method based on SVM models that can be employed to assess different data sources, from different DRG systems, or test DRG algorithm in data sources from settings that have not begun to implement a DRG system. Our results using SVM models were consistent with the APR-DRG grouping logics, reinforcing its validity. We thus highlight the importance of accurate and complete coding of hospital procedures as an indicator of quality and suitability of administrative data for DRG grouping, considering that other actions should be consecutively taken, such as continuous improvements regarding health records and patient documentation, mainly in discharge summaries and daily reports, as those instruments are the main source of information for clinical coding [25].

Conflicts of interest

The authors declare that there are no conflicts of interest.

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Table 1. Changes in APR-DRG classification and hospital payments in Portuguese data, by MDC and procedure category

	MDC 4 - Diseases and Disorders of the Respiratory System			MDC 5 - Diseases and Disorders of the Circulatory System		
	Percentage of APR-DRG Change (%)	Differences in hospital payments (€)	Relative Percentage Change in hospital payments (%)	Percentage of APR-DRG Change (%)	Differences in hospital payments (€)	Relative Percentage Change in hospital payments (%)
Minor diagnostic	1,3%(611/47887 episodes)	-34.615 €	~0	34,9%(44223/126673 episodes)	-33.206.988,5 €	-8,8
Minor therapeutic	5,3%(7448/139661 episodes)	-58.667.767,5 €	-14,4	18,8%(34237/182491 episodes)	-38.035.326,8 €	-5,6
Major diagnostic	50,7%(2713/5352 episodes)	-4.649.423 €	-26,5	33,2%(249/751 episodes)	-753.102 €	-19,8
Major therapeutic	86,2%(11204/13004 episodes)	-25.768.256,8 €	-47	65,5%(93191/142250 episodes)	-256.368.054,6 €	-41,8

Table 2. Changes in APR-DRG classification and hospital payments in Brazilian data, by MDC and procedure category

	MDC 4 - Diseases and Disorders of the Respiratory System			MDC 5 - Diseases and Disorders of the Circulatory System		
	Percentage of APR-DRG Change (%)	Differences in hospital payments (€)	Relative Percentage Change in hospital payments (%)	Percentage of APR-DRG Change (%)	Differences in hospital payments (€)	Relative Percentage Change in hospital payments (%)
Minor diagnostic	0,9% (5/546 episodes)	250,20 €	0	60,9% (1019/1672 episodes)	-610.565,4 €	-18,3
Minor therapeutic	1,6% (18/1124 episodes)	-10.950,6 €	-0,6	27,4% (947/3454 episodes)	-1.390.037,1 €	-19,9
Major diagnostic	41,2% (42/102 episodes)	-71.849,7 €	-34,6	37,1% (13/35 episodes)	-8.913,6 €	-15,2
Major therapeutic	51,4% (390/759 episodes)	-695.092,9 €	-40,3	79,2% (9440/11914 episodes)	-13.267.813,5 €	-48,1

Table 3. Proportion of APR-DRG changes, by SOI level and base APR-DRG

	MDC 4		MDC 5	
	Portugal	Brazil	Portugal	Brazil
	Minor Diagnostic		Minor Diagnostic	
SOI 1	1,4%(261/19071 episodes)	0,2%(1/454 episodes)	1,4%(1067/77456 episodes)	0,4%(5/1331 episodes)
SOI 2	0,8%(126/15895 episodes)	6,3%(4/63 episodes)	2,5%(838/33968 episodes)	2,9%(6/207 episodes)
SOI 3	1,6%(170/10490 episodes)	0%(0/21 episodes)	1,6%(183/11488 episodes)	1,7%(2/119 episodes)
SOI 4	1,2%(28/2431 episodes)	0%(0/8 episodes)	1,4%(54/3761 episodes)	0%(0/15 episodes)
Another base APR-DRG	0,1%(26/47887 episodes)	0%(0/546 episodes)	33,2%(42081/126673 episodes)	60,2%(1006/1672 episodes)
	Minor Therapeutic		Minor Therapeutic	
SOI 1	0,6%(156/25836 episodes)	0,4%(3/838 episodes)	0,5%(366/78668 episodes)	0,4%(11/2625 episodes)
SOI 2	1,7%(767/46420 episodes)	4,5%(8/178 episodes)	1,4%(839/60779 episodes)	0,3%(1/308 episodes)
SOI 3	1,9%(1034/54712 episodes)	3,4%(3/89 episodes)	3,8%(1225/32222 episodes)	22,8%(114/501 episodes)
SOI 4	0,7%(89/12693 episodes)	15,8%(3/19 episodes)	8,8%(953/10822 episodes)	5%(1/20 episodes)
Another base APR-DRG	3,9%(5402/139661 episodes)	0,1%(1/1124 episodes)	16,9%(30854/182491 episodes)	23,7%(820/3454 episodes)
	Major Diagnostic		Major Diagnostic	
SOI 1	1%(31/3004 episodes)	0%(0/88 episodes)	0,9%(2/216 episodes)	0%(0/31 episodes)
SOI 2	1,4%(18/1324 episodes)	0%(0/8 episodes)	4,5%(13/288 episodes)	33,3%(1/3 episodes)
SOI 3	4,2%(37/877 episodes)	0%(0/4 episodes)	2,3%(4/176 episodes)	100%(1/1 episodes)
SOI 4	2%(3/147 episodes)	0%(0/2 episodes)	2,8%(2/71 episodes)	-
Another base APR-DRG	49%(2624/5352 episodes)	41,2%(42/102 episodes)	30,4%(228/751 episodes)	31,4%(11/35 episodes)
	Major Therapeutic		Major Therapeutic	
SOI 1	0,2%(16/8797 episodes)	0,7%(4/589 episodes)	0,3%(319/92762 episodes)	0,1%(8/10918 episodes)
SOI 2	1,2%(28/2373 episodes)	1%(1/101 episodes)	1,1%(408/37130 episodes)	9,9%(67/678 episodes)
SOI 3	1,3%(17/1289 episodes)	3,7%(2/54 episodes)	2,9%(252/8565 episodes)	2,8%(6/218 episodes)
SOI 4	0,7%(4/545 episodes)	33,3%(5/15 episodes)	6,7%(254/3793 episodes)	1%(1/100 episodes)

Another base APR-DRG	85,7%(11139/13004 episodes)	49,8%(378/759 episodes)	64,6%(91958/142250 episodes)	78,5%(9358/11914 episodes)
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Supplementary table 1 - Overview of evaluation metrics obtained with SVM for base APR-DRG and SOI classification

MDC 4 Classification (Diseases and Disorders of the Respiratory System)				
Base APR-DRG Assignment				
APR-DRG	Precision	Recall	% Correctly Classified	% Correctly Classified (2016 unseen data)
144 - Respiratory System Signs, Symptoms & Other Diagnoses	0.999	0.998	99.8	99.7
143 - Other Respiratory Diagnosis Except Signs, Symptoms & Minor Diagnoses	0.997	0.997	99.7	94.1
142 - Interstitial Lung Disease	0.993	0.999	99.9	72.2
141 - Asthma	0.999	1.000	100.0	99.1
140 - Chronic Obstructive Pulmonary Disease	0.999	1.000	100.0	100.0
139 - Other Pneumonia	0.998	0.999	99.9	99.9
138 - Bronchiolitis & RSV Pneumonia	0.987	1.000	100.0	100
137 - Major Respiratory Infections & Inflammations	0.989	0.998	99.8	99.8
136 - Respiratory Malignancy	0.997	0.999	99.9	99.9
135 - Major Chest & Respiratory Trauma	0.995	0.996	99.6	99.9
134 - Pulmonary Embolism	0.994	1.000	100	100.0
133 - Pulmonary Edema & Respiratory Failure	0.990	0.998	99.8	99.9
132 - BPD & Oth Chronic Respiratory Dis Arising In Perinatal Period	0.967	1.000	100	100.0
131 - Cystic Fibrosis - Pulmonary Disease	0.985	1.000	100	100.0
130 - Respiratory System Diagnosis w/ Ventilator Support 96+ Hours	0.963	0.845	84.5	99.6
121 - Other Respiratory & Chest Procedures	1.000	0.955	95.5	99.6
120 - Major Respiratory & Chest Procedures	1.000	0.992	99.2	99.7
Severity of Illness (SOI) subclass Assignment				
Severity of Illness (SOI)	Precision	Recall	% Correctly Classified	% Correctly Classified (2016 unseen data)
1 (Minor)	0.918	0.922	92.2	92.1

2 (Moderate)	0.870	0.867	86.7	85.3
3 (Major)	0.878	0.882	88.2	89.2
4 (Extreme)	0.903	0.879	87.9	88.4
MDC 5 Classification (Diseases and Disorders of the Circulatory System)				
Base APR-DRG Assignment				
APR-DRG	Precision	Recall	% Correctly Classified	% Correctly Classified (2016 unseen data)
199 - Hypertension	0.992	0.999	99.9	91.5
198 - Angina Pectoris & Coronary Atherosclerosis	0.997	0.999	99.9	98.1
197 - Peripheral & Other Vascular Disorders	0.993	1.000	100.0	98.1
196 - Cardiac Arrest	0.980	0.990	99.0	99.8
194 - Heart Failure	0.999	1.000	100.0	96.9
193 - Acute & Subacute Endocarditis	0.960	1.000	100.0	100
192 - Cardiac Catheterization for Ischemic Heart Disease	0.998	1.000	100.0	95.8
191 - Cardiac Catheterization w/ Circ Disord Exc Ischemic Heart Disease	0.996	0.998	99.8	95.9
190 - Acute Myocardial Infarction	0.997	1.000	100.0	97.5
180 - Other Circulatory System Procedures	0.998	0.989	98.9	100
177 - Cardiac Pacemaker & Defibrillator Revision Except Device Replacement	0.991	0.983	98.3	99.2
176 - Cardiac Pacemaker & Defibrillator Device Replacement	0.988	0.989	98.9	99.9
175 - Percutaneous Cardiovascular Procedures w/o AMI	0.999	1.000	100.0	99.8
174 - Percutaneous Cardiovascular Procedures w/ AMI	0.999	1.000	100.0	98.7
173 - Other Vascular Procedures	0.998	0.992	99.2	97.4
171 - Perm Cardiac Pacemaker Implant w/o AMI, Heart Failure or Shock	0.992	0.999	99.9	97.8
170 - Permanent Cardiac Pacemaker Implant w/ AMI, Heart Failure or Shock	0.963	0.973	97.3	99.9
207 - Other Circulatory System Diagnoses	0.997	0.992	99.2	99.6
206 - Malfunction, Reaction & Comp of Cardiac or Vasc Device or Proc	0.979	0.994	99.4	99.9

205 - Cardiomyopathy	0.997	0.994	99.4	100
204 - Syncope & Collapse	0.995	0.998	99.8	100
203 - Chest Pain	0.997	1.000	100.0	99.5
169 - Major Thoracic & Abdominal Vascular Procedures	0.990	0.960	96.0	99.9
201 - Cardiac Arrhythmia & Conduction Disorders	0.998	0.995	99.5	100
200 - Cardiac Congenital & Valvular Disorders	0.993	0.996	99.6	100
167 - Other Cardiothoracic Procedures	0.980	0.949	94.9	99.4
166 - Coronary Bypass w/o Cardiac Cath Or Percutaneous Cardiac Procedure	0.995	0.999	99.9	98.7
165 - Coronary Bypass w/ Cardiac Cath Or Percutaneous Cardiac Procedure	0.994	0.978	97.8	100
163 - Cardiac Valve Procedures w/o Cardiac Catheterization	0.999	0.997	99.7	100
162 - Cardiac Valve Procedures w/ Cardiac Catheterization	0.981	0.972	97.2	99.6
161 - Cardiac Defibrillator & Heart Assist Anomaly	0.999	0.977	97.7	100
160 - Major Cardiothoracic Repair of Heart Anomaly	1.000	0.929	92.9	99.2
Severity of Illness (SOI) subclass Assignment				
Severity of Illness (SOI)	Precision	Recall	% Correctly Classified	% Correctly Classified (2016 unseen data)
1 (Minor)	0.923	0.945	94.5	94.2
2 (Moderate)	0.855	0.839	83.9	84.3
3 (Major)	0.822	0.813	81.3	83.8
4 (Extreme)	0.902	0.819	81.9	81.2

Supplementary table 2 – Descending ranking of procedures according to their effects on APR-DRG changes for respiratory system diseases (Portugal)

Procedure	Percentage change of APR-DRG	Number of episodes that changed their APR-DRG	Total differences in hospital payments (€)	Percentage change in hospital payments	Procedure category
3179 - Other repair and plastic operations on trachea	100	64/64 episodes	-135.441 €	-42,5	major therapeutic
3791 - Open chest cardiac massage	100	6/6 episodes	-41.659,90 €	-49,4	major therapeutic
3805 - Incision of vessel, other thoracic vessels	100	8/8 episodes	-19.330,20 €	-54	major therapeutic
3815 - Endarterectomy, other thoracic vessels	100	9/9 episodes	-30.637 €	-57,8	major therapeutic
9227 - Implantation or insertion of radioactive elements	100	53/53 episodes	-66.055,50 €	-51,3	major therapeutic
3474 - Repair of pectus deformity	99	378/382 episodes	-798.706,70 €	-65,6	major therapeutic
3241 - Thoracoscopic lobectomy of lung	97,5	230/236 episodes	-393.673,20 €	-42,2	major therapeutic
3393 - Puncture of lung	96,7	59/61 episodes	-98.642,70 €	-39,7	major therapeutic
3979 - Other endovascular procedures on other vessels	95,9	47/49 episodes	-194.976,40 €	-68,5	major therapeutic
9672 - Continuous invasive mechanical ventilation for 96 consecutive hours or more	92,9	5066/5455 episodes	-54.963.416,40 €	-67,6	minor therapeutic
3224 - Percutaneous ablation of lung lesion or tissue	91,7	44/48 episodes	-31.199,40 €	-24,2	major therapeutic
3129 - Other permanent tracheostomy	90,7	107/118 episodes	-473.057,50 €	-58,8	major therapeutic
8152 - Partial hip replacement	90	18/20 episodes	-103.168,40 €	-58,4	major therapeutic
2769 - Other plastic repair of palate	88,9	8/9 episodes	-6.018,90 €	-41,5	major therapeutic
4021 - Excision of deep cervical lymph node	88,7	63/71 episodes	-108.906,20 €	-41,9	major therapeutic
3199 - Other operations on trachea	88,4	122/138 episodes	-204.940,70 €	-38,2	major therapeutic
8417 - Amputation above knee	86,5	64/74 episodes	-580.070,80 €	-68,5	major therapeutic
3249 - Other lobectomy of lung	86,4	2184/2529 episodes	-3.334.947,10 €	-32,3	major therapeutic
3162 - Closure of fistula of larynx	85,7	6/7 episodes	-8.521,20 €	-34,9	major therapeutic
3991 - Freeing of vessel	85,7	6/7 episodes	1.690,40 €	4	major therapeutic
7861 - Removal of implanted devices from bone, scapula, clavicle, and thorax [ribs and sternum]	85,7	6/7 episodes	-7.476,80 €	-50,7	major therapeutic
3259 - Other and unspecified pneumonectomy	85,4	169/198 episodes	-265.213,60 €	-28,3	major therapeutic

3329 - Other diagnostic procedures on lung or bronchus	85,1	63/74 episodes	-97.309 €	-34	major diagnostic
3239 - Other and unspecified segmental resection of lung	84,8	933/1100 episodes	-1.863.362,40 €	-43,1	major therapeutic
4023 - Excision of axillary lymph node	84,6	33/39 episodes	-50.433,50 €	-32,5	major therapeutic
8411 - Amputation of toe	84,6	22/26 episodes	-101.886,10 €	-53,7	major therapeutic
5371 - Laparoscopic repair of diaphragmatic hernia, abdominal approach	84,2	16/19 episodes	-22.409 €	-47,5	major therapeutic
7811 - Application of external fixator device, scapula, clavicle, and thorax [ribs and sternum]	84,2	16/19 episodes	-19.871,40 €	-38,1	major therapeutic
5384 - Other and open repair of diaphragmatic hernia, with thoracic approach	83,3	5/6 episodes	5.685,10 €	22,5	major therapeutic
7865 - Removal of implanted devices from bone, femur	83,3	5/6 episodes	-11.881,30 €	-42,6	major therapeutic
3009 - Other excision or destruction of lesion or tissue of larynx	81,5	22/27 episodes	-27.635,20 €	-30	major therapeutic
3451 - Decortication of lung	80,9	702/868 episodes	-775.634,70 €	-20	major therapeutic
5718 - Other suprapubic cystostomy	80	8/10 episodes	-21.119,10 €	-43,9	major therapeutic
3174 - Revision of tracheostomy	78,3	72/92 episodes	-65.987,10 €	-21	major therapeutic
3250 - Thoracoscopic pneumonectomy	77,8	7/9 episodes	-15.558,10 €	-31,2	major therapeutic
5503 - Percutaneous nephrostomy without fragmentation	77,8	7/9 episodes	-30.330,90 €	-41,6	major therapeutic
8151 - Total hip replacement	77,8	7/9 episodes	-30.880 €	-65,7	major therapeutic
7915 - Closed reduction of fracture with internal fixation, femur	76,9	30/39 episodes	-323.445 €	-64,2	major therapeutic
3328 - Open biopsy of lung	75,9	397/523 episodes	-479.769,40 €	-32	major diagnostic
3398 - Other operations on bronchus	75,8	25/33 episodes	-31.496,70 €	-21	major therapeutic
3230 - Thoracoscopic segmental resection of lung	75,6	671/887 episodes	-1.258.556,80 €	-40,1	major therapeutic
3885 - Other surgical occlusion of vessels, thoracic vessels	75,6	59/78 episodes	-79.471 €	-25,6	major therapeutic
3334 - Thoracoplasty	75	6/8 episodes	-8.505,70 €	-34,3	major therapeutic
7935 - Open reduction of fracture with internal fixation, femur	75	18/24 episodes	-184.728,80 €	-56	major therapeutic
7936 - Open reduction of fracture with internal fixation, tibia and fibula	75	6/8 episodes	-12.457,10 €	-30,7	major therapeutic
3927 - Arteriovenostomy for renal dialysis	73,9	17/23 episodes	-105.922,30 €	-53,3	major therapeutic
1769 - Laser interstitial thermal therapy [LITT] of lesion or tissue of other and unspecified site under guidance	73,2	52/71 episodes	-189.191,20 €	-44,7	major therapeutic
3173 - Closure of other fistula of trachea	72,4	21/29 episodes	-27.346,40 €	-31,1	major therapeutic

3780 - Insertion of permanent pacemaker, initial or replacement, type of device not specified	71,4	10/14 episodes	-52.885 €	-40	major therapeutic
7855 - Internal fixation of bone without fracture reduction, femur	71,4	5/7 episodes	-34.887,80 €	-58,3	major therapeutic
3320 - Thoracoscopic lung biopsy	71,1	128/180 episodes	-226.966 €	-31,7	major diagnostic
3226 - Other and unspecified ablation of lung lesion or tissue	70	14/20 episodes	-20.976,10 €	-32,5	major therapeutic
3325 - Open biopsy of bronchus	70	7/10 episodes	-14.879,50 €	-43,4	major diagnostic
3771 - Initial insertion of transvenous lead [electrode] into ventricle	69,1	47/68 episodes	-127.715,70 €	-30,9	minor therapeutic
3772 - Initial insertion of transvenous leads [electrodes] into atrium and ventricle	68,5	50/73 episodes	-171.371,10 €	-33,3	minor therapeutic
3192 - Lysis of adhesions of trachea or larynx	66,7	4/6 episodes	-3.571,20 €	-24,6	major therapeutic
3845 - Resection of vessel with replacement, thoracic vessels	66,7	4/6 episodes	-6.910,80 €	-17,5	major therapeutic
4019 - Other diagnostic procedures on lymphatic structures	66,7	12/18 episodes	-50.559 €	-40	major diagnostic
3229 - Other local excision or destruction of lesion or tissue of lung	66	919/1393 episodes	-1.138.553,90 €	-30,8	major therapeutic
7932 - Open reduction of fracture with internal fixation, radius and ulna	65	13/20 episodes	-24.738,50 €	-30,1	major therapeutic
0782 - Other total excision of thymus	64,7	11/17 episodes	-17.419,50 €	-38,3	major therapeutic
5372 - Other and open repair of diaphragmatic hernia, abdominal approach	64,7	11/17 episodes	-8.008 €	-6,5	major therapeutic
3421 - Transpleural thoracoscopy	64,5	599/929 episodes	-1.335.175,60 €	-34,8	major diagnostic
5419 - Other laparotomy	64,3	18/28 episodes	-105.296,70 €	-32	major therapeutic
7939 - Open reduction of fracture with internal fixation, other specified bone	63,6	14/22 episodes	-3.843,60 €	-4,5	major therapeutic
3209 - Other local excision or destruction of lesion or tissue of bronchus	62,7	42/67 episodes	-91.789,80 €	-29,6	major therapeutic
2161 - Turbinectomy by diathermy or cryosurgery	62,5	5/8 episodes	-2.215,40 €	-19,6	major therapeutic
3818 - Endarterectomy, lower limb arteries	62,5	5/8 episodes	-23.250,10 €	-22,4	major therapeutic
7841 - Other repair or plastic operations on bone, scapula, clavicle, and thorax [ribs and sternum]	62,5	10/16 episodes	-8.943,70 €	-17,7	major therapeutic
3198 - Other operations on larynx	60,9	14/23 episodes	-27.549,80 €	-34,3	major therapeutic
7761 - Local excision of lesion or tissue of bone, scapula, clavicle, and thorax [ribs and sternum]	60,7	17/28 episodes	-21.739,20 €	-28,8	major therapeutic
3942 - Revision of arteriovenous shunt for renal dialysis	60	6/10 episodes	-29.717,60 €	-36,1	major therapeutic
5749 - Other transurethral excision or destruction of lesion or tissue of bladder	60	18/30 episodes	-35.489,20 €	-25,6	major therapeutic

3479 - Other repair of chest wall	59,4	38/64 episodes	-39.505 €	-15,5	major therapeutic
3782 - Initial insertion of single-chamber device, rate responsive	59	23/39 episodes	-69.468,60 €	-25,9	minor therapeutic
3422 - Mediastinoscopy	58,8	365/621 episodes	-458.432,10 €	-29,2	major diagnostic
4011 - Biopsy of lymphatic structure	58,3	392/672 episodes	-698.385,10 €	-26,5	major diagnostic
3222 - Lung volume reduction surgery	57,9	11/19 episodes	-23.479,30 €	-36,1	major therapeutic
4611 - Temporary colostomy	57,9	11/19 episodes	-132.688,80 €	-42,1	major therapeutic
5411 - Exploratory laparotomy	57,4	39/68 episodes	-89.648,70 €	-11,4	major therapeutic
3950 - Angioplasty of other non-coronary vessel(s)	55,8	24/43 episodes	-49.563,70 €	-23,2	major therapeutic
5123 - Laparoscopic cholecystectomy	55,6	5/9 episodes	-23.589 €	-45,2	major therapeutic
3808 - Incision of vessel, lower limb arteries	54,5	6/11 episodes	-23.425,60 €	-14,6	major therapeutic
4024 - Excision of inguinal lymph node	54,5	6/11 episodes	-37.038 €	-51,1	major therapeutic
3429 - Other diagnostic procedures on mediastinum	54,2	13/24 episodes	-29.255,50 €	-26,4	major diagnostic
5381 - Plication of the diaphragm	53,6	15/28 episodes	-22.063,90 €	-20,6	major therapeutic
4901 - Incision of perianal abscess	52,9	9/17 episodes	-51.476,50 €	-50,2	major therapeutic
4573 - Open and other right hemicolectomy	51,7	15/29 episodes	-143.594 €	-28,7	major therapeutic
3499 - Other operations on thorax	51,1	23/45 episodes	-67.445,60 €	-21,2	major therapeutic
3420 - Thoracoscopic pleural biopsy	50,8	327/644 episodes	-565.762,60 €	-23,2	major diagnostic
3220 - Thoracoscopic excision of lesion or tissue of lung	50,7	138/272 episodes	-168.437,30 €	-23,1	major therapeutic
3452 - Thoracoscopic decortication of lung	50,4	237/470 episodes	-294.675,90 €	-16,5	major therapeutic
0780 - Thymectomy, not otherwise specified	50	3/6 episodes	-3.434,80 €	-24,6	major therapeutic
4466 - Other procedures for creation of esophagogastric sphincteric competence	50	3/6 episodes	-22.603 €	-44,9	major therapeutic
4469 - Other repair of stomach	50	4/8 episodes	-9.836,90 €	-32,5	major therapeutic
5122 - Cholecystectomy	50	12/24 episodes	-73.471,90 €	-22,1	major therapeutic
5383 - Laparoscopic repair of diaphragmatic hernia, with thoracic approach	50	3/6 episodes	-3.454,20 €	-14,1	major therapeutic
8016 - Other arthrotomy, knee	50	3/6 episodes	-1.746 €	-12,1	major therapeutic
8364 - Other suture of tendon	50	3/6 episodes	192,20 €	0,8	major therapeutic
3339 - Other surgical collapse of lung	47,6	69/145 episodes	-104.571,50 €	-17,8	major therapeutic

3781 - Initial insertion of single-chamber device, not specified as rate responsive	47,6	20/42 episodes	-67.037,80 €	-28,6	minor therapeutic
3427 - Biopsy of diaphragm	47,4	18/38 episodes	-18.152,30 €	-13,9	major diagnostic
3223 - Open ablation of lung lesion or tissue	46,2	48/104 episodes	-63.786 €	-21,5	major therapeutic
3712 - Pericardiectomy	46,2	24/52 episodes	-79.113,30 €	-23,5	major therapeutic
8165 - Percutaneous vertebroplasty	45,5	5/11 episodes	-27.124,30 €	-40,6	major therapeutic
3402 - Exploratory thoracotomy	44,8	91/203 episodes	-152.687,30 €	-14,3	major therapeutic
3225 - Thoracoscopic ablation of lung lesion or tissue	44,4	12/27 episodes	-13.267,40 €	-17,9	major therapeutic
3343 - Closure of laceration of lung	44,4	20/45 episodes	-19.534,10 €	-9,2	major therapeutic
8412 - Amputation through foot	44,4	4/9 episodes	-34.957,80 €	-42,1	major therapeutic
3121 - Mediastinal tracheostomy	42,9	3/7 episodes	-17.046,10 €	-44,3	major therapeutic
3803 - Incision of vessel, upper limb vessels	42,9	3/7 episodes	-34.650 €	-46,1	major therapeutic
3929 - Other (peripheral) vascular shunt or bypass	42,9	3/7 episodes	10.798,20 €	21,9	major therapeutic
7911 - Closed reduction of fracture with internal fixation, humerus	42,9	3/7 episodes	-11.099,40 €	-34,9	major therapeutic
3426 - Open mediastinal biopsy	41	34/83 episodes	-49.106,50 €	-18,5	major diagnostic
0781 - Other partial excision of thymus	40	4/10 episodes	-5.412 €	-20,7	major therapeutic
3473 - Closure of other fistula of thorax	37,6	35/93 episodes	-48.812,10 €	-10,7	major therapeutic
3789 - Revision or removal of pacemaker device	37,5	3/8 episodes	-7.304,20 €	-18,5	major therapeutic
7851 - Internal fixation of bone without fracture reduction, scapula, clavicle, and thorax [ribs and sternum]	36,7	11/30 episodes	21.620,50 €	12,3	major therapeutic
4575 - Open and other left hemicolectomy	36,4	4/11 episodes	-40.577,70 €	-21	major therapeutic
7931 - Open reduction of fracture with internal fixation, humerus	36,4	4/11 episodes	-6.224,10 €	-10,1	major therapeutic
7731 - Other division of bone, scapula, clavicle, and thorax [ribs and sternum]	35,7	5/14 episodes	-353,50 €	-0,8	major therapeutic
0066 - Percutaneous transluminal coronary angioplasty [PTCA]	34,4	22/64 episodes	-55.366,70 €	-9	major therapeutic
0012 - Administration of inhaled nitric oxide	33,3	2/6 episodes	-7.559 €	-8	minor therapeutic
0022 - Intravascular imaging of intrathoracic vessels	33,3	2/6 episodes	1.067,30 €	4,2	minor diagnostic
0124 - Other craniotomy	33,3	2/6 episodes	-24.873,40 €	-40,2	major therapeutic
3342 - Closure of bronchial fistula	33,3	4/12 episodes	-8.054,20 €	-8,1	major therapeutic

3941 - Control of hemorrhage following vascular surgery	33,3	2/6 episodes	-6.772,10 €	-12,7	major therapeutic
4022 - Excision of internal mammary lymph node	33,3	3/9 episodes	1.970,60 €	7,6	major therapeutic
5012 - Open biopsy of liver	33,3	2/6 episodes	-3.452,60 €	-16,9	major diagnostic
7869 - Removal of implanted devices from bone, other bones	33,3	2/6 episodes	-5.613,10 €	-18,2	major therapeutic
8670 - Pedicle or flap graft, not otherwise specified	33,3	2/6 episodes	-1.355,90 €	-5,9	major therapeutic
3482 - Suture of laceration of diaphragm	32	8/25 episodes	-12.410,50 €	-13,8	major therapeutic
5091 - Percutaneous aspiration of liver	31,6	6/19 episodes	-9.786 €	-17,7	minor therapeutic
3406 - Thoracoscopic drainage of pleural cavity	31,3	181/579 episodes	-359.876,80 €	-14,5	major therapeutic
4562 - Other partial resection of small intestine	31	9/29 episodes	-127.105,90 €	-25,3	major therapeutic
3399 - Other operations on lung	30,2	42/139 episodes	-68.430 €	-13,1	major therapeutic
6829 - Other excision or destruction of lesion of uterus	30	3/10 episodes	-8.644,40 €	-18,6	major therapeutic
0159 - Other excision or destruction of lesion or tissue of brain	28,6	2/7 episodes	-7.064,30 €	-22,9	major therapeutic
3822 - Percutaneous angiography	28,6	2/7 episodes	-1.026,60 €	-4,2	minor diagnostic
9670 - Continuous invasive mechanical ventilation of unspecified duration	28	199/711 episodes	-201.003,70 €	-7	minor therapeutic
3949 - Other revision of vascular procedure	27,3	3/11 episodes	-12.746,60 €	-8,3	major therapeutic
3428 - Other diagnostic procedures on chest wall, pleura, and diaphragm	26,9	7/26 episodes	-34.083,70 €	-26,5	major diagnostic
3493 - Repair of pleura	26,7	4/15 episodes	-8.704,90 €	-11	major therapeutic
3998 - Control of hemorrhage, not otherwise specified	26,7	23/86 episodes	-81.675,30 €	-20,8	major therapeutic
3221 - Plication of emphysematous bleb	26,3	10/38 episodes	-10.725 €	-9,6	major therapeutic
0309 - Other exploration and decompression of spinal canal	25	5/20 episodes	-14.419,30 €	-13,4	major therapeutic
4620 - Ileostomy, not otherwise specified	25	2/8 episodes	-12.093,60 €	-8,4	major therapeutic
5349 - Other open umbilical herniorrhaphy	25	2/8 episodes	2.376,40 €	3,9	major therapeutic
0046 - Insertion of two vascular stents	23,5	4/17 episodes	5.513,20 €	3,6	minor therapeutic
8415 - Other amputation below knee	23,1	3/13 episodes	-22.312,80 €	-17,5	major therapeutic
0040 - Procedure on single vessel	22,4	22/98 episodes	-36.303,90 €	-5,3	minor therapeutic
8674 - Attachment of pedicle or flap graft to other sites	21,9	7/32 episodes	-2.064,70 €	-1,5	major therapeutic
3783 - Initial insertion of dual-chamber device	21,7	18/83 episodes	-54.900,80 €	-10,4	minor therapeutic

3484 - Other repair of diaphragm	20,7	6/29 episodes	-4.997,10 €	-3,4	major therapeutic
0392 - Injection of other agent into spinal canal	20	4/20 episodes	-4.072,80 €	-8,2	minor therapeutic
5300 - Unilateral repair of inguinal hernia, not otherwise specified	20	2/10 episodes	-3.871,20 €	-5,3	major therapeutic
5412 - Reopening of recent laparotomy site	20	2/10 episodes	6.839 €	5,4	major therapeutic
8162 - Fusion or refusion of 2-3 vertebrae	20	3/15 episodes	-14.903,20 €	-24,3	major therapeutic
9671 - Continuous invasive mechanical ventilation for less than 96 consecutive hours	19,9	804/4044 episodes	-1.014.853,20 €	-5,9	minor therapeutic
3459 - Other excision of pleura	19,8	99/499 episodes	-151.540,40 €	-7,6	major therapeutic
4029 - Simple excision of other lymphatic structure	18,8	57/304 episodes	11.440,40 €	1,1	major therapeutic
2311 - Removal of residual root	18,2	6/33 episodes	-12.344,90 €	-10,7	minor therapeutic
2611 - Closed [needle] biopsy of salivary gland or duct	18,2	4/22 episodes	6.921,30 €	14,7	minor diagnostic
7904 - Closed reduction of fracture without internal fixation, phalanges of hand	17,6	3/17 episodes	-1.829,80 €	-5	minor therapeutic
7905 - Closed reduction of fracture without internal fixation, femur	17,6	6/34 episodes	-6.358 €	-6,4	minor therapeutic
8052 - Intervertebral chemonucleolysis	17,6	3/17 episodes	-1.493,20 €	-3,8	minor therapeutic
0531 - Injection of anesthetic into sympathetic nerve for analgesia	16,7	1/6 episodes	-746,70 €	-6,8	minor therapeutic
2001 - Myringotomy with insertion of tube	16,7	1/6 episodes	-443,10 €	-5	major therapeutic
5423 - Biopsy of peritoneum	16,7	1/6 episodes	-2.358,60 €	-5,5	major diagnostic
5631 - Ureteroscopy	16,7	2/12 episodes	-2.417,30 €	-4,7	minor diagnostic
7791 - Total ostectomy, scapula, clavicle, and thorax [ribs and sternum]	16,7	4/24 episodes	-4.865,20 €	-4,9	major therapeutic
7741 - Biopsy of bone, scapula, clavicle, and thorax [ribs and sternum]	15,6	7/45 episodes	-13.127,80 €	-10,7	major diagnostic
3724 - Biopsy of pericardium	15,4	4/26 episodes	-23.241,90 €	-13,2	major diagnostic
4229 - Other diagnostic procedures on esophagus	15,4	2/13 episodes	1.513,60 €	7,9	minor diagnostic
7781 - Other partial ostectomy, scapula, clavicle, and thorax [ribs and sternum]	15,4	4/26 episodes	-9.802,40 €	-11,3	major therapeutic
2729 - Other diagnostic procedures on oral cavity	14,3	3/21 episodes	-1.439,10 €	-4,3	minor diagnostic
5791 - Sphincterotomy of bladder	14,3	1/7 episodes	-1.691,10 €	-2,3	major therapeutic
8665 - Heterograft to skin	14,3	1/7 episodes	-1.795,50 €	-5,3	major therapeutic
2912 - Pharyngeal biopsy	13,6	3/22 episodes	4.147,30 €	5,5	minor diagnostic
3403 - Reopening of recent thoracotomy site	13,3	12/90 episodes	-18.589,60 €	-3,4	major therapeutic

5424 - Closed [percutaneous] [needle] biopsy of intra-abdominal mass	13,2	5/38 episodes	-9.828,50 €	-7,9	minor diagnostic
9983 - Other phototherapy	13	3/23 episodes	-42,50 €	-0,1	minor therapeutic
3770 - Initial insertion of lead [electrode], not otherwise specified	12,5	2/16 episodes	-4.622,80 €	-5	minor therapeutic
4610 - Colostomy, not otherwise specified	12,5	1/8 episodes	-9.123,10 €	-7,8	major therapeutic
9225 - Teleradiotherapy using electrons	12,5	1/8 episodes	2.426,70 €	9,3	minor therapeutic
4292 - Dilation of esophagus	12,2	5/41 episodes	-2.227 €	-1,8	minor therapeutic
3996 - Total body perfusion	12,1	18/149 episodes	1.671,70 €	0,6	minor therapeutic
9902 - Transfusion of previously collected autologous blood	12	3/25 episodes	-4.037,40 €	-3,6	minor therapeutic
5188 - Endoscopic removal of stone(s) from biliary tract	11,4	4/35 episodes	-1.921 €	-1,4	minor therapeutic
5198 - Other percutaneous procedures on biliary tract	11,1	1/9 episodes	-1.740 €	-4,2	minor therapeutic
5422 - Biopsy of abdominal wall or umbilicus	11,1	1/9 episodes	541,50 €	1,7	major diagnostic
5717 - Percutaneous cystostomy	10,4	13/125 episodes	-12.894 €	-2,4	minor therapeutic
3348 - Other repair and plastic operations on bronchus	10,2	21/206 episodes	-17.528,90 €	-1,8	major therapeutic
4719 - Other incidental appendectomy	10	1/10 episodes	653,10 €	1,1	major therapeutic
6812 - Hysteroscopy	10	1/10 episodes	-2.426,70 €	-10	minor diagnostic
3606 - Insertion of non-drug-eluting coronary artery stent(s)	9,7	3/31 episodes	-13.018,10 €	-4,8	minor therapeutic
8105 - Dorsal and dorsolumbar fusion of the posterior column, posterior technique	9,6	7/73 episodes	-15.195,70 €	-7,6	major therapeutic
8651 - Replantation of scalp	9,5	2/21 episodes	1.051,60 €	1,5	minor therapeutic
3194 - Injection of locally-acting therapeutic substance into trachea	9,1	1/11 episodes	-760 €	-1,7	minor therapeutic
5523 - Closed [percutaneous] [needle] biopsy of kidney	9	8/89 episodes	-8.289,30 €	-3	minor diagnostic
8511 - Closed [percutaneous] [needle] biopsy of breast	8,9	7/79 episodes	-10.217,60 €	-5	minor diagnostic
3892 - Umbilical vein catheterization	8,8	5/57 episodes	-20.565,90 €	-4,7	minor therapeutic
4543 - Endoscopic destruction of other lesion or tissue of large intestine	8,5	4/47 episodes	4.186,10 €	2,4	minor therapeutic
5733 - Closed [transurethral] biopsy of bladder	8,3	1/12 episodes	443,50 €	1	major diagnostic
3931 - Suture of artery	7,9	3/38 episodes	1.536,20 €	0,7	major therapeutic
9228 - Injection or instillation of radioisotopes	7,8	6/77 episodes	-3.120,20 €	-2,2	minor therapeutic
2724 - Biopsy of mouth, unspecified structure	7,7	1/13 episodes	1.740 €	6,2	minor diagnostic

4576 - Open and other sigmoidectomy	7,7	1/13 episodes	9.032,80 €	4,6	major therapeutic
4593 - Other small-to-large intestinal anastomosis	7,7	1/13 episodes	-1.566,40 €	-0,9	major therapeutic
8669 - Other skin graft to other sites	7,7	1/13 episodes	-13.824,20 €	-16,9	major therapeutic
0711 - Closed [percutaneous] [needle] biopsy of adrenal gland	7,1	1/14 episodes	-2.144,70 €	-6,4	minor diagnostic
3749 - Other repair of heart and pericardium	6,9	2/29 episodes	-12.306,10 €	-8,1	major therapeutic
8104 - Dorsal and dorsolumbar fusion of the anterior column, anterior technique	6,7	1/15 episodes	-386,20 €	-0,8	major therapeutic
3193 - Replacement of laryngeal or tracheal stent	6,5	4/62 episodes	-3.925,60 €	-2	minor therapeutic
3778 - Insertion of temporary transvenous pacemaker system	6,5	7/107 episodes	-35.092,60 €	-4,3	minor therapeutic
8605 - Incision with removal of foreign body or device from skin and subcutaneous tissue	6,4	5/78 episodes	1.176,80 €	0,4	minor therapeutic
2171 - Closed reduction of nasal fracture	6,2	1/16 episodes	-525,80 €	-1,5	minor therapeutic
4519 - Other diagnostic procedures on small intestine	6,2	1/16 episodes	541,50 €	1,3	minor diagnostic
5498 - Peritoneal dialysis	6,2	9/145 episodes	-1.929,90 €	-0,6	minor therapeutic
7906 - Closed reduction of fracture without internal fixation, tibia and fibula	6,1	3/49 episodes	2.950,40 €	2,7	minor therapeutic
9971 - Therapeutic plasmapheresis	6,1	2/33 episodes	-11.719,10 €	-6,2	minor therapeutic
4443 - Endoscopic control of gastric or duodenal bleeding	5,9	9/153 episodes	-9.855,20 €	-1,4	minor therapeutic
8452 - Insertion of recombinant bone morphogenetic protein	5,9	1/17 episodes	410,20 €	1	minor therapeutic
9222 - Orthovoltage radiation	5,8	3/52 episodes	5.220,10 €	3,9	minor therapeutic
3172 - Closure of external fistula of trachea	5,7	7/122 episodes	9.198,70 €	3,8	major therapeutic
3990 - Insertion of non-drug-eluting peripheral (non-coronary) vessel stent(s)	5,6	2/36 episodes	2.417,30 €	2,4	minor therapeutic
3379 - Endoscopic insertion of other bronchial device or substances	5,4	11/202 episodes	-11.457 €	-1,8	minor therapeutic
4233 - Endoscopic excision or destruction of lesion or tissue of esophagus	5,3	2/38 episodes	-2.417,30 €	-1,5	minor therapeutic
0023 - Intravascular imaging of peripheral vessels	5	1/20 episodes	-990,30 €	-1,7	minor diagnostic
8611 - Closed biopsy of skin and subcutaneous tissue	5	17/341 episodes	25.581 €	2,2	minor diagnostic
9973 - Therapeutic erythrocytapheresis	5	1/20 episodes	-12.466,30 €	-12,8	minor therapeutic
4224 - Closed [endoscopic] biopsy of esophagus	4,9	3/61 episodes	704 €	0,4	minor diagnostic
7909 - Closed reduction of fracture without internal fixation, other specified bone	4,9	4/82 episodes	-2.650,40 €	-2,2	minor therapeutic
3471 - Suture of laceration of chest wall	4,8	1/21 episodes	1.792,10 €	2,7	minor therapeutic

5110 - Endoscopic retrograde cholangiopancreatography [ERCP]	4,8	4/83 episodes	-2.192,50 €	-0,8	minor diagnostic
5994 - Replacement of cystostomy tube	4,8	1/21 episodes	541,50 €	0,7	minor therapeutic
8604 - Other incision with drainage of skin and subcutaneous tissue	4,8	8/166 episodes	5.647,40 €	0,9	minor therapeutic
3723 - Combined right and left heart cardiac catheterization	4,5	4/89 episodes	9.124 €	3,3	minor diagnostic
5101 - Percutaneous aspiration of gallbladder	4,5	1/22 episodes	2.673,40 €	2,1	minor therapeutic
4131 - Biopsy of bone marrow	4,3	38/877 episodes	-7.855,80 €	-0,3	minor diagnostic
3391 - Bronchial dilation	4,2	2/48 episodes	3.591,80 €	2,5	minor therapeutic
8396 - Injection of therapeutic substance into bursa	4,2	1/24 episodes	-760 €	-1,5	minor therapeutic
8855 - Coronary arteriography using a single catheter	4,2	3/71 episodes	1.495,10 €	0,5	minor diagnostic
8622 - Excisional debridement of wound, infection, or burn	4,1	10/244 episodes	-28.556,80 €	-2,5	major therapeutic
0068 - Intravascular pressure measurement of peripheral arteries	4	4/99 episodes	11.261,60 €	1,1	minor diagnostic
9226 - Teleradiotherapy of other particulate radiation	4	1/25 episodes	410,20 €	0,7	minor therapeutic
4281 - Insertion of permanent tube into esophagus	3,9	3/76 episodes	3.510,50 €	1,4	minor therapeutic
3141 - Tracheoscopy through artificial stoma	3,8	1/26 episodes	-9.222 €	-9,4	minor diagnostic
8321 - Open biopsy of soft tissue	3,8	2/52 episodes	2.738,80 €	1,3	major diagnostic
0018 - Infusion of immunosuppressive antibody therapy	3,7	1/27 episodes	-1.740 €	-1,8	minor therapeutic
3607 - Insertion of drug-eluting coronary artery stent(s)	3,7	1/27 episodes	-4.421,90 €	-1,6	minor therapeutic
0881 - Linear repair of laceration of eyelid or eyebrow	3,6	1/28 episodes	990,30 €	1,8	minor therapeutic
4319 - Other gastrostomy	3,6	1/28 episodes	-1.552,40 €	-1	minor therapeutic
2309 - Extraction of other tooth	3,5	5/144 episodes	-371,50 €	-0,1	minor therapeutic
8607 - Insertion of totally implantable vascular access device [VAD]	3,5	7/202 episodes	-3.365,30 €	-0,5	minor therapeutic
2202 - Aspiration or lavage of nasal sinus through natural ostium	3,4	3/87 episodes	2.633,70 €	3,6	minor therapeutic
3144 - Closed [endoscopic] biopsy of trachea	3,4	1/29 episodes	443,50 €	0,5	minor diagnostic
3728 - Intracardiac echocardiography	3,4	4/117 episodes	4.895,60 €	1,9	minor diagnostic
8853 - Angiocardiography of left heart structures	3,4	5/149 episodes	-16.562,60 €	-3,3	minor diagnostic
2101 - Control of epistaxis by anterior nasal packing	3,3	6/180 episodes	4.092,20 €	0,7	minor therapeutic
2121 - Rhinoscopy	3,3	5/151 episodes	-3.212,70 €	-0,8	minor diagnostic

4059 - Radical excision of other lymph nodes	3,3	9/270 episodes	-20.324,60 €	-1,8	major therapeutic
4311 - Percutaneous [endoscopic] gastrostomy [PEG]	3,3	18/553 episodes	-5.450,40 €	-0,3	minor therapeutic
7740 - Biopsy of bone, unspecified site	3,3	1/30 episodes	990,30 €	1,4	major diagnostic
0045 - Insertion of one vascular stent	3,2	2/62 episodes	-18.246,20 €	-3,9	minor therapeutic
3321 - Bronchoscopy through artificial stoma	3	2/66 episodes	4.822,50 €	2,3	minor diagnostic
3409 - Other incision of pleura	3	24/801 episodes	-37.865,90 €	-1,2	minor therapeutic
7971 - Closed reduction of dislocation of shoulder	3	2/67 episodes	-9.831,70 €	-5,7	minor therapeutic
3731 - Pericardiectomy	2,9	1/35 episodes	-1.551,30 €	-0,8	major therapeutic
1621 - Ophthalmoscopy	2,8	4/143 episodes	2.881,60 €	0,6	minor diagnostic
3481 - Excision of lesion or tissue of diaphragm	2,8	1/36 episodes	-1.151,40 €	-0,7	major therapeutic
3721 - Right heart cardiac catheterization	2,8	4/143 episodes	-3.683,90 €	-0,5	minor diagnostic
7749 - Biopsy of bone, other bones	2,8	4/141 episodes	72 €	0	major diagnostic
5491 - Percutaneous abdominal drainage	2,7	25/916 episodes	25.282,20 €	0,7	minor therapeutic
8609 - Other incision of skin and subcutaneous tissue	2,7	1/37 episodes	-3.438,70 €	-1,8	minor therapeutic
9905 - Transfusion of platelets	2,7	31/1131 episodes	20.603,60 €	0,4	minor therapeutic
2103 - Control of epistaxis by cauterization (and packing)	2,4	1/42 episodes	-1.307 €	-1,3	minor therapeutic
5839 - Other local excision or destruction of lesion or tissue of urethra	2,4	2/82 episodes	878,80 €	0,5	minor therapeutic
3722 - Left heart cardiac catheterization	2,3	11/478 episodes	3.615,60 €	0,2	minor diagnostic
3894 - Venous cutdown	2,3	3/128 episodes	2.034,30 €	0,6	minor therapeutic
4414 - Closed [endoscopic] biopsy of stomach	2,3	8/341 episodes	-10.091,50 €	-1,3	minor diagnostic
9925 - Injection or infusion of cancer chemotherapeutic substance	2,3	43/1896 episodes	17.033 €	0,3	minor therapeutic
0390 - Insertion of catheter into spinal canal for infusion of therapeutic or palliative substances	2,2	22/1000 episodes	-16.700,40 €	-0,4	minor therapeutic
3228 - Endoscopic excision or destruction of lesion or tissue of lung	2,2	1/45 episodes	1.552,40 €	1,4	minor therapeutic
3401 - Incision of chest wall	2,2	8/364 episodes	-21.193,10 €	-2,5	minor therapeutic
5187 - Endoscopic insertion of stent (tube) into bile duct	2,2	1/45 episodes	1.740 €	1,4	minor therapeutic
6011 - Closed [percutaneous] [needle] biopsy of prostate	2,2	1/45 episodes	541,50 €	0,4	minor diagnostic

8852 - Angiocardiography of right heart structures	2,2	2/90 episodes	3.452,60 €	1,7	minor diagnostic
9901 - Exchange transfusion	2,2	2/93 episodes	-4.429 €	-1,3	minor therapeutic
0014 - Injection or infusion of oxazolidinone class of antibiotics	2	22/1127 episodes	-3.944,10 €	-0,1	minor therapeutic
8856 - Coronary arteriography using two catheters	2	5/251 episodes	-13.827,40 €	-1,4	minor diagnostic
9908 - Transfusion of blood expander	2	19/961 episodes	-23.989,50 €	-0,6	minor therapeutic
3142 - Laryngoscopy and other tracheoscopy	1,9	15/796 episodes	-21.413,90 €	-0,8	minor diagnostic
3201 - Endoscopic excision or destruction of lesion or tissue of bronchus	1,9	6/324 episodes	4.449,60 €	0,5	minor therapeutic
3899 - Other puncture of vein	1,9	111/5866 episodes	102.197,30 €	0,9	minor therapeutic
4523 - Colonoscopy	1,9	62/3219 episodes	-75.231,10 €	-0,9	minor diagnostic
9224 - Teleradiotherapy using photons	1,9	6/314 episodes	11.224,60 €	1,3	minor therapeutic
3322 - Fiber-optic bronchoscopy	1,8	172/9655 episodes	49.835,60 €	0,2	minor diagnostic
4516 - Esophagogastroduodenoscopy [EGD] with closed biopsy	1,8	24/1338 episodes	11.999,90 €	0,3	minor diagnostic
7901 - Closed reduction of fracture without internal fixation, humerus	1,8	1/55 episodes	-990,30 €	-0,7	minor therapeutic
8191 - Arthrocentesis	1,8	2/114 episodes	-2.542,80 €	-1	minor therapeutic
9915 - Parenteral infusion of concentrated nutritional substances	1,8	20/1127 episodes	-22.938,70 €	-0,3	minor therapeutic
0391 - Injection of anesthetic into spinal canal for analgesia	1,7	17/1028 episodes	15.479,80 €	0,4	minor therapeutic
3327 - Closed endoscopic biopsy of lung	1,7	27/1545 episodes	-41.880,20 €	-1,1	major diagnostic
4823 - Rigid proctosigmoidoscopy	1,7	1/58 episodes	541,50 €	0,3	minor diagnostic
5185 - Endoscopic sphincterotomy and papillotomy	1,7	1/59 episodes	410,20 €	0,2	minor therapeutic
8628 - Nonexcisional debridement of wound, infection or burn	1,7	6/362 episodes	-6.767,20 €	-0,6	minor therapeutic
8659 - Closure of skin and subcutaneous tissue of other sites	1,7	12/719 episodes	-19.432,60 €	-1,2	minor therapeutic
3143 - Closed [endoscopic] biopsy of larynx	1,6	1/61 episodes	-1.740 €	-1,2	minor diagnostic
4525 - Closed [endoscopic] biopsy of large intestine	1,6	10/608 episodes	-1.928,10 €	-0,1	minor diagnostic
3492 - Injection into thoracic cavity	1,5	26/1734 episodes	-8.526,90 €	-0,2	minor therapeutic
3895 - Venous catheterization for renal dialysis	1,5	22/1438 episodes	87.403,30 €	0,7	minor therapeutic
3997 - Other perfusion	1,5	34/2286 episodes	-8.051,20 €	-0,1	minor therapeutic
4052 - Radical excision of periaortic lymph nodes	1,5	15/968 episodes	-48.290,10 €	-1,1	major therapeutic

4524 - Flexible sigmoidoscopy	1,4	3/221 episodes	2.347,40 €	0,3	minor diagnostic
5732 - Other cystoscopy	1,4	1/70 episodes	-653 €	-0,2	minor diagnostic
8619 - Other diagnostic procedures on skin and subcutaneous tissue	1,4	5/360 episodes	-5.676,90 €	-0,9	minor diagnostic
9907 - Transfusion of other serum	1,4	17/1231 episodes	-16.331,10 €	-0,2	minor therapeutic
3898 - Other puncture of artery	1,3	56/4217 episodes	-46.463,60 €	-0,5	minor therapeutic
4542 - Endoscopic polypectomy of large intestine	1,3	3/233 episodes	4.751,90 €	0,9	minor therapeutic
8857 - Other and unspecified coronary arteriography	1,3	4/303 episodes	-1.613 €	-0,1	minor diagnostic
9903 - Other transfusion of whole blood	1,3	9/708 episodes	-6.928,80 €	-0,3	minor therapeutic
0017 - Infusion of vasopressor agent	1,2	27/2314 episodes	25.564,40 €	0,1	minor therapeutic
5795 - Replacement of indwelling urinary catheter	1,2	10/847 episodes	5.570,60 €	0,2	minor therapeutic
7902 - Closed reduction of fracture without internal fixation, radius and ulna	1,2	1/85 episodes	677,30 €	0,4	minor therapeutic
9909 - Transfusion of other substance	1,2	5/428 episodes	4.753,50 €	0,3	minor therapeutic
3995 - Hemodialysis	1,1	63/5511 episodes	-93.721,10 €	-0,4	minor therapeutic
9223 - Radioisotopic teleradiotherapy	1,1	1/92 episodes	972 €	0,3	minor therapeutic
0331 - Spinal tap	1	25/2461 episodes	-39.853,20 €	-0,5	minor diagnostic
0611 - Closed [percutaneous] [needle] biopsy of thyroid gland	1	2/196 episodes	1.373,30 €	0,3	minor diagnostic
3891 - Arterial catheterization	1	73/7173 episodes	-86.221,60 €	-0,1	minor therapeutic
3893 - Venous catheterization, not elsewhere classified	1	142/14857 episodes	-270.605,50 €	-0,3	minor therapeutic
4223 - Other esophagoscopy	1	3/286 episodes	-5.132,80 €	-0,5	minor diagnostic
3326 - Closed [percutaneous] [needle] biopsy of lung	0,9	51/5717 episodes	47.415,90 €	0,5	minor diagnostic
9604 - Insertion of endotracheal tube	0,9	91/9644 episodes	98.633,40 €	0,1	minor therapeutic
4413 - Other gastroscopy	0,8	7/902 episodes	8.008,20 €	0,4	minor diagnostic
3491 - Thoracentesis	0,7	86/12259 episodes	-6.395,40 €	0	minor therapeutic
4513 - Other endoscopy of small intestine	0,7	41/6183 episodes	-31.333,70 €	-0,2	minor diagnostic
3404 - Insertion of intercostal catheter for drainage	0,6	94/14595 episodes	-78.003,30 €	-0,2	minor therapeutic
3424 - Other pleural biopsy	0,6	19/2958 episodes	18.050,60 €	0,2	minor diagnostic
5011 - Closed (percutaneous) [needle] biopsy of liver	0,6	2/316 episodes	2.556,70 €	0,3	minor diagnostic

3323 - Other bronchoscopy	0,5	9/1788 episodes	17.035,60 €	0,3	minor diagnostic
3324 - Closed [endoscopic] biopsy of bronchus	0,4	47/11114 episodes	-24.393,50 €	-0,1	minor diagnostic
3425 - Closed [percutaneous] [needle] biopsy of mediastinum	0,4	2/454 episodes	5.550,70 €	0,6	minor diagnostic
5794 - Insertion of indwelling urinary catheter	0,4	144/33889 episodes	-176.350,50 €	-0,2	minor therapeutic
9229 - Other radiotherapeutic procedure	0,4	3/851 episodes	-25.829,70 €	-1	minor therapeutic
3897 - Central venous catheter placement with guidance	0,3	1/333 episodes	4.127,60 €	0,2	minor therapeutic
9605 - Other intubation of respiratory tract	0,3	19/6435 episodes	8.310,10 €	0,1	minor therapeutic
9904 - Transfusion of packed cells	0,3	68/21479 episodes	-75.661,90 €	-0,1	minor therapeutic
1811 - Otoscopy	0,2	7/4289 episodes	7.516,50 €	0,2	minor diagnostic
9390 - Non-invasive mechanical ventilation	0,2	81/33157 episodes	-166.832,70 €	-0,2	minor therapeutic
0013 - Injection or infusion of nesiritide	0	0/7 episodes	0 €	0	minor therapeutic
0021 - Intravascular imaging of extracranial cerebral vessels	0	0/20 episodes	0 €	0	minor diagnostic
0028 - Intravascular imaging, other specified vessel(s)	0	0/11 episodes	0 €	0	minor diagnostic
0041 - Procedure on two vessels	0	0/17 episodes	0 €	0	minor therapeutic
0110 - Intracranial pressure monitoring	0	0/10 episodes	0 €	0	minor diagnostic
0396 - Percutaneous denervation of facet	0	0/6 episodes	0 €	0	minor therapeutic
0411 - Closed [percutaneous] [needle] biopsy of cranial or peripheral nerve or ganglion	0	0/25 episodes	0 €	0	minor diagnostic
0481 - Injection of anesthetic into peripheral nerve for analgesia	0	0/37 episodes	0 €	0	minor therapeutic
0601 - Aspiration of thyroid field	0	0/8 episodes	0 €	0	minor therapeutic
2009 - Other myringotomy	0	0/18 episodes	0 €	0	minor therapeutic
2100 - Control of epistaxis, not otherwise specified	0	0/15 episodes	0 €	0	minor therapeutic
2102 - Control of epistaxis by posterior (and anterior) packing	0	0/33 episodes	0 €	0	minor therapeutic
2122 - Biopsy of nose	0	0/20 episodes	0 €	0	minor diagnostic
2131 - Local excision or destruction of intranasal lesion	0	0/10 episodes	0 €	0	minor therapeutic
2200 - Aspiration and lavage of nasal sinus, not otherwise specified	0	0/201 episodes	0 €	0	minor therapeutic
2211 - Closed [endoscopic] [needle] biopsy of nasal sinus	0	0/8 episodes	0 €	0	minor diagnostic
2219 - Other diagnostic procedures on nasal sinuses	0	0/13 episodes	0 €	0	minor diagnostic

2301 - Extraction of deciduous tooth	0	0/6 episodes	0 €	0	minor therapeutic
2319 - Other surgical extraction of tooth	0	0/26 episodes	0 €	0	minor therapeutic
2751 - Suture of laceration of lip	0	0/16 episodes	0 €	0	minor therapeutic
2911 - Pharyngoscopy	0	0/43 episodes	0 €	0	minor diagnostic
3195 - Tracheoesophageal fistulization	0	0/6 episodes	0 €	0	minor therapeutic
3332 - Artificial pneumothorax for collapse of lung	0	0/29 episodes	0 €	0	minor therapeutic
3349 - Other repair and plastic operations on lung	0	0/10 episodes	0 €	0	major therapeutic
3371 - Endoscopic insertion or replacement of bronchial valve(s), single lobe	0	0/24 episodes	0 €	0	minor therapeutic
3373 - Endoscopic insertion or replacement of bronchial valve(s), multiple lobes	0	0/12 episodes	0 €	0	minor therapeutic
3378 - Endoscopic removal of bronchial device(s) or substances	0	0/47 episodes	0 €	0	minor therapeutic
3423 - Biopsy of chest wall	0	0/21 episodes	0 €	0	minor diagnostic
3489 - Other operations on diaphragm	0	0/6 episodes	0 €	0	major therapeutic
3521 - Open and other replacement of aortic valve with tissue graft	0	0/7 episodes	0 €	0	major therapeutic
3611 - (Aorto)coronary bypass of one coronary artery	0	0/6 episodes	0 €	0	major therapeutic
3725 - Biopsy of heart	0	0/9 episodes	0 €	0	minor diagnostic
3727 - Cardiac mapping	0	0/15 episodes	0 €	0	minor diagnostic
3733 - Excision or destruction of other lesion or tissue of heart, open approach	0	0/7 episodes	0 €	0	major therapeutic
3821 - Biopsy of blood vessel	0	0/19 episodes	0 €	0	major diagnostic
3865 - Other excision of vessels, thoracic vessels	0	0/12 episodes	0 €	0	major therapeutic
3932 - Suture of vein	0	0/6 episodes	0 €	0	major therapeutic
3961 - Extracorporeal circulation auxiliary to open heart surgery	0	0/27 episodes	0 €	0	minor therapeutic
4050 - Radical excision of lymph nodes, not otherwise specified	0	0/16 episodes	0 €	0	major therapeutic
4064 - Ligation of thoracic duct	0	0/7 episodes	0 €	0	major therapeutic
4132 - Closed [aspiration] [percutaneous] biopsy of spleen	0	0/8 episodes	0 €	0	minor diagnostic
4138 - Other diagnostic procedures on bone marrow	0	0/58 episodes	0 €	0	minor diagnostic
4341 - Endoscopic excision or destruction of lesion or tissue of stomach	0	0/39 episodes	0 €	0	minor therapeutic
4412 - Gastroscopy through artificial stoma	0	0/12 episodes	0 €	0	minor diagnostic

4442 - Suture of duodenal ulcer site	0	0/7 episodes	0 €	0	major therapeutic
4512 - Endoscopy of small intestine through artificial stoma	0	0/9 episodes	0 €	0	minor diagnostic
4514 - Closed [endoscopic] biopsy of small intestine	0	0/31 episodes	0 €	0	minor diagnostic
4591 - Small-to-small intestinal anastomosis	0	0/11 episodes	0 €	0	major therapeutic
4621 - Temporary ileostomy	0	0/10 episodes	0 €	0	major therapeutic
4632 - Percutaneous (endoscopic) jejunostomy [PEJ]	0	0/8 episodes	0 €	0	minor therapeutic
4639 - Other enterostomy	0	0/12 episodes	0 €	0	minor therapeutic
4673 - Suture of laceration of small intestine, except duodenum	0	0/6 episodes	0 €	0	major therapeutic
4824 - Closed [endoscopic] biopsy of rectum	0	0/55 episodes	0 €	0	minor diagnostic
4836 - [Endoscopic] polypectomy of rectum	0	0/27 episodes	0 €	0	minor therapeutic
4921 - Anoscopy	0	0/24 episodes	0 €	0	minor diagnostic
4929 - Other diagnostic procedures on anus and perianal tissue	0	0/6 episodes	0 €	0	minor diagnostic
4947 - Evacuation of thrombosed hemorrhoids	0	0/6 episodes	0 €	0	minor therapeutic
5211 - Closed [aspiration] [needle] [percutaneous] biopsy of pancreas	0	0/7 episodes	0 €	0	minor diagnostic
5380 - Repair of diaphragmatic hernia with thoracic approach, not otherwise specified	0	0/9 episodes	0 €	0	major therapeutic
5421 - Laparoscopy	0	0/14 episodes	0 €	0	major diagnostic
5425 - Peritoneal lavage	0	0/9 episodes	0 €	0	minor diagnostic
5459 - Other lysis of peritoneal adhesions	0	0/13 episodes	0 €	0	major therapeutic
5461 - Reclosure of postoperative disruption of abdominal wall	0	0/14 episodes	0 €	0	major therapeutic
5593 - Replacement of nephrostomy tube	0	0/13 episodes	0 €	0	minor therapeutic
5711 - Percutaneous aspiration of bladder	0	0/39 episodes	0 €	0	minor therapeutic
5822 - Other urethroscopy	0	0/7 episodes	0 €	0	minor diagnostic
6811 - Digital examination of uterus	0	0/9 episodes	0 €	0	minor diagnostic
6816 - Closed biopsy of uterus	0	0/36 episodes	0 €	0	major diagnostic
6959 - Other aspiration curettage of uterus	0	0/8 episodes	0 €	0	minor therapeutic
7534 - Other fetal monitoring	0	0/24 episodes	0 €	0	minor diagnostic
7693 - Closed reduction of temporomandibular dislocation	0	0/12 episodes	0 €	0	minor therapeutic

7769 - Local excision of lesion or tissue of bone, other bones	0	0/7 episodes	0 €	0	major therapeutic
7789 - Other partial ostectomy, other bones	0	0/7 episodes	0 €	0	major therapeutic
7900 - Closed reduction of fracture without internal fixation, unspecified site	0	0/6 episodes	0 €	0	minor therapeutic
7903 - Closed reduction of fracture without internal fixation, carpals and metacarpals	0	0/19 episodes	0 €	0	minor therapeutic
7907 - Closed reduction of fracture without internal fixation, tarsals and metatarsals	0	0/9 episodes	0 €	0	minor therapeutic
7975 - Closed reduction of dislocation of hip	0	0/15 episodes	0 €	0	minor therapeutic
7979 - Closed reduction of dislocation of other specified sites	0	0/6 episodes	0 €	0	minor therapeutic
8051 - Excision of intervertebral disc	0	0/9 episodes	0 €	0	major therapeutic
8108 - Lumbar and lumbosacral fusion of the anterior column, posterior technique	0	0/10 episodes	0 €	0	major therapeutic
8163 - Fusion or refusion of 4-8 vertebrae	0	0/37 episodes	0 €	0	major therapeutic
8164 - Fusion or refusion of 9 or more vertebrae	0	0/44 episodes	0 €	0	major therapeutic
8166 - Percutaneous vertebral augmentation	0	0/7 episodes	0 €	0	major therapeutic
8192 - Injection of therapeutic substance into joint or ligament	0	0/13 episodes	0 €	0	minor therapeutic
8314 - Fasciotomy	0	0/7 episodes	0 €	0	major therapeutic
8339 - Excision of lesion of other soft tissue	0	0/7 episodes	0 €	0	major therapeutic
8394 - Aspiration of bursa	0	0/19 episodes	0 €	0	minor therapeutic
8401 - Amputation and disarticulation of finger	0	0/8 episodes	0 €	0	major therapeutic
8451 - Insertion of interbody spinal fusion device	0	0/86 episodes	0 €	0	minor therapeutic
8601 - Aspiration of skin and subcutaneous tissue	0	0/28 episodes	0 €	0	minor therapeutic
8663 - Full-thickness skin graft to other sites	0	0/6 episodes	0 €	0	major therapeutic
8699 - Other operations on skin and subcutaneous tissue	0	0/6 episodes	0 €	0	minor therapeutic
8854 - Combined right and left heart angiocardigraphy	0	0/27 episodes	0 €	0	minor diagnostic
9221 - Superficial radiation	0	0/23 episodes	0 €	0	minor therapeutic
9239 - Stereotactic radiosurgery, not elsewhere classified	0	0/16 episodes	0 €	0	minor therapeutic
9906 - Transfusion of coagulation factors	0	0/167 episodes	0 €	0	minor therapeutic
9972 - Therapeutic leukopheresis	0	0/19 episodes	0 €	0	minor therapeutic
9975 - Administration of neuroprotective agent	0	0/10 episodes	0 €	0	minor therapeutic

9979 - Other therapeutic apheresis	0	0/6 episodes	0 €	0	minor therapeutic
9985 - Hyperthermia for treatment of cancer	0	0/14 episodes	0 €	0	minor therapeutic

Supplementary table 3 – Descending ranking of procedures according to their effects on APR-DRG changes for respiratory system diseases (Portugal)

Procedure	Percentage change of APR-DRG	Number of episodes that changed their APR-DRG	Total differences in hospital payments (€)	Percentage change in hospital payments	Procedure category
0525 - Periarterial sympathectomy	100	33/33 episodes	-27.241,60 €	-45,9	major therapeutic
3506 - Transapical replacement of aortic valve	100	44/44 episodes	-367.075,70 €	-73,9	major therapeutic
3754 - Replacement or repair of other implantable component of (total) replacement heart system	100	18/18 episodes	-104.038,60 €	-83	major therapeutic
3767 - Implantation of cardiomyostimulation system	100	9/9 episodes	-74.178,60 €	-78,1	major therapeutic
3794 - Implantation or replacement of automatic cardioverter/defibrillator, total system [AICD]	99,8	2637/2642 episodes	-16.075.760 €	-75,8	major therapeutic
3796 - Implantation of automatic cardioverter/defibrillator pulse generator only	98,6	73/74 episodes	-133.764,20 €	-48,4	major therapeutic
3786 - Replacement of any type of pacemaker device with single-chamber device, rate responsive	98,3	575/585 episodes	-410.919,80 €	-30,8	major therapeutic
3734 - Excision or destruction of other lesion or tissue of heart, endovascular approach	98,2	5534/5636 episodes	-4.050.146,40 €	-28,6	major therapeutic
3785 - Replacement of any type pacemaker device with single-chamber device, not specified as rate responsive	98,1	403/411 episodes	-257.694 €	-28,4	major therapeutic
3798 - Replacement of automatic cardioverter/defibrillator pulse generator only	98	396/404 episodes	-457.599,80 €	-43,8	major therapeutic
3552 - Repair of atrial septal defect with prosthesis, closed technique	97,4	666/684 episodes	-425.439,40 €	-26,1	major therapeutic
0051 - Implantation of cardiac resynchronization defibrillator, total system [CRT-D]	97,3	2037/2094 episodes	-12.512.540,50 €	-75,9	major therapeutic
3772 - Initial insertion of transvenous leads [electrodes] into atrium and ventricle	95,9	18146/18921 episodes	-11.243.117,70 €	-26,5	minor therapeutic
3597 - Percutaneous mitral valve repair with implant	95,7	66/69 episodes	-43.600,60 €	-19	major therapeutic
3771 - Initial insertion of transvenous lead [electrode] into ventricle	95,4	9105/9541 episodes	-7.913.263,90 €	-33,4	minor therapeutic
3787 - Replacement of any type pacemaker device with dual-chamber device	95,3	2260/2371 episodes	-1.545.649 €	-26,5	major therapeutic
0053 - Implantation or replacement of cardiac resynchronization pacemaker pulse generator only [CRT-P]	95,1	270/284 episodes	-225.904,10 €	-34,2	major therapeutic

3563 - Repair of endocardial cushion defect with tissue graft	94,7	90/95 episodes	-92.119,20 €	-12,5	major therapeutic
0050 - Implantation of cardiac resynchronization pacemaker without mention of defibrillation, total system [CRT-P]	93,9	791/842 episodes	-813.702,70 €	-33,7	major therapeutic
0529 - Other sympathectomy and ganglionectomy	93,9	46/49 episodes	-48.715,10 €	-51	major therapeutic
3599 - Other operations on valves of heart	93,5	172/184 episodes	-854.685,90 €	-55,2	major therapeutic
3782 - Initial insertion of single-chamber device, rate responsive	93,3	5863/6283 episodes	-4.852.936,40 €	-32,1	minor therapeutic
3783 - Initial insertion of dual-chamber device	93	17635/18958 episodes	-13.523.823,60 €	-31,9	minor therapeutic
0057 - Implantation or replacement of subcutaneous device for intracardiac or great vessel hemodynamic monitoring	92,6	25/27 episodes	-21.019,50 €	-44,8	major therapeutic
3921 - Caval-pulmonary artery anastomosis	92,2	59/64 episodes	-191.267,40 €	-35,6	major therapeutic
3781 - Initial insertion of single-chamber device, not specified as rate responsive	92,1	3246/3525 episodes	-2.687.162,80 €	-28,8	minor therapeutic
3780 - Insertion of permanent pacemaker, initial or replacement, type of device not specified	91,7	467/509 episodes	-468.668,80 €	-31,5	major therapeutic
3581 - Total repair of tetralogy of fallot	91,2	114/125 episodes	-80.955,60 €	-8,4	major therapeutic
3976 - Endovascular embolization or occlusion of vessel(s) of head or neck using bioactive coils	90,9	10/11 episodes	-32.216,20 €	-54,5	major therapeutic
5569 - Other kidney transplantation	90,9	20/22 episodes	-72.724,10 €	-59,3	major therapeutic
3573 - Other and unspecified repair of endocardial cushion defect	90,3	56/62 episodes	-117.772,30 €	-22,8	major therapeutic
3505 - Endovascular replacement of aortic valve	90,1	336/373 episodes	-192.529,70 €	-14,6	major therapeutic
3790 - Insertion of left atrial appendage device	90,1	73/81 episodes	-55.384,50 €	-23,9	minor therapeutic
3770 - Initial insertion of lead [electrode], not otherwise specified	89,7	427/476 episodes	-122.386,80 €	-8,6	minor therapeutic
3582 - Total repair of total anomalous pulmonary venous connection	89,4	59/66 episodes	-159.401,20 €	-28,8	major therapeutic
0054 - Implantation or replacement of cardiac resynchronization defibrillator pulse generator only [CRT-D]	88,9	562/632 episodes	-869.128,80 €	-39	major therapeutic
3762 - Insertion of temporary non-implantable extracorporeal circulatory assist device	88,9	8/9 episodes	-68.082 €	-47,3	major therapeutic
3768 - Insertion of percutaneous external heart assist device	88,9	8/9 episodes	-105.156,60 €	-76,1	major therapeutic
8332 - Excision of lesion of muscle	88,9	8/9 episodes	-3.376,60 €	-26,7	major therapeutic
8401 - Amputation and disarticulation of finger	88,9	249/280 episodes	-342.125,90 €	-33,6	major therapeutic

3859 - Ligation and stripping of varicose veins, lower limb veins	88,5	16415/18552 episodes	- 12.181.007,60 €	-37,8	major therapeutic
3521 - Open and other replacement of aortic valve with tissue graft	88,2	6765/7674 episodes	- 21.836.695,30 €	-31,6	major therapeutic
3803 - Incision of vessel, upper limb vessels	88,1	672/763 episodes	-1.797.086,40 €	-53,1	major therapeutic
3501 - Closed heart valvotomy, aortic valve	87,5	28/32 episodes	-119.684,20 €	-40,5	major therapeutic
3592 - Creation of conduit between right ventricle and pulmonary artery	86,7	26/30 episodes	-38.506,40 €	-16,4	major therapeutic
3596 - Percutaneous balloon valvuloplasty	86,7	396/457 episodes	-299.016,90 €	-19,2	major therapeutic
3925 - Aorta-iliac-femoral bypass	86,5	1264/1462 episodes	-4.194.107,10 €	-39,1	major therapeutic
3452 - Thoracoscopic decortication of lung	85,7	6/7 episodes	-27.109,70 €	-53,7	major therapeutic
3883 - Other surgical occlusion of vessels, upper limb vessels	85,7	126/147 episodes	-293.378,20 €	-42,9	major therapeutic
3797 - Replacement of automatic cardioverter/defibrillator lead(s) only	85,5	59/69 episodes	-112.702,40 €	-38,9	major therapeutic
3594 - Creation of conduit between atrium and pulmonary artery	84,6	33/39 episodes	-90.500,70 €	-24,2	major therapeutic
3776 - Replacement of transvenous atrial and/or ventricular lead(s) [electrode]	84,2	453/538 episodes	-185.935 €	-13,3	major therapeutic
3593 - Creation of conduit between left ventricle and aorta	83,3	5/6 episodes	-7.514 €	-15,4	major therapeutic
3862 - Other excision of vessels, other vessels of head and neck	83,3	10/12 episodes	-21.537,80 €	-54,9	major therapeutic
3975 - Endovascular embolization or occlusion of vessel(s) of head or neck using bare coils	83,3	15/18 episodes	-39.784,40 €	-42,8	major therapeutic
3978 - Endovascular implantation of branching or fenestrated graft(s) in aorta	83,3	25/30 episodes	51.872,70 €	47,1	major therapeutic
8666 - Homograft to skin	83,3	20/24 episodes	-18.583,20 €	-30,7	major therapeutic
8667 - Dermal regenerative graft	83,3	5/6 episodes	-17.125,80 €	-53,5	major therapeutic
3513 - Open heart valvuloplasty of pulmonary valve without replacement	82,9	34/41 episodes	-121.091,30 €	-26,8	major therapeutic
3009 - Other excision or destruction of lesion or tissue of larynx	82,4	14/17 episodes	-12.871,20 €	-30,6	major therapeutic
3972 - Endovascular (total) embolization or occlusion of head and neck vessels	82,4	56/68 episodes	-145.923,80 €	-47,2	major therapeutic
3922 - Aorta-subclavian-carotid bypass	82,1	69/84 episodes	102.999,50 €	14,8	major therapeutic
3863 - Other excision of vessels, upper limb vessels	81,6	31/38 episodes	-83.932 €	-34,3	major therapeutic

3860 - Other excision of vessels, unspecified site	81,2	26/32 episodes	-39.139,70 €	-27,1	major therapeutic
0523 - Lumbar sympathectomy	81	124/153 episodes	-146.770,10 €	-33,6	major therapeutic
3952 - Other repair of aneurysm	80,8	185/229 episodes	-508.636,80 €	-29,6	major therapeutic
3971 - Endovascular implantation of other graft in abdominal aorta	80,7	1060/1314 episodes	-3.320.873,20 €	-38,1	major therapeutic
3584 - Total correction of transposition of great vessels, not elsewhere classified	80	20/25 episodes	-67.357,30 €	-26,5	major therapeutic
3832 - Resection of vessel with anastomosis, other vessels of head and neck	80	12/15 episodes	-27.979,20 €	-48,4	major therapeutic
3950 - Angioplasty of other non-coronary vessel(s)	79,4	5584/7035 episodes	-11.241.769,50 €	-36,8	major therapeutic
3555 - Repair of ventricular septal defect with prosthesis, closed technique	78,3	18/23 episodes	-13.140,30 €	-13	major therapeutic
3884 - Other surgical occlusion of vessels, aorta, abdominal	78,3	18/23 episodes	-98.522,60 €	-24,9	major therapeutic
2743 - Other excision of lesion or tissue of lip	77,8	7/9 episodes	-2.437,70 €	-20,7	major therapeutic
3522 - Open and other replacement of aortic valve	77,7	2781/3578 episodes	-9.606.594,10 €	-31,4	major therapeutic
3731 - Pericardiectomy	77,4	82/106 episodes	-346.690,80 €	-47,5	major therapeutic
3806 - Incision of vessel, abdominal arteries	77,1	259/336 episodes	-443.475,50 €	-21,4	major therapeutic
0522 - Cervical sympathectomy	76,9	10/13 episodes	-12.194,10 €	-40,3	major therapeutic
3813 - Endarterectomy, upper limb vessels	76,9	40/52 episodes	-110.664,40 €	-39,9	major therapeutic
3979 - Other endovascular procedures on other vessels	75,4	752/997 episodes	-1.836.475,30 €	-39,3	major therapeutic
3779 - Revision or relocation of cardiac device pocket	75,3	512/680 episodes	-542.440,90 €	-27,6	major therapeutic
1692 - Excision of lesion of orbit	75	6/8 episodes	-4.439,10 €	-29,2	major therapeutic
3421 - Transpleural thoracoscopy	75	48/64 episodes	-156.610,80 €	-41,1	major diagnostic
3853 - Ligation and stripping of varicose veins, upper limb vessels	75	9/12 episodes	-6.525,30 €	-27,2	major therapeutic
3880 - Other surgical occlusion of vessels, unspecified site	75	6/8 episodes	-8.737,80 €	-18,2	major therapeutic
3525 - Open and other replacement of pulmonary valve with tissue graft	74,8	89/119 episodes	-370.221,20 €	-29,1	major therapeutic
8402 - Amputation and disarticulation of thumb	73,7	14/19 episodes	-25.513,40 €	-36,5	major therapeutic
3554 - Repair of endocardial cushion defect with prosthesis	73,3	11/15 episodes	-51.275,40 €	-36,6	major therapeutic

3833 - Resection of vessel with anastomosis, upper limb vessels	72,4	42/58 episodes	-85.981,50 €	-30,1	major therapeutic
3882 - Other surgical occlusion of vessels, other vessels of head and neck	72,2	13/18 episodes	-36.731,40 €	-26,5	major therapeutic
8669 - Other skin graft to other sites	71,5	363/508 episodes	-389.321,60 €	-24,3	major therapeutic
3977 - Temporary (partial) therapeutic endovascular occlusion of vessel	71,4	5/7 episodes	2.455,20 €	7,1	major therapeutic
5502 - Nephrostomy	71,4	10/14 episodes	-50.170,90 €	-37,7	major therapeutic
3927 - Arteriovenostomy for renal dialysis	71	137/193 episodes	-522.973,10 €	-44,3	major therapeutic
8407 - Amputation through humerus	71	22/31 episodes	-50.797,10 €	-29,4	major therapeutic
3844 - Resection of vessel with replacement, aorta, abdominal	70,7	597/844 episodes	-3.141.490,70 €	-35,8	major therapeutic
4011 - Biopsy of lymphatic structure	70,1	61/87 episodes	-182.822 €	-42,9	major diagnostic
3795 - Implantation of automatic cardioverter/defibrillator lead(s) only	70	35/50 episodes	-60.684,50 €	-28,4	major therapeutic
7708 - Sequestrectomy, tarsals and metatarsals	70	7/10 episodes	-9.924,50 €	-31,4	major therapeutic
3836 - Resection of vessel with anastomosis, abdominal arteries	69,6	16/23 episodes	-47.860,20 €	-23,1	major therapeutic
3511 - Open heart valvuloplasty of aortic valve without replacement	68,6	181/264 episodes	-495.471,90 €	-21,2	major therapeutic
3799 - Other operations on heart and pericardium	67,3	70/104 episodes	-291.464,90 €	-36	major therapeutic
1751 - Implantation of rechargeable cardiac contractility modulation [CCM], total system	66,7	4/6 episodes	26.326 €	84,5	major therapeutic
3807 - Incision of vessel, abdominal veins	66,7	12/18 episodes	-26.173,80 €	-20	major therapeutic
3842 - Resection of vessel with replacement, other vessels of head and neck	66,7	14/21 episodes	-30.833,60 €	-25,7	major therapeutic
3865 - Other excision of vessels, thoracic vessels	66,7	12/18 episodes	-26.659,80 €	-21,8	major therapeutic
8665 - Heterograft to skin	66,7	4/6 episodes	-13.205,70 €	-24,6	major therapeutic
3973 - Endovascular implantation of graft in thoracic aorta	66,5	183/275 episodes	-3.181.365,10 €	-61,2	major therapeutic
4023 - Excision of axillary lymph node	65,2	15/23 episodes	-57.247 €	-48,9	major therapeutic
5493 - Creation of cutaneous peritoneal fistula	64,8	35/54 episodes	-108.650,10 €	-29,1	major therapeutic
3524 - Open and other replacement of mitral valve	64,4	1073/1665 episodes	-2.802.212,60 €	-17,3	major therapeutic
3761 - Implant of pulsation balloon	63,9	736/1151 episodes	-4.994.961,40 €	-31,4	major therapeutic
3526 - Open and other replacement of pulmonary valve	63,6	7/11 episodes	-28.807 €	-21,2	major therapeutic

7915 - Closed reduction of fracture with internal fixation, femur	63,6	21/33 episodes	-148.851,60 €	-54,7	major therapeutic
3728 - Intracardiac echocardiography	63,5	113/178 episodes	-350.908,60 €	-19,6	minor diagnostic
3420 - Thoracoscopic pleural biopsy	63,4	26/41 episodes	-83.119,70 €	-37,1	major diagnostic
3843 - Resection of vessel with replacement, upper limb vessels	63,4	26/41 episodes	-71.432,60 €	-32,4	major therapeutic
3774 - Insertion or replacement of epicardial lead [electrode] into epicardium	63,2	156/247 episodes	-158.743,40 €	-12,2	major therapeutic
3775 - Revision of lead [electrode]	63,1	435/689 episodes	-453.952,70 €	-23,1	major therapeutic
3847 - Resection of vessel with replacement, abdominal veins	62,5	5/8 episodes	-3.715,60 €	-3,5	major therapeutic
3864 - Other excision of vessels, aorta, abdominal	62,5	25/40 episodes	-80.238,40 €	-20,8	major therapeutic
3804 - Incision of vessel, aorta	62	57/92 episodes	-130.994,40 €	-14,8	major therapeutic
3503 - Closed heart valvotomy, pulmonary valve	61,5	8/13 episodes	-21.834,10 €	-29	major therapeutic
0052 - Implantation or replacement of transvenous lead [electrode] into left ventricular coronary venous system	60,6	220/363 episodes	-446.866 €	-27,6	major therapeutic
3773 - Initial insertion of transvenous lead [electrode] into atrium	60,5	181/299 episodes	-114.503,30 €	-16	minor therapeutic
3848 - Resection of vessel with replacement, lower limb arteries	60,4	174/288 episodes	-415.014 €	-31,8	major therapeutic
3929 - Other (peripheral) vascular shunt or bypass	60,3	2902/4814 episodes	-5.870.600,40 €	-25,2	major therapeutic
3839 - Resection of vessel with anastomosis, lower limb veins	60	12/20 episodes	-8.700,40 €	-18,5	major therapeutic
5495 - Incision of peritoneum	60	6/10 episodes	-22.626,90 €	-34,7	major therapeutic
3571 - Other and unspecified repair of atrial septal defect	59,9	407/679 episodes	-1.153.298,30 €	-27,7	major therapeutic
3808 - Incision of vessel, lower limb arteries	59,6	1719/2883 episodes	-4.185.858,50 €	-27,7	major therapeutic
3816 - Endarterectomy, abdominal arteries	59,2	100/169 episodes	-106.962 €	-10,4	major therapeutic
3866 - Other excision of vessels, abdominal arteries	57,9	11/19 episodes	-72.673 €	-34,5	major therapeutic
8660 - Free skin graft, not otherwise specified	57,9	62/107 episodes	-73.524,60 €	-22	major therapeutic
3835 - Resection of vessel with anastomosis, other thoracic vessels	57,5	23/40 episodes	-55.565,90 €	-22,7	major therapeutic
3616 - Double internal mammary-coronary artery bypass	57,4	1343/2341 episodes	-5.880.369,60 €	-37,1	major therapeutic
3512 - Open heart valvuloplasty of mitral valve without replacement	57,2	1152/2014 episodes	-2.994.229,80 €	-16,8	major therapeutic

3509 - Endovascular replacement of unspecified heart valve	57,1	4/7 episodes	-3.504,10 €	-6,2	major therapeutic
3802 - Incision of vessel, other vessels of head and neck	57,1	8/14 episodes	-24.296,90 €	-30,4	major therapeutic
3993 - Insertion of vessel-to-vessel cannula	57,1	16/28 episodes	-70.622,70 €	-33,9	major therapeutic
4945 - Ligation of hemorrhoids	57,1	4/7 episodes	3.339,30 €	16,4	major therapeutic
5749 - Other transurethral excision or destruction of lesion or tissue of bladder	57,1	20/35 episodes	-44.224,80 €	-19,5	major therapeutic
7729 - Wedge osteotomy, other bones	57,1	4/7 episodes	-4.350,90 €	-26,5	major therapeutic
3999 - Other operations on vessels	56,2	27/48 episodes	-87.827,20 €	-30,6	major therapeutic
3712 - Pericardiectomy	56,1	213/380 episodes	-428.701,90 €	-16,4	major therapeutic
0061 - Percutaneous angioplasty of extracranial vessel(s)	55,7	44/79 episodes	-96.059,90 €	-23,2	major therapeutic
3857 - Ligation and stripping of varicose veins, abdominal veins	55,6	5/9 episodes	-12.448,90 €	-36,7	major therapeutic
3953 - Repair of arteriovenous fistula	55,6	75/135 episodes	-178.817,60 €	-24,8	major therapeutic
4021 - Excision of deep cervical lymph node	55,6	10/18 episodes	-18.356,50 €	-27,6	major therapeutic
7935 - Open reduction of fracture with internal fixation, femur	55,6	15/27 episodes	-99.091,10 €	-36,8	major therapeutic
8342 - Other tenonectomy	55,6	5/9 episodes	-133,70 €	-0,5	major therapeutic
3834 - Resection of vessel with anastomosis, aorta	55,3	88/159 episodes	-355.033,60 €	-25,2	major therapeutic
3741 - Implantation of prosthetic cardiac support device around the heart	54,5	6/11 episodes	7.809,70 €	13,7	major therapeutic
3846 - Resection of vessel with replacement, abdominal arteries	54,5	54/99 episodes	-206.408,20 €	-26,4	major therapeutic
0056 - Insertion or replacement of implantable pressure sensor with lead for intracardiac or great vessel hemodynamic monitoring	53,8	7/13 episodes	-6.325,10 €	-14,3	major therapeutic
8165 - Percutaneous vertebroplasty	53,8	7/13 episodes	-28.761,80 €	-45,3	major therapeutic
3942 - Revision of arteriovenous shunt for renal dialysis	53,5	54/101 episodes	-148.088,30 €	-31,5	major therapeutic
3561 - Repair of atrial septal defect with tissue graft	53,4	312/584 episodes	-657.462,30 €	-18,8	major therapeutic
3923 - Other intrathoracic vascular shunt or bypass	53,3	8/15 episodes	-38.611 €	-29,4	major therapeutic
3991 - Freeing of vessel	52,2	12/23 episodes	-28.709 €	-19,6	major therapeutic
8663 - Full-thickness skin graft to other sites	52,2	72/138 episodes	-111.009,50 €	-16,9	major therapeutic
3885 - Other surgical occlusion of vessels, thoracic vessels	52,1	244/468 episodes	-609.731,80 €	-19,9	major therapeutic
3868 - Other excision of vessels, lower limb arteries	51,6	32/62 episodes	-80.280,20 €	-27,8	major therapeutic

3402 - Exploratory thoracotomy	50,9	29/57 episodes	-214.088,40 €	-35,3	major therapeutic
3523 - Open and other replacement of mitral valve with tissue graft	50,2	511/1018 episodes	-1.604.079,80 €	-14,6	major therapeutic
0125 - Other craniectomy	50	3/6 episodes	-7.022,30 €	-9,5	major therapeutic
2612 - Open biopsy of salivary gland or duct	50	3/6 episodes	-6.721,10 €	-34,4	major diagnostic
3502 - Closed heart valvotomy, mitral valve	50	5/10 episodes	-24.415,20 €	-31,5	major therapeutic
3852 - Ligation and stripping of varicose veins, other vessels of head and neck	50	4/8 episodes	-8.929,80 €	-21,2	major therapeutic
5494 - Creation of peritoneovascular shunt	50	3/6 episodes	-10.522,20 €	-24	major therapeutic
7738 - Other division of bone, tarsals and metatarsals	50	3/6 episodes	-2.019,70 €	-12,3	major therapeutic
3926 - Other intra-abdominal vascular shunt or bypass	48,7	38/78 episodes	-132.859,10 €	-14,1	major therapeutic
3805 - Incision of vessel, other thoracic vessels	46,7	14/30 episodes	-42.089 €	-17,9	major therapeutic
3886 - Other surgical occlusion of vessels, abdominal arteries	46,7	35/75 episodes	-135.347,70 €	-16,1	major therapeutic
5411 - Exploratory laparotomy	46,4	85/183 episodes	-584.048,20 €	-22,7	major therapeutic
0062 - Percutaneous angioplasty of intracranial vessel(s)	46,2	6/13 episodes	-10.983,50 €	-26,1	major therapeutic
3849 - Resection of vessel with replacement, lower limb veins	45,9	17/37 episodes	-26.673,20 €	-23,1	major therapeutic
0131 - Incision of cerebral meninges	45,5	5/11 episodes	-55.141,40 €	-40,8	major therapeutic
5718 - Other suprapubic cystostomy	45,5	5/11 episodes	-27.038,60 €	-29,7	major therapeutic
8410 - Lower limb amputation, not otherwise specified	45,5	5/11 episodes	-18.528,60 €	-18,4	major therapeutic
3541 - Enlargement of existing atrial septal defect	44,4	4/9 episodes	2.752,30 €	6,2	minor therapeutic
3789 - Revision or removal of pacemaker device	44,1	180/408 episodes	-278.054 €	-17,9	major therapeutic
3724 - Biopsy of pericardium	43,7	52/119 episodes	-147.240,60 €	-21,5	major diagnostic
3850 - Ligation and stripping of varicose veins, unspecified site	42,9	6/14 episodes	-6.822,10 €	-16,2	major therapeutic
3951 - Clipping of aneurysm	42,9	12/28 episodes	-81.444,20 €	-24,5	major therapeutic
6829 - Other excision or destruction of lesion of uterus	42,9	3/7 episodes	-5.588,40 €	-21,1	major therapeutic
9983 - Other phototherapy	42,9	3/7 episodes	-40.671,90 €	-57,9	minor therapeutic
5503 - Percutaneous nephrostomy without fragmentation	42,3	11/26 episodes	-47.409,20 €	-22,4	major therapeutic
5419 - Other laparotomy	40,7	48/118 episodes	-340.709,10 €	-21,3	major therapeutic

3603 - Open chest coronary artery angioplasty	40,5	32/79 episodes	-131.216,10 €	-23,6	major therapeutic
8339 - Excision of lesion of other soft tissue	39,3	11/28 episodes	-4.153,30 €	-8,3	major therapeutic
4709 - Other appendectomy	38,9	7/18 episodes	-3.275,80 €	-4,2	major therapeutic
4946 - Excision of hemorrhoids	38,9	7/18 episodes	-4.673,80 €	-7,7	major therapeutic
3615 - Single internal mammary-coronary artery bypass	38,8	3453/8906 episodes	-8.672.086,50 €	-13,1	major therapeutic
8674 - Attachment of pedicle or flap graft to other sites	38,8	19/49 episodes	-7.719,60 €	-3,2	major therapeutic
3229 - Other local excision or destruction of lesion or tissue of lung	37,5	6/16 episodes	-8.747,20 €	-6,8	major therapeutic
4610 - Colostomy, not otherwise specified	37,5	6/16 episodes	-48.492,10 €	-16,5	major therapeutic
6849 - Other and unspecified total abdominal hysterectomy	37,5	6/16 episodes	-4.280,30 €	-10,2	major therapeutic
2109 - Control of epistaxis by other means	36,4	4/11 episodes	-2.900,10 €	-9,1	major therapeutic
3528 - Open and other replacement of tricuspid valve	36,4	12/33 episodes	-41.876,30 €	-9,6	major therapeutic
5300 - Unilateral repair of inguinal hernia, not otherwise specified	36,4	4/11 episodes	-8.561,40 €	-17,7	major therapeutic
8606 - Insertion of totally implantable infusion pump	36,4	4/11 episodes	-8.018,80 €	-22,9	major therapeutic
3527 - Open and other replacement of tricuspid valve with tissue graft	35	21/60 episodes	-73.626,30 €	-10,7	major therapeutic
3838 - Resection of vessel with anastomosis, lower limb arteries	34,5	51/148 episodes	-108.352,60 €	-15,9	major therapeutic
1341 - Phacoemulsification and aspiration of cataract	33,3	2/6 episodes	-1.557,20 €	-8,5	major therapeutic
3199 - Other operations on trachea	33,3	2/6 episodes	-19.609,60 €	-37,9	major therapeutic
3321 - Bronchoscopy through artificial stoma	33,3	2/6 episodes	766,60 €	4,1	minor diagnostic
3766 - Insertion of implantable heart assist system	33,3	2/6 episodes	-6.220,90 €	-10,8	major therapeutic
3810 - Endarterectomy, unspecified site	33,3	2/6 episodes	-7.588,90 €	-12,4	major therapeutic
5421 - Laparoscopy	33,3	8/24 episodes	-41.357,60 €	-20,4	major diagnostic
5423 - Biopsy of peritoneum	33,3	3/9 episodes	-26.234,50 €	-33,2	major diagnostic
7788 - Other partial ostectomy, tarsals and metatarsals	33,3	3/9 episodes	-872,60 €	-2,9	major therapeutic
8670 - Pedicle or flap graft, not otherwise specified	33,3	3/9 episodes	-4.612,70 €	-10,5	major therapeutic
3699 - Other operations on vessels of heart	32,8	19/58 episodes	-59.774,90 €	-13,1	major therapeutic
3889 - Other surgical occlusion of vessels, lower limb veins	32,7	593/1812 episodes	-451.751,70 €	-13,7	major therapeutic

8152 - Partial hip replacement	32	8/25 episodes	-47.333,80 €	-25,2	major therapeutic
3949 - Other revision of vascular procedure	31,9	357/1120 episodes	-808.403 €	-12,6	major therapeutic
3800 - Incision of vessel, unspecified site	31,8	7/22 episodes	-16.923 €	-17,2	major therapeutic
3749 - Other repair of heart and pericardium	31	75/242 episodes	-334.596,30 €	-12,1	major therapeutic
3845 - Resection of vessel with replacement, thoracic vessels	31	527/1701 episodes	416.237 €	2,7	major therapeutic
3777 - Removal of lead(s) [electrode] without replacement	30,3	80/264 episodes	-101.287,40 €	-7,4	major therapeutic
1756 - Atherectomy of other non-coronary vessel(s)	30	3/10 episodes	-24.330,50 €	-32,2	major therapeutic
5994 - Replacement of cystostomy tube	30	3/10 episodes	1.257 €	2,7	minor therapeutic
8403 - Amputation through hand	30	3/10 episodes	-8.361,70 €	-18,1	major therapeutic
8672 - Advancement of pedicle graft	30	6/20 episodes	-3.301,40 €	-3,6	major therapeutic
3809 - Incision of vessel, lower limb veins	28,6	42/147 episodes	-81.627,40 €	-13,2	major therapeutic
3887 - Other surgical occlusion of vessels, abdominal veins	28,6	8/28 episodes	-16.536,10 €	-5	major therapeutic
7781 - Other partial ostectomy, scapula, clavicle, and thorax [ribs and sternum]	28,6	2/7 episodes	-231,50 €	-0,3	major therapeutic
3613 - (Aorto)coronary bypass of three coronary arteries	28,3	72/254 episodes	-350.551,30 €	-16,6	major therapeutic
3818 - Endarterectomy, lower limb arteries	28,2	386/1371 episodes	-923.732,10 €	-14,2	major therapeutic
3562 - Repair of ventricular septal defect with tissue graft	28	45/161 episodes	-1.320,50 €	-0,1	major therapeutic
3572 - Other and unspecified repair of ventricular septal defect	27,9	34/122 episodes	-29.244,80 €	-2,7	major therapeutic
3328 - Open biopsy of lung	27,8	5/18 episodes	-22.101,60 €	-12,1	major diagnostic
3974 - Endovascular removal of obstruction from head and neck vessel(s)	27,8	5/18 episodes	-45.637,80 €	-26,2	major therapeutic
9672 - Continuous invasive mechanical ventilation for 96 consecutive hours or more	27,7	957/3461 episodes	-6.589.438,50 €	-16	minor therapeutic
3723 - Combined right and left heart cardiac catheterization	26,4	1487/5642 episodes	-706.293,10 €	-5,1	minor diagnostic
0055 - Insertion of drug-eluting stent(s) of other peripheral vessel(s)	26,3	35/133 episodes	7.412,30 €	1,1	minor therapeutic
3888 - Other surgical occlusion of vessels, lower limb arteries	25,9	28/108 episodes	-55.514,90 €	-10,4	major therapeutic
3943 - Removal of arteriovenous shunt for renal dialysis	25,5	35/137 episodes	-83.776,70 €	-13,9	major therapeutic
3422 - Mediastinoscopy	25	3/12 episodes	-9.313 €	-16,8	major diagnostic
3619 - Other bypass anastomosis for heart revascularization	25	9/36 episodes	-5.369,70 €	-2,1	major therapeutic

6909 - Other dilation and curettage	25	2/8 episodes	-1.846,30 €	-10	major diagnostic
8689 - Other repair and reconstruction of skin and subcutaneous tissue	25	3/12 episodes	-29.455,70 €	-36,4	major therapeutic
3931 - Suture of artery	24,1	156/647 episodes	-495.848,30 €	-15,9	major therapeutic
3733 - Excision or destruction of other lesion or tissue of heart, open approach	23,6	240/1016 episodes	-907.651,70 €	-10,9	major therapeutic
8417 - Amputation above knee	23,5	187/796 episodes	-616.456,90 €	-10,6	major therapeutic
3614 - (Aorto)coronary bypass of four or more coronary arteries	23,1	3/13 episodes	-12.716 €	-13,2	major therapeutic
3959 - Other repair of vessel	23,1	127/549 episodes	-315.770,50 €	-7,5	major therapeutic
8852 - Angiocardiography of right heart structures	23	129/562 episodes	-152.633,60 €	-9,3	minor diagnostic
3932 - Suture of vein	22,4	22/98 episodes	-30.507,20 €	-4,6	major therapeutic
3129 - Other permanent tracheostomy	22,2	4/18 episodes	-21.585,70 €	-8,1	major therapeutic
3474 - Repair of pectus deformity	22,2	2/9 episodes	10.009,70 €	9,7	major therapeutic
3617 - Abdominal-coronary artery bypass	22,2	2/9 episodes	-10.722,30 €	-27,5	major therapeutic
4019 - Other diagnostic procedures on lymphatic structures	22,2	2/9 episodes	-620,60 €	-2,7	major diagnostic
5551 - Nephroureterectomy	22,2	4/18 episodes	-9.348,40 €	-7,5	major therapeutic
8016 - Other arthrotomy, knee	22,2	2/9 episodes	6.780,50 €	21,1	major therapeutic
8413 - Disarticulation of ankle	22,2	2/9 episodes	-1.946,60 €	-3,1	major therapeutic
3721 - Right heart cardiac catheterization	22	869/3947 episodes	-485.123,50 €	-4,1	minor diagnostic
3791 - Open chest cardiac massage	21,9	16/73 episodes	-116.563,60 €	-11,3	major therapeutic
8858 - Negative-contrast cardiac roentgenography	21,9	7/32 episodes	-8.408,60 €	-7,1	minor diagnostic
3535 - Operations on trabeculae carneae cordis	21,7	5/23 episodes	-15.196,60 €	-9,1	major therapeutic
4576 - Open and other sigmoidectomy	21,4	6/28 episodes	-74.118,80 €	-13,6	major therapeutic
3553 - Repair of ventricular septal defect with prosthesis, open technique	21,1	37/175 episodes	-119.241,60 €	-8	major therapeutic
3736 - Excision, destruction, or exclusion of left atrial appendage (LAA)	21	74/352 episodes	-139.872,70 €	-4,7	minor therapeutic
0060 - Insertion of drug-eluting stent(s) of superficial femoral artery	20,8	30/144 episodes	-67.421,40 €	-13,6	minor therapeutic
0021 - Intravascular imaging of extracranial cerebral vessels	20,7	6/29 episodes	-2.803,20 €	-4,2	minor diagnostic
3726 - Catheter based invasive electrophysiologic testing	20,4	1417/6959 episodes	-1.299.864,50 €	-7,4	minor diagnostic

3869 - Other excision of vessels, lower limb veins	20	311/1557 episodes	-239.931,70 €	-7,7	major therapeutic
4573 - Open and other right hemicolectomy	20	9/45 episodes	-72.030,80 €	-10	major therapeutic
4901 - Incision of perianal abscess	20	3/15 episodes	-3.095 €	-5,2	major therapeutic
9670 - Continuous invasive mechanical ventilation of unspecified duration	19,6	110/561 episodes	-133.846,80 €	-3,7	minor therapeutic
5349 - Other open umbilical herniorrhaphy	17,8	8/45 episodes	-4.741 €	-3,1	major therapeutic
0058 - Insertion of intra-aneurysm sac pressure monitoring device (intraoperative)	17,6	3/17 episodes	11.659,20 €	8,8	minor diagnostic
3732 - Excision of aneurysm of heart	17,3	23/133 episodes	-62.071,10 €	-4,7	major therapeutic
3239 - Other and unspecified segmental resection of lung	16,7	2/12 episodes	-5.434,60 €	-4,4	major therapeutic
3924 - Aorta-renal bypass	16,7	6/36 episodes	-1.597,90 €	-0,4	major therapeutic
7722 - Wedge osteotomy, humerus	16,7	1/6 episodes	-392,30 €	-1,8	major therapeutic
7932 - Open reduction of fracture with internal fixation, radius and ulna	16,7	1/6 episodes	-5.878,60 €	-13,5	major therapeutic
8452 - Insertion of recombinant bone morphogenetic protein	16,7	7/42 episodes	3.779,90 €	4,3	minor therapeutic
8491 - Amputation, not otherwise specified	16,7	1/6 episodes	-3.841,30 €	-17,4	major therapeutic
8621 - Excision of pilonidal cyst or sinus	16,7	1/6 episodes	-1.322,30 €	-9,1	major therapeutic
8683 - Size reduction plastic operation	16,7	1/6 episodes	-2.358,60 €	-12,7	major therapeutic
8412 - Amputation through foot	15,9	77/483 episodes	-184.214,90 €	-6,2	major therapeutic
3610 - Aortocoronary bypass for heart revascularization, not otherwise specified	15,8	3/19 episodes	-29.712,50 €	-12,5	major therapeutic
4593 - Other small-to-large intestinal anastomosis	15,8	3/19 episodes	-40.755,50 €	-15,2	major therapeutic
4591 - Small-to-small intestinal anastomosis	15,6	5/32 episodes	-41.799,30 €	-7,8	major therapeutic
7902 - Closed reduction of fracture without internal fixation, radius and ulna	15,6	5/32 episodes	5.703,10 €	8,3	minor therapeutic
8309 - Other incision of soft tissue	15,6	7/45 episodes	-10.258,10 €	-5	major therapeutic
3691 - Repair of aneurysm of coronary vessel	15,4	2/13 episodes	4.447,50 €	3,6	major therapeutic
3822 - Percutaneous angiography	15,2	5/33 episodes	7.057,40 €	7,4	minor diagnostic
3595 - Revision of corrective procedure on heart	14,8	47/317 episodes	-234.735,10 €	-6,5	major therapeutic
7731 - Other division of bone, scapula, clavicle, and thorax [ribs and sternum]	14,8	4/27 episodes	14.893,20 €	6,2	major therapeutic
0093 - Transplant from cadaver	14,3	1/7 episodes	2.986 €	10,2	minor therapeutic
0781 - Other partial excision of thymus	14,3	2/14 episodes	-8.447,90 €	-8,1	major therapeutic

3406 - Thoracoscopic drainage of pleural cavity	14,3	2/14 episodes	-4.708,50 €	-4,4	major therapeutic
3570 - Other and unspecified repair of unspecified septal defect of heart	14,3	1/7 episodes	1.668,30 €	1,8	major therapeutic
4389 - Open and other partial gastrectomy	14,3	1/7 episodes	2.152,90 €	2,3	major therapeutic
4526 - Open biopsy of large intestine	14,3	1/7 episodes	-1.440,20 €	-2,5	major diagnostic
4651 - Closure of stoma of small intestine	14,3	1/7 episodes	-2.986 €	-2,5	major therapeutic
5187 - Endoscopic insertion of stent (tube) into bile duct	14,3	3/21 episodes	4.420,40 €	5,9	minor therapeutic
7817 - Application of external fixator device, tibia and fibula	14,3	1/7 episodes	-2.819,20 €	-5	major therapeutic
8389 - Other plastic operations on fascia	14,3	1/7 episodes	-1.440,20 €	-4,9	major therapeutic
8454 - Implantation of other internal limb lengthening device	14,3	1/7 episodes	690,50 €	3,4	minor therapeutic
8699 - Other operations on skin and subcutaneous tissue	14,3	1/7 episodes	-1.366,20 €	-5	minor therapeutic
3598 - Other operations on septa of heart	14	6/43 episodes	-23.628,30 €	-6,8	major therapeutic
4029 - Simple excision of other lymphatic structure	14	6/43 episodes	-17.770 €	-6,6	major therapeutic
8415 - Other amputation below knee	13,9	50/361 episodes	-110.412,50 €	-4,7	major therapeutic
3539 - Operations on other structures adjacent to valves of heart	13,6	11/81 episodes	20.226,40 €	2,4	major therapeutic
8344 - Other fasciectomy	13,3	2/15 episodes	-2.924,10 €	-2,2	major therapeutic
5459 - Other lysis of peritoneal adhesions	13,2	5/38 episodes	-22.002,50 €	-4,2	major therapeutic
3957 - Repair of blood vessel with synthetic patch graft	13,1	27/206 episodes	-80.481,60 €	-6,7	major therapeutic
3958 - Repair of blood vessel with unspecified type of patch graft	13	6/46 episodes	24.607,60 €	5,8	major therapeutic
5425 - Peritoneal lavage	13	3/23 episodes	-39.466,80 €	-9,4	minor diagnostic
9224 - Teleradiotherapy using photons	13	3/23 episodes	-3.175,90 €	-5,2	minor therapeutic
9229 - Other radiotherapeutic procedure	12,9	8/62 episodes	-2.287,10 €	-1,3	minor therapeutic
2419 - Other diagnostic procedures on teeth, gums, and alveoli	12,5	1/8 episodes	3.162,70 €	17,4	minor diagnostic
2722 - Biopsy of uvula and soft palate	12,5	1/8 episodes	-976,20 €	-2,4	major diagnostic
3955 - Reimplantation of aberrant renal vessel	12,5	2/16 episodes	2.452,30 €	1,1	major therapeutic
4442 - Suture of duodenal ulcer site	12,5	1/8 episodes	-766,80 €	-1,1	major therapeutic
5321 - Unilateral repair of femoral hernia with graft or prosthesis	12,5	2/16 episodes	-612,40 €	-1	major therapeutic
5461 - Reclosure of postoperative disruption of abdominal wall	12,2	5/41 episodes	27.486 €	6,7	major therapeutic

4524 - Flexible sigmoidoscopy	12,1	21/174 episodes	16.525,80 €	1,9	minor diagnostic
7740 - Biopsy of bone, unspecified site	11,8	2/17 episodes	-1.750,10 €	-3,5	major diagnostic
3941 - Control of hemorrhage following vascular surgery	11,5	23/200 episodes	-74.149,40 €	-4,1	major therapeutic
4562 - Other partial resection of small intestine	11,5	9/78 episodes	-26.434,70 €	-2,2	major therapeutic
0392 - Injection of other agent into spinal canal	11,1	1/9 episodes	861,20 €	3,9	minor therapeutic
2911 - Pharyngoscopy	11,1	1/9 episodes	1.190,30 €	3,2	minor diagnostic
5110 - Endoscopic retrograde cholangiopancreatography [ERCP]	11,1	6/54 episodes	4.862,30 €	2,8	minor diagnostic
8662 - Other skin graft to hand	11,1	1/9 episodes	-1.440,20 €	-6,9	major therapeutic
4024 - Excision of inguinal lymph node	10,9	7/64 episodes	-6.594 €	-3,8	major therapeutic
3425 - Closed [percutaneous] [needle] biopsy of mediastinum	10,5	2/19 episodes	-11.454,70 €	-22,3	minor diagnostic
6011 - Closed [percutaneous] [needle] biopsy of prostate	10,5	2/19 episodes	1.996,60 €	3,1	minor diagnostic
3514 - Open heart valvuloplasty of tricuspid valve without replacement	10,4	145/1392 episodes	-254.091,20 €	-2	major therapeutic
9671 - Continuous invasive mechanical ventilation for less than 96 consecutive hours	10,4	644/6172 episodes	-1.246.746 €	-2,7	minor therapeutic
0064 - Percutaneous insertion of other extracranial artery stent(s)	10,3	3/29 episodes	-15.659,30 €	-12,4	minor therapeutic
3323 - Other bronchoscopy	10,2	9/88 episodes	55.966,30 €	10,2	minor diagnostic
0139 - Other incision of brain	10	1/10 episodes	-132,10 €	-0,1	major therapeutic
3451 - Decortication of lung	10	2/20 episodes	-17.981,10 €	-8,4	major therapeutic
6811 - Digital examination of uterus	10	1/10 episodes	897,50 €	4,2	minor diagnostic
8405 - Amputation through forearm	10	1/10 episodes	-1.058,60 €	-2,3	major therapeutic
3542 - Creation of septal defect in heart	9,5	2/21 episodes	-4.999,40 €	-2,4	major therapeutic
3812 - Endarterectomy, other vessels of head and neck	9,5	19/199 episodes	-23.445,50 €	-1,8	major therapeutic
5011 - Closed (percutaneous) [needle] biopsy of liver	9,5	8/84 episodes	5.639,80 €	2,3	minor diagnostic
6816 - Closed biopsy of uterus	9,5	2/21 episodes	-448,50 €	-0,7	major diagnostic
3611 - (Aorto)coronary bypass of one coronary artery	9,2	484/5242 episodes	-730.481 €	-1,9	major therapeutic
0066 - Percutaneous transluminal coronary angioplasty [PTCA]	9,1	4472/48990 episodes	-4.112.571 €	-2,6	major therapeutic
2103 - Control of epistaxis by cauterization (and packing)	9,1	8/88 episodes	13.351,50 €	5,6	minor therapeutic

5304 - Other and open repair of indirect inguinal hernia with graft or prosthesis	9,1	2/22 episodes	-985,80 €	-2,4	major therapeutic
7916 - Closed reduction of fracture with internal fixation, tibia and fibula	9,1	1/11 episodes	-3.534,70 €	-6,3	major therapeutic
8396 - Injection of therapeutic substance into bursa	9,1	1/11 episodes	897,60 €	2	minor therapeutic
3612 - (Aorto)coronary bypass of two coronary arteries	8,8	227/2587 episodes	-585.899,90 €	-3,2	major therapeutic
0124 - Other craniotomy	8,3	1/12 episodes	-1.604,80 €	-1,2	major therapeutic
2102 - Control of epistaxis by posterior (and anterior) packing	8,3	5/60 episodes	-3.324,90 €	-1,5	minor therapeutic
7749 - Biopsy of bone, other bones	8,3	3/36 episodes	875,10 €	0,9	major diagnostic
9925 - Injection or infusion of cancer chemotherapeutic substance	8,1	21/259 episodes	-12.633,10 €	-1,7	minor therapeutic
4443 - Endoscopic control of gastric or duodenal bleeding	8	21/261 episodes	39.723,60 €	3,4	minor therapeutic
4233 - Endoscopic excision or destruction of lesion or tissue of esophagus	7,8	8/102 episodes	14.152,80 €	2,6	minor therapeutic
0049 - Supersaturated oxygen therapy	7,7	2/26 episodes	-2.106,80 €	-2,5	minor therapeutic
2751 - Suture of laceration of lip	7,7	1/13 episodes	-195,80 €	-0,6	minor therapeutic
4229 - Other diagnostic procedures on esophagus	7,7	1/13 episodes	1.440,20 €	3,2	minor diagnostic
8418 - Disarticulation of hip	7,7	1/13 episodes	3.534,70 €	4,1	major therapeutic
8607 - Insertion of totally implantable vascular access device [VAD]	7,5	12/161 episodes	-14.624 €	-2,9	minor therapeutic
0023 - Intravascular imaging of peripheral vessels	7,4	2/27 episodes	1.385,20 €	3,4	minor diagnostic
3892 - Umbilical vein catheterization	7,4	2/27 episodes	-2.880,50 €	-1,3	minor therapeutic
5717 - Percutaneous cystostomy	7,2	9/125 episodes	-7.918,70 €	-1,1	minor therapeutic
3507 - Endovascular replacement of pulmonary valve	7,1	1/14 episodes	-3.516,60 €	-9,1	major therapeutic
3930 - Suture of unspecified blood vessel	7,1	1/14 episodes	1.556,30 €	1	major therapeutic
8651 - Replantation of scalp	7,1	1/14 episodes	195,80 €	0,2	minor therapeutic
9902 - Transfusion of previously collected autologous blood	7,1	2/28 episodes	3.482,10 €	2	minor therapeutic
5795 - Replacement of indwelling urinary catheter	6,8	19/279 episodes	14.371,50 €	1,5	minor therapeutic
4671 - Suture of laceration of duodenum	6,7	1/15 episodes	-1.753,10 €	-0,7	major therapeutic
5303 - Other and open repair of direct inguinal hernia with graft or prosthesis	6,7	1/15 episodes	-3.789,40 €	-7,1	major therapeutic
7901 - Closed reduction of fracture without internal fixation, humerus	6,7	1/15 episodes	861,20 €	2,5	minor therapeutic
8511 - Closed [percutaneous] [needle] biopsy of breast	6,7	3/45 episodes	2.985,40 €	2,8	minor diagnostic

3479 - Other repair of chest wall	6,6	5/76 episodes	45.399,30 €	4,1	major therapeutic
3606 - Insertion of non-drug-eluting coronary artery stent(s)	6,4	876/13623 episodes	-614.449,10 €	-1,3	minor therapeutic
8314 - Fasciotomy	6,4	17/266 episodes	-6.571,20 €	-0,4	major therapeutic
0068 - Intravascular pressure measurement of peripheral arteries	6,2	6/97 episodes	16.113,60 €	2,4	minor diagnostic
3142 - Laryngoscopy and other tracheoscopy	6,2	12/195 episodes	-13.050,60 €	-1,4	minor diagnostic
3998 - Control of hemorrhage, not otherwise specified	6,2	22/353 episodes	-13.667,90 €	-0,4	major therapeutic
7971 - Closed reduction of dislocation of shoulder	6,2	1/16 episodes	795,40 €	2,4	minor therapeutic
3961 - Extracorporeal circulation auxiliary to open heart surgery	6,1	1257/20537 episodes	-2.744.417,10 €	-1,6	minor therapeutic
8609 - Other incision of skin and subcutaneous tissue	6,1	9/147 episodes	12.729,90 €	2,2	minor therapeutic
9972 - Therapeutic leukopheresis	6,1	2/33 episodes	-3.258,60 €	-2,3	minor therapeutic
2311 - Removal of residual root	6	11/183 episodes	24.008,50 €	2	minor therapeutic
8857 - Other and unspecified coronary arteriography	6	1852/30860 episodes	-1.403.883,50 €	-1,5	minor diagnostic
0063 - Percutaneous insertion of carotid artery stent(s)	5,9	4/68 episodes	-1.967,80 €	-0,6	minor therapeutic
3956 - Repair of blood vessel with tissue patch graft	5,9	49/833 episodes	-55.080,20 €	-0,9	major therapeutic
4439 - Other gastroenterostomy without gastrectomy	5,9	1/17 episodes	-14.567,30 €	-5,9	major therapeutic
5412 - Reopening of recent laparotomy site	5,9	3/51 episodes	-4.132,70 €	-0,5	major therapeutic
8414 - Amputation of ankle through malleoli of tibia and fibula	5,9	1/17 episodes	-3.534,70 €	-2,8	major therapeutic
9909 - Transfusion of other substance	5,9	17/286 episodes	100.245,90 €	7	minor therapeutic
3722 - Left heart cardiac catheterization	5,8	4924/84353 episodes	-2.838.288,60 €	-1,1	minor diagnostic
3609 - Other removal of coronary artery obstruction	5,6	82/1464 episodes	-104.038,50 €	-1,9	major therapeutic
5123 - Laparoscopic cholecystectomy	5,6	1/18 episodes	7,10 €	0	major therapeutic
3327 - Closed endoscopic biopsy of lung	5,3	4/75 episodes	-8.661,10 €	-2,9	major diagnostic
3727 - Cardiac mapping	5,3	54/1018 episodes	5.804,70 €	0,2	minor diagnostic
4444 - Transcatheter embolization for gastric or duodenal bleeding	5,3	1/19 episodes	-1.190,30 €	-1,4	minor therapeutic
1811 - Otoscopy	5,2	12/233 episodes	-8.357,40 €	-1,2	minor diagnostic

8611 - Closed biopsy of skin and subcutaneous tissue	5,1	16/311 episodes	-4.068,90 €	-0,4	minor diagnostic
2100 - Control of epistaxis, not otherwise specified	5	1/20 episodes	-725 €	-1	minor therapeutic
3471 - Suture of laceration of chest wall	5	2/40 episodes	-4.447,50 €	-0,9	minor therapeutic
8191 - Arthrocentesis	5	6/120 episodes	12.971,70 €	3,2	minor therapeutic
8605 - Incision with removal of foreign body or device from skin and subcutaneous tissue	5	13/262 episodes	-5.269,30 €	-0,6	minor therapeutic
0390 - Insertion of catheter into spinal canal for infusion of therapeutic or palliative substances	4,8	49/1015 episodes	-26.122,10 €	-0,5	minor therapeutic
0611 - Closed [percutaneous] [needle] biopsy of thyroid gland	4,8	5/105 episodes	1.531,40 €	0,5	minor diagnostic
3720 - Noninvasive programmed electrical stimulation [NIPS]	4,8	13/269 episodes	-42.812 €	-5,6	minor diagnostic
4575 - Open and other left hemicolectomy	4,7	2/43 episodes	-16.202,90 €	-1,9	major therapeutic
0391 - Injection of anesthetic into spinal canal for analgesia	4,5	44/979 episodes	49.014,10 €	0,9	minor therapeutic
0881 - Linear repair of laceration of eyelid or eyebrow	4,5	1/22 episodes	690,50 €	1,3	minor therapeutic
4224 - Closed [endoscopic] biopsy of esophagus	4,5	1/22 episodes	523,90 €	0,8	minor diagnostic
2101 - Control of epistaxis by anterior nasal packing	4,4	12/272 episodes	776 €	0,1	minor therapeutic
3403 - Reopening of recent thoracotomy site	4,3	9/210 episodes	-94.120,30 €	-3,4	major therapeutic
3424 - Other pleural biopsy	4,3	20/470 episodes	12.945,50 €	1	minor diagnostic
3829 - Other diagnostic procedures on blood vessels	4,3	1/23 episodes	2.223,80 €	3,7	major diagnostic
2309 - Extraction of other tooth	4,2	23/549 episodes	-27.699,70 €	-0,9	minor therapeutic
3711 - Cardiotomy	4,2	44/1048 episodes	-25.584,60 €	-0,3	major therapeutic
7906 - Closed reduction of fracture without internal fixation, tibia and fibula	4,2	1/24 episodes	455,20 €	0,6	minor therapeutic
5732 - Other cystoscopy	4	4/100 episodes	7.168,70 €	1,8	minor diagnostic
8601 - Aspiration of skin and subcutaneous tissue	4	2/50 episodes	15.428,60 €	7,4	minor therapeutic
4514 - Closed [endoscopic] biopsy of small intestine	3,8	1/26 episodes	2.242,30 €	3,4	minor diagnostic
9903 - Other transfusion of whole blood	3,8	19/506 episodes	-34.862,70 €	-1,6	minor therapeutic
9915 - Parenteral infusion of concentrated nutritional substances	3,8	21/549 episodes	-31.504,90 €	-0,6	minor therapeutic
3963 - Cardioplegia	3,7	174/4764 episodes	-217.282,70 €	-0,6	minor therapeutic
1755 - Transluminal coronary atherectomy	3,6	2/56 episodes	-328,10 €	-0,2	major therapeutic
3534 - Infundibulectomy	3,6	1/28 episodes	4.657,30 €	1,8	major therapeutic

3824 - Intravascular imaging of coronary vessel(s) by optical coherence tomography [OCT]	3,6	2/55 episodes	-877,90 €	-0,6	minor diagnostic
4341 - Endoscopic excision or destruction of lesion or tissue of stomach	3,6	2/56 episodes	-1.585,10 €	-0,7	minor therapeutic
8411 - Amputation of toe	3,6	69/1894 episodes	-43.563,10 €	-0,4	major therapeutic
8854 - Combined right and left heart angiocardiology	3,4	53/1542 episodes	-77.616,40 €	-1,8	minor diagnostic
4131 - Biopsy of bone marrow	3,3	17/514 episodes	14.785,80 €	0,9	minor diagnostic
8856 - Coronary arteriography using two catheters	3,2	1825/56217 episodes	-1.377.685,10 €	-0,9	minor diagnostic
3996 - Total body perfusion	3,1	19/621 episodes	-30.691,40 €	-1,7	minor therapeutic
3533 - Annuloplasty	3	25/840 episodes	-108.389 €	-1,3	major therapeutic
3725 - Biopsy of heart	3	13/435 episodes	-28.900,70 €	-3,2	minor diagnostic
9906 - Transfusion of coagulation factors	3	10/338 episodes	60.373,80 €	1,9	minor therapeutic
2319 - Other surgical extraction of tooth	2,9	2/68 episodes	6.154,60 €	2,5	minor therapeutic
4519 - Other diagnostic procedures on small intestine	2,9	1/34 episodes	861,20 €	0,9	minor diagnostic
8855 - Coronary arteriography using a single catheter	2,9	270/9320 episodes	-232.781,30 €	-0,8	minor diagnostic
0331 - Spinal tap	2,8	16/567 episodes	10.454,30 €	0,4	minor diagnostic
2349 - Other dental restoration	2,8	1/36 episodes	4.153,50 €	1,7	minor therapeutic
5498 - Peritoneal dialysis	2,8	6/214 episodes	-4.978,10 €	-0,5	minor therapeutic
3532 - Operations on chordae tendineae	2,7	1/37 episodes	-766,80 €	-0,3	major therapeutic
4542 - Endoscopic polypectomy of large intestine	2,7	7/259 episodes	-36.289 €	-3,2	minor therapeutic
3322 - Fiber-optic bronchoscopy	2,6	19/735 episodes	-19.885 €	-0,5	minor diagnostic
4543 - Endoscopic destruction of other lesion or tissue of large intestine	2,6	2/78 episodes	1.758,80 €	0,5	minor therapeutic
4824 - Closed [endoscopic] biopsy of rectum	2,6	1/38 episodes	897,50 €	0,5	minor diagnostic
9908 - Transfusion of blood expander	2,6	40/1524 episodes	-52.683,60 €	-0,4	minor therapeutic
3898 - Other puncture of artery	2,5	38/1519 episodes	-65.735,10 €	-1,1	minor therapeutic
3324 - Closed [endoscopic] biopsy of bronchus	2,4	15/615 episodes	-16.375,90 €	-0,5	minor diagnostic
3814 - Endarterectomy, aorta	2,4	15/621 episodes	-30.870,60 €	-0,6	major therapeutic
3326 - Closed [percutaneous] [needle] biopsy of lung	2,3	2/87 episodes	1.714,20 €	0,6	minor diagnostic

4413 - Other gastroscopy	2,3	14/601 episodes	-12.893,60 €	-0,8	minor diagnostic
8619 - Other diagnostic procedures on skin and subcutaneous tissue	2,3	1/44 episodes	1.096,60 €	1,3	minor diagnostic
8853 - Angiocardigraphy of left heart structures	2,3	605/26474 episodes	-1.710.891,90 €	-2,4	minor diagnostic
0048 - Insertion of four or more vascular stents	2,2	30/1374 episodes	-40.600,80 €	-0,9	minor therapeutic
4414 - Closed [endoscopic] biopsy of stomach	2,2	5/229 episodes	3.902,30 €	0,7	minor diagnostic
5491 - Percutaneous abdominal drainage	2,2	26/1184 episodes	-15.734,50 €	-0,4	minor therapeutic
4525 - Closed [endoscopic] biopsy of large intestine	2,1	12/571 episodes	13.696,10 €	0,7	minor diagnostic
4611 - Temporary colostomy	2,1	1/48 episodes	-5.201,10 €	-0,6	major therapeutic
3401 - Incision of chest wall	2	1/51 episodes	-897,50 €	-0,5	minor therapeutic
3962 - Hypothermia (systemic) incidental to open heart surgery	2	123/6017 episodes	-104.722 €	-0,2	minor therapeutic
0059 - Intravascular pressure measurement of coronary arteries	1,9	8/423 episodes	4.796,60 €	0,5	minor diagnostic
3404 - Insertion of intercostal catheter for drainage	1,9	32/1690 episodes	-180.064 €	-1,6	minor therapeutic
3792 - Injection of therapeutic substance into heart	1,9	1/53 episodes	-2.068,40 €	-1,2	minor therapeutic
4823 - Rigid proctosigmoidoscopy	1,9	1/54 episodes	-3.357,80 €	-1,4	minor diagnostic
8659 - Closure of skin and subcutaneous tissue of other sites	1,9	10/532 episodes	3.151,70 €	0,2	minor therapeutic
9901 - Exchange transfusion	1,9	3/162 episodes	3.318,50 €	0,6	minor therapeutic
3964 - Intraoperative cardiac pacemaker	1,8	49/2789 episodes	-47.974,60 €	-0,2	minor therapeutic
5523 - Closed [percutaneous] [needle] biopsy of kidney	1,8	3/164 episodes	6.316 €	1,5	minor diagnostic
0043 - Procedure on four or more vessels	1,7	7/420 episodes	-5.025,60 €	-0,3	minor therapeutic
3607 - Insertion of drug-eluting coronary artery stent(s)	1,7	569/33394 episodes	-176.184,10 €	-0,2	minor therapeutic
3997 - Other perfusion	1,7	13/747 episodes	13.557,30 €	0,6	minor therapeutic
3894 - Venous cutdown	1,6	1/63 episodes	-861,20 €	-0,3	minor therapeutic
9604 - Insertion of endotracheal tube	1,6	150/9153 episodes	-79.030,30 €	-0,1	minor therapeutic
0014 - Injection or infusion of oxazolidinone class of antibiotics	1,5	8/535 episodes	-27.006,40 €	-0,7	minor therapeutic
3891 - Arterial catheterization	1,5	218/14952 episodes	267.490,90 €	0,2	minor therapeutic

3897 - Central venous catheter placement with guidance	1,5	5/337 episodes	1.755,60 €	0,1	minor therapeutic
3899 - Other puncture of vein	1,5	169/11309 episodes	251.901,60 €	0,9	minor therapeutic
3995 - Hemodialysis	1,5	125/8328 episodes	55.215 €	0,1	minor therapeutic
2121 - Rhinoscopy	1,4	1/70 episodes	-19.212 €	-5,6	minor diagnostic
0017 - Infusion of vasopressor agent	1,3	89/6704 episodes	-270.803,90 €	-0,5	minor therapeutic
0031 - Computer assisted surgery with CT/CTA	1,3	1/79 episodes	-666,50 €	-0,3	minor diagnostic
3893 - Venous catheterization, not elsewhere classified	1,3	214/17061 episodes	-773.876,80 €	-0,6	minor therapeutic
9905 - Transfusion of platelets	1,3	18/1389 episodes	-17.500,60 €	-0,1	minor therapeutic
1621 - Ophthalmoscopy	1,2	3/245 episodes	-3.877,90 €	-0,4	minor diagnostic
0047 - Insertion of three vascular stents	1,1	40/3631 episodes	-70.098 €	-0,6	minor therapeutic
3409 - Other incision of pleura	1,1	2/176 episodes	14.553,40 €	1,1	minor therapeutic
3601 - not found	1,1	5/453 episodes	3.869,20 €	0,3	major therapeutic
3604 - Intracoronary artery thrombolytic infusion	1,1	6/569 episodes	-3.762,70 €	-0,2	minor therapeutic
9907 - Transfusion of other serum	1,1	41/3758 episodes	-41.911,50 €	-0,1	minor therapeutic
3729 - Other diagnostic procedures on heart and pericardium	1	1/101 episodes	-254,80 €	-0,2	minor diagnostic
8604 - Other incision with drainage of skin and subcutaneous tissue	1	7/724 episodes	14.955,60 €	0,5	minor therapeutic
3778 - Insertion of temporary transvenous pacemaker system	0,9	43/5056 episodes	-93.410,20 €	-0,5	minor therapeutic
4523 - Colonoscopy	0,9	26/2944 episodes	-22.857,10 €	-0,2	minor diagnostic
9605 - Other intubation of respiratory tract	0,9	4/428 episodes	-5.088,70 €	-0,3	minor therapeutic
0024 - Intravascular imaging of coronary vessels	0,7	6/913 episodes	-11.538,80 €	-0,5	minor diagnostic
3551 - Repair of atrial septal defect with prosthesis, open technique	0,7	1/136 episodes	-3.338,80 €	-0,4	major therapeutic
3895 - Venous catheterization for renal dialysis	0,7	22/3119 episodes	44.841,10 €	0,2	minor therapeutic
4223 - Other esophagoscopy	0,7	23/3226 episodes	20.584,40 €	0,1	minor diagnostic
0045 - Insertion of one vascular stent	0,6	181/32170 episodes	-110.523,90 €	-0,1	minor therapeutic
0046 - Insertion of two vascular stents	0,6	75/11806 episodes	-54.900,30 €	-0,1	minor therapeutic

5794 - Insertion of indwelling urinary catheter	0,6	134/20800 episodes	-159.739,70 €	-0,2	minor therapeutic
8628 - Nonexcisional debridement of wound, infection or burn	0,6	4/707 episodes	1.521,40 €	0,1	minor therapeutic
0040 - Procedure on single vessel	0,5	205/43022 episodes	160.835 €	0,1	minor therapeutic
0041 - Procedure on two vessels	0,5	49/10499 episodes	96.404,20 €	0,3	minor therapeutic
3491 - Thoracentesis	0,5	25/5043 episodes	9.851,80 €	0,1	minor therapeutic
4513 - Other endoscopy of small intestine	0,5	22/4517 episodes	66.981,10 €	0,5	minor diagnostic
4516 - Esophagogastroduodenoscopy [EGD] with closed biopsy	0,5	6/1210 episodes	4.343,80 €	0,1	minor diagnostic
9390 - Non-invasive mechanical ventilation	0,5	81/15667 episodes	-158.896,70 €	-0,3	minor therapeutic
9904 - Transfusion of packed cells	0,5	114/21285 episodes	-467.908,80 €	-0,4	minor therapeutic
3605 - not found	0,4	1/230 episodes	2.068,40 €	0,3	major therapeutic
3992 - Injection of sclerosing agent into vein	0,4	1/228 episodes	-861,20 €	-0,2	major therapeutic
0044 - Procedure on vessel bifurcation	0,3	4/1316 episodes	-17.662,80 €	-0,4	minor therapeutic
3990 - Insertion of non-drug-eluting peripheral (non-coronary) vessel stent(s)	0,3	11/3154 episodes	-3.434,30 €	0	minor therapeutic
8622 - Excisional debridement of wound, infection, or burn	0,3	8/3167 episodes	-35.009,20 €	-0,3	major therapeutic
0010 - Implantation of chemotherapeutic agent	0	0/6 episodes	0 €	0	minor therapeutic
0016 - Pressurized treatment of venous bypass graft [conduit] with pharmaceutical substance	0	0/8 episodes	0 €	0	minor therapeutic
0018 - Infusion of immunosuppressive antibody therapy	0	0/10 episodes	0 €	0	minor therapeutic
0025 - Intravascular imaging of renal vessels	0	0/7 episodes	0 €	0	minor diagnostic
0028 - Intravascular imaging, other specified vessel(s)	0	0/14 episodes	0 €	0	minor diagnostic
0042 - Procedure on three vessels	0	1/2018 episodes	-1.440,20 €	0	minor therapeutic
0065 - Percutaneous insertion of intracranial vascular stent(s)	0	0/9 episodes	0 €	0	minor therapeutic
0067 - Intravascular pressure measurement of intrathoracic arteries	0	0/17 episodes	0 €	0	minor diagnostic
0110 - Intracranial pressure monitoring	0	0/23 episodes	0 €	0	minor diagnostic
0309 - Other exploration and decompression of spinal canal	0	0/23 episodes	0 €	0	major therapeutic
0601 - Aspiration of thyroid field	0	0/6 episodes	0 €	0	minor therapeutic

0782 - Other total excision of thymus	0	0/14 episodes	0 €	0	major therapeutic
1771 - Non-coronary intra-operative fluorescence vascular angiography [IFVA]	0	0/44 episodes	0 €	0	minor diagnostic
2122 - Biopsy of nose	0	0/8 episodes	0 €	0	minor diagnostic
2131 - Local excision or destruction of intranasal lesion	0	0/22 episodes	0 €	0	minor therapeutic
2132 - Local excision or destruction of other lesion of nose	0	0/7 episodes	0 €	0	minor therapeutic
2171 - Closed reduction of nasal fracture	0	0/8 episodes	0 €	0	minor therapeutic
2181 - Suture of laceration of nose	0	0/8 episodes	0 €	0	minor therapeutic
2301 - Extraction of deciduous tooth	0	0/7 episodes	0 €	0	minor therapeutic
2431 - Excision of lesion or tissue of gum	0	0/7 episodes	0 €	0	minor therapeutic
2499 - Other dental operations	0	0/7 episodes	0 €	0	minor therapeutic
2611 - Closed [needle] biopsy of salivary gland or duct	0	0/20 episodes	0 €	0	minor diagnostic
2724 - Biopsy of mouth, unspecified structure	0	0/8 episodes	0 €	0	minor diagnostic
3143 - Closed [endoscopic] biopsy of larynx	0	0/9 episodes	0 €	0	minor diagnostic
3249 - Other lobectomy of lung	0	0/6 episodes	0 €	0	major therapeutic
3372 - Endoscopic pulmonary airway flow measurement	0	0/8 episodes	0 €	0	minor therapeutic
3459 - Other excision of pleura	0	0/7 episodes	0 €	0	major therapeutic
3472 - Closure of thoracostomy	0	0/11 episodes	0 €	0	minor therapeutic
3492 - Injection into thoracic cavity	0	0/69 episodes	0 €	0	minor therapeutic
3499 - Other operations on thorax	0	0/10 episodes	0 €	0	major therapeutic
3583 - Total repair of truncus arteriosus	0	0/10 episodes	0 €	0	major therapeutic
3602 - not found	0	0/7 episodes	0 €	0	major therapeutic
3710 - Incision of heart, not otherwise specified	0	0/6 episodes	0 €	0	major therapeutic
3764 - Removal of external heart assist system(s) or device(s)	0	0/26 episodes	0 €	0	major therapeutic
3765 - Implant of single ventricular (extracorporeal) external heart assist system	0	0/6 episodes	0 €	0	major therapeutic
3811 - Endarterectomy, intracranial vessels	0	0/7 episodes	0 €	0	major therapeutic
3815 - Endarterectomy, other thoracic vessels	0	0/12 episodes	0 €	0	major therapeutic
3821 - Biopsy of blood vessel	0	0/39 episodes	0 €	0	major diagnostic

3825 - Intravascular imaging of non-coronary vessel(s) by optical coherence tomography [OCT]	0	0/21 episodes	0 €	0	minor diagnostic
4059 - Radical excision of other lymph nodes	0	0/6 episodes	0 €	0	major therapeutic
4138 - Other diagnostic procedures on bone marrow	0	0/18 episodes	0 €	0	minor diagnostic
4311 - Percutaneous [endoscopic] gastrostomy [PEG]	0	0/39 episodes	0 €	0	minor therapeutic
4412 - Gastroscopy through artificial stoma	0	0/6 episodes	0 €	0	minor diagnostic
4528 - Other diagnostic procedures on large intestine	0	0/8 episodes	0 €	0	minor diagnostic
4530 - Endoscopic excision or destruction of lesion of duodenum	0	0/8 episodes	0 €	0	minor therapeutic
4572 - Open and other cecectomy	0	0/6 episodes	0 €	0	major therapeutic
4579 - Other and unspecified partial excision of large intestine	0	0/12 episodes	0 €	0	major therapeutic
4582 - Open total intra-abdominal colectomy	0	0/11 episodes	0 €	0	major therapeutic
4620 - Ileostomy, not otherwise specified	0	0/13 episodes	0 €	0	major therapeutic
4621 - Temporary ileostomy	0	0/26 episodes	0 €	0	major therapeutic
4639 - Other enterostomy	0	0/14 episodes	0 €	0	minor therapeutic
4672 - Closure of fistula of duodenum	0	0/7 episodes	0 €	0	major therapeutic
4673 - Suture of laceration of small intestine, except duodenum	0	0/12 episodes	0 €	0	major therapeutic
4719 - Other incidental appendectomy	0	0/11 episodes	0 €	0	major therapeutic
4832 - Other electrocoagulation of rectal lesion or tissue	0	0/7 episodes	0 €	0	minor therapeutic
4836 - [Endoscopic] polypectomy of rectum	0	0/27 episodes	0 €	0	minor therapeutic
4862 - Anterior resection of rectum with synchronous colostomy	0	0/8 episodes	0 €	0	major therapeutic
4921 - Anoscopy	0	0/18 episodes	0 €	0	minor diagnostic
4942 - Injection of hemorrhoids	0	0/8 episodes	0 €	0	minor therapeutic
5013 - Transjugular liver biopsy	0	0/7 episodes	0 €	0	minor diagnostic
5022 - Partial hepatectomy	0	0/9 episodes	0 €	0	major therapeutic
5101 - Percutaneous aspiration of gallbladder	0	0/21 episodes	0 €	0	minor therapeutic
5122 - Cholecystectomy	0	0/59 episodes	0 €	0	major therapeutic
5185 - Endoscopic sphincterotomy and papillotomy	0	0/37 episodes	0 €	0	minor therapeutic
5188 - Endoscopic removal of stone(s) from biliary tract	0	0/30 episodes	0 €	0	minor therapeutic

5305 - Repair of inguinal hernia with graft or prosthesis, not otherwise specified	0	0/10 episodes	0 €	0	major therapeutic
5341 - Other and open repair of umbilical hernia with graft or prosthesis	0	0/7 episodes	0 €	0	major therapeutic
5351 - Incisional hernia repair	0	0/12 episodes	0 €	0	major therapeutic
5359 - Repair of other hernia of anterior abdominal wall	0	0/10 episodes	0 €	0	major therapeutic
5361 - Other open incisional hernia repair with graft or prosthesis	0	0/9 episodes	0 €	0	major therapeutic
5422 - Biopsy of abdominal wall or umbilicus	0	0/26 episodes	0 €	0	major diagnostic
5424 - Closed [percutaneous] [needle] biopsy of intra-abdominal mass	0	0/34 episodes	0 €	0	minor diagnostic
5462 - Delayed closure of granulating abdominal wound	0	0/8 episodes	0 €	0	major therapeutic
5463 - Other suture of abdominal wall	0	0/9 episodes	0 €	0	major therapeutic
5474 - Other repair of omentum	0	0/8 episodes	0 €	0	major therapeutic
5492 - Removal of foreign body from peritoneal cavity	0	0/8 episodes	0 €	0	major therapeutic
5499 - Other operations of abdominal region	0	0/12 episodes	0 €	0	minor therapeutic
5631 - Ureteroscopy	0	0/8 episodes	0 €	0	minor diagnostic
5733 - Closed [transurethral] biopsy of bladder	0	0/13 episodes	0 €	0	major diagnostic
6029 - Other transurethral prostatectomy	0	0/7 episodes	0 €	0	major therapeutic
6561 - Other removal of both ovaries and tubes at same operative episode	0	0/10 episodes	0 €	0	major therapeutic
6812 - Hysteroscopy	0	0/7 episodes	0 €	0	minor diagnostic
7534 - Other fetal monitoring	0	0/14 episodes	0 €	0	minor diagnostic
7768 - Local excision of lesion or tissue of bone, tarsals and metatarsals	0	0/7 episodes	0 €	0	major therapeutic
7851 - Internal fixation of bone without fracture reduction, scapula, clavicle, and thorax [ribs and sternum]	0	0/15 episodes	0 €	0	major therapeutic
7867 - Removal of implanted devices from bone, tibia and fibula	0	0/8 episodes	0 €	0	major therapeutic
7905 - Closed reduction of fracture without internal fixation, femur	0	0/15 episodes	0 €	0	minor therapeutic
7975 - Closed reduction of dislocation of hip	0	0/7 episodes	0 €	0	minor therapeutic
8051 - Excision of intervertebral disc	0	0/8 episodes	0 €	0	major therapeutic
8052 - Intervertebral chemonucleolysis	0	0/7 episodes	0 €	0	minor therapeutic
8105 - Dorsal and dorsolumbar fusion of the posterior column, posterior technique	0	0/7 episodes	0 €	0	major therapeutic

8162 - Fusion or refusion of 2-3 vertebrae	0	0/6 episodes	0 €	0	major therapeutic
8192 - Injection of therapeutic substance into joint or ligament	0	0/12 episodes	0 €	0	minor therapeutic
8212 - Fasciotomy of hand	0	0/6 episodes	0 €	0	major therapeutic
8244 - Other suture of flexor tendon of hand	0	0/9 episodes	0 €	0	major therapeutic
8245 - Other suture of other tendon of hand	0	0/6 episodes	0 €	0	major therapeutic
8321 - Open biopsy of soft tissue	0	0/21 episodes	0 €	0	major diagnostic
8364 - Other suture of tendon	0	0/20 episodes	0 €	0	major therapeutic
8365 - Other suture of muscle or fascia	0	0/27 episodes	0 €	0	major therapeutic
8382 - Graft of muscle or fascia	0	0/16 episodes	0 €	0	major therapeutic
8395 - Aspiration of other soft tissue	0	0/9 episodes	0 €	0	minor therapeutic
8461 - Insertion of partial spinal disc prosthesis, cervical	0	0/8 episodes	0 €	0	major therapeutic
8471 - Application of external fixator device, monoplanar system	0	0/9 episodes	0 €	0	minor therapeutic
8623 - Removal of nail, nail bed, or nail fold	0	0/28 episodes	0 €	0	minor therapeutic
8671 - Cutting and preparation of pedicle grafts or flaps	0	0/13 episodes	0 €	0	major therapeutic
8692 - Electrolysis and other epilation of skin	0	0/7 episodes	0 €	0	minor therapeutic
9221 - Superficial radiation	0	0/6 episodes	0 €	0	minor therapeutic
9900 - Perioperative autologous transfusion of whole blood or blood components	0	0/52 episodes	0 €	0	minor therapeutic
9971 - Therapeutic plasmapheresis	0	0/30 episodes	0 €	0	minor therapeutic
9973 - Therapeutic erythrocytapheresis	0	0/9 episodes	0 €	0	minor therapeutic
9975 - Administration of neuroprotective agent	0	0/8 episodes	0 €	0	minor therapeutic

Supplementary table 4 – Descending ranking of procedures according to their effects on APR-DRG changes for respiratory system diseases (Brazil)

Procedure	Percentage change of APR-DRG	Number of episodes that changed their APR-DRG	Total differences in hospital payments (€)	Percentage change in hospital payments	Procedure category
3328 - Open biopsy of lung	100	12/12 episodes	-18.125,30 €	-56,5	major diagnostic
3451 - Decortication of lung	96,9	31/32 episodes	-57.468,70 €	-57,8	major therapeutic
3179 - Other repair and plastic operations on trachea	91,7	11/12 episodes	-39.991,80 €	-69,8	major therapeutic
3402 - Exploratory thoracotomy	86	98/114 episodes	-142.573,60 €	-49,5	major therapeutic
3129 - Other permanent tracheostomy	82,5	132/160 episodes	-304.863,50 €	-53,2	major therapeutic
3421 - Transpleural thoracoscopy	81,2	13/16 episodes	-20.379,90 €	-48,8	major diagnostic
3229 - Other local excision or destruction of lesion or tissue of lung	75	6/8 episodes	-5.598,50 €	-32,4	major therapeutic
4029 - Simple excision of other lymphatic structure	75	6/8 episodes	-5.839,30 €	-33,8	major therapeutic
3422 - Mediastinoscopy	63,6	7/11 episodes	-22.839,30 €	-52,6	major diagnostic
5411 - Exploratory laparotomy	50	5/10 episodes	-13.166,90 €	-43,7	major therapeutic
4011 - Biopsy of lymphatic structure	42,9	3/7 episodes	-2.399,70 €	-16,1	major diagnostic
8622 - Excisional debridement of wound, infection, or burn	33,3	5/15 episodes	-12.133,30 €	-23,4	major therapeutic
3428 - Other diagnostic procedures on chest wall, pleura, and diaphragm	16,7	1/6 episodes	-1.235,90 €	-17,1	major diagnostic
3721 - Right heart cardiac catheterization	12	3/25 episodes	-143,10 €	-0,4	minor diagnostic
4319 - Other gastrostomy	9,1	1/11 episodes	541,50 €	4,3	minor therapeutic
8607 - Insertion of totally implantable vascular access device [VAD]	5,6	1/18 episodes	-541,50 €	-2,3	minor therapeutic
3324 - Closed [endoscopic] biopsy of bronchus	4,8	1/21 episodes	760 €	2,4	minor diagnostic
3409 - Other incision of pleura	3,3	4/122 episodes	-7.486,10 €	-4,3	minor therapeutic
3404 - Insertion of intercostal catheter for drainage	0,6	3/506 episodes	2.647,20 €	0,3	minor therapeutic
3323 - Other bronchoscopy	0,4	1/277 episodes	-366,70 €	-0,1	minor diagnostic
3142 - Laryngoscopy and other tracheoscopy	0	0/35 episodes	0 €	0	minor diagnostic
3175 - Reconstruction of trachea and construction of artificial larynx	0	0/9 episodes	0 €	0	major therapeutic
3322 - Fiber-optic bronchoscopy	0	0/44 episodes	0 €	0	minor diagnostic

3326 - Closed [percutaneous] [needle] biopsy of lung	0	0/12 episodes	0 €	0	minor diagnostic
3327 - Closed endoscopic biopsy of lung	0	0/48 episodes	0 €	0	major diagnostic
3424 - Other pleural biopsy	0	0/41 episodes	0 €	0	minor diagnostic
3425 - Closed [percutaneous] [needle] biopsy of mediastinum	0	0/11 episodes	0 €	0	minor diagnostic
3491 - Thoracentesis	0	0/128 episodes	0 €	0	minor therapeutic
3609 - Other removal of coronary artery obstruction	0	0/9 episodes	0 €	0	major therapeutic
3610 - Aortocoronary bypass for heart revascularization, not otherwise specified	0	0/9 episodes	0 €	0	major therapeutic
3770 - Initial insertion of lead [electrode], not otherwise specified	0	0/8 episodes	0 €	0	minor therapeutic
3993 - Insertion of vessel-to-vessel cannula	0	0/6 episodes	0 €	0	major therapeutic
4413 - Other gastroscopy	0	0/15 episodes	0 €	0	minor diagnostic
4513 - Other endoscopy of small intestine	0	0/21 episodes	0 €	0	minor diagnostic
5491 - Percutaneous abdominal drainage	0	0/10 episodes	0 €	0	minor therapeutic
8917 - Polysomnogram	0	0/11 episodes	0 €	0	minor diagnostic
8932 - Esophageal manometry	0	0/9 episodes	0 €	0	minor diagnostic
9604 - Insertion of endotracheal tube	0	0/28 episodes	0 €	0	minor therapeutic
9723 - Replacement of tracheostomy tube	0	0/11 episodes	0 €	0	minor therapeutic
9921 - Injection of antibiotic	0	0/10 episodes	0 €	0	minor therapeutic
9925 - Injection or infusion of cancer chemotherapeutic substance	0	0/25 episodes	0 €	0	minor therapeutic
9928 - Injection or infusion of biological response modifier [BRM] as an antineoplastic agent	0	0/12 episodes	0 €	0	minor therapeutic
9929 - Injection or infusion of other therapeutic or prophylactic substance	0	0/9 episodes	0 €	0	minor therapeutic

Supplementary table 5 – Descending ranking of procedures according to their effects on APR-DRG changes for circulatory system diseases (Brazil)

Procedure	Percentage change of APR-DRG	Number of episodes that changed their APR-DRG	Total differences in hospital payments (€)	Percentage change in hospital payments	Procedure category
1692 - Excision of lesion of orbit	100	6/6 episodes	-6.829,40 €	-54,7	major therapeutic
3421 - Transpleural thoracoscopy	100	8/8 episodes	-2.777,70 €	-20,6	major diagnostic
3573 - Other and unspecified repair of endocardial cushion defect	100	13/13 episodes	-38.739,40 €	-50,6	major therapeutic
3581 - Total repair of tetralogy of fallot	100	19/19 episodes	-75.156,30 €	-67,1	major therapeutic
3723 - Combined right and left heart cardiac catheterization	100	8/8 episodes	-6.842,90 €	-44	minor diagnostic
3731 - Pericardiectomy	100	6/6 episodes	-23.560,70 €	-74	major therapeutic
3775 - Revision of lead [electrode]	100	9/9 episodes	-5.691,70 €	-35,9	major therapeutic
3785 - Replacement of any type pacemaker device with single-chamber device, not specified as rate responsive	100	9/9 episodes	-14.300 €	-46,6	major therapeutic
3794 - Implantation or replacement of automatic cardioverter/defibrillator, total system [AICD]	100	25/25 episodes	-157.103,10 €	-78,9	major therapeutic
3836 - Resection of vessel with anastomosis, abdominal arteries	100	12/12 episodes	-23.848,50 €	-45,3	major therapeutic
3953 - Repair of arteriovenous fistula	100	14/14 episodes	-31.865,10 €	-68,8	major therapeutic
8401 - Amputation and disarticulation of finger	100	7/7 episodes	-5.075,20 €	-42,7	major therapeutic
3859 - Ligation and stripping of varicose veins, lower limb veins	99,7	6568/6587 episodes	-4.778.095,10 €	-42,5	major therapeutic
3734 - Excision or destruction of other lesion or tissue of heart, endovascular approach	99,3	279/281 episodes	-353.381,40 €	-58	major therapeutic
3776 - Replacement of transvenous atrial and/or ventricular lead(s) [electrode]	97,4	74/76 episodes	-43.358,40 €	-30,6	major therapeutic
3524 - Open and other replacement of mitral valve	96,7	175/181 episodes	-1.042.670,80 €	-76,4	major therapeutic
3596 - Percutaneous balloon valvuloplasty	94,7	18/19 episodes	-17.934,50 €	-38,8	major therapeutic
3882 - Other surgical occlusion of vessels, other vessels of head and neck	93,8	15/16 episodes	-34.065,80 €	-64,6	major therapeutic
8857 - Other and unspecified coronary arteriography	93,3	180/193 episodes	-109.585,40 €	-34,4	minor diagnostic

3780 - Insertion of permanent pacemaker, initial or replacement, type of device not specified	92,9	26/28 episodes	-19.701,70 €	-26,4	major therapeutic
3869 - Other excision of vessels, lower limb veins	90,9	10/11 episodes	-7.250,30 €	-38,8	major therapeutic
3800 - Incision of vessel, unspecified site	90,5	38/42 episodes	-82.863,20 €	-61,9	major therapeutic
3402 - Exploratory thoracotomy	90,2	46/51 episodes	-192.189,60 €	-69,6	major therapeutic
3561 - Repair of atrial septal defect with tissue graft	90	9/10 episodes	-30.733,70 €	-60,1	major therapeutic
3921 - Caval-pulmonary artery anastomosis	90	9/10 episodes	-33.130,20 €	-60,8	major therapeutic
3952 - Other repair of aneurysm	88,9	8/9 episodes	-55.193,90 €	-66,5	major therapeutic
3603 - Open chest coronary artery angioplasty	88,6	39/44 episodes	-137.831,80 €	-67,8	major therapeutic
8417 - Amputation above knee	88	22/25 episodes	-42.262,40 €	-55,7	major therapeutic
3834 - Resection of vessel with anastomosis, aorta	87,9	29/33 episodes	-198.952,40 €	-57,3	major therapeutic
3522 - Open and other replacement of aortic valve	86,4	172/199 episodes	-1.047.503,80 €	-71,4	major therapeutic
3844 - Resection of vessel with replacement, aorta, abdominal	86,2	50/58 episodes	-288.664 €	-52,8	major therapeutic
3803 - Incision of vessel, upper limb vessels	85,7	18/21 episodes	-39.510,90 €	-54,4	major therapeutic
3860 - Other excision of vessels, unspecified site	85,7	6/7 episodes	-13.394,70 €	-66,7	major therapeutic
3971 - Endovascular implantation of other graft in abdominal aorta	85,6	77/90 episodes	-190.191,90 €	-31,8	major therapeutic
3808 - Incision of vessel, lower limb arteries	85,3	180/211 episodes	-437.063 €	-55	major therapeutic
3451 - Decortication of lung	83,3	5/6 episodes	-14.507,50 €	-61,8	major therapeutic
3845 - Resection of vessel with replacement, thoracic vessels	83,3	5/6 episodes	-30.952,10 €	-71,3	major therapeutic
3866 - Other excision of vessels, abdominal arteries	83,3	5/6 episodes	-15.746,60 €	-61,9	major therapeutic
3868 - Other excision of vessels, lower limb arteries	83,3	5/6 episodes	-11.162,20 €	-58	major therapeutic
8411 - Amputation of toe	82,1	46/56 episodes	-36.299,70 €	-30,6	major therapeutic
3925 - Aorta-iliac-femoral bypass	80,5	33/41 episodes	-77.682 €	-35	major therapeutic
8410 - Lower limb amputation, not otherwise specified	80	12/15 episodes	-5.194,20 €	-17,7	major therapeutic
3864 - Other excision of vessels, aorta, abdominal	79,4	27/34 episodes	-115.300,80 €	-51,9	major therapeutic
3582 - Total repair of total anomalous pulmonary venous connection	77,8	7/9 episodes	-14.932 €	-35,4	major therapeutic
3571 - Other and unspecified repair of atrial septal defect	77,7	73/94 episodes	-262.512,50 €	-57,8	major therapeutic

3880 - Other surgical occlusion of vessels, unspecified site	76,9	10/13 episodes	-22.178,50 €	-56,8	major therapeutic
8415 - Other amputation below knee	76,5	13/17 episodes	-30.568,90 €	-49,8	major therapeutic
3512 - Open heart valvuloplasty of mitral valve without replacement	75	9/12 episodes	-44.208,40 €	-61,3	major therapeutic
3721 - Right heart cardiac catheterization	74,7	733/981 episodes	-413.860,10 €	-19,9	minor diagnostic
3929 - Other (peripheral) vascular shunt or bypass	74,6	88/118 episodes	-200.648,70 €	-42,6	major therapeutic
3950 - Angioplasty of other non-coronary vessel(s)	72,8	107/147 episodes	-230.820,30 €	-45,6	major therapeutic
3818 - Endarterectomy, lower limb arteries	70,6	12/17 episodes	-25.193,30 €	-40,9	major therapeutic
3812 - Endarterectomy, other vessels of head and neck	70	7/10 episodes	-15.627,20 €	-55,3	major therapeutic
3959 - Other repair of vessel	70	21/30 episodes	-66.201,10 €	-51,9	major therapeutic
8412 - Amputation through foot	70	7/10 episodes	-10.999,30 €	-41,7	major therapeutic
3931 - Suture of artery	66,7	8/12 episodes	-45.559,30 €	-59,8	major therapeutic
3927 - Arteriovenostomy for renal dialysis	64,7	11/17 episodes	-7.781,60 €	-26,4	major therapeutic
3726 - Catheter based invasive electrophysiologic testing	63	75/119 episodes	-69.230,10 €	-29,8	minor diagnostic
3979 - Other endovascular procedures on other vessels	62,8	27/43 episodes	-210.837,90 €	-51,3	major therapeutic
3809 - Incision of vessel, lower limb veins	62	31/50 episodes	-37.535,40 €	-25,9	major therapeutic
3885 - Other surgical occlusion of vessels, thoracic vessels	60,5	26/43 episodes	-48.514,20 €	-22,5	major therapeutic
3732 - Excision of aneurysm of heart	54,5	6/11 episodes	-19.967 €	-55,1	major therapeutic
8853 - Angiocardiology of left heart structures	50	16/32 episodes	-9.395,90 €	-20,3	minor diagnostic
3584 - Total correction of transposition of great vessels, not elsewhere classified	48,1	13/27 episodes	10.893,30 €	12	major therapeutic
3606 - Insertion of non-drug-eluting coronary artery stent(s)	47,1	795/1689 episodes	-1.132.640,90 €	-30,1	minor therapeutic
3572 - Other and unspecified repair of ventricular septal defect	44,2	23/52 episodes	-84.635,80 €	-34,3	major therapeutic
3991 - Freeing of vessel	44	11/25 episodes	-148.492 €	-54,6	major therapeutic
3949 - Other revision of vascular procedure	42,9	3/7 episodes	-2.163,40 €	-9,5	major therapeutic
3609 - Other removal of coronary artery obstruction	35,8	487/1362 episodes	-612.893,50 €	-20,8	major therapeutic
3886 - Other surgical occlusion of vessels, abdominal arteries	35,7	5/14 episodes	-8.823,50 €	-17,9	major therapeutic

3961 - Extracorporeal circulation auxiliary to open heart surgery	34,8	16/46 episodes	-75.044,90 €	-25,7	minor therapeutic
5411 - Exploratory laparotomy	25,9	7/27 episodes	-24.739 €	-10,1	major therapeutic
3563 - Repair of endocardial cushion defect with tissue graft	25	2/8 episodes	7.983,30 €	76,3	major therapeutic
8314 - Fasciotomy	18,2	4/22 episodes	-4.350,90 €	-8	major therapeutic
5421 - Laparoscopy	16,7	1/6 episodes	-1.058,60 €	-12,7	major diagnostic
5494 - Creation of peritoneovascular shunt	16,7	1/6 episodes	2.986 €	16,5	major therapeutic
3610 - Aortocoronary bypass for heart revascularization, not otherwise specified	15,7	95/604 episodes	-238.333,50 €	-23,1	major therapeutic
3810 - Endarterectomy, unspecified site	14,3	1/7 episodes	-861,20 €	-5,9	major therapeutic
3770 - Initial insertion of lead [electrode], not otherwise specified	13,8	109/792 episodes	-139.445,10 €	-12,4	minor therapeutic
3541 - Enlargement of existing atrial septal defect	12,5	1/8 episodes	-588,60 €	-2,1	minor therapeutic
5569 - Other kidney transplantation	12,5	1/8 episodes	523,90 €	4,9	major therapeutic
3129 - Other permanent tracheostomy	12	3/25 episodes	-6.441 €	-11,8	major therapeutic
3583 - Total repair of truncus arteriosus	11,1	1/9 episodes	-865,80 €	-3,7	major therapeutic
0124 - Other craniotomy	10	1/10 episodes	-394,80 €	-2,4	major therapeutic
3783 - Initial insertion of dual-chamber device	10,8	14/130 episodes	-17.147,20 €	-9,1	minor therapeutic
3727 - Cardiac mapping	9,1	2/22 episodes	-1.186,80 €	-2,5	minor diagnostic
8607 - Insertion of totally implantable vascular access device [VAD]	5,9	1/17 episodes	-1.440,20 €	-4,6	minor therapeutic
3323 - Other bronchoscopy	5,3	1/19 episodes	9.032,80 €	25,2	minor diagnostic
3602 - not found	3,3	1/30 episodes	-712,90 €	-1,1	major therapeutic
3601 - not found	2,8	17/615 episodes	-1.293,60 €	-0,1	major therapeutic
8622 - Excisional debridement of wound, infection, or burn	2,2	4/184 episodes	-979,80 €	-0,4	major therapeutic
3409 - Other incision of pleura	2,1	1/47 episodes	-897,60 €	-1	minor therapeutic
3404 - Insertion of intercostal catheter for drainage	1,3	3/236 episodes	-19.593,20 €	-3,8	minor therapeutic
0159 - Other excision or destruction of lesion or tissue of brain	0	0/6 episodes	0 €	0	major therapeutic
3424 - Other pleural biopsy	0	0/22 episodes	0 €	0	minor diagnostic
3491 - Thoracentesis	0	0/86 episodes	0 €	0	minor therapeutic

3528 - Open and other replacement of tricuspid valve	0	0/6 episodes	0 €	0	major therapeutic
3535 - Operations on trabeculae carnae cordis	0	0/10 episodes	0 €	0	major therapeutic
3605 - not found	0	0/11 episodes	0 €	0	major therapeutic
3778 - Insertion of temporary transvenous pacemaker system	0	0/20 episodes	0 €	0	minor therapeutic
3881 - Other surgical occlusion of vessels, intracranial vessels	0	0/18 episodes	0 €	0	major therapeutic
3893 - Venous catheterization, not elsewhere classified	0	0/7 episodes	0 €	0	minor therapeutic
3895 - Venous catheterization for renal dialysis	0	0/15 episodes	0 €	0	minor therapeutic
3990 - Insertion of non-drug-eluting peripheral (non-coronary) vessel stent(s)	0	0/49 episodes	0 €	0	minor therapeutic
3995 - Hemodialysis	0	0/15 episodes	0 €	0	minor therapeutic
4413 - Other gastroscopy	0	0/12 episodes	0 €	0	minor diagnostic
4513 - Other endoscopy of small intestine	0	0/22 episodes	0 €	0	minor diagnostic
4523 - Colonoscopy	0	0/8 episodes	0 €	0	minor diagnostic
5491 - Percutaneous abdominal drainage	0	0/15 episodes	0 €	0	minor therapeutic
5498 - Peritoneal dialysis	0	0/6 episodes	0 €	0	minor therapeutic
5523 - Closed [percutaneous] [needle] biopsy of kidney	0	0/11 episodes	0 €	0	minor diagnostic
8416 - Disarticulation of knee	0	0/10 episodes	0 €	0	major therapeutic
8604 - Other incision with drainage of skin and subcutaneous tissue	0	0/6 episodes	0 €	0	minor therapeutic
8628 - Nonexcisional debridement of wound, infection or burn	0	0/34 episodes	0 €	0	minor therapeutic
8741 - Computerized axial tomography of thorax	0	0/12 episodes	0 €	0	minor diagnostic
8840 - Arteriography using contrast material, unspecified site	0	0/21 episodes	0 €	0	minor diagnostic
8841 - Arteriography of cerebral arteries	0	0/9 episodes	0 €	0	minor diagnostic
8842 - Aortography	0	0/35 episodes	0 €	0	minor diagnostic
8847 - Arteriography of other intra-abdominal arteries	0	0/11 episodes	0 €	0	minor diagnostic
8848 - Arteriography of femoral and other lower extremity arteries	0	0/74 episodes	0 €	0	minor diagnostic
8849 - Arteriography of other specified sites	0	0/19 episodes	0 €	0	minor diagnostic
8850 - Angiocardiography, not otherwise specified	0	0/18 episodes	0 €	0	minor diagnostic
8872 - Diagnostic ultrasound of heart	0	0/24 episodes	0 €	0	minor diagnostic

9205 - Cardiovascular and hematopoietic scan and radioisotope function study	0	0/11 episodes	0 €	0	minor diagnostic
9357 - Application of other wound dressing	0	0/12 episodes	0 €	0	minor therapeutic
9604 - Insertion of endotracheal tube	0	0/23 episodes	0 €	0	minor therapeutic
9904 - Transfusion of packed cells	0	0/7 episodes	0 €	0	minor therapeutic
9921 - Injection of antibiotic	0	0/11 episodes	0 €	0	minor therapeutic
9922 - Injection of other anti-infective	0	0/32 episodes	0 €	0	minor therapeutic
9962 - Other electric countershock of heart	0	0/47 episodes	0 €	0	minor therapeutic

Discussion and Conclusions

7. Discussion and Conclusions

In this thesis, we focused on the importance of the quality of clinical data held in administrative datasets for implementing and optimizing DRG-based classification systems, with emphasis on accurate and complete coding of secondary diagnoses representing comorbidities and inpatient procedures. Among other factors, such as the capacity of generating clinical and costing data and linking them using an adequate information technology system [Mathauer and Wittenbecher, 2013], DRGs heavily rely on the expertise of clinical coders, who extract information on diseases and procedures from largely unstructured notes and medical records and translate them using a set of complex rules and official guidelines which are subject to the different interpretations, besides an extensive list of diagnosis and procedure codes [Spencer, 2016].

The assignment of episodes to the DRGs is a complex method of summarizing the numerous permutations of diagnoses and procedures into a manageable number of clinically and economically homogenous groups. The individual role of the several diagnoses, comorbidities, complications and procedures on DRG grouping is not straightforward and is domain-specific. Since its creation, the DRG structure has been modified multiple times, becoming a more complex and often confusing process [Aiello et al., 2017]. Clinicians, providers and other hospital professionals working with inpatient documentation and coding should, however, become comfortable and facile with the system. Therefore, a way to improve data quality for implementing an effective DRG system is by acknowledging how and which codes are the drivers in the different DRG disease domains, as well as how common issues such as using less-specific codes, under-

coding of comorbidities or procedures would affect DRG classification and hospital funding.

In this thesis, we considered that understanding and characterizing the effects of secondary diagnoses representing comorbidities and the variety of hospital procedures would be a key process for assessing coded clinical data quality in administrative databases in the context of DRG classification. Furthermore, we employed a machine learning-based approach using SVM models to provide a methodology to explore the APR-DRG remuneration technical structure and coded clinical data in order to acknowledge and characterize how this system responds to the different Charlson and Elixhauser comorbidities and types of hospital procedures. Our main goal was to provide more detailed insights on the role of each one of these codes within the APR-DRG grouping logic and hospital payments by using a generic and reproducible methodology that can also be used to investigate different DRG systems and to be used in data from hospitals that have not implemented DRGs, such as the case of Brazil, specified on the study described in chapter 6.

Clinical coding guidelines generally state that additional conditions to be coded as secondary diagnoses should be those affecting patient care, especially the ones requiring the use of diagnostic procedures, clinical evaluation, therapeutic treatment, longer hospital stay and increased nursing care or monitoring, resulting in a higher use of hospital resources [Centers for Disease Control and Prevention, 2011]. Those definitions allow medical coders the capacity to include diseases that could influence episodes to be grouped into more complex and resource-demanding DRGs. In Portuguese hospitals within the National Health Service (NHS), each inpatient episode should be coded by a trained coder based upon a discharge summary, combined with other information from

daily medical reports, emergency room records and surgical and pathological anatomy reports [Administração Central do Sistema de Saúde, 2014]. Medical coding of diagnoses in Portugal is based on the official guidelines provided by The CMS and the National Center for Health Statistics (NCHS), two departments within the U.S. Federal Government's Department of Health and Human Services (DHHS) [Centers for Disease Control and Prevention, 2011]. Those guidelines do not contain specific rules for coding comorbidities, apart from a set of rules on coding additional diagnoses, including preexisting conditions, which can thereby influence coding of comorbidities [Centers for Disease Control and Prevention, 2011].

[Freitas et al., 2016] found that the number of comorbidities reported by inpatient episode has increased in the period 2000-2010 in Portuguese administrative datasets, with the average number of Elixhauser and Charlson comorbidities by episode increasing, respectively, by 81% and 48%. Nevertheless, this increasing trend was found to be not equal for all comorbidities. The proportion of episodes with Charlson's AIDS/HIV and peptic ulcer disease, as well as Elixhauser's drug abuse, blood loss anemia, peptic ulcer disease excluding bleeding and complicated diabetes has in fact decreased over the studied period. On the other hand, the proportion of episodes with Charlson's myocardial infarction, dementia and renal disease, as well as Elixhauser's complicated and uncomplicated hypertension, uncomplicated diabetes, hypothyroidism, renal failure, coagulopathy, obesity and depression have increased above 100%. Those discrepancies in reporting certain comorbidities, which was also described elsewhere in the literature, should be of utmost concern due to their impact on morbidity and resource use. Thus, investigating and acknowledging how each comorbidity affects the different base APR-DRGs and knowing whether and which comorbidities are key within the grouping logic

across the different diseases is a relevant matter to improve the quality of coded clinical data and raise awareness on the importance of a comprehensive report of these conditions.

In line with the general grouping logic of the APR-DRG and previous studies [Dewilde et al., 2018], higher SOI levels were clearly the most affected by Charlson and Elixhauser comorbidities. Our results strengthened these previous findings on the role and importance of comorbidities regarding SOI determination by adding information that included all respiratory and cardiovascular diseases and conditions represented in the APR-DRG structure. Also, our findings were in accordance with the basic clinical principle of the APR-DRG classification as our scenario showed that the influence of comorbidities for determining SOI was disease-specific and their significance depends upon the underlying problem, which is generally characterized by the base APR-DRG. The consistency of our results on comorbidities strengthens the methodology based on SVM models.

By estimating the financial consequences of underreporting comorbidities in the study described in chapter 5, we confirmed that most of the assessed comorbidities would lead to a substantial impact on hospital payments due to their influence on SOI determination. Hospitals that admit proportionally more patients with higher SOI would be underfunded when clinical data fail to provide a more precise SOI calculation, with comorbid conditions playing a crucial role in this task. Apart from affecting the performance of the grouper software and thus hospital funding, incomplete coding of comorbidities can make unfeasible the reutilization of clinical data for health care quality measurement, which often relies on coded clinical data for the calculation of quality indicators (e.g. risk-adjusted in-hospital mortality), for biomedical research and for other

tasks related to health care management, as the use of APR-DRGs in conjunction with SOI can also be applied for evaluating resource use and establishing patient care guidelines [Averill et al., 2013].

We then reinforce that a comprehensive reporting of secondary diagnoses representing comorbidities is imperative for APR-DRG grouping as our findings, in line with previous research, showed that such group of diagnoses, if not properly coded, may undermine the correct identification of most resource-consuming patients and thus underestimate hospital funding. Efforts should be made to conduct better documentation of comorbidities, which in turn should lead to more accurate grouping into higher SOI levels in the APR-DRG system. Finally, collecting information on preexisting or newly acquired comorbidities should always be encouraged in hospitals and the inclusion of more specific rules in guidelines focusing on coding of comorbidities is then highly recommended to achieve a more comprehensive report of such conditions and thus improve the quality of clinical data.

Concerning inpatient procedures, coding guidelines elsewhere usually state that all significant diagnostic and therapeutic procedures should be coded, which includes those that are surgical in nature, carry a procedural or anesthetic risk and demand special facilities, equipment or training [Reid et al., 1999]. In general, coders tend to not code routine procedures, which are performed in most stays and occur several times during a hospitalization (e.g. ultrasound, electrocardiography, computed tomography, catheterization, magnetic resonance, etc.) [Reid et al., 1999]. In fact, when hospital reimbursement is via DRGs, coding of inpatient procedures is usually required when the presence of the procedure (usually surgical) affects DRG assignment, even though there are occasions in which procedures are coded for another reasons, such as specific hospital

policies, medical coder training and to justify costs [Dismuke, 2004]. That occur because the typical DRG classification starts with the patient's stay being assigned to 1 of 25 MDCs according to the principal diagnosis, followed by a second classification phase, based either on diagnoses or procedures that are normally performed in the operating room, in addition to other patient characteristics such as age, gender and discharge status. Consequently, if coders report mostly for reimbursement purposes, most procedures performed in settings other than the operating room may not be coded and thus will not be found in inpatient databases. There is an estimated of more than 1500 non-operating room procedures within ICD-9-CM list, of which only about 116 determine DRG classification, which corresponds to about a third of all listed procedures that are subject to underreporting, since they are not required to reimbursement via DRGs [Dismuke et al., 2005]. This issue is of concern not only for health services researchers and policy-makers that aim to use administrative data to examine variations in procedure utilization, outcomes and treatment costs, but also for grouping into SOI and ROM levels, as well as other risk-adjustment methodologies [Dismuke et al., 2005].

In chapter 4, we described a significant variability between hospitals with burn units in Portugal with regard to coding of non-operating room procedures, namely insertion of endotracheal tube, excisional debridement, venous catheterization, continuous invasive mechanical ventilation, packed cell transfusion, serum transfusion and fiber-optic bronchoscopy. Although the role of this type of procedures within APR-DRG technical structure may not be determinant in most cases, findings elsewhere have reported that non-operating room procedures serve as markers of costlier and complicated hospitalizations [Hughes et al., 1989] and thus, especially when combined with certain principal diagnoses and certain APR-DRGs, can be linked with higher SOI

levels and thus higher reimbursement. In chapter 6, after evaluating Portuguese inpatient data, we reported that non-operating room procedures such as continuous invasive mechanical ventilation and certain diagnostic procedures on esophagus impacted the assignment to respiratory APR-DRGs in a substantial proportion of episodes they occurred, whereas insertion, removal, replacement and revision of pacemaker, as well as intracardiac echocardiography drove the classification into circulatory system APR-DRGs in a considerable proportion of cases. For Brazilian data, however, we found that non-operating room procedures were, in general, much smaller and limited, with coronary arteriography and extracorporeal circulation auxiliary to open heart surgery driving a high proportion of circulatory system APR-DRGs being the most noticeable cases. Moreover, and in general, non-operating room procedures influenced SOI determination in some cases, though in a quite small proportion.

Apart from significant inter-hospital dissimilarities concerning coding of non-operating room procedures, we found in the study from chapter 4 that facilities also differed significantly in reporting some crucial diagnosis codes for grouping burns hospitalizations into their correct APR-DRG, such as the case of extensive third-degree burns, as well as some comorbidities, such as hypertension, depressive disorder and obesity. The comprehensiveness' of coding should thus be monitored across the different hospitals and a feasible way to perform such task would be based on the methodology described in chapter 4, with separate code counts for each APR-DRG combined with the SOI level. In our study, we assumed that the evaluated hospitals were comparable because they were the five facilities in Portugal to present a burn unit and thus should not differ greatly in the context of burns hospitalizations, which is a small diagnosis area, with less variety of conditions and procedures if compared to other areas. In this sense, to properly

monitor variability in coding between hospitals and include several other relevant diagnosis areas, we support the use of case-mix or complexity adjusted code counts for each APR-DRG, in order to address differences in hospital that could naturally account for discrepancies in the frequencies of diagnoses and procedures.

When assessing the effects of different AHRQ procedure categories on APR-DRG grouping, which is described in chapter 6, we found that in both Brazilian and Portuguese data, and as expected, major procedures affected more APR-DRG grouping when compared to the minor categories in respiratory and cardiovascular diseases. Although major categories were the most crucial in determining APR-DRGs, it is important to point that minor therapeutic procedures did considerably influence grouping in cardiovascular diseases in both countries' datasets, accounting for a substantial amount of hospital reimbursement. In the Brazilian database, coding patterns of procedures were considerably different when compared to the Portuguese data, with a much lower incidence and variety of inpatient procedures, especially those considered non-operating room procedures. However, the effects in terms of APR-DRG changes in circulatory system diseases were similar between the two countries because the minor categories continued affecting a much higher proportion of episodes when compared to respiratory APR-DRGs. Despite the smaller influence in MDC 4 regarding APR-DRG changes, the financial impact of underreporting minor therapeutic procedures, in particular, was considerably elevated when assessing data from Portugal. Our findings also reflected that the influence of the different types of procedures in APR-DRG grouping is domain-specific, though underreporting minor categories, which comprise non-operating room procedures, may have a very high financial impact on hospital funding, especially in the context of circulatory system diseases.

Overall, regarding the studies presented in chapters 5 and 6, the results obtained with this machine-learning approach to assess the impact of comorbidities and procedures were consistent and in line with the APR-DRG grouping logic, reinforcing then its validity to study DRG classification. Thus, we also presented in this thesis a generic and reproducible methodology that can be applied to study different DRG versions and also to evaluate data from countries that have not used DRGs, such as the case of Brazil, providing ways to acknowledge how the DRG system responds to their data and which information would be crucial to implement an effective DRG-based system in different contexts and settings. Therefore, the advantages of employing a methodology based on machine learning rather than directly using the grouper software, besides the possibility of being used in different data sources from different DRG versions, include the feasibility to simulate different coding behaviors and assess the response of the DRG system to these behaviors, as well as the possibility to investigate the impact of specific diagnosis or procedures in domains of interest. Finally, to the best of our knowledge, our findings add evidence on the applicability of a machine learning-based approach for DRG prediction to the results obtained by [Gartner et al., 2015], in which machine learning techniques were employed to group inpatient episodes into DRGs based on early admission rather than discharge data in order to create resource allocation models.

As a limitation, we mention that this thesis was based upon results from studies that rely and are limited to the reality abstracted from the coded clinical data extracted from Portugal's National DRG Database. For instance, certain procedures or comorbidities might have had little to no significant impact on APR-DRG classification because they might simply be under-reported in some hospitals and thus the SVM models, which were artificially constructed through patterns learned from the data, will minimize their

importance in terms of classification. Another important limitation includes the utilization of classification results obtained with SVM models applied on the original data as baseline to compare changes in APR-DRGs and hospital reimbursement and to characterize the roles of the different medical codes. Therefore, existing errors associated with the original SVM models might have influenced or been replicated in our results. Another limitation includes the use of ICD-9-CM data to perform all analyses, as this classification system ceased to be updated in 2015. The transition to ICD-10-CM in Portugal was enacted in 2017 and it is still an ongoing process and much of the available ICD-10-CM inpatient data was still incomplete, being thus not viable to perform this study. Furthermore, we should take into account the inherent bias of using GEM files to map between ICD-9 and ICD-10 codes for Brazilian data, as this method, in many cases, only finds approximate matches to a given code.

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