Lifting the weight of a diagnosis-related groups family change: a comparison between refined and non-refined DRG systems for top-down cost accounting and efficiency indicators

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Abstract

Public healthcare providers in all Spanish Regions – Autonomous Communities (ACs) use All Patients Diagnosis-Related Groups (AP-DRGs) for billing non-insured patients, cost accounting and inpatient efficiency indicators. A national migration to All Patients Refined Diagnosis-Related Groups (APR-DRGs) has been scheduled for 2016. The analysis was performed on 202,912 inpatient care episodes ranging from 2005 to 2010. All episodes were grouped using AP-DRG v25.0 and APR-DRG v24.0. Normalised DRG weight variations for an AP-DRG to APR-DRG migration scenario were calculated and compared. Major differences exist between normalised weights for inpatient episodes depending on the DRGs family used. The usage of the APR-DRG system in Spain without any adjustments, as it was developed in the United States, should be approached with care. In order to avoid reverse incentives and provider financial risks, coding practices should be reviewed and structural differences between DRG families taken into account.

Keywords (MeSH): *Diagnosis-Related Groups, Hospital Costs, Inpatients, International Classification of Diseases, Prospective Payment System*

Introduction

The right to healthcare was defined in the Spanish constitution of the year 1978 and a central authority, the *Instituto Nacional de la Salud* (INSALUD), was created to manage all public healthcare institutions. The General Healthcare Act of 1986 defined the roadmap for the transfer of healthcare responsibilities to the Spanish Autonomous Communities (ACs). This process was completed in 2001. From then on the function of the Ministry of Healthcare and Social Services (MoHSS) was reduced to healthcare policy coordinative functions, reporting and inter-regional retribution (Lopez Casasnovas, Costa Font & Planas 2005; Ley 16/2003 de 28 de mayo, de cohesión y calidad del Sistema Nacional de Salud).

Currently, the Spanish Healthcare System is publicly funded and grants universal access to all patients and free-of-charge services for patients with a social security insurance. Most healthcare providers are publicly owned. As in most developed countries, healthcare costs have remained a significant concern. Each Autonomous Community has established its own way of financing public and private healthcare providers. In the case of specialised care, several funding approaches exist: capitation, fee for service (FFS) and prospective payment systems (PPS). The latter are mainly based on pre-established fees multiplied by diagnosis-related group (DRG) weights. Currently, public healthcare providers in all ACs use All Patients Diagnosis-related Groups (AP-DRG) for billing non-insured patients, cost accounting and inpatient efficiency performance indicators. In all ACs, intra-hospital departmental budget incentives are usually based on indicators dependent on AP-DRGs. Due to the current economic situation in Spain, public hospital financing for inpatient care in all ACs is likely to be linked to DRGs in the near future.

US DRG weights are used without adjustments for all of the aforementioned purposes, although even earlier studies suggested that this would cause large deviations in several DRGs (Rivera Cuadrado 1999). In order to address this issue, national AP-DRG weights are calculated from a sample of Spanish hospitals every two years. However, the transfer of healthcare responsibilities to the ACs has resulted in differences between cost accounting practices (Gogorcena Aoiz et al. 2013) and minimum dataset databases (MDS), which contain the administrative information necessary for DRG assignment. This causes national Spanish AP-DRG weights to be calculated with a 1-2 year delay. Individual ACs could calculate their own DRG weights, although an ample inpatient database (with sufficient cases in each DRG) with precise costs per episode is needed for this purpose. Although some of the larger ACs (Community of Madrid, Andalusia and Catalonia) might have such a database, to the best of the authors' knowledge, the original US weights are used in all ACs.

AP-DRGs have a long history of use in Spanish healthcare, but they are at their end-of-life phase and a substitute is needed. International Refined DRGs (IR-DRGs) have been considered, but finally, a migration to APR-DRGs has been proposed by the MoHSS in 2016. The criterion for the choice of one grouper over the other was not publicly stated. Some reasons might be the similarity between APR-DRGs and AP-DRGs (both rely on the principal diagnosis as the main classification criterion) and the usage of APR-DRGs in other European countries (Busse et al. 2011).

Although APR-DRGs have been shown to have higher correlation with hospitalisation costs (Averill et al. 1998; Marazzi, Gardiol & Duong 2007; Muldoon 1999) and allow healthcare quality analyses with risk of mortality sublevels unavailable in AP-DRGs, the migration scenario has not been carefully considered given procedural workflows, clinical reporting and coding, as well as provider incentives in Spanish healthcare.

This migration from non-refined to refined DRGs is likely to affect financing of both private and public healthcare providers as well as inpatient efficiency indicators. If this transition is not carefully planned, providers might have incentives to reject certain groups of patients (which become unprofitable with this migration), over-provide certain procedures (if these result in a higher weight DRG) or under-report certain complications that do not result in a DRG weight increase. The reasons for this are numerous: (a) APR-DRGs have several fundamental differences in the grouper logic compared to AP-DRGs; (b) There is a larger number of groups in APR-DRGs (base DRG + severity sublevel) than in AP-DRG (base DRG only); and (c) The United States weights that are used in Spain for both DRG families are calculated upon different datasets.

The objective of this paper was to estimate the DRG normalised weight variations for individual DRGs in different DRG family migration scenarios, since these are likely to be used as patient cost estimators. If two DRG families produce similar normalised weights, then either of them can be used with analogous outcomes. However, if the results are appreciably different, it is important to answer why these differences exist; how large they are and how they can be addressed.

Methods

Since DRG weights from different families (AP and APR) cannot be directly compared, we used normalised weights, which are a valid approximation of the variation of the percentage of healthcare care costs if a top-down DRG-based costing approach is used.

The top-down costing approach and normalised DRG weights

Firstly, it is important to describe the top-down costing methodology used, as well as the concept of normalised DRG weights.

The traditional method for a top-down costing approach with DRGs is the following:

$$\frac{TCH}{\sum_j (DRG_j weight \cdot Cases_j)} = \text{Cost per DRG weight unit for a given hospital}$$

Where:

TCH = total hospital cost of inpatients

j = all DRGs for a given hospital

This calculation can also be performed at the department level:

$$\frac{TCD}{\sum_i (DRG_i weight \cdot Cases_i)} = \text{Cost per DRG weight unit for a given department}$$

Where:

TCI = total department cost of inpatients

i = all DRGs for a given department

Several DRG-weight normalisation approaches are possible.

The departmental cost contribution ratio (DEP_CCR) compared to the overall hospital cost enables scrutiny of significant changes by service type. It can be estimated as:

$$\text{DEP\_CCR} = \frac{\sum_i (DRG_i weight \cdot Cases_i)}{\sum_j (DRG_j weight \cdot Cases_j)}$$

The DRG cost contribution ratio (DRG_CCR) is useful as an estimator of cost contribution of a single DRG and can be used to identify cost/funding impact at the system level.

$$\text{DRG\_CCR for DRG}_k = \frac{(DRG_k weight \cdot Cases_k)}{\sum_j (DRG_j weight \cdot Cases_j)}$$

Inpatient cost contributed by the cohort of patients of DRG_k can then be calculated as:

DRG_CCR for DRG_k · *Total hospital costs of inpatients*

The variation in DEP_CCR and DRG_CCR can be used to assess the impact of the variation of cost contribution ascribed to each department and DRG:

$$\Delta\ \%\ DRG\_CCR = (DRG\_CCR_{DRGF\ B} - DRG\_CCR_{DRGF\ A}) / DRG\_CCR_{DRGF\ A}$$

$$\Delta\ \%\ DEP\_CCR = (DEP\_CCR_{DRGF\ B} - DEP\_CCR_{DRGF\ A}) / DRG\_CCR_{DRGF\ A}$$

Where:

DRGF A = DRG family A

DRGF B = DRG family B

Study setting

The Ramon y Cajal University Hospital (RyCUH) is 1100-bed specialised care referral centre that serves >500,000 people with approximately 33,500 yearly inpatient discharges. It provides services in all medical specialties excepting obstetrics. The analysis was performed on the inpatient minimum data set (MDS).

Grouping

All registers corresponding to the data for inpatient care period of six years of data (from 2005 to 2010) were obtained from the RyCUH Health Information System. The dataset had a maximum capacity of 13 diagnoses and 22 procedures for each hospitalisation episode. Then, all patient episodes were grouped using AP-DRG v25.0 and APR-DRG v24.0. Erroneous and duplicate registers were excluded. A total of 202,912 episodes with their respective DRGs were obtained. All information that could lead to the identification of specific patients was removed. DRG_CCR and DEP_CCR variations were calculated for a migration from AP-DRGs to APR-DRGs. When high DEP_CCR variations occurred, individual DRGs were examined in the context of the departmental case-mix in order to determine the likely cause of these changes.

Data availability

Under Spanish law and jurisprudence, anonymous aggregated data may be used for statistical or research purposes with the consent of the institution were the research is performed. As with other similar studies, the permission to use the data for this research was granted by the Deputy Managing Director of the Ramon y Cajal University Hospital. All authors have access to the data used in the article as part of their professional activity in the Ramon y Cajal University Hospital.

Results

With a DRG family migration, DRG CCR contributions are likely to change. Table 1 shows 15 AP-DRGs where the highest loss of DRG CCR was observed. Long-term mechanical ventilation is extremely expensive and requires a tracheotomy. AP-DRGs assign a very high weight to almost all episodes with tracheotomy procedures. APR-DRGs, on the other hand, are much more restrictive when assuming a patient has been on mechanical ventilation according to the All-Patient Refined Diagnosis Related Groups (APR–DRGs) Methodology Overview (3M Health Information Systems 2007). A tracheotomy APR-DRG requires an

Table 1: Top 15 DRG_CCR variations between APR and AP DRGs where $AP_{DRG\_CCR} > APR_{DRG\_CCR}$

AP-DRG	AP-DRG LABEL	AP-DRG TYPE	DRG_CCR AP * 1000	DRG_CCR APR * 1000	Δ DRG_CCR	TOTAL CASES
877	ECMO OR TRACH W MV 96+ HRS OR PDX EXC FACE, MOUTH & NECK W MAJ O.R.	S	52.488	23.839	-28.648	439
878	TRACH W MV 96+ HRS OR PDX EXC FACE, MOUTH & NECK W/O MAJ O.R.	S	13.328	6.522	-6.806	181
544	CHF & CARDIAC ARRHYTHMIA W MAJOR CC	M	23.533	16.868	-6.665	2,786
558	MAJOR MUSCULOSKELETAL PROCEDURES W MAJOR CC	S	15.179	10.182	-4.997	942
557	HEPATOBILIARY AND PANCREAS DISORDERS W MAJOR CC	M	17.924	13.431	-4.493	1,926
541	SIMPLE PNEUMONIA & OTH RESPIRATORY DISORD EXC BRONCHITIS, ASTHMA W MAJOR CC	M	41.787	37.441	-4.346	7,221
480	LIVER TRANSPLANT AND/OR INTESTINAL TRANSPLANT	S	16.425	12.404	-4.021	209
533	OTHER NERVOUS SYSTEM DISORD EXCEPT TIA, SEIZURE & HEADACHE W MAJOR CC	M	9.760	6.642	-3.118	892
576	ACUTE LEUKEMIA W MAJOR CC	M	5.587	3.293	-2.294	179
567	KIDNEY & URINARY TRACT PROCEDURES EXCEPT KIDNEY TRANSPLANT W MAJOR CC	S	7.148	4.883	-2.265	459
209	MAJ JOINT & LIMB REATTACH PROC OF LOW EXT, EXC HIP, EXC FOR COMP	S	16.513	14.331	-2.182	2,039
578	LYMPHOMA & NON-ACUTE LEUKEMIA W MAJOR CC	M	5.398	3.326	-2.072	340
818	HIP REPLACEMENT EXCEPT FOR COMPLICATIONS	S	15.394	13.442	-1.953	1,728
116	OTHER PERMANENT CARDIAC PACEMAKER IMPLANT	S	14.927	13.078	-1.849	1,683
549	MAJOR CARDIOVASCULAR PROCEDURES W MAJOR CC	S	8.952	7.200	-1.752	360

M = Medical DRG, S = Surgical DRG

explicit coding of 96+ hour mechanical ventilation and subdivides the DRG based on the presence of an organ removal procedure. Other tracheotomy patients are assigned to non-tracheotomy APR-DRG categories with low weights.

Some of the most common APR-DRGs assigned to AP-DRG 877 (ECMO or trach. w. m.v. 96+ hrs. or PDX exc. face, mouth & neck with maj. o.r.) for our dataset can be seen in Table 2. However, a total of 74 APR-DRG classes (APR-DRGs with severity subclass) have been found. Even tracheotomy APR-DRGs with high severity sublevels produced a decrease in DRG_CCR.

AP-DRGs 803 and 804 (Allogeneic and Autologous bone marrow transplants, respectively) have not been included in Table 1 since there are relatively few cases of these DRGs and the DRG_CCR variation produced for these is not large. However an important difference exists between AP and APR logic for these DRGs. Bone marrow transplants are always assigned a very high weight with AP-DRGs. In the APR case, all bone marrow transplants AP-DRGs are merged in one APR-DRG 003 (Bone marrow transplant) with severity sub-levels. With the dataset used in this study, it was found that more than 50% of cases in AP-DRG 803, 804 were assigned to APR-DRG 003 severity sublevel 1, with a consequent decrease in DRG_CCR.

Another important difference is the rerouting logic used in APR-DRGs, which introduces contextual clinical adjustments upon the principal diagnosis re-assigning the patient to a new DRG. It applies to episodes were the sequencing of principal and secondary diagnosis is unclear, or a surgical procedure clarifies the reason for the hospitalisation (3M Health Information Systems 2007). This is the case of AP-DRG 558 (Major musculoskeletal procedures w. major CC), which is assigned to much more descriptive APR-DRGs: 309 (Hip & femur procedures for trauma

Table 2: Most common APR DRGs assigned to AP-DRG 877 (AP-DRG weight = 48.409)

APR-DRG	APR-DRG LABEL	APR-DRG TYPE	APR-DRG SEVERITY LEVEL	APR-DRG WEIGHT	CASES	DRG_CCR AP * 1000	DRG_CCR APR * 1000	Δ DRG_CCR
004	ECMO OR TRACHEOSTOMY W LONG TERM MECHANICAL VENTILATION W EXTENSIVE PROCEDURE	S	SEV4	17.374	203	24.271	14.951	-9.320
004	ECMO OR TRACHEOSTOMY W LONG TERM MECHANICAL VENTILATION W EXTENSIVE PROCEDURE	S	SEV3	12.994	76	9.087	4.186	-4.900
004	ECMO OR TRACHEOSTOMY W LONG TERM MECHANICAL VENTILATION W EXTENSIVE PROCEDURE	S	SEV2	9.674	18	2.152	0.738	-1.414
005	TRACHEOSTOMY W LONG TERM MECHANICAL VENTILATION W/O EXTENSIVE PROCEDURE	S	SEV3	9.898	11	1.315	0.462	-0.854
005	TRACHEOSTOMY W LONG TERM MECHANICAL VENTILATION W/O EXTENSIVE PROCEDURE	S	SEV4	13.389	9	1.076	0.511	-0.565
004	ECMO OR TRACHEOSTOMY W LONG TERM MECHANICAL VENTILATION W EXTENSIVE PROCEDURE	S	SEV1	7.531	7	0.837	0.223	-0.613
163	CARDIAC VALVE PROCEDURES W/O CARDIAC CATHETERIZATION	S	SEV4	11.527	7	0.837	0.342	-0.495
162	CARDIAC VALVE PROCEDURES W CARDIAC CATHETERIZATION	S	SEV4	12.01	6	0.717	0.305	-0.412
221	MAJOR SMALL & LARGE BOWEL PROCEDURES	S	SEV4	6.97	6	0.717	0.177	-0.540
162	CARDIAC VALVE PROCEDURES W CARDIAC CATHETERIZATION	S	SEV3	7.308	5	0.598	0.155	-0.443
165	CORONARY BYPASS W CARDIAC CATH OR PERCUTANEOUS CARDIAC PROCEDURE	S	SEV4	9.85	4	0.478	0.167	-0.311
169	MAJOR THORACIC & ABDOMINAL VASCULAR PROCEDURES	S	SEV3	4.011	4	0.478	0.068	-0.410
021	CRANIOTOMY EXCEPT FOR TRAUMA	S	SEV3	5.017	3	0.359	0.064	-0.295
021	CRANIOTOMY EXCEPT FOR TRAUMA	S	SEV4	9.243	3	0.359	0.118	-0.241
950	EXTENSIVE PROCEDURE UNRELATED TO PRINCIPAL DIAGNOSIS	S	SEV3	3.989	3	0.359	0.051	-0.308

M = Medical DRG, S = Surgical DRG

except joint replacement), 301 (Hip joint replacement), 302 (Knee joint replacement) and 304 (Dorsal & lumbar fusion proc. except for curvature of back) among others with their respective severity subclasses. This refinement also causes a decrease in DRG_CCR, since the original AP-DRG is overly generic and is assigned an exceedingly high weight. Since the main objective of DRG usage is efficiency, this effect should be carefully considered, as reverse incentives might be created.

APR-DRGs include a reassessment of secondary diagnoses considered complications. In the case of AP-DRGs, roughly 530 diagnoses listed in the All Patients Diagnosis Related Groups Definitions Manual (3M Health Information Systems 2005) are considered complications or co morbidities for almost all cases. The presence of these diagnoses causes an increase in DRG weight by assigning a DRG 'with complications'. APR-DRGs, on the other hand, evaluate secondary diagnoses contextually depending on the principal diagnosis. This is likely to decrease normalised weights, as fewer diagnoses are likely to be considered as a reason to change to a DRG of a higher severity level.

The effect of this approach can be seen in Table 1 – medical DRGs with complications and comorbidities lose DRG_CCR with a transition from AP-DRGs to APR-DRGs and some AP-DRGs were the principal diagnosis is less important than some secondary diagnoses are re-assigned to APR-DRGs with a lower weight. Such is the case of most episodes assigned to AP-DRGs 'with major complications' in Table 1.

APR-DRGs provide a higher granularity with its four severity levels than AP-DRG. High-weight DRGs with complications are often assigned to similar APR-DRGs with a 2 o 3 severity sub-score, which frequently produces a decrease of DRG_CCR. In other cases, although the base APR-DRG is similar to the original AP-DRG, the APR logic assigns a level 2 or 3 severity subclass to a large enough number of patients to increase the DRG_CCR. This happens in AP-DRGs 167, 158, 105 and 410 (Table 3).

Other differences might be due to the fact that the databases upon which AP and APR US DRG weights are calculated are different, therefore yielding different weights for supposedly similar DRGs.

Table 3: Top 15 DRG_CCR variations between APR and AP DRGs where $AP_{DRG\_CCR} < APR_{DRG\_CCR}$

AP-DRG	AP-DRG LABEL	AP-DRG TYPE	DRG_CCR AP * 1000	DRG_CCR APR * 1000	Δ DRG_CCR	TOTAL CASES
162	INGUINAL & FEMORAL HERNIA PROCEDURES AGE >17 W/O CC	S	2.508	4.036	1.528	1,372
867	LOCAL EXCISION & REMOVAL OF INT FIX DEVICES EXCEPT HIP & FEMUR W/O CC	S	4.329	5.946	1.616	1,519
219	LOWER EXTREM & HUMER PROC EXC HIP,FOOT,FEMUR AGE >17 W/O CC	S	5.405	7.061	1.656	1,608
167	APPENDECTOMY W/O COMPLICATED PRINCIPAL DIAG W/O CC	S	3.892	5.607	1.715	1,728
158	ANAL & STOMAL PROCEDURES W/O CC	S	2.629	4.348	1.719	1,615
105	CARDIAC VALVE & OTHER MAJOR CARDIOTHORACIC PROC W/O CARDIAC CATH	S	9.365	11.911	2.546	636
808	PERCUTANEOUS CARDIOVASCULAR PROC W AMI,HEART FAILURE OR SHOCK	S	5.317	8.063	2.746	797
112	PERCUTANEOUS CARDIOVASCULAR PROC W/O AMI,HEART FAILURE OR SHOCK	S	3.200	5.981	2.780	735
410	CHEMOTHERAPY	M	5.805	8.754	2.948	2,060
494	LAPAROSCOPIC CHOLECYSTECTOMY W/O C.D.E. W/O CC	S	4.077	7.151	3.074	1,716
055	MISCELLANEOUS EAR, NOSE, MOUTH & THROAT PROCEDURES	S	4.239	7.598	3.360	2,270
756	SPINAL FUSION W/O CC	S	3.669	7.101	3.432	586
119	VEIN LIGATION & STRIPPING	S	3.623	7.809	4.186	1,648
125	CIRCULATORY DISORD EXCEPT AMI, W CARD CATH W/O COMPLEX DIAG	M	5.050	10.886	5.836	2,318

M = Medical DRG, S = Surgical DRG

Table 4: DEP_CCR variations between APR and AP DRGs

DEPARTMENT	DEP_CCR AP * 1000	DEP_CCR APR * 1000	Δ DEP_ CCR * 1000	TOTAL CASES
Neurology	36.970	30.132	-6.838	7,917
Internal Medicine	81.455	75.886	-5.568	15,668
Neumology	49.771	45.072	-4.699	12,227
Hematology	28.653	23.971	-4.681	2,395
Neurosurgery	34.098	30.293	-3.805	4,574
Adult Cardiac Surgery	51.894	49.456	-2.438	3,087
Digestive Diseases	42.531	40.325	-2.206	8,965
Anesthesia and Resuscitation	34.875	32.908	-1.967	1,767
Nephrology	35.149	33.832	-1.317	6,118
Intensive Medicine ICU	11.684	10.486	-1.198	654
Psychiatry	6.711	5.666	-1.045	2,189
Thoracic Surgery	13.827	12.789	-1.038	2,262
Microbiology	22.472	21.506	-0.966	3,898
Medical Oncology	32.092	31.273	-0.819	6,223
Traumatology	112.664	111.970	-0.694	20,957
Rheumatology	5.570	5.297	-0.273	1,491
Maxillofacial Surgery	12.789	12.547	-0.242	3,245
Endocrinology	6.131	6.090	-0.042	2,164
Nuclear medicine	0.857	0.907	0.050	431
Pain Unit	0.877	1.050	0.173	192
Allergology	2.536	2.717	0.181	1,036
Radiation Oncology	14.702	14.914	0.212	3,575
Dermatology	3.097	3.437	0.340	1,006
Paediatric Cardiac Surgery	9.009	9.731	0.722	669
Paediatrics	17.466	19.036	1.570	6,934
Gynaecology	16.057	17.667	1.610	5,610
Paediatric Cardiology	7.533	9.597	2.063	1,540
Urology	45.091	47.169	2.078	14,626
Vascular Surgery	33.776	36.064	2.288	5,795
Plastic Surgery	10.658	13.684	3.026	3,471
Ophthalmology	12.863	16.906	4.043	5,397
Otolaryngology	20.123	25.117	4.993	8,010
Cardiology	73.052	79.625	6.573	14,823
General Surgery	112.966	122.879	9.914	23,996

M = Medical DRG, S = Surgical DRG

Once some of the most significant differences between DRG_CCR on this case-mix have been explained, DEP_CCR differences (Table 4) can be better understood.

Most departments with tracheotomy AP-DRGs exhibit an important loss of DEP_CCR. Such is the case of Neurology, Neurosurgery, Anesthesia and Resuscitation and Intensive Medicine ICU. The cause of DEP_CCR loss in most departments can be deduced from Table 1. There are numerous occurrences of AP-DRGs 544 (CHF & cardiac arrhythmia w. major CC), AP-DRG 541 (Simple pneumonia & oth. respiratory disord. exc. bronchitis, asthma w. major CC) in Neumology, AP-DRG 557 (Hepatobiliary and pancreas disorders w. major CC) in Digestive Diseases, AP-DRG 578 (Lymphoma & non-acute leukemia w. major CC) are observed in Internal Medicine, Hematology and Medical Oncology, AP-DRGs 803 and 804 are also present in Haematology. Various episodes in these AP-DRGs are not longer considered 'with major complications' (i.e. are assigned to low severity sublevels) in the transition to APR-DRGs.

Generally speaking, most medical departments experience a loss of DEP_CCR. The opposite is true for most surgical departments, which are, obviously, more procedure-intensive than medical departments. APR-DRGs extract more information from procedures than AP-DRGs and tend to assign higher severity subclasses to APR-DRGs with complex procedures as stated in the All-Patient Refined Diagnosis Related Groups (APR–DRGs) Methodology Overview (3M Health Information Systems 2007). Also the rerouting logic assigns DRGs based on information obtained from procedures if the principal diagnosis is overly broad or unclear.

All paediatric care departments (Paediatric Cardiology, Paediatric Cardiology and Paediatrics) show a gain of DEP_CCR due to age-based adjustments within the APR-DRGs grouper logic. In APR-DRGs several secondary diagnoses, such as hypertension, are considered major complications throughout all childhood years.

The Psychiatry department exhibits a loss of DEP_CCR. Its main AP-DRG is the 430 (Psychoses), which is transformed mainly into APR-DRGs 750 (Schizophrenia), 753 (Bipolar disorders), 751 (Major depressive disorders & other/unspecified psychoses) and 760 (Other mental health disorders) with severity 1 subclass.

Discussion

Model of care

Certain procedures are almost always ambulatory in the United States. This has lead to the consolidation (merging) of certain APR-DRGs in version 24 due to their low incidence. A good example is the carpal tunnel release DRG, which had its own DRG in previous versions, but has been merged into the 'Other nervous system & related procedures' DRG in version 24. This, however, seems to have lead to an increase in the weight of actual carpal tunnel release episodes, which are now in a more general higher weight DRG. Other examples of such an approach are AP-DRGs 119 (Vein ligation & stripping), 867 (Local excision & removal of int. fix. devices except hip & femur w/o CC), 219 (Lower extrem & humer proc. exc. hip, foot, femur age >17 w/o CC) and 125 (Circulatory disord. except AMI, w. card. cath. w/o complex diag.) as presented on Table 3. Most potentially ambulatory (PA) procedures that are performed with a hospitalisation in the United States have some underlying complications that require inpatient care. Hence, the corresponding APR-DRGs are likely to have a high DRG weight. In other countries, where hospitalisation rates are higher, an inpatient approach might be used for these PA procedures without the underlying complications. If US APR-DGR weights are used, these inefficiencies might actually be rewarded by a higher DRG_CCR.

Alignment of incentives

Surgical departments in Spanish public hospitals already have several payments for performance incentives in most ACs, which medical departments lack. One example is the *Tiempos Quirúrgicos Estándar* (TQEs) (Surgical Times Standards) (Corella Monzón et al. 2009; Zlotnik et al. 2010) used in the Madrid region. If budgetary decisions are made based on APR-DRG weights, the gap between surgical and medical departments' financing might increase furthermore due to the underlying nature of the APR-DRG grouper.

There are certain exceptions such as the situation that occurs in Cardiology with an increase in DEP_CCR and Adult Cardiac Surgery, with a decrease (Table 4). A deeper analysis shows that some of the gains in DEP_CCR in the Cardiology case-mix are actually due to potentially ambulatory episodes (such as AP-DRG 125), which are assigned to high-weight APR-DRGs due to the phenomenon described in Table 2. Also, the 'Chest pain' AP-DRG is now assigned to high-weight APR-DRGs due to the APR-DRG rerouting logic, which assigns cases to much more specific high-weight DRGs. Adult cardiac surgery, on the other hand, loses DEP_CCR with the 'Cardiac valve procedure with major CC', which is now assigned mostly to a similar APR-DRG but to low severity subclasses in most cases. There are also several cases of tracheotomy DRGs in its case-mix, which also causes a loss of DEP_CCR with the transition.

Limitations and Fit for Purpose

Most healthcare providers in the United States are private and have great incentives, organisational flexibility and resources to optimise coding for the highest possible reimbursement. The usage of APR-DRGs in a mostly public healthcare system such as the Spanish might result in less financing for many providers, unable to achieve a sufficient level of coding quality. At the very least, national Spanish APR-DRG weights should be calculated and promptly made available for each new version of the grouper. Furthermore, although the cost of the development and updating of a national DRG system is substantial, it should be a possibility to consider given the overall costs of healthcare in Spain, its importance for social well-being and the acute necessity of more cost-effective management practices. Provisions for high-cost outliers, which would decrease financial risks for specialised healthcare providers, such as large university hospitals (Busse et al. 2011), should also be made.

Conclusion

We have shown that major differences exist between DRG_CCRs and DEP_CCRs for inpatients depending on which DRG family is used. A migration from AP-DRGs to APR-DRGs would fundamentally change inpatient efficiency indicators based on DRG weights and cost accounting indicators. APR-DRGs present higher normalised weights in surgical services and lower normalised weights in medical services, excepting medical paediatric services. The transition to APR-DRGs also shows disadvantages for departments with large numbers of tracheotomy and bone marrow AP-DRGs. On the other hand, potentially ambulatory procedures might exhibit a normalised weight gain with APR-DRGs. This is due to the merging of infrequently hospitalised DRGs with more frequently hospitalised DRGs in APR-DRGs. Since the main stated purpose of DRG usage is efficiency increase, this effect must be taken into account.

Several steps should be taken in order to ensure a smooth transition to APR-DRGs from AP-DRGs. Coding practices should be reviewed and structural differences between AP and APR-DRGs should be taken into account. In patients on mechanical ventilation, mechanical ventilation time must be watchfully

included in either a fifth digit of the corresponding ICD-9-CM code or a special field in the minimum data set. Likewise, weight at birth must be carefully coded as a critical factor in neonate DRG (Marazzi, Gardiol & Duong 2007). Reporting complications is critical for calculating quality of care indicators. Since APR-DRGs tend to not consider general, but only contextually related complications as a severity increase factor, specific steps must be taken to ensure accurate complications data reporting. Systematic coding audits are necessary in order to avoid upcoding and complications under-reporting.

Further research is needed to establish whether some of the largest variations between AP and APR-DRGs could be mitigated with better coding practices and a dataset with a larger number of diagnoses.

The usage of the APR-DRG system in Spain without any adjustments, as it was developed in the United States, should be carefully considered. The structure of healthcare systems, provider incentives and resources are fundamentally different in the United States compared to Spain. Since some of the assumptions implied in the usage of APR-DRGs are not fulfilled, either regional adjustments should be performed or a national DRG system should be considered.

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Appendix A - List of abbreviations

MoHSS	Ministry of Healthcare and Social Services
AC	(Spanish) Autonomous Community / Region
ICD	International Classification of Diseases
DRG	Diagnosis-related group
AP-DRGs	All Patients Diagnosis-related Groups
APR-DRGs	All Patients Refined Diagnosis-related Groups
IR-DRGs	International Refined Diagnosis-related Groups
CMS-DRGs	Medicare Diagnosis-related Groups
DEP_CCR	% contributed to overall hospital cost for a department
DRG_CCR	% contributed to overall hospital cost for a DRG
CC	complications (DRG name abbreviation)
m.v.	mechanical ventilation
hrs.	hours
exc.	excepting
maj. o.r.	major organ removal
wo.	without (DRG name abbreviation)
w. major CC	With major complications (DRG name abbreviation)