

## DIAGNOSIS-RELATED GROUP ANALYSIS AND STRATEGIC HEALTHCARE BUDGETING.

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### SUMMARY

The term Diagnosis-related Group (DRG) refers to a classification system used to assess hospital services with the aim of streamlining health care costs and improving performance. The DRG system focuses on the utilization of resources, and is not concerned with the specific type of care provided to the patient. This system highlights any diseconomies and eventual critical aspects of the hospital system. This article examines the variables used to correctly evaluate hospital performance based on the DRG system. These include: Average Length of Stay, Average Daily Patient Load, Comparative Performance Index and Case Mix Index.

### Introduction

The process of corporatization involving the health care sector in Italy has resulted in profound changes within the entities that constitute the Italian National Health System (*Sistema Sanitario Nazionale*; SSN), i.e. Local Health Units (*Aziende Sanitarie Locali*; USL) and hospitals. This paper proposes concrete DRG application models, with the aim of facilitating the reading and interpretation of DRG-related data that can be used as a tool to redefine future objectives and to improve health care services.

### Methodological definition of DRG

The Diagnosis-related Group (DRG) system is a patient classification system (1). It is used to evaluate the performance levels of hospitals through monitoring the economic resources that are used for different categories of patients with homogenous resource consumption. The DRG system can be used to pinpoint the resources expended for hospital services, without taking into account the therapeutic approaches employed. This classification system offers the advantage of allowing the definition of health expenditure for each patient category. In the DRG system, patient records are categorized into homogenous groups, according to the diagnosis and healthcare expenses involved. The key objective is to rationalize the costs incurred for providing appropriate healthcare services. DRGs are categorized by dividing clinical cases into groups receiving similar health care services. This process takes into account the following parameters: diagnostic and therapeutic expenses, utility costs etc. The DRG system can therefore highlight eventual *diseconomies* in the healthcare system (2).

The DRG system was established in the late seventies by a group of American researchers from Yale, headed by Prof. Fetter. The group proposed to create a calculation procedure to aggregate similar diagnosis and classify patients according to their pathologies. This system has been in use in USA since 1983 and in Italy since 1995 (3). Initially, the DRG system was proposed in Italy as a qualitative analysis tool for hospital admissions. Successively, it has also been used to calculate funding appointed to healthcare structures. According to

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the Italian law, individual Regions or Autonomous Provinces must establish their own healthcare tariffs. The Regions are allowed to choose between two modalities:

- Application of national tariffs
- Application of regional tariffs.

The current Italian Ministerial Decree recognizes three healthcare service categories:

1. healthcare services provided during inpatient hospital stay;
2. healthcare services provided during outpatient hospital admissions (*day hospital*);
3. rehabilitative healthcare services.

In order to allocate each patient to a specific DRG, some of the information contained in the Hospital Discharge Records (HDR) is evaluated. These include the following data:

- 1) Principal diagnosis;
- 2) Gender,
- 3) Age,
- 4) Status of the patient at discharge,
- 5) Length of hospital stay;
- 6) Secondary diagnosis;
- 7) Interventions and procedures performed (4).

In Italy, 492 clinically similar DRG categories have been identified. DRGs are established as follows:

[*First stage*]. Exclusion of non homogenous data. For example highly divergent hospitalizations - *outliers*.

[*Second stage*]. The application of statistical algorithms to improve the database.

[*Third stage*]. A further subdivision of the groups.

[*Fourth stage*]. A more thorough analysis of the data takes place, with greater attention to secondary diagnoses that could lead to further subdivision.

[*Fifth stage*]. The last stage involves a definitive analysis taking into account the age of the patients. The conclusive DRGs are thus formed.

### Description of Hospital Discharge Records (HDR)

Hospital Discharge Records (HDRs) are used to collect information about individual patients discharged from hospitals on a national scale (5). This is done in observance with the currently applicable Personal Data Protection Code. HDRs are compiled by doctors who treated the patient during his/her hospital stay. These records have legal value, and contain general information on the patient, inpatient data, de-

tails of implemented therapies/operations, as well as clinical discharge information. HDR collection is mandatory. This includes both ordinary and outpatient admissions (*day hospital*). Outpatient clinic visits are excluded. Diagnoses are divided into 17 sectors. Each category is further divided into three-digit categories (001-999) and then into four/five-digit subcategories (001.0-999.9) (*Table 1*). The Principal Diagnosis (PD) at discharge is the main condition treated during the hospital stay; in other words, the pathology that required most care and therefore absorbed the greatest amount of resources in terms of diagnostics and treatment during the hospital stay. Diagnostic and therapeutic procedures are divided into 16 sectors (*Table 2*).

### Definition of Average Length of Stay (ALOS)

The average length of stay corresponds to the ratio between days spent in the hospital and number of discharges:

$$\text{Average Length of Stay} = \frac{\text{Total Inpatient days}}{\text{Total Number of Discharges}}$$

### Definition of Average Daily Patient Load (ADPL)

The average daily patient load corresponds to the ratio between inpatient days and time interval in days (6,7):

$$\text{Average Daily Patient Load} = \frac{\text{Total Inpatient Days}}{\text{Time Interval in Days}}$$

### Comparative Performance Index (CPI)

The CPI is used to evaluate a hospital's operating efficiency. It is obtained by assessing the collective Average Length of Stay data of patients. A score greater than 1 represents a longer hospitalization duration than expected (8,9,10). CPI also allows the comparison of the operating efficiencies of two hospitals. The formula used to calculate the CPI is as follows:

$$CPI_0 = \frac{\sum_{i=1}^{R_{0S}} d_i \frac{N_i}{N_{S0}}}{\sum_{i=1}^{R_{0S}} D_i \frac{N_i}{N_{S0}}} = \frac{\sum_{i=1}^{R_{0S}} d_i N_i}{\sum_{i=1}^{R_{0S}} D_i N_i} * \frac{N_{S0}}{N_{S0}} = \frac{\sum_{i=1}^{R_{0S}} d_i N_i}{\sum_{i=1}^{R_{0S}} D_i N_i}$$

$$\sum_{i=1}^{R_S} D_i N_i \geq \sum_{i=1}^{R_{0S}} D_i N_i$$

$d_i$  = average length of stay in hospital I  
 $D_i$  = average length of stay in hospital II  
 $n_i$  = mean number of discharges from hospital I  
 $N_i$  = mean number of discharges from hospital II  
 $N_o$  = total number of discharges from hospital I  
 $N_s$  = total number of discharges from hospital II  
 $N_{os}$  = total number of discharges from hospital I and hospital II  
 $N_{so}$  = total number of discharges from hospital II and hospital I  
 $R_o$  = number of HDRs at hospital I  
 $R_s$  = number of HDRs at hospital II

### Definition of Case Mix Index (CMI)

The Case Mix Index (CMI) expresses the average complexity of diseases treated in the hospital, compared to the average complexity data from a set of reference hospitals (e.g. all Italian hospitals). This index can be calculated with the following parameters:

- 1) number of patient records from each hospital;
- 2) DRG data;
- 3) number of patient records from all the hospitals operating in the regional or provincial health system (11,12).

CMI calculation formula:

$$CMI = \frac{\sum_{i=1}^{492} (a_i * N_{ih})}{\sum_{i=1}^{492} (a_i * N_{ir})} = \frac{\sum_{i=1}^{492} N_{ih}}{\sum_{i=1}^{492} N_{ir}}$$

$a_i$  = weight of each DRG (annex 1A of the Ministerial Decree 15/4/94);

$N_{ih}$  = number of discharged patients by DRG, in each hospital;

$N_{ir}$  = number of discharged patients in the region or province.

### Conclusions

The use of the DRG system allows the assessment of hospital performance levels, with the aim of rationalizing healthcare costs. This method can help to pinpoint the extent of resources used for producing

hospital services. The DRG system is used to classify pathologies according to the following parameters: type of medical treatment, diagnosis, and resources utilized. DRG analysis allows a thorough cost-benefit assessment, and highlights any eventual *diseconomies* or critical aspects of the hospital that is being evaluated. The DRG system uses the following data for hospital performance evaluation: Average Length of Stay, Average Patient Load, Comparative Performance Index and Case Mix Index.

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**Table 1.** Description of diagnostic sectors by body system.

SECTOR	DESCRIPTION	Category
I	Infectious and parasitic diseases	001-139
II	Neoplasms	140-239
III	Endocrine and metabolic diseases etc.	240-279
IV	Diseases of the blood and blood-forming organs	280-289
V	Mental disorders	290-319
VI	Diseases of the nervous system and sense organs	320-389
VII	Diseases of the circulatory system	390-459
VIII	Diseases of the respiratory system	460-519
IX	Diseases of the digestive system	520-579
X	Diseases of the genitourinary system	580-629
XI	Complications of pregnancy, childbirth and the puerperium	630-679
XII	Diseases of the skin and subcutaneous tissue	680-709
XII	Diseases of the musculoskeletal system and connective tissue	710-739
XIV	Congenital anomalies	740-759
XV	Conditions originating in the perinatal period	760-779
XVI	Ill-defined symptoms and signs	780-799
XVII	Injury and poisoning	800-999

**Table 2.** Classification of diagnostic and therapeutic procedures by organ and body system.

SECTOR	ORGAN/BODY SYSTEM	CATEGORY
1.	Operations on the nervous system	01-05
2.	Operations on the endocrine system	06-07
3.	Operations on the eye	08-16
4.	Operations on the ear	17-20
5.	Operations on the eye, nose and pharynx	21-29
6.	Operations on the respiratory system	30-34
7.	Operations on the cardiovascular system	35-39
8.	Operations on the hemic and lymphatic system	40-41
9.	Operations on the digestive system	42-54
10.	Operations on the urinary system	55-59
11.	Operations on the male genital organs	60-64
12.	Operations on the female genital organs	65-71
13.	Obstetrical procedures	72-75
14.	Operations on the musculoskeletal system	76-84
15.	Operations on the integumentary system	85-86
16.	Miscellaneous procedures	87-99