Towards An Improvement of Hospital Services and Streamlining of Health Care Costs: The DRG Analysis in Italy

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Abstract

The term Diagnosis-related Group (DRG) refers to a classification system used to assess hospital services with the aim of a better management of 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, starting from the history of heath care financing in Italy and pointing out the difficulty to define the "quality" of health care services, describes the variables used to evaluate correctly hospital performance based on the DRG system. These include Average Length of Stay, Average Daily Patient Load, Comparative Performance Index, and Case Mix Index.

Keywords: Hospital services, Health, Case, indexes, Italy

Introduction

The System of Health Financing in Italy: The Four Last Decades History

The slowdown in economic growth following the crisis of the 70s was accompanied by a reduction in the rate of increase in resources for the protection of public health. Control policies and cost containment were developed; allocative behaviors based on the principles of technical and managerial efficiency became the main targets of innovations in the organization and financing of the sanitary sector. Policies aimed to economic control were concentrated on hospital assistance, which represented the largest health expenditure component. Inefficiency in the health sector was mainly due to the retrospective funding system, which led to behaviors tending to diseconomies; the retrospective funding system was then replaced by the prospective one.

This financing system based on predetermined rates for homogeneous diagnostic groups (DRG, Diagnosis Related Group) was experienced first in the U.S. and then adopted in Italy.

The Italian National Health Plan (1994-1996), approved by Presidential Decree on 1994, confirmed that funding for all public and private providers, should be based on predetermined rates established at regional level according to general national criteria. This mode of financing was intended to remunerate the delivered product (instead of the inputs used) proportionally to the work actually performed for the benefit of patients.

Effects of Prospective Financing System Based On DRG in Italy

The Italian health system, which in the past was oriented to the payment of production factors and

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focused on the number of days of hospitalization, then used another method based on predetermined rates for performance, classified by DRG.

The effects produced by the prospective financing system can be summarized as follows:

1. Contraction of the duration of hospitalization, in order to avoid the unnecessary days of hospitalization (waiting for carrying out the examinations), also through greater use of less expensive forms of post-hospital care
2. Containment of diagnostic procedures through prescription of those considered actually necessary
3. Trend towards specialization of offered units
4. Adoption of technologies aimed to save resources and, in any case, more selective use of the technologies themselves
5. Greater integration between different health care services

The main reason why Italy decided to switch from one system based on the reimbursement of incurred costs to a prospective funding system of hospitals was the right objective of achieving cost saving; one could encourage health facilities to be more efficient and the funding body (the Region) could push dispensing facilities to provide less expensive treatments maintaining, however, a good level of quality.

Definition of Quality of Health Care Service

Health economists usually distinguish three meanings of quality:

- Quality in input: measured in terms of quantity and type of resources used, staff and equipment
- Quality in processes: measured by indicators of use of facilities and level of services offered, cost of hospitalization and hospital stays, duration of stay, number of diagnostic tests, number of procedures treatment, number of prescriptions and number of surgeries
- Quality in the output: measured through indicators of morbidity and mortality.

The analysis of the incentive properties of the funding criteria for hospitals considers especially the first two meanings, identifying them synthetically with the concept of intensive treatment of patients (amount of resources and/or output intermediates used for single case). However, it seems evident that the quality understood as the intensity of treatment not necessarily coincides with the desired quality by customers/users.

The notion of quality should be released by the intensity of treatment and instead related directly to the perception of the quality expressed by customers/users in terms of mobility choices to health care facilities other than those of residence.

Guidelines of Italian Ministry of Health about Rate System of Health Care

References are at the national level but each region is responsible the definition of remuneration mechanism to be adopted within their own territory. Over the years, they chose the following options:

1) estimation of the standard cost of production of a panel of hospitals (which represent examples of good economy management), to calculate the costs attributable to services provided under outpatient (which should be not considered), and to attribute to each DRG using specific algorithms and taking account of the case-mix encountered (CDA analytical method)
2) to build standard costs of production attributable to specific DRG (ideally chosen among the most homogeneous in terms of underlying performance) and from these values to reconstruct the tariff of all other DRGs by applying the proper system of relative weights given by the Ministry (known as the method of weights).

The standard cost of production for the benefit is calculated based on costs collected from a sample of providers operating within the Region. This cost refers to the composition and quality factors of materials used for the production of performance, measured based on average unit purchase price reported last year and its possible expected changes due to the rate of inflation.

The cost components to be considered for the calculation of the standard cost of production of the performance are as follows:

- the cost of staff directly employed
- the cost of materials consumed;
- the cost of equipment used;
- the overall costs of the production unit of performance

The ministerial rates are fixed only for all types of hospital; Regions has however the opportunity to modulate its own rate system as a function of the various types of patients, identified on the basis of the complexity of cases treated and organizational and functional complexity, and based on the volume of the performance provided.

Methodological Definition of DRG System

The process of corporatization involving the health care field in Italy has resulted in significant 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.

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

1) Application of national tariffs
2) 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:

1) [First stage]. Exclusion of non-homogenous data. For example highly divergent hospitalizations – outliers
2) [Second stage]. The application of statistical algorithms to improve the database
3) [Third stage]. A further subdivision of the groups
4) [Fourth stage]. A more thorough analysis of the data takes place, with greater attention to secondary diagnoses that could lead to further subdivision
5) [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, details 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.

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
XIII	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

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:

Average Length of Stay= Total Inpatient Days/Total Number of Discharges

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

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);
Average Daily Patient Load= Total Inpatient Days/Total Interval in Day

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 one represents longer hospitalization duration than expected (8-10).

CPI also allows the comparison of the operating efficiencies of two hospitals.

The formula used to calculate the CPI is as follows:

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

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

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_0 = total number of discharges from hospital I
N_S = total number of discharges from hospital II
N_{0S} = total number of discharges from hospital I and hospital II
N_{S0} = total number of discharges from hospital II and hospital I
R_0 = number of HDRs at hospital I
R_S = number of HDRs at hospital II
R_{0S} = R_{S0} = number of HDRs in common between hospital I and 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.

Conclusion

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.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

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