

Comparison of cost-weights scales methodologies in the perspective of a financing system based on pathologies

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Received: 4 December 2009 / Accepted: 15 June 2010 / Published online: 4 July 2010
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Abstract

Objectives Objectives of this article are to evaluate the possibility to create a CW scale by pathology on the basis of cost data from Belgian hospitals, to compare several methodologies to create this CW scale, and to evaluate the financial impact of a modification of the financing system on hospitals' income.

Methods CW scales were elaborated according to various methodologies in order to isolate the scale allowing the most adequate financing system, i.e. approaching the real costs as much as possible. Twelve scales were created. They vary according to the type of data used, according to DRGs and severities of illness included within the scale, and according to the variable used in order to isolate outliers.

Results For a similar case-mix, Hospitals H2 and H5 would see their financing increased through a prospective system based on the selected CW scale (No. 6). This modification would generate a reduction in financing going from -1 to -9% according to hospitals.

Conclusions The cost database created made it possible to create a CW scale according to a technique which could constitute the first step of a PPS if advantages of a such financing system were established. In the Belgian context, it would be probably judicious to envisage regional databases allowing diversified methodological approaches whose results would be confronted, discussed, and coordinated at the federal level.

Keywords Financing · DRGs · Prospective payment system · Cost-weight

JEL Classification Health · I19 – Other

Introduction

In 1983, diagnosis-related groups (DRGs) were integrated, in United States (USA), in the prospective hospital funding system based on case-mix. This classification is the result of studies undertaken since 1975 by Fetter [1]. The originality of DRGs was that they are synthesis of classifications based on medical criteria and those based on economic criteria. DRGs' classification is a compromise between two different logics: the first one which is articulated around the disease and the second one which is oriented around the amount of resources consumed. By constituting DRGs, Fetter created an operational financing system for authorities and hospitals. Even if this classification presents disadvantages, it is the only one that have been imposed (with alternatives) in the Western countries [2].

The concept of DRGs was introduced in Belgium at the end of the 1970s. In the 1970s, first studies about medical discharges summaries (RCM), necessary for DRGs determinations, began in Belgian academic hospitals. The systematic record of all medical discharges summaries in all Belgian general hospitals began in 1990. Several partial studies about the linkage between DRGs and financing were undertaken since 1980, but the first large study began only in 1985.

In that period, Closon and Roger France proposed a relative weights' scale based on lengths of stays of pathologies. The creation of a minimum financial summary

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(RFM) based on inpatient invoices was an objective of authorities.

The objective was to combine RCM and RFM for a reform of hospitals financing but this project was not concretised. However, DRGs were gradually integrated in the financing system as an indicator of performance through the length of stay. They took progressively an increasingly important place (financing of nursing costs, administrative costs, hotel costs, imaging costs, laboratory costs, drugs, etc.).

The intention in Belgium is not yet to use DRGs as a prospective payment system but rather as a tool to adjust the current funding model according to activity, measured by DRGs.

The actual Belgian hospital funding system for inpatients combines different elements: a global budget system ("Budget des Moyens Financiers") for administrative costs, hotel costs, investments, nursing care, etc. ($\pm 52\%$); a fee for service system for medical procedures ($\pm 32\%$); reimbursement of drugs, prosthesis, blood ($\pm 14\%$); other revenues ($\pm 2\%$). Approximately 2.5% of the hospital budget for inpatients is influenced by DRGs: some activities of the BMF based on justified days, combination of fee for services and lump sums based on DRGs for medical procedures, and combination of per drug financing and lump sums based on DRGs for drugs financing.

Others countries also integrated a case-mix system for their hospital financing system but gave them a more important influence than in Belgium through all-in lump sums by DRGs. Those systems are based on tariffs by DRG based on cost data. It is the case in France, in Germany, in Switzerland, etc. In France [3], a prospective payment system was introduced in 2004–2005. The system is called («tarification à l'activité» or T2A) and replaces the previous financing system which was different for public and private hospitals.

Public hospitals were financed according to a global budget, whereas private hospitals were financed on the basis of a negotiated daily tariff.

Principal limits of this policy were as follows: no incentive for productivity and effectiveness, coexistence of two systems of financing limiting comparisons between the two systems, and inequities between public and private hospitals, but also within each sector. Those reasons justified an evolution towards a single national prospective payment system in which resources are allocated according to the nature and the level of activity developed by hospitals. T2A gives a financing related to case-mix of hospitals. This financing is combined with other complementary funding mechanisms. Specific activities badly evaluated through DRGs are financed in a distinct way (e.g. emergencies, missions of general interest, expensive and

innovating drugs). In Germany, first studies to introduce DRGs in hospitals began in the 1990s. Several families of DRGs were evaluated (French GHM, Austrian LKF, American AP-DRGs, and Australian AR-DRGs). The choice to introduce Australian AR-DRGs, refined in a second step in German-DRGs, was carried out in 2002. Since 2003, a prospective payment system called "German DRG-system" was introduced into German hospitals. Just like in France, tariffs by pathology are calculated on the basis of cost data.

If Belgium followed this European tendency, it is expected that the basic methodology of the financing would be based on a cost-weights (CW) scale.

Objectives of this article are to evaluate the possibility to create a CW scale by pathology on the basis of cost data from Belgian hospitals, to compare several methodologies to create this CW scale, and to evaluate the financial impact of a modification of the financing system on hospitals income. The CW scale is the essential component of a prospective financing system.

Methods

Hospitals samples

Since 6 years, several hospitals situated in the south part of Belgium, a professional association for hospitals and a university participate in a project called «PACHA or Projet d'analyse des coûts des hôpitaux associés». Objectives of this project are as follows: (a) to develop an expertise in cost accounting methodologies, (b) to influence the hospital financing system through the development of cost data, and (c) to compare cost data between hospitals to improve hospitals management through practice standardisations.

The costing methodology

The methodology [4] is based on a top down method. This analytic accountancy methodology calculates total costs of departments using drivers reflecting resources consumptions. This analytical accountancy is done by allocating costs between cost centres on the basis of reciprocal allocations. When total costs (direct and indirect costs) of each section are determined, they are used to calculate activity cost of departments. Each act or activity is weighted according to its resources consumption. When cost of production is determined, it is attached to each patient according to his respective consumption. All patients with same APR-DRG are aggregated in order to calculate the cost of pathology.

CW methodologies

Data

Each stay is grouped into one APR-DRG (V15.0). Each DRG has 4 severity of illness index. There are 1,239 case-mix groups in the database. 641 groups have more than 25 patients, 598 have less than 25 patients.

Hospitals

Hospitals are general hospitals, situated in Wallonia. They are public hospitals, have a comparable structure and homogenous case-mix. The number of beds and admissions are presented in Table 1. Data from 2004 (H1-H2-H3-H4-H5) -2005 (H1-H2-H3-H5) -2006 (H1-H2-H3) were selected to create the CW scale.

Size of the sample

About 140,375 inpatient stays were available. We excluded 7,518 inpatient stays because of unusable DRGs or atypical cost data (e.g. death after admission). For the CW scale, 132,857 were used.

Indexation

Data for years 2004 and 2005 were indexed according to the health index.

CW scales methodologies

CW scales were elaborated according to various methodologies in order to isolate the scale allowing the most adequate financing system, i.e. approaching the real costs as much as possible. 12 scales were created. They vary (1) according to the type of data used (real costs or charges), (2) according to DRGs and severities of illness included within the scale (all DRGs and severities of illness or only those including at least 25 patients), and (3) according to the variable used in order to eliminate extreme values or outliers (cost outliers, charges outliers, length of stay

(LOS) outliers, cost and LOS outliers, charges and LOS outliers). Figure 1 gives a description of scales.

Outliers suppression

Only APR-DRGs comprising at least 25 patients were selected for outliers suppressions (641 groups including 127,373 patients). Patients from DRGs comprising less than 25 patients are considered as inliers. The 75th percentile +1, 5* inter-quartile range was used to select high cost, LOS, and charges outliers. The removal of low-cost outliers from the database was carried out according to the following rule: 25th percentile -1, 5* inter-quartile range. Only inliers are including for the scale. Those rules were used in previous studies [5, 6].

Calculation of CW

CW of each DRG and each severity of illness is calculated by dividing average costs (or average charges) of inliers of each DRG and each severity of illness by the average cost (or average charges) of all inliers.

Financing simulations

In order to isolate the most adequate scale, the current inpatient financing was distributed according to the CW corresponding to each patient, through his APR-DRG and its severity of illness. This simulation was done only for inliers, outliers being financed in a specific way in all countries financed by case-mix. For each inlier stay, the difference between the real financing and the simulation is calculated. The most adequate scale was selected on the basis of the mean-squared error. The most adequate scale is that making it possible to obtain the smallest mean-squared error.

Case-mix index

Case-mix index was calculated on the basis of the most appropriate scale and only on DRGs with more than 25 inliers patients. The case-mix index is calculated by making the average of the number of points per stay. This indicator reflects the case-mix intensity of hospitals.

Table 1 Number of beds and admissions for hospitals

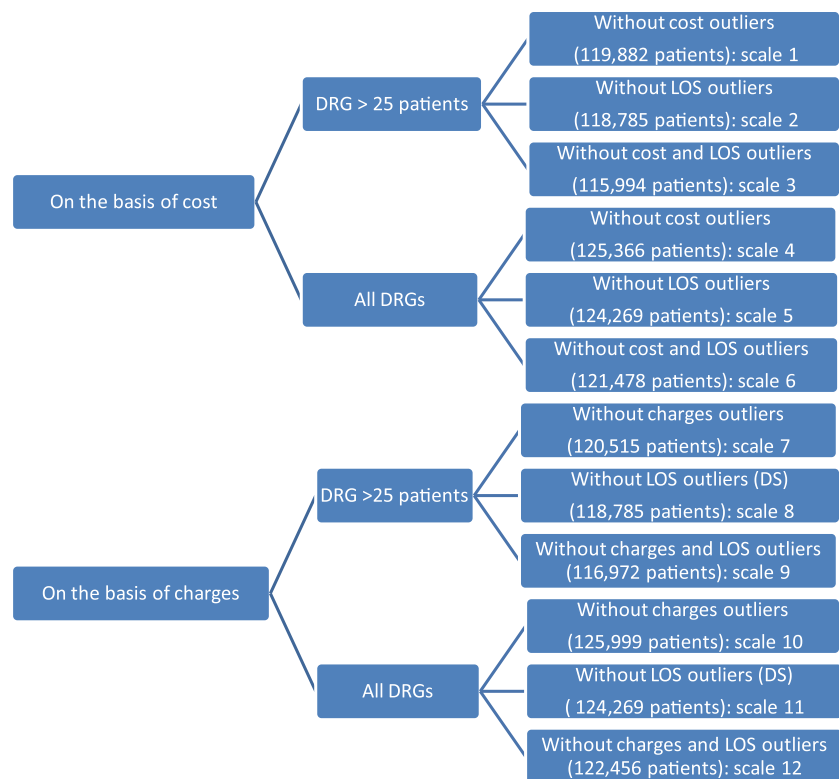
	Number of beds	Mean of admissions
H1	330	7,622
H2	428	15,140
H3	317	10,363
H4	458	16,531
H5	403	11,638

Results

Cost outliers

For DRGs with more than 25 patients, there are 7,079 high-cost outliers. (5.56% of patients), 412 patients were isolated as low-cost outliers (0.32% of patients), and 119,882

Fig. 1 Methodology for the creation of the 12 CW scales



as cost inliers (94.12% of patients). The percentage of high-cost outliers varies between 0 and 20.45% according to DRGs and severities of illness. The percentage of low-cost outliers varies between 0 and 10.53% according to DRGs and severities of illness.

LOS outliers

About 8,303 stays are high-LOS outliers (6.52% of the patients), 285 are low-LOS outliers (0.22% from the patients), and 118,785 are LOS inliers (93.26% of the patients). The percentage of high-LOS outliers varies between 0 and 21.05% according to DRGs and severities of illness. The percentage of low-LOS outliers varies between 0 and 7.69% according to DRGs and severity of illness index.

Charges outliers

About 6,703 stays are high-charges outliers (5.26% of patients), 155 are low-charges outliers (0.12% from patients) and 120,515 are charges inliers (94.62% of patients). The percentage of high-charges outliers varies between 0 and 17.65% according to DRGs and severity of illness index. The percentage of low-charges outliers varies between 0 and 8.57% according to DRGs and severity of illness index.

Comparison between cost outliers and LOS outliers

About 65.18% of high-cost outliers are also high-LOS outliers (4,614 patients/7,079 patients). 55.57% of high-LOS outliers are also high-cost outliers (4,614 patients/8,303 patients).

Comparison between cost outliers and charges outliers

About 66.61% of the high-cost outliers are also high-charges outliers (4,715 patients/7,079 patients). About 70.34% of high-charges outliers are also high-cost outliers (4,715 patients/6,073 patients).

CW scales

On the basis of the mean-squared error, the best CW scale is the CW scale No. 6 (followed by scale No. 3 and scale No. 4) (Table 2). It allows a financing closed to real costs. For remember, this scale is calculated on the basis of real costs, while having before eliminated cost and LOS outliers. This scale is calculated for all APR-DRGs of the sample. The second scale having the lowest mean-squared error is the scale No. 3. It is calculated on the basis of real costs, while having before eliminated cost and LOS outliers but only for APR-DRGs with more than 25 patients. Scale No. 4 is also based on costs. It was calculated on the basis

Table 2 Mean-squared errors for the 12 financing simulations based on CW scales

CW scales	Mean-squared errors
CW scale 6	325,703.21
CW scale 3	378,903.10
CW scale 4	604,023.60
CW scale 1	688,027.41
CW scale 10	1,014,723.88
CW scale 7	1,014,723.88
CW scale 12	1,030,493.06
CW scale 9	1,030,493.06
CW scale 5	1,064,613.31
CW scale 2	1,125,949.65
CW scale 11	1,157,867.08
CW scale 8	1,157,867.50

Table 3 Case-mix index of hospitals

HOP	ICM
H1	0.94
H2	0.97
H3	1.06
H4	0.98
H5	1.04

Table 4 Comparison between the actual financing per case-mix point and the simulated financing per case-mix point

HOP	Actual financing per case-mix point	Simulated financing per case-mix point
H1	3,898.45	3,833.26
H2	3,800.29	3,833.26
H3	3,875.90	3,833.26
H4	4,230.87	3,833.26
H5	3,512.37	3,833.26

of all APR-DRGs while having before eliminated cost outliers.

Case-mix index

Hospital H3 has the highest case-mix index (Table 3).

Impact of the CW scale on hospitals financing

For a similar case-mix, Hospitals H2 and H5 would see their financing increased through a prospective system based on the selected CW scale (No. 6) (Table 4). This modification would generate a reduction in financing going from -1 to -9% according to hospitals (Table 5).

Table 5 Modification of financing for hospitals with a change of the financing system

HOP	Modification of financing (%)
H1	-1.67
H2	0.87
H3	-1.10
H4	-9.40
H5	9.14

Discussion

Belgium began, since the 1980s, a reform of its financing system with the introduction of DRGs into hospitals financing mechanisms. The system became more and more complex with a lot of rules and the progressive introduction of lump sums (justified activities, «montants de référence», drugs lump sums, etc.). Whereas «all-in» PPS set up in France, in Germany, in Switzerland, in Nordic countries, etc., no strategic reflexion on advantages and disadvantages of a such system was undertaken in Belgium till 2008.

If a reorientation of the financing system was considered in Belgium, what would be the conditions to prepare this reform? The ministry which is responsible for the health policy would have to determine tariffs by pathologies. It cannot be an arbitrary act. Even if some tariffs can be raised or lowered to support public health orientations, tariffs have to reflect, in general, real costs of medical practices in hospitals. To be adequate and equitable, tariffs must be determined on CW scales based on clinical costing studies, realised in large samples of hospitals. The objective of this study was to show that several Belgian hospitals and their federation, supported by a university department, were able to open the reflexion of a possible reform of the financing system by comparing several methodologies of CW scales.

The first step would be the implantation of clinical costing methods in a sample of hospitals. Usually, analytic accountancy systems need to be adapted for such studies. The complexity is to have a good coherence between costs of services and activity produced by them.

The «PACHA» study, realised with a sample of hospitals, allowed creating a database of the size of that used in Switzerland for first reflexions on PPS. The constitution of a CW scale by pathology is the second step because tariffs must be determined on CW. The problem seems easy because it is necessary to calculate average costs of each pathology and to situate them on a common scale for all DRGs. Actually, several assumptions must be compared and discussed: (1) can we take into account all DRGs or only those with a minimum of patients ? (2) Which method can be used to separate “inliers” and “ouliers”. This question is important because average costs of each pathology are calculated on the basis of “inliers”, (3) even



if it seems normal to use costs for the CW scale, it seems interesting to evaluate the methodology using charges for the CW scale (charges are costs for the ministry and are easily available). Simulations presented in our study brought answers to these questions. This study allowed choosing the best CW scale among 12 possibilities. It is satisfying to note that the best scale (No. 6) is that which was calculated on the basis of costs, after the elimination of cost and LOS outliers. The option consisting in using charges as a substitute of real costs gave significantly less good results. This option presents moreover several disadvantages. The first one is that it less well reflects real costs of hospitals. A second major disadvantage of this alternative is that it reproduces current distortions of tariffs from one pathology to another. Moreover, it cannot be adapted during time, which is the case of a CW scale based on real costs.

As it was expected, results of this study show that a new financing system would modify financial income of hospitals. With a constant budget and for a similar case-mix, hospitals which currently invoice more would see their income decreased while increasing income for hospitals which have a more moderate actual financing.

Principal limits of our study are as follows: (1) simulations of this study are only based on inliers. Outliers were eliminated from analyses. In all PPS, they are financed in a specific way to avoid patient selections. (2) This first CW scale is a first base of reflexion for an alternative financing policy. Tariffs are not average costs. Tariffs are the reflect of the available budget, of political choices in health, of specific financing choices such as expensive drugs, medical devices, teaching missions, and emergencies. (3) A more important sample and better diversified should help to constitute a better cost database and thus better CW. In France, 40 hospitals provide each year cost data allowing to bring up tariffs. (4) Clinical costing methodologies must constantly be improved.

One of the important question is to know whether medical fees or part of them would be or not included in lump sums by DRGs (the cost of the practice could be included while the remuneration itself could be financed with a fee for service way). This last option is not incompatible with a PPS because it was the choice in USA. Costing studies, CW, and tariffs will obviously depend on this choice which is before a political choice.

Conclusion

For 10 years, a university department help several hospitals situated in the south part of the country to develop clinical costing studies. The cost database created made it possible to create a CW scale according to a technique which could constitute the first step of a PPS if advantages of a such financing system were established. Limits of this study were discussed. They show that a considerable work should be continued to pass from the current experience to an operational system but that hospitals and an academic department would be ready for studies leading to a change of the financing. Decisions for the choice of costing methods, for the selection of hospitals included in the costing sample, of what will be or not will be included in the lump sum are political decisions. In the Belgian context, it would be probably judicious to envisage regional databases allowing diversified methodological approaches whose results would be confronted, discussed, and coordinated at the federal level.

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