DESIGN OF A PROTOTYPE FOR PERFORMING HOSPITAL BENCHMARKING

Production and Management of Hospital Quality Indicators

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Abstract: Introduction: Hospitals are complex organizations and the quality and efficiency of care and the hospital assessment performance are complex features to measure and estimate.

Aim: To extract an useful knowledge from hospital databases to develop a hospital dashboard for quality and management indicators and to generate sufficient information, relevant and timely, to assist in decision-making processes.

Methods: This study was structured with four distinct phases: preliminary study, literature review, definition and development, and evaluation results.

Results: The preliminary studies were grouped in production and quality hospital indicators. In 2010 there was a reduction (3.5%) in the total number of episodes, a reduction (30%) on exceptional short LOS episodes, a significant reduction of obstetric complications, and an increase the problems related to clinical coding.

Discussion: In a preliminary way, it can be observed the importance in a hospital management of such results synthesized and summarized in groups of production and quality hospital indicators.

Conclusion: This work comprises the study of solutions can contribute to the improvement of healthcare delivery, aiming towards management support and the desired hospital operating costs reduction.

1 INTRODUCTION

Medical databases usually involve several data types and store large amounts of information. Among the various health services, the hospital stands out for gathering/organizing the procedures of greater complexity and cost. The availability of reliable information, from solid data, is vital to support health professionals and technicians in their decision-making and also to support hospital managers.

Over the last 20 years, one of the major challenges of most western countries health systems has been dealing with rising health care costs, which, in many cases, obliged systems to cut spending in other sectors in order to provide the public with a reasonable healthcare system (Ronen and Pliskin, 2006).

Hospitals are often acknowledged as organizations with the greater complexity in its structure and administration (Freitas et al., 2010); (Freitas et al., 2011). The multiproduct nature in this activity, due to an enormous variety of diagnoses and procedures performed in a hospital and matters related to hospital management, out of which emerges the quality and efficiency care's, delivery and financing of health organizations, contribute to the complexity of management, administration, cost reduction, setting and measurement of production, as well as the evaluation of hospital performance (Gaspar et al., 2011); (Costa et al., 2010).

The problems with the recent budgetary control and the difficulties in the Portugal economy, specially the urgent necessity to control the national growth expenditure and the immediate cost reduction, revealed a need to develop new solutions

and strategies in the health public institutions management (Largartinho and Anunciação, 2011).

In 2011 May, through the "Portugal Memorandum of Understanding on Specific Economic Policy Conditionality", Portugal is committed to fulfill measures aimed at the economy stabilization in the country. Among health matters, goals standout such as "Improve efficiency and effectiveness in the health care system, inducing a more rational use of services and control of expenditures; […] generate additional savings in hospital operating costs" (EFSM et al., 2011). Specifically for this kind of services, two items stand out (EFSM et al., 2011):

▪ 3.75 - "Set up a system for comparing hospital performance (benchmarking) on the basis of a comprehensive set of indicators and produce regular annual reports";

▪ 3.76 - "Ensure full interoperability of IT systems in hospital, in order for the ACSS to gather real time information on hospital activities and to produce monthly reports to the Ministry of Health and the Ministry of Finance".

1.1 Dashboards

Dashboards can have an important contribution, while providing a visual representation of main performance indicators (Truttero, 2008), as they use carefully selected indicators that help managers to continuously monitor, measure and manage performance of an institution (Korst et al., 2011). It provides a pictorial representation of organizational performance, while generating an overview of the current institution situation, providing an intuitive and timely strategic, financial and operational data visualization.

The dashboards are characterized by an interface consisting of one or more virtual instruments such as dials or bar graphs, in which variables are associated in order to be monitored as well as graphs showing the evolution of variables (Wolpin, 2005).

A dashboard tool usage can help understand and optimize hospital processes, as well as extend the institutions self-knowledge (Hagland, 2011). Due to specific characteristics and complex needs of hospitals and management, there is not a default dashboard (Norton, 2009). One of its greatest qualities is the fact that it is structured, developed specifically and designed to meet the real needs of an institution (Riedel, 2007).

2 AIM

The main aim of this study is to extract knowledge in hospital databases that might be useful to improve the delivery of health care.

Specifically, it is intended to develop a dashboard, a summary of quality and management indicators for inpatient and outpatient episodes, which may represent the production and the quality of the hospital.

This study should provide relevant information for the managers, to assist them in their decision making processes, either at a local level (hospital), a regional level (ARS[1]), or even at a national level (ACSS[2]).

3 METHODS

The structure (acquisition, validation and understanding) of existing data in hospital databases will be a major focus on this work.

It is intended to evaluate the quality and management indicators currently being used by hospitals, analyze the results, propose new indicators and, as well, assess the need to collect data from other data sources of the institution (data integration), e.g. administrative and organizational databases.

It is expect to analyze the possible contributions that techniques, such as Data Mining, Balanced Scorecard, Business Intelligence and maturity models for software development (CMMI[3] and TDQM[4]), can bring to the objective proposed.

Finally, the data quality is an important factor to be considered in the development of quality indicators and dashboard, since the level of accuracy and data quality is proportionally connected to the significance and relevance of results.

In this prototype implementation, it is intended to use technologies such as PHP, HTML, CSS and JavaScript, as well as open source packages like JQuery User Interface, Google Graphs API, and others.

This study was divided into four distinct phases:

▪ Preliminary study;

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[1]ARS: Administração Regional de Saúde (in portuguese)
[2]ACSS: Administração Central do Sistema de Saúde (in portuguese)
[3]CMMI: Capability Maturity Model Integration
[4]TDQM: Total Data Quality Management

- Review of the literature;
- Definition and development of the prototype;
- Assessment of the results.

3.1 Preliminary Study

Accomplish a preliminary study with a sample of data from a Portuguese hospital, in order to fit the existing data previously in summarized tables and getting a vision of the possible outcomes that the dashboard can produce.

This study proposes to perform a comparative study between the first semester of 2009 and first semester of 2010 of the Portuguese hospital from NHS[5], involving approximately 29 thousand records. The database used is composed by hospital episodes, hospitalizations and ambulatory data from medical or surgical specialties.

Access to this data was possible due to the ACSS collaboration and the HR-QoD[6] project developed by the Department of Health Information and Decision Sciences (CIDES[7]) of Faculty of Medicine of University of Porto. All data used was anonymous and clinical data was coded in ICD-9-CM[8] and DRG[9].

3.2 Literature Review

The initial knowledge on the proposed topic should be updated, detailed and systematic, consolidating the respective knowledge base in this area. Thus it is expected an initial literature review, with the purpose of identifying quality indicators used in other countries.

The purpose is to study quality and management indicators used by hospitals, and analyze the results and data acquisition processes. This step should result in a consolidated set of indicators that are common to hospitals and based on data currently available in hospital databases.

After this stage, a study on techniques for developing dashboards, balance scorecards, business intelligence and data mining that can be applied in healthcare data should be performed.

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[5]National Health Service

[6]HR-QoD: Quality of data (outliers, inconsistencies and errors) in hospital inpatient databases: methods and implications for data modeling, cleansing and analysis

[7]CIDES: Ciências da Informação e da Decisão em Saúde (in portuguese)

[8]ICD-9-CM: International Classification of Diseases, Ninth revision, Clinical Modification

[9]DRG: Diagnosis Related Group

And finally, the necessity for indicators related to hospital, at the hospital level, regional, national and international, should be defined. It is intended to identify the indicators currently used and to identify other needs for the aid on decision making by managers.

3.3 Definition and Development

This stage should be used to:

- consolidate the results obtained from the literature review, systematize and compare the existing indicators, as well as the data acquisition process.

- Identify possible measures of quality and health quality indicators used in other countries, in order to obtain a pool of potential candidates for implementation.

- Evaluate the possibility of using data from administrative and organizational databases hospitals in developing the new indicators.

- Implement quality and management indicators hospital defined. Implement the techniques and selected parameters to create a dashboard prototype.

- Define and implement a set of user definable alerts. Identify and present the possible inconsistencies or errors data.

3.4 Results Evaluations

With the implemented indicators, results can be evaluate their fidelity, reliability and compare the results to local, regional, national and international, with the assessment of experts in the field of hospital management. It's possible to determine the relevance of the results and identify possible areas of improvement.

Based on the results presented by the dashboard is intended to evaluate and compare the quality and management of hospital care at different levels of the health system (local, regional and national). At this stage, based on summaries and automatic reports, there will be an evaluation of the provision of health care, especially through the performance and quality indicators pointing to possible problems by comparing with predefined targets, in order to help managers to develop strategies to overcome problems and improve the delivery of health care as well as to prevent problems and reduce costs by optimizing existing resources.

Accomplish a comparative study sorted by years, as well as a benchmarking a set of Portuguese hospitals.

To analyze, evaluate and quantify data quality problems existent in databases, it's intended that the figures presented in the dashboard, have a value associated with the degree of reliability values obtained when considering the amount of data quality problems detected in the used data.

It is intended to correct any problems where feasible, propose solutions and recommendations to the authorities so they can avoid or resolve possible problems, both in terms of data quality in general and quality in the health context.

4 RESULTS

The preliminary study results are presented by period (first half of 2010 and first half of 2009). The results were grouped into production and quality hospital indicators.

4.1 Hospital Production Indicators

Table 1: Number of Patients Discharged.

Description	Year	N	%*
Global episodes	2010	14278	-
	2009	14782	-
Medical DRG	2010	9966	69.8
	2009	10282	69.6
Surgical DRG	2010	4312	30.2
	2009	4500	30.4

* Percentage of total episodes

The table 1 shows de number of patients discharged global and by type of DRG classification (Medical DRG and Surgical DRG). It is observed a reduction of 3.5% in the total volume of episodes in 2010 face the same period last year.

Table 2: Length-of-stay (LOS).

Description	Year	N
Global episodes	2010	7.7
	2009	7.2
Medical DRG	2010	8.1
	2009	7.8
Surgical DRG	2010	6.7
	2009	5.9

The table 2 presents the global Length-of-Stay (LOS) and Medical and Surgical LOS. It is verified an increase of 0.5% in the Global LOS, a increase of 0.3% in the Medical DRG LOS and a increase of 0.8% in the Surgical DRG LOS.

Table 3: Episodes with Short LOS.

Description	Year	N	%*
Global episodes	2010	179	1.25*
	2009	254	1.72*
Medical DRG	2010	170	1.70**
	2009	210	2.04**
Surgical DRG	2010	9	0.20***
	2009	44	0.98***

* Percentage of total episodes
** Percentage of total Medical DRG episodes
*** Percentage of total Surgical DRG episodes

The table 3 shows the episodes with a exceptional LOS, in this case, episodes with short stay. It is observed a reduction of 30% in 2010 over the same period in 2009, and approximately 86% are Medical DRG episodes.

Table 4: Case-mix Index.

Description	Year	Value
Global episodes	2010	0.963
	2009	0.976
Medical DRG	2010	0.748
	2009	0.805
Surgical DRG	2010	1.422
	2009	1.314

It is noted in Table 4 a reduction in the global case-mix index in 2010. This decrease is related with Medical DRG, since Surgical DRG case-mix index increase.

4.2 Hospital Quality Indicators

Table 5: Readmission and Mortality.

Description	Year	N	%*
Deaths	2010	779	5.5
	2009	806	5.5
Readmission	2010	403	2.8
	2009	398	2.7

* Percentage of total episodes

Table 5 shows a 3.4% reduction in hospital mortality rate, however in the same period prescribed, an increase of 2.2% in readmission rates.

Table 6: Complications in Medical DRG.

Description	Year	N	%*
Pressure ulcers	2010	80	1.86
	2009	103	2.29
Urinary infections	2010	406	9.41
	2009	327	7.27

* Percentage of total Medical DRG episodes

The table 6 shows the complications in Medical DRG. The hospital reduces the complications in

22.4% with pressure ulcers, although increases 19.5% the complications related with urinary infections.

Table 7: Complications in Surgical DRG.

Description	Year	N	%*
Hemorrhage or hematoma	2010	14	0.14
	2009	27	0.26
Accidental puncture or laceration	2010	10	0.10
	2009	0	0.00
Postoperative infections	2010	20	0.20
	2009	15	0.15
Dehiscences	2010	29	0.29
	2009	20	0.19

* Percentage of total Surgical DRG episodes

The table 7 shows the complications in specific Surgical DRG like hemorrhages or hematoma, accidental puncture or lacerations, dehiscenses and postoperative infections.

Table 8: Obstetric Quality Indicator.

Description	Year	N	%*
Deliveries	2010	843	-
	2009	850	-
Cesarean	2010	360	42.7
	2009	358	42.1
Birth trauma	2010	2	0.2
	2009	19	2.2
Obstetrical trauma	2010	2	0.2
	2009	43	5.0
Puerperium readmission	2010	1	0.1
	2009	4	0.5

* Percentage of total deliveries

It is observed in table 8, that the hospital has a high percentage of cesareans, 42.7% in 2010, considering the national benchmark 32.9%. It is also observed a significant reduction in 2010 of the obstetric complications, such as birth trauma and obstetrical trauma.

Table 9: Clinical Coding Quality Indicator.

Description	Year	N	%
Non-specific principal diagnosis	2010	275	1.92*
	2009	128	0.87*
Questionable principal diagnosis	2010	35	0.25*
	2009	0	0.00*
Unacceptable principal diagnosis	2010	14	0.10*
	2009	9	0.06*
Non-specific surgical procedures	2010	116	2.69**
	2009	55	1.22**

* Percentage of total episodes
** Percentage of total Surgical DRG episodes

The table 9 presents the clinical coding quality indicators. In general all indicators show in this table show the increase of the problems related with the clinical coding in 2010.

These indicators were chosen to exemplify some of the possible outcomes that can display the dashboard. A specific study should be conducted to define what the best indicators to delineate the hospital health.

5 DISCUSSION

It can be observed that the preliminary study results on the hospital production have reduced in the total volume of patients in 2010 over the same period in 2009, however there was a small increase of the global LOS. There is a positive feature which 30% the reduction of the episodes with exceptional short LOS, considering that the hospital is not repaid if the episode with LOS under the preset limit. On the other hand, the case-mix index for the hospital was reduced which could lead to a lower repayment by the hospital with funding sources.

Related with the hospital quality, was observed an improvement in mortality rates and complications such as pressure ulcers in Medical DRG, birth trauma, obstetrical trauma and puerperium readmission. However, on the other side was also observed a worse performance in hospital quality when analyzed the rates of readmission, complications in Surgical DRG, complications in Medical DRG (urinary infections) and increase of the volume of cesareans. They also observed that the clinical coding quality is much worse in 2010 compared to 2009.

Preliminarily can be observed the importance for the hospital management of these results, synthesized and summarized in two groups, hospital production indicators and hospital quality indicators. This demonstrates the relevance and importance of these kinds of studies and developments with the intention of improve the quality of hospital health care.

6 CONCLUSIONS

The scope of work includes the study of solutions that can contribute to improve the supply of health care, in order to help manage and reduce in operating costs of NHS hospitals.

This work intends to understand an analysis of the quality indicators and hospital management already used by Portuguese hospitals, the

development of new indicators and the implementation of a dashboard with the most relevant information and summarized, that includes information on hospital performance through an intuitive visualization and timely data on the quality of care, financial and operational costs of hospitals.

Evaluate the quality of data used is crucial to obtain reliable results and accepted by the health care providers and by the various kinds of managers in health. From this assessment, we intend to identify and propose improvements to data quality problems detected.

6.1 Future Work

In a future work we intend to realize a literature review, the definition of which indicators can be use and a prototype development and evaluation of results.

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