

# WHAT DO TEACHING AND RESEARCH COST IN TEACHING HOSPITALS? A SURVEY FROM ITALY

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## **1. Introduction**

Teaching Hospitals (THs) have specific characteristics affecting their management system. In such healthcare organizations (HCOs) a threefold function is carried out: traditional healthcare, teaching and research (Bevan and Rutten, 1987).

Nevertheless, the tripartite mission complicates the managing of THs, especially considering the different time perspectives of the three activities (Borgonovi, 2010).

The simultaneous provision of those different functions, indeed, on the one hand emphasizes the crucial role played by university hospital in health systems (Blumenthal et al. 1997) and, on the other hand, enhances the organizational complexity of these *peaks of excellence* that show, compared to non-teaching hospitals, a less efficiency (Grosskopf et al., 2001; Schreyögg and Von Reitzenstein, 2008).

International studies highlight that the major exploitation of financial resources by THs is directly correlated to both the institutional and organizational context, in which teaching and research programs are carried out, and some aspects of care such as: case-mix and severity of cases treated; quality of care; the innovative profile of treatments.

Over the last decade, the research interest on issues concerning THs assessment and containment of costs has increased, probably as a result of the fundamental pro-competitive healthcare reforms adopted by the major European countries (Saltman and Figueras 1998).

As a matter of fact, current surveys focus the attention on the urgent need to manage the THs additional costs in providing medical treatment trying to get higher levels of efficiency and effectiveness, conditions of economic sustainability and fair funding systems (Lopez-Casasnovas and Saez, 1999; Linna e Hakkinen 2006).

Starting from these remarks, this work first of all develops a comprehensive review of existing studies and institutional documentation focused on THs, in order to identify a set of indicators for the data collection in the case-study analysis. This is the first part of a more complete research project: this phase is aimed at testing the proposition that teaching hospitals submit, in the provision of health services, additional costs compared to other hospitals.

The empirical analysis is based on the development and on the implementation of a detection system focused on an efficiency analysis with respect to the costs analysis of health care services in THs e non-THs and an assessment of services provided by university hospitals, compared to non-THs.

The research can be classified as an exploratory-explanatory study (Fattore, 2005): the objective is to find a confirmation of the propositions not supported by sufficient empirical evidence suggesting a first idea of understanding the phenomenon.

The value added of the work can be identified in the effort to measure teaching and research costs of Italian teaching hospitals by testing an original set of indicators and in consequent attempt to identify an optimal financial solution.

In light of those above aims, the next section sets the objectives proposed and the research methodology adopted.

Section 3 carries out a review of prior studies on university hospitals, investigating, in particular, teaching and research costs and funding systems analysis.

After that, respectively in Sections 4 and 5 we describe results and we discuss the main findings. The last paragraph concludes the discussion.

The second phase of the research will provide a mapping of Italian teaching hospitals followed by a reconstruction of the different funding criteria adopted by Italian Regions. Such stage will allow us to use all those useful data in order to pick out which are the main characteristics of an optimal financial solutions.

## **2. Objective and method**

Some scholars recognize the additional costs of teaching hospitals in the production of health services and, therefore, critically discuss their funding system congruity through analysis in terms of resource consumption (Culyer et al., 1978; Frick et al, 1985; Bevan, 1987; Huttin and De Pourville, 2001; Cameron, 1985; Rich et al., 1990; Perrin, 1987); otherwise a proper allocation of costs between the three different functions carried out by teaching hospitals is very difficult (Bevan, 1987; Foster, 1987; Lehner and Burgess, 1995; Perrin, 1987).

Starting from such considerations, the research is aimed at testing the proposition that teaching hospitals submit, in the provision of health services, additional costs compared to other hospitals; the research proposes a comparative analysis of some cost and activity variables of two "classes" of hospitals: on one hand teaching hospitals and on the other hand non-teaching hospitals in order to highlight the "quantum" of the impact of teaching and research on the health care services production costs. To do so will be compared 2 health care organizations: on one hand a teaching hospital (TH); on the other hand is been chosen a hospital (H) located in the same territory.

Considering that the hospital is of greater dimension, with 625 beds - of which 126 reserved for day hospital and 22 for day surgery -, while the TH has 163 beds - of which 30 reserved for day hospital and 13 for day surgery -, the comparison is developed considering relative value. In other words all analysis are conducted considering the unitary values.

The empirical analysis, referred to 2008 and 2009 years, is based on the development and on the implementation of a detection system focused on an efficiency analysis with respect to the following: a) costs analysis of health care services in THs e non-THs; b) an assessment of services provided by teaching hospitals, compared to non-THs.

As regard the data source, for the hospital the information have been taken directly from the company management control system. For the TH the balance sheets has been utilized together with data directly delivered by management.

The production of services of the two hospitals, and the related costs, is connected to the activity of stay in hospital (in ordinary and day hospital regime) and to the outpatients' department. Considering the difficulty in finding data related to the outpatients' department the research will consider together the activities of ordinary and day hospital.

Finally the paper proposes a discussion of the existing funding systems for the TH, identifying optimal financial solutions in order to formulate conclusions about the opportunity to "*rationalize*" health care spending.

### 3. Teaching Hospitals: the literature review

Teaching Hospitals (THs) are characterized by a joint production of patient care, teaching and research.

Since their threefold mission and the important economic function (Blumenthal et al., 1997) that such organizations carry out in health care systems, one of the most important objectives for international studies on teaching hospitals has been to understand how to measure their performance and to increase hospitals' accountability (Langabeer 2006, Lambiase and Harrison 2007).

The first research area in this field concerns **hospital efficiency estimates** using a frontier approach. A majority of the studies utilized non-parametric techniques such as DEA or SFA (Grosskopf et al. 2001, Linna et al. 1998, Rosko 2004).

A panel design was used by Rosko (2004) to analyze changes in performance variables related to profitability, volume, and efficiency in an American sample of major teaching hospitals from 1990 to 1999.

More recently, there was a significant increase in the application of parametric models (Hollingsworth, 2003).

Although Teaching Hospitals and Non-Teaching Hospitals (NTHs) produce different outputs, which make comparisons difficult (Pardes 1997), several studies evaluating the efficiency of teaching and research based the analysis on comparisons between TH and NTHs counterparts (Cameron 1985, Frick et al. 1985, Grosskopf et al. 2001, Huttin and De Pourvouille 2001, Rich et al. 1990).

Other THs efficiency analysis have been realized in terms of **costs estimates** (in regard of teaching and research intensity) or by an **evaluation of the production function** (Jensen and Morrissey 1986), although this last subject obtained a little amount of interest among scholars.

International literature on **teaching and research costs** has been critically discussing teaching hospitals system congruity by estimating a fair level of reimbursement for such organizations; the most common approach in this field has been to estimate an indirect cost function for the hospitals (Linna and Hakkinen 2006).

While most authors constructed a behavioural cost function with a linear or log-linear functional form (Anderson and Lave 1986, Culyer et al. 1978, Hadley 1983, Rogowski and Newhouse 1992, Thorpe 1988), others applied neoclassical production theory only utilizing cost, output and price variables in the model (Sloan et al. 1983, Grannemann et al. 1986). The so-called 'hybrid functions' that include variables other than output quantities and factor price in the specification have been used by Grannemann et al. (1986).

Recently, models were used to estimate a frontier cost approach (Linna and Hakkinen 2006, Lopez-Casasnovas and Saez 1999) in which teaching and research are closely joint in care services. The first study in this field was by Zuckerman et al. (1994).

The impact of teaching and research activities has been measured by a variety of **indicators** (Linna and Hakkinen 2006). Although, there are, in fact, some negative opinions that have accompanied the use of performance measurement indicators in the healthcare sector (Broadbent et al. 1991, Pollitt 1984 and 1986, Smith 1992), if the set of indicators is defined in a correct way (Van Peursen et al. 1995), it can effectively direct management behaviours to measure progress of organizational objectives (Aidemark 2001, Churchman 1971).

Most studies have explicitly taken into account **teaching effects** using a teaching dummy. While Milne et al. (1989) engaged the number of medical students and nurses in training, Sloan et al. (1983) utilized three types of teaching dummy (medical school affiliation, approved residency program, membership on a council of teaching hospitals). The number of residents has been frequently used as an indicator of teaching reimbursement by several authors (Lopez-Casnovas and Saez 1999, Kittelsen et al. 2002), also if the best known application of a cost function to measure teaching intensity is the Pettengill-Vertrees-specification (Sheingold 1990), which generated considerable interest among scholars because it was used in Medicare's indirect medical education payments to reimburse indirect teaching costs to hospitals (Dalton and Norton 2000, Rogowski and Newhouse 1992).

More recent studies also measured the burden of **research intensity** in teaching hospitals activities. Research performance was measured by impact-weighted numbers of published articles in an assessment of Norwegian hospitals (Kittelsen et al. 2002) and also using the number of referenced medical articles published by the doctors in French hospitals (Huttin and De Pourville 2001).

Clear of the different methodologies, it is generally reported in the health economics literature that teaching hospitals are more costly than non-teaching hospitals (Cameron 1985, Frick et al. 1985, Grosskopf et al. 2001, Huttin and De Pourville 2001, Morey et al. 1995, Rich et al. 1990, Schreyögg and Von Reitzenstein 2008). There are, however, different opinions among scholars on the explanation of the additional costs.

A majority of the studies suggested that teaching medical residents may negatively affect the hospital productivity (Cameron 1985, Jensen and Morrisey 1986, Lopez-Casnovas and Saez, 1999, Sloan et al. 1983) also if, since residents are low-paid than physicians, they may be cost saving substitutes for attending doctors (Grosskopf et al. 2001).

Teaching hospitals are significantly different than other hospitals because of the complexity of the case-mix (Frick et al. 1985) and the outcome of the process of care (Taylor et al., 1999).

In an extensive literature review, Ayanian and Weissman (2002) show that for common conditions major teaching hospitals are characterized by better care services and superior outcomes than other hospitals.

Thus some authors concluded that intensity of care provided and more complex case-mix are relevant for the higher costs of teaching hospitals (Foley e Mulhausen 1986, Mechanic et al. 1998, Pesci et al. 1999, Sloan and Valvona 1986), also if others found that the different case mix explain only a low share of the differential cost (Cameron 1985, Frick et al. 1985).

Many other factors were mentioned by scholars as a cause of the additional costs, for example Anderson (1996) concluded that the accounting system has a marked effect on the efficiency.

Nevertheless, for teaching hospitals the overall impact of teaching and research on hospitals' costs has been estimated to vary between 8 and 30%. Rich et al. (1990) found an 9-30% additional cost by teaching hospitals and Cameron (1985) concluded that university hospitals are 33% more costly than non-teaching hospitals counterparts.

Using a stochastic frontier cost function to estimate teaching and research costs of Finnish hospitals Linna and Hakkinen (2006) found that teaching hospitals were underfunded regarding both research and teaching output and that the average rate of teaching and research reimbursement should be

approximately 11–15% of the total operating costs in university teaching hospitals including direct costs and indirect productivity losses.

Finally, the literature review revealed that:

- patient care, teaching and research are jointly produced in Teaching Hospitals, and there is no unambiguous way to have a clear costs allocation between their three different functions (Bevan 1987, Foster 1987, Lehner and Burgess 1995, Perrin 1987, Sloan et al. 1983).
- international literature being unanimous in recognizing a major inefficiency of THs than other hospitals tried to estimate a fair level of reimbursement for such organizations (Bevan 1987, Cameron 1985, Culyer et al. 1978, Frick et al 1985, Huttin and De Pourville 2001, Perrin 1987, Rich et al. 1990). The actual reimbursement of teaching and research costs in different countries varies from 8 to 22% of hospitals' recurrent costs. However, the supplementary payment systems require continuous assessment and monitoring as they may create incentives for the hospitals to change their behaviour (Nicholson and Song 2001).
- there are different opinions among scholars on the explanation of THs additional costs also if most studies have demonstrated that teaching and research have a marked impact on hospital costs (Grosskopf et al. 2001, Linna and Hakkinen 2006, Linna et al.1998). Particularly, most studies have found it depends on the number of residents being trained in the hospital (Cameron 1985, Jensen and Morrisey 1986, Lopez-Casasnovas and Saez 1999, Sloan et al. 1983).

#### 4. Findings and Discussion

First results are concerned with costs and revenues on beds (table 1). The Hospital (H) has 625 beds in 2009 and 642 in 2008, the Teaching Hospital (TH) has 163 beds in 2009 and 166 in 2008.

	2009		2008	
	<i>TH</i>	<i>H</i>	<i>TH</i>	<i>H</i>
<i>Total Costs/beds</i>	473.585	293.953	558.915	283.236
<i>Directs Costs/beds</i>	368.500	231.696	331.047	223.564
<i>Total Revenues/beds</i>	389.317	187.439	393.317	238.694
<i>Revenues for services/beds</i>	369.590	147.299	369.244	197.899

During the observed period cost and revenue on beds show higher values for TH than H.

In the case of H, an increase in the value of costs is recorded in 2009 and revenues, particularly total revenues, are decreased from 2008 to 2009. In the same period, for TH while revenues remain fairly constant over the two years, total costs have greatly reduced and direct costs had a slight increase.

In the next tables (table 2 and table 3) two main activity indexes are indicated: the days of stay in hospital and the DRG points. In the first table we consider the total costs incurred, in the latter one the direct costs only. Thus, we can evaluate the hospitals efficiency by comparing the costs to parameters that indicate the volume of care activities also taking into account, through the DRG points, different levels of expenditure arising from the different level of performance complexity.

	2009		2008	
	<i>TH</i>	<i>H</i>	<i>TH</i>	<i>H</i>
<i>Total Costs</i>	77.194.418	183.720.950	92.779.849	181.837.318
<i>DRG Points</i>	2.328	30.973	1.980	34.762
<i>Day of stay</i>	50.641	152.000	47.032	158.163
<i>Total Costs per DRG points</i>	33.159	5.932	46.858	5.231
<i>Total costs/day of stay</i>	1.524	1.209	1.973	1.150

The choice to use the cost for DRG points and day of stay in hospital is done in order to estimate the differences between the costs of the two structures derives from the economic literature (Beresford and Griffiths, 1970). In particular the first index is generally suggested for cost analysis of hospitals characterized from a short stays in hospital, while the second one is proposed to the aim to take in consideration the greater costs linked to the extension of the stay in hospital.

	2009		2008	
	<i>TH</i>	<i>H</i>	<i>TH</i>	<i>H</i>
<i>Direct Costs</i>	60.065.520	144.809.691	54.953.890	143.528.325
<i>DRG Points</i>	2.328	30.973	1.980	34.762
<i>Day of stay</i>	50.641	152.000	47.032	158.163
<i>Direct costs per DRG points</i>	25.801	4.675	27.754	4.129
<i>Direct costs/day of stay</i>	1.186	953	1.168	907

Because of the hospitals diverse sizes, differences in absolute values are not particularly significant while it is interesting to analyze the relative values. As assumed we can confirm the major costs of TH compared to H both in terms of total costs and direct costs.

In particular, we could note that higher direct costs of the teaching hospital allow us to confirm the further hypothesis of major consumption of drugs and diagnostic services by the hospitals where the training of medicine students is carried out (Pesci et al. 1999).

Said that, we have to consider that while the TH costs (except direct costs/day of stay index that is quite steady in the two-year period) are recording a net decrease from 2008 to 2009, the costs of H are increasing both in absolute and relative terms.

The efficiency and the productivity of the hospitals can also be observed using other two sets of indicators, the first one regards efficiency and clinical-healthcare productivity profile and the other one, efficiency and economic productivity profile.

In relation to the first set of indicators, the ordinary stay activity considers, the average DRG weight (table 4). The average DRG weight, is given by the relationship between the total of DRG points and the number of the shelters carried out in the period, it offers an indication of the consumption of

resources and of the medium complexity of a shelter. The average length of stay in hospital is given by the relationship between the number of total days of stay in hospital in the period considered and the number of relative shelters.

As can be seen from the table 4, regarding clinical efficiency, there is a substantial consistency in the value of indicators for both of the considered hospitals. With regards to TH, the analysis highlights that the average DRG weight is slightly upward in the period. Coherently, the average length of stay is also increasing. Otherwise, in the case of the hospital, both indexes are reduced in 2009.

	2009		2008	
	<i>TH</i>	<i>H</i>	<i>TH</i>	<i>H</i>
<i>Average DRG Weight</i>	0,21	1.39	0,17	1.49
<i>Average Length of Stay</i>	6,41	9,14	6,26	9,74

The second set of indicators (table 5), relative to economic productivity, shows, except for the utilization facilities rate in the teaching hospital, a reduction of hospital efficiency levels.

In both of the hospitals, from 2008 to 2009, the total allocation (OH, DH, DS) of beds has changed (from 166 to 163 units in the case of TH and from 642 to 625 units in the case of H) and, especially, the number of patients discharged has also reduced (from 11.364 to 10.859 units in the case of TH and from 23.241 to 22.356 units in the case of H).

	2009		2008	
	<i>TH</i>	<i>H</i>	<i>TH</i>	<i>H</i>
<i>Medical Staff Productivity</i>	54,3	54,7	58,2	61
<i>Total Turnover Index</i>	66,7	35,8	68,4	36,1
<i>Utilization Facilities Rate</i>	85,12%	66,63%	77,61%	67,39%

The utilization facilities rate - given by the relationship between the days of hospitalization made and the beds for working days - does not show an adequate level of capacity utilization of the non-teaching hospital respect to teaching hospital; although the value of the average length of stay is content the total turnover index - given by the relationship between the number of patients discharged and beds - shows that the hospitals appear not to be properly used. Such analysis must also take account of not negligible values such as the average DRG weight: an higher value indicates a greater complexity of diseases and, therefore, a larger use of structural and human resources.

Furthermore by analyzing the values of the average length of stay, teaching hospital seems to be more efficient than non-teaching hospital although there is a slight increase of the TH index and a slight decrease of the H index in the observed period. However, as reported by the literature (Pesci et al. 1999) teaching hospitals are able to reduce days of stay in operating units where the level of specialization and severity of cases is low. The situation changes in the case of high-specialty units where patients present higher level of complexity disease respect non-teaching hospital. For this reason we believe that it should be necessary to investigate the average length of stay and the average DRG weight by analyzing systematically the most representative operating units.

Finally, we have to consider that for both of the hospitals the medical staff productivity (number of patients discharged / medical staff units) is falling in the period because of the increasing number of doctors (from 195 to 200 doctors in the case of teaching hospital and from 381 to 409 doctors in the case of the hospital) does not correspond to an increase of the hospital productivity in the number of patients discharged.

## **5. Conclusion and future research directions**

This paper performs a comparative analysis of some cost and activity variables of THs and non-THs, with the primary aim of testing an original set of indicators for measuring teaching and research costs. The literature review points out that several researches recognize the additional costs of THs, in the production of health services, and highlights the urgent need to manage the additional costs trying to get higher level of efficiency and effectiveness.

The objective of this study was to test the proposition that Italian THs support additional costs compared to non-THs and to provide some suggestions regarding the opportunity to rationalize health care spending. It is motivated by the recent debate about the “fair funding systems”, as result of the healthcare reforms adopted by the major National Health Systems.

The prior results of the research suggest that higher direct costs of THs are confirmed. The outcomes of the average length of stay index also indicate that TH seems to be more efficient than non-TH, although there is a slight increase of the TH index in the observed period.

Even though the results cannot be generalized, we believe that this analysis would prove our propositions, and would positively support the set of indicators.

However, our study does not come without limitations: there are many ways in which this work can be improved.

First, one aspect that is not captured in the analysis is the set of variables that looking at other measures such as investment of technology, risk management and quality of care. Second, it is clear that the present research is a pilot study: the model must be applied to a representative sample of THs and non-THs. Finally, in the analyzed cases, we also have not yet incorporated any characteristics of regions/countries or health care systems.

There are some fruitful areas of future research to pursue.

First, future research can extend the analysis to include additional cases of THs and non-THs. Second, with available database, future study can investigate the existence of economies or

diseconomies of scale effects and explore the long term efficiency differences between THs and non-THs. Third, future work can develop a map of Italian THs, that is an useful tool to reconstruct the funding criteria adopted by Regions, with a focus on agreements between the Regions and the Universities. Besides, from a policy point of view, more accurate efficiency estimates are crucial in guiding policy decisions of designing financing systems.

## 6. References

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