Title: Planning,budgeting and control systems,and management strategies of inputs in lean hospitals: literature review and potentialities of HTA

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Abstract

Background:
In recent years, the major organizational changes in healthcare took place in the hospital setting through the progressive adoption of the lean hospitals. A similar evolution requires a redefinition of the planning, budgeting and control systems. Then, we aim to review the scientific literature regarding the planning, budgeting and control systems and management strategies of inputs in hospitals with intensity of care organization. Our secondary outcome was to prearrange a Health Technology Assessment concerning organizational and reorganizational processes in the Italian setting.

Methods: We conducted a review, using four databases, regarding processes and pathways-based systems of planning, control and management. The search was completed using a snowball strategy and through reference list screening.

Results: We included in the review 11 studies. The main strategies of analysis emerging from our review were Activity Based Costing (ABC) and its revised forms including Simplified-Activity Based Costing (S-ABC), Time-Driven Activity Based Costing (TDABC), and Activity Based Management (ABM). Furthermore, the analysis outlined that most of the reorganizational experiences retrieved were only partial, not completely replacing the previous organizational approaches. The Health Technology Assessment design was widened through some Italian experiences. However, data regarding national experiences appeared scarce.

Discussion: Considering the paucity of available data regarding process-based analysis in intensity of care reorganization, further studies with rigorous and multidisciplinary approach are required. However, a key element was the importance of aligning the new organizational structures to innovative planning, budgeting and control systems. In this framework, the Health Technology Assessment represents a useful tool for all hospitals projecting similar reorganizations.

Keywords: Intensity of care; management strategies; Health Technology Assessment

1. Introduction

The constant growth of population's health needs led to the fragmentation of medical approach towards patients, translating in highly specialized units within healthcare organization [1-3]. This phenomenon is often associated with poor efficiency and potential services duplications, resulting in a risk for budgetary balance [1-3]. Progressively, the amount of money spent for healthcare by both countries and individuals has increased [3- 5]. However, in recent years, healthcare managers worldwide had to deal with budget restrictions, maintaining or improving in the same time the quality of care [5, 6]. In this difficult context, processes orientation represents an important endeavor in order to ameliorate cost-effectiveness as well as medical outcomes [3]. Consequently, within the clinical governance, several tools, aimed to project, standardize and evaluate clinical processes, were developed including clinical pathways, clinical audit, and guidelines [3, 4, 7-9]. This transition translated into hospital rearrangements including, also in Italy, the intensity of care reorganization [10-12]. A similar restructuring aims to overcome the traditional Department establishment related to specialist disciplines. Indeed, traditional Departments are replaced by aggregations arising from case gravity and complexity of care [11, 12]. A similar organization appears patient-centered and requires four main organizational changes namely clinical integration, resource integration, focus on patient and engagement of clinicians [12]. The inherent logic of intensity of care arrangement includes multidisciplinary integration through the enhancement of healthcare pathways, conjugating safety, effectiveness and efficiency of care [4, 12]. Furthermore, the reorganization according to intensity of care introduced innovative professional figures as medical tutors or case managers, designed to enhance the integration process [3, 4, 12]. As mentioned above, these changes required a hospital redefinition through the employment of new planning, budgeting and control systems [13]. A similar reorganization also required new cost accounting methodologies, directed to evaluate these processes [10]. Indeed, traditional methodology assesses cost vertically; conversely, processes-based systems require horizontally oriented cost estimations [10, 14]. In this context, the planning, budgeting and control systems aim to reach the selected goals throughout the most effective and efficient modalities [13]. Recently, the attention towards performance evaluation significantly grew, shifting the focus towards corporate processes [14]. Besides, the process-based management presented several advantages including the transition to a transversal vision, the reorganization of responsibility system, the accurate evaluation of healthcare outputs and a better monitoring of management [cycle of continuous improvement of results] [3, 15]. A similar organization is highly topical considering the recent launch of new approaches of care [13]. In this context, the Health Technology Assessment [HTA], a multidisciplinary analysis of healthcare technologies, appears worthwhile [16, 17]. Indeed, organizational and managerial strategies can be the potential target of HTA, focusing on multiple aspects as performance, impact, effectiveness, costs, and ethical and social repercussions [18]. In this way, the HTA supports decision makers, leading to evidence-based decisions [19]. Given the potential application of HTA methods to a wide range of healthcare levels, this strategy acts as a connection between clinical and managerial worlds [16-19].

Then, the aim of our work is to review the scientific literature regarding planning, budgeting and control systems and management strategies of inputs in hospitals with intensity of care organization. Based on the review findings, our secondary outcome was to formulate a HTA evaluation regarding the organizational and reorganizational processes. Besides, we intend to individuate specific organizational models in the Italian setting, in order to compare hospitals arranged for intensity of care.

2. Methods

In order to investigate the systems of program, management and control in hospitals organized in accordance with intensity of care, we reviewed the available scientific evidences. For this purpose,

on June 2014 we conducted our search using the following four databases: PubMed, EconLit, Ebscho, and Ovid. After a first examination of the main management and control models, we elaborated some specific search strings, employing multiple search strings as summarized in Table 1.

Table 1 The table summarizes the search strings used for our literature review, including specific terms and potential synonyms.

Measurement	Setting [AND]	Measuring Instruments
- Lean management OR - Lean thinking OR - Lean process OR - Lean methodology OR - Clinical pathway OR - Intensity of care	- Health care OR - Hospital	- Cost Accounting OR - Lean Accounting OR - Lean Cost Accounting OR - Budgeting OR - Value Stream Mapping OR - Activity Based Costing OR - Activity Based Budget OR - Activity Based Management

The search was completed using a "snowball" strategy and through the reference list screening of the retrieved papers.
Studies were considered eligible for inclusion if:

- They were written in English or Italian languages
- They were published after 2000
- They considered the planning, budgeting and control systems of inputs based on clinical pathways and processes

Studies were excluded if:

- They did not focus specifically on health care settings
- There was no full-text available

Three public health researchers, supported by health economics experts, independently conducted this search. Then, a first selection, based on title and abstract, allowed the exclusion of duplicated and irrelevant sources. Finally, the second screening was conducted after full text reading.

2.1 Data Extraction

In order to summarize the data of interest, the investigators independently extracted for each paper the following information: country in study, publication year, setting, study design, modality of data collection, reported keywords and model of analysis.

2.2 Formulation of Health Technology Assessment evaluation

The main findings of the first phase of the study were employed to set up an HTA evaluation of the organizational models. The potentialities of HTA within an intensity of care reorganization were discussed and the parameters required for the evaluation were individuated in order to describe the clinical, economical, organizational and social consequences subordinate to intensity of care reorganization. Besides, considering the program and control systems, we selected comparable hospitals, in the Italian context. The HTA method includes the definition of the main outcomes, the sharing of available information, the delineation of a reproducible methodology, the analysis of

information gap, the detailed description of intensity of care organization and the identification of the all the possible impacts [clinical, economical and ethical] of a similar reorganization.

3. Results

Our search returned 263 results. After removing duplicates and irrelevant sources, we obtained eight articles for full text review. This selection was further extended using the "snowball" strategy and the reference list screening, obtaining five additional papers. The final selection included 11 sources (see Figure 1).

Figure 1 Flowchart - The figure summarizes the selection procedures of our review.

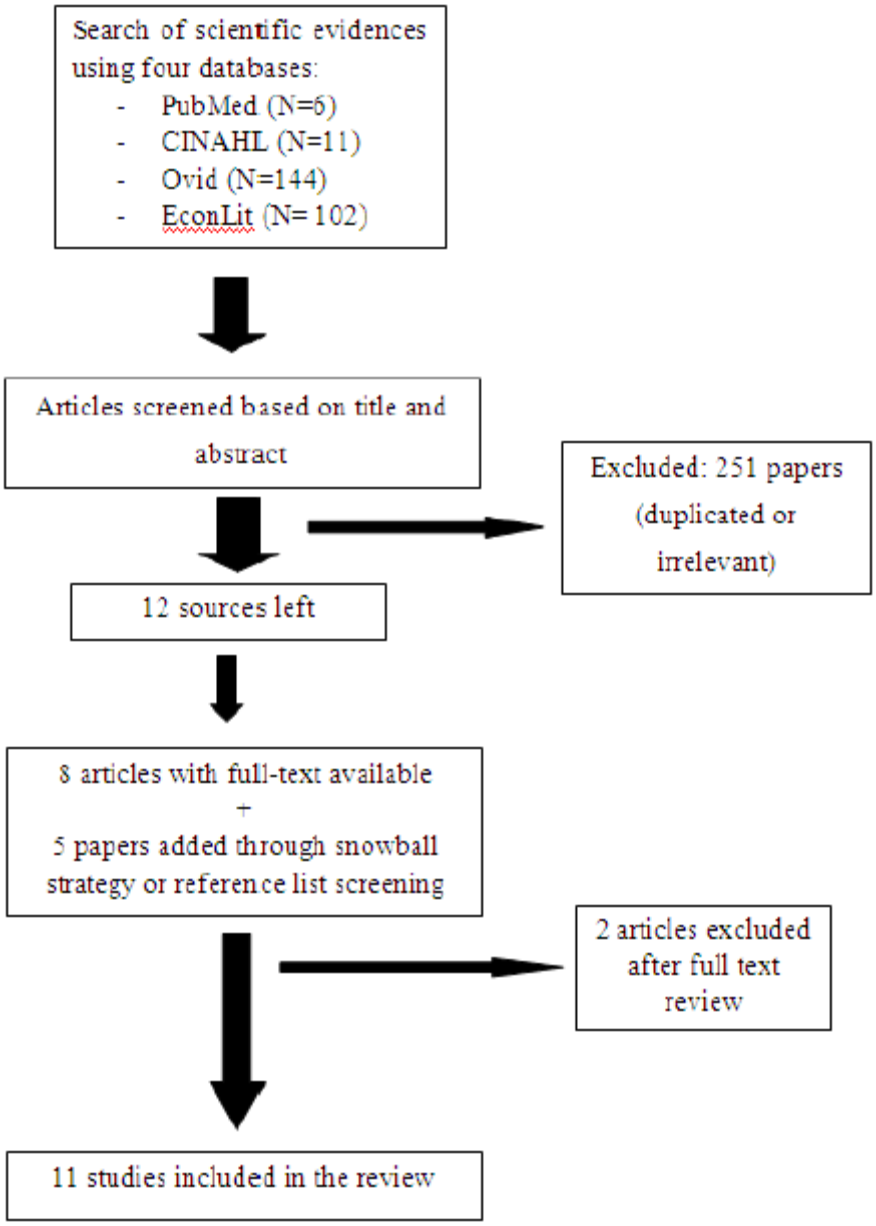

Table 2 The table summarized the main characteristics of the studies selected during the review process including country, year of publication, setting, study design and strategy of analysis.

Table 2 Summarized main characteristics of the retrieved studies.

Article	Country	Year	Setting	Study Design	Strategy
Ak Ergun et al.	Turkey	2013	Pathology laboratory services in hospital	Cost-analysis	ABC
Alrashdan et al.	USA	2012	Diagnostic service	Cost analysis	ABC e ABM
Cao et al.	Japan	2006	Hospital [example of three laboratory tests]	Cost analysis	Simplified-ABC; ABC; versus VBC
Devine et al.		2008		Framework	ABC, ABC/M
Goldberg et al.	USA	2011	Hospital [GI Unit - endoscopic activity]	Cost analysis	ABC, ABC/M
Lee et al.	USA	2003	Long-term care facilities	Cost analysis	PBC
Lin et al.	Taiwan	2007	Department of Colorectal Surgery in a public teaching hospital	Cost analysis	ABC
Oker et al.	Cyprus	2013	General Surgery Department of a private hospital	Cost-analysis	Time-driven-ABC;
Reed et al.	USA	2012	Pilot Testing in Heart Failure management	Development of economic tool	Specific costing tool
Ridderstolpe et al.	Sweden	2002	Heart Center	Cost-Analysis	ABC
Yereli et al.	Turkey	2009	UniversityHospital	Cost analysis	ABC

3.1 Review findings

The first observation outlined from the literature review was the heterogeneity of the intensity of care organizations. Indeed, in some cases a similar organization involved the entire hospital, while

in other cases it was limited to specific Departments or interested only the organizational aspects. The main strategies used to assess general production expenses, emerging from our analysis, were the Activity Based Costing [ABC] [5, 10, 20-23], and its adaptation: the Simplified-ABC [24], the Time-Driven-ABC [25] and the Activity Based Management [ABM] [10, 23].
The ABC is a calculation methodology aimed at identifying all activities of the healthcare production, and at assigning to each of these activities the corresponding cost. The purpose of this method is, therefore, to undertake an activity-oriented analysis rather than focusing on which units generate a given cost. Overall costs are composed by direct [directly linked to the service performance] and indirect costs [allocated to multiple services]. This strategy provides accurate costing information to managers. In particular, it permits to individuate areas of inefficient resources' use. Nevertheless, considering the great number of different activities taking place in hospitals, data collection for this model appears time consuming and costly [5, 10, 20-23]. The simplified-ABC is a simplification of the strategy described above, that, decreasing the cost drivers employed, obtains a workload reduction [24]. A further alternative strategy is the Time-Driven-ABC. This strategy introduces in the analysis the time parameter, considering two factors, namely the capacity cost rate and the time required to execute an activity. This analysis simplifies standard analysis, reaching a more applicable model [25].
Ergun et al. in their study compared the ABC strategy to the Current Pricing System, focusing on the Turkish setting. This study clearly highlighted that the ABC strategy was more suitable than Current Pricing System in both providing real costs and analyzing in details activities expenses [5]. These findings are in accordance with Alrashdan et al. [20] and Lin et al. results [21]. The first study assessed the ABC implementation to evaluate diagnostic outpatient procedures, adopting a processes orientation [20]. The second study implemented the ABC methodology to evaluate the costs for inpatients following colon-rectal surgical procedures. This analysis was employed also in order to individuate potential inappropriate procedures. The main purpose was to standardize healthcare processes and in this way improve the overall quality [21]. Moreover, when correctly implemented, the ABC methodology appeared useful in improving costs management and in supporting managers regarding strategic arrangements [26]. As observed by Ridderstolpe et al. [2002], considering a Swedish Heart Center, the employment of the ABC methodology in hospitals led to new potential evaluations such as process and activity analysis and price calculations. The primary objective of this analysis was, indeed, to map all healthcare processes in order to obtain quality improvement containing in meantime costs. Each process is further dissociated in several sub-processes and activities, hierarchically structured. Process mapping appeared feasible and useful, supporting the individuation of non-efficient steps [10].

As above-mentioned, the ABC strategy resulted time and cost consuming; then Cao et al. projected a simplified methodology [Simplified-ABC] in order to reduce workload. This particular model of analysis combined two primary benefits as methodology simplification and accuracy of results. Indeed, the greatest difference retrieved in cost accounting between Simplified-ABC and traditional ABC was lower than 3%. On the contrary, the differences found comparing ABC to Volume-Based Costing were significant [up to 60%] [24].
Another variant to ABC, namely the Time-Driven-ABC, was analyzed by Oker et al. [2013]. This recent study, conducted in the General Surgery Department of a Cypriot private hospital, outlined the preferable implementation of this methodology to fast-changing organizations. Deriving from traditional ABC strategy, the Time-Driven-ABC presents remarkable similarity with it. However, this newer strategy introduces "time" as a further costing item, evaluating not only actual activity, but also the unused capacities. In summary, considering time, the practical capacity was defined [25].

In addition, the ABM, as the previously described revised ABC strategies, represents an evolution of the traditional ABC. This methodology is a process analysis tool based on activities management. The primary aim of similar analysis is to distinguish efficient and inefficient activities, in order to improve their value. Besides, ABM connects standard ABC with other methodologies including performance measurement and benchmarking, supporting more accurately decision makers [10, 23].
Finally, the Process Based Costing [PBG], described by Lee et al., is composed by four main phases: the development of a flowchart, the estimation of resource use, valuing resources, and the calculation of direct costs. The main advantage of this strategy is the potential assessment of costs related to quality improvement, without requiring complex analysis programs [27].
Devine et al. outlined that for all the previously cited strategies is essential the availability of a sophisticated Information Technology system. Indeed, at least data regarding pharmacological, personnel and supplies costs are required, as well as information related to the activity time [26].
In order to facilitate the cost estimation, Reed et al. devised a spreadsheet program aiding healthcare professionals concerning budgetary proceedings. This informatics tool was implemented considering Heart Failure management, and it has proved user-friendly as well as reliable in its estimations [28].

3.2 Formulation of Health Technology Assessment process

In order to set up a HTA evaluation to compare planning, budgeting and control systems in hospital arranged for intensity of care, we widened our analysis considering specific Italian data. In particular, we considered a study describing some local reorganizational experiences, in order to identify the main organizational variations [13]. In this work, the authors individuated five dimensions of the reorganizational process: the push for change [as a top-down or a bottom-up approach], the setting of reorganization [all the hospital or part of it], the effects on permanent inputs management [e.g. the number of beds, the technologies], the individuation of responsibility centers, and the junction between economic responsibility and corporate budgeting. These same dimensions could effectively be employed in projecting the HTA model. The best example of a similar reorganization in Italy can be individuated in Poretta Terme Hospital located in Bologna Local Health unit [13]. Indeed, in 2010, this hospital generated three patient areas, namely high, medium or low intensity of care. We chose this hospital inasmuch changing in budgeting strategies were available. In this context, two responsibilities can be individuated: clinical and process responsibilities. The clinical responsibility is attributed to medical staff, which elaborated, supported by the case manager, the patient pathway within the hospital, individuating the modality and the expected date of discharge. The process responsibility is ascribed to nursing staff, ensuring continuity of care. The reorganizational experimentation taking place in the considered hospital brought to the transition toward an Activity-Based Budgeting, considering the processes as a set of activities. This strategy is based on transversal clinical pathways.
Other Italian experiences resulted only partial. We employed as examples the Sant'Anna of Como Hospital and the Hospital of Legnano, Cuggiono, Magenta and Abbiategrasso. In these hospitals, the intensity of care reorganization is not complete and the hospital are yet partly organized following the traditional Departmental point of view [13].
Ultimately, the limited Italian experiences outlined that organizational systems changes required longer times compared to reorganizational processes. Moreover, not always these changes resulted perfectly aligned. These observations are essential when projecting the HTA evaluation. Indeed, a "settling time" is needed in order to analyze the variations in planning, budgeting and control systems. Moreover, the evaluation of reorganizational models appears extremely important for all those hospital in process of implementing similar changes. Considering also the findings of our review, it results particularly important to identify all actors involved and the specific setting.

However, first of all, an univocal definition of intensity of care organization is necessary, and unfortunately not always available especially considering Italian setting.

4. Discussion

In recent years, the attention toward performance evaluation has significantly increased, in order to achieve corporate objectives [1-6]. In this context, several measurement devices were developed, focusing on activity and processes and providing more accurate data [10, 13, and 14]. Therefore, there was a progressive transition towards healthcare management, ensuring a more objective representation of corporate performances.

A common element detected by our study was the need of an alignment between new organizational structures and innovative planning, budgeting and control systems [10, 13, and 25]. In all the cases examined, the reorganizational process was only partial, without the complete replacement of previous models [13]. The experiences retrieved in our analysis were heterogeneous also considering settings as some affected all the hospital, while the greatest part was limited only to specific Departments or procedures like surgical or diagnostic fields. In particular, the few Italian experiences detected highlighted that organizational systems' changes required longer times compared to reorganizational processes, the so called "settling time" [13]. Consequently, when projecting a HTA evaluation, it results important to consider this effect. Moreover, it appears important to settle a univocal definition of intensity of care organization, to date not always available especially considering Italian setting.

The main evaluating strategy emerging from our analysis is the ABC, in its traditional [5, 10, 20-23] or revised forms [24, 25]. This specific strategy was applied also in the only Italian retrieved experience [13]. In particular, our review outlined the potential and effective applicability of ABC analysis and its revised forms in various healthcare settings, including intensity of care reorganization in hospitals [5, 10, 13, 20-23]. Moreover, our review identified this strategy as more accurate than standard cost accounting, thanks to its activities orientation. However, the correct employment of similar methodological tools demands specific personnel trainings as well as further insights regarding the models and the available information, as outlined also by Riddlestop et al. [10]. Moreover, the process-based reorganization appears both time and money consuming, and needs for its correct implementation acceptance commitment of employees as well as a program of overall reorganization. The mapping of processes, required by similar analysis permitted, moreover, to individuate any inefficient activity, in order to rationalize and improve clinical processes. In particular, Riddlestop et al. highlighted the role of the ABC analysis even in evaluating the congruity of practical guidelines, supporting multi-disciplinary decisions [10].

In particular, in our review, we did not find scientific evidences regarding Italian hospitals. Thus, extending similar evaluations to our context resulted difficult. The main limitations to the implementation of process-based systems is represented by the emergence of employee resistance to organizational changes. Another potential issue appears to be the regional budgeting policies.

Considering the paucity of available data regarding process-based analyses in intensity of care reorganization, further studies are required to better describe the effectiveness in changing organizational models. In this framework, the HTA represents a useful tool for all hospitals projecting similar reorganization. Finally, considering the shortage of similar evaluation experiences and the high complexity of these models, further studies with rigorous and multidisciplinary approach are desirable. Fortunately, in the next years, thanks to an increasing amount of information regarding experimental reorganizations, the HTA will become more and more feasible in similar contexts, in order to overcome all the potential arising obstacles.

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