

How CEOs use management information systems for strategy implementation in hospitals

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Abstract

Institutional and market changes seem to force hospitals across the Western world to revitalize their corporate strategies towards more cost efficiency on the one hand, and more flexibility towards customer demands on the other hand. Hospitals, however, apparently differ in the extent to which they are able to implement such strategies effectively. This paper explores whether these different levels of effectiveness depend on how hospitals' top managers' use of the available management information systems (MIS). Based on data obtained from the 218 CEOs of public hospitals in Spain, we analyze how CEOs' professional and educational backgrounds affect their use of MIS, and how the use of the MIS subsequently supports or inhibits the implementation of these strategic goals. The results indicate that CEOs with a predominant clinical background focus more on non-financial information for decision-making and prefer an interactive style of using MIS, which together support flexibility strategies. CEOs with a predominant administrative background seem more effective in establishing cost-reduction strategies, through their larger inclination to emphasize financial information in combination with a diagnostic use of the MIS. Implications for the strategic management of hospitals are outlined.

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1. Introduction

The medical industry across the Western world is currently involved in processes of serious strategic and managerial reorientation [1,2]. These processes originate in a number of different structural and demographic developments, such as the progressive ageing of the Western population, the impact of new pathologies and technologies, autonomous increases

in health care demands by citizens, and the need to repair supposed inefficiencies in the design and running of national health care systems [3–6]. In several countries, such as Spain, formal legislation requires regional health care authorities to encourage hospitals to become flexible organizations that are more receptive to the demands from the public, and to offer these higher quality services at lower cost [7,8,9]. Although these strategic goals and policies are not mutually exclusive by definition, the strategic management literature suggests that the organizational requirements for the effective implementation of qual-

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ity strategies and cost-reduction strategies may differ strongly [10,11,12]. This explains why hospitals pressed towards both cost reduction and flexibility enhancement may often perform better on one strategic dimension than the other [1,4,10,13]. In this paper we analyze the impact on strategic performance of hospitals of a combination of two such types of organizational requirements, which are the characteristics of the hospital's CEO and of the hospital's management information system (MIS). Based on the upper echelon theory of organizations, which recognizes the impact of managers' backgrounds on their subsequent choices and behavior [14,15], we develop a model that explains hospital's pursuit of strategic objectives by the way in which CEOs with different educational and professional backgrounds use the hospital's MIS differently [14,15]. In particular, we expect systematic differences between hospital CEOs with an administrative and with a clinical background in their use of the MIS, which subsequently affects the hospital's strategic focus. For the aim of this paper, we define a MIS broadly as the information system that provides management with information about financial and operational aspects of hospital management. Typical information elements contained in a hospital MIS relate to financial data on operational budgets, cost information per patient, per activity or treatment, and non-financial data on such diverse issues as number of treatments, bed occupancy, staff absenteeism and discharge rate [16,17]. Although it is obvious that any MIS plays an important role in day-to-day hospital management [18,19,20], we investigate the strategic role of MIS use here, which is increasingly acknowledged in the contemporary strategic management literature [1,4,5,10–13]. This literature in particular suggests that quality enhancement and cost reduction may require quite a different use of MIS by hospital management [20,21]. In sum therefore, we will contrast the clinical versus administrative background of CEOs, explore whether CEO background reflects in their use of the hospital's MIS, and how this use of MIS explains the subsequent pursuit of strategic policies by the hospital.

2. Theory and research objectives

As CEOs are ultimately responsible for strategy implementation, they can and will influence the deter-

mination and implementation of organizational strategy [15,22]. CEOs may do so consciously, choosing courses of action that are rational and optimal, but, as research has demonstrated, also less consciously using heuristics and 'standard' patterns of thinking. The upper echelon theory in particular predicts that CEO background plays an important role in determining the behavior and choices of the CEO, and the organization overall [22,23]. Research on managerial decision-making shows that CEOs' decisions are determined and biased by patterns of knowledge formed by previous experience and training. These patterns and the associated heuristics enable them to make decisions and take actions without consuming much time and cognitive resources [14,22,23]. The upper echelon perspective in particular asserts that for hospitals the 'clinical' or 'administrative' orientations of hospital CEOs may be a good predictor of subsequent choices and behaviors [23,24,25]. Clinical managers have a dominant background in medicine or nursing, which are areas that are strongly related to the core operational processes in the hospital. Administrative managers, instead, are defined as those who have a dominant background in areas such as law or business that are general to a larger range of organizations. Research confirms that these different backgrounds cause different behaviours, and different outcomes for the organization overall [25,26,27]. As clinicians have typically been educated and trained in the technical core activities of the organization, they are knowledgeable about applying medicine and providing care in hospital [15,26,27]. Moreover, they are socialized into giving priority to the needs of individual patients regarding care, the allocation of resources and the provision of (emotional) support [26,27]. While clinicians may be committed to the hospital, they are often expected to give higher priority to the interests of patients. This supports the belief held by some that clinicians do not make good managers, since management requires watching over the interests of the collective organization rather than the individual patient [25,26,27]. In contrast, administrators have been educated and have experience in general management and business administration [25,26]. They are more likely to stress the needs of the organization, rather than the individual [25,26], and rely more on formal and hierarchical forms of management [27]. In times of strategic pressure, these skills seem particularly valuable. Research confirms the prevalence and relevance

<i>Parameters</i>	<i>Administrators</i>	<i>Clinicians</i>
Training	Short; on-the-job; general skill	Extensive; external; specialized skills learned.
Task	Partial: Interdependent with other tasks	Complete tasks
Loyalty	To the organization	To the profession
Career	Ascent in organizational hierarchy	Ascent in the professional hierarchy
Source of power	Accountability and administrative authority	Collegial influence
Enforcement	Sanctions, tight control and direction	Advice, rituals and ideology
Autonomy	Underspecification of ends and overspecification of means	Extensive autonomy and participation in determination of ends as well as means
Supervision	Close supervision	General supervision only; professional standards of evaluation

Fig. 1. Differences between clinicians and administrators in managing hospitals. Source: Bacharach et al. [26].

of these managerial archetypes. Fig. 1 shows typical differences between CEOs with a dominant clinical backgrounds ('clinicians') and CEOs with a dominant administrative background ('administrators') based on a study by Bacharach et al. [26].

Upper echelon research has argued and demonstrated that differences in the experience of top managers not only explain differences in managerial behavior and strategic choices [22], but also in the management techniques and information processes they choose to apply in their tasks [14]. Abernethy and Stoelwinder [20], for example, showed that administrators have a higher preference for formal controls than clinicians, and they use MIS more for economic decision-making than clinicians. In another study, Abernethy [28] found the managerial competences of medical directors in hospitals to be a necessary condition for the effective use of control systems in hospitals. The relatively straightforward argument was that medical education, which emphasizes patient care and is directed towards

improving patients' health, is quite different from business school education, which emphasizes organizational performance. Thus, clinical and administrative managers will emphasize different elements of an organizational information system. This may increasingly be the case when considering the use of MIS for strategic management. Indeed, information from the MIS is relevant in all three phases of a typical strategic management cycle, i.e. strategy formulation, strategy implementation and performance feedback [1,11,18,29,30]. During strategy formulation, the MIS is used for exploring and evaluating strategic alternatives and the viability of available strategies vis-à-vis the strategic needs of the organization [1,11]. During strategy implementation, the MIS should support financial analysis, results monitoring and information on resource deployment [11,30]. Finally, in the control and feedback stages, management information should provide information on the drivers of success, as well as on the causes of failures [18,29]. Available evidence sug-

<i>MIS features</i>	<i>Administrators</i>	<i>Clinicians</i>
Supervision	Close-Control to evaluate performance	Self-Control, discretion and work autonomy
Governance	No debate or discussions, top-down management	Focused on negotiation, discuss and share decisions with other members of the organization
Management Emphasis	General activities. Efficiency and effectiveness of the organization.	Core activities. Effective distribution of the task and means according to the workload and processing time.
Skills	Focused on organizational performance and how to improve the financial position of a firm	Focused on the patient care and how to improve the health of patients.

Fig. 2. Differences between clinicians and administrators in using MIS. Source: based on Benveniste [25], Bacharach et al. [26] and Lawson and Rotem [27].

gests that clinicians and administrators will use the MIS differently which affects each of these three phases. Fig. 2 shows the different features of the use of MIS by administrative and clinical managers based on extant research [25,26,27].

To explore the differential use of MIS made by different CEOs, we choose to focus on three types of MIS use, which are the type of information CEOs prefer, the main perceived purpose of management information, and the management style in which they use MIS [29,30,31]. The *type of information* preferred by CEOs expresses the distinction between financial and non-financial (operational) information [31,32]. Financial indicators are generally seen as relevant and objective for measuring short term costs and economic performance, but less so for in the long run, as they may cause myopia, risk aversion [33], and history-fixation [34]. Non-financial (operational) information may be more actionable and controllable [31], and more future oriented [29], but may come at the cost of higher subjectivity [32]. This distinction is relevant in light of recent discussions on balanced-scorecard type information systems. As regards the dominant *purpose of management information*, we distinguish between the decision-making and performance evaluation functions of MIS [35,36]. Resource allocation decision-making refers to the distribution of resources among different units or services of the organization. These decisions are important for ex ante planning and coordination future action. Performance evaluation decision-making refers to ex post monitoring and supervision. The third aspect we explore regards the *management style* that CEOs apply using the MIS. We distinguish between a diagnostic style and an interactive style of using

MIS, following a typology developed in the management literature recently that we will explain briefly now [30,37,38]. A diagnostic use of the MIS emphasizes the use of MIS for ‘diagnosis’, i.e. the observation of deviations of organizational processes from a preset norm. This use of MIS reflects a management style that relies on standard setting, measuring, comparing, and taking corrective actions, and which emphasizes monitoring, top-down control and the pursuit of efficiency [21,30,37]. Instead, the so-called interactive use of the MIS emphasizes its role to engage in ‘interaction’ with organizational participants. This reflects a management style in which higher level managers ‘involve themselves regularly and personally in the decision activities of subordinates’ [30, p. 95]. The defining feature of interactive MIS use is the continuous interaction and exchange of information between organizational members, across levels and functions which is believed to encourage organizational learning, and stimulate creative responses to environmental changes [30,37,38]. MIS information is used as a trigger for dialogue, rather than the conclusion of a dialogue. Some of the salient features of diagnostic and interactive use of the MIS are summarized in Fig. 3 which is based on extant empirical research [21,30,37].

Finally, in line with the strategic management literature [1,4,10–13], we expect that the use of the MIS subsequently influences the implementation of the strategic goals. We expect differences between strategic goals that are formulated in terms of cost reduction and goals that are formulated in terms of quality enhancement, in line with the multiple objectives of the Spanish government, and the typology of Porter [10]. Porter distinguishes between quality-oriented strategies, which

<i>Parameters</i>	Diagnostic use of MIS	Interactive use of MIS
MIS focus	Detecting negative variances from plan.	Signalling key areas for strategic improvement.
Objectives	To monitor and reward the achievement of pre-established goals.	To expand opportunity seeking and learning throughout the organization.
Manager's view of MIS	As a tool that provides diagnoses and information about critical performance indicators of the organization (“Answering Machine”)	As a tool that stimulates continuous challenge and debate concerning data, assumptions and action plans (“Learning Machine”)
Involvement of top management	Little discussion of data with subordinates during execution. Much discussion based on period results.	Much discussion and interpretation of data among organizational members of different hierarchical levels during execution.

Fig. 3. Differences between diagnostic and interactive use of MIS. Source: based on Simons [30] and Henri [37].

<i>Characteristics</i>	<i>Strategy focused on cost</i>	<i>Strategy focused on quality and flexibility</i>
Level of Detail	Detailed and tight controls made possible by the stability of the environment	Flexible controls to allow for the changes required in the environment
Focus	Problem solving with little assistance for new product development and opportunity identification	Accommodates an environment where sharing information is encouraged and necessary with a focus on opportunity identification
Nature of Jobs	Jobs are tightly defined and relatively static	Jobs are broadly defined and evolving.
Power Centers	Decision-making and control are largely centralized	Decision-making and control are largely decentralized.
Goals/Objectives	A premium is placed on efficiency and standardization	A premium is placed on effectiveness and uniqueness
Control Environment	Work rules abound with prescriptive controls being emphasized as consequence of environmental stability	Work rules are non-existent with general guidelines substituted as consequence of environmental dynamism

Source: Based on Porter [6] and Miles and Snow [35].

Fig. 4. Relationship between MIS and strategic policies. Source: based on Porter [10] and Miles and Snow [13].

require the use of MIS to facilitate product customization, rather than standardization, and which support both coordination, and decentralized autonomy. Cost-oriented strategies, instead, require the use of MIS that support the standardization and comparability of products and activities, and allow the assessment of the efficiency of units and services of the organization [10]. Fig. 4 shows the relationships between MIS characteristics and the pursuit of cost-oriented and quality-oriented strategic policies based on the strategic management literature [10,13].

Fig. 5 displays the relationships we analyze in a comprehensive model that allows us to investigate whether there are systematic differences between hospital CEOs with an administrative and clinical background in their use of the MIS, and subsequent pursuit of strategic objectives.

With these observations in mind, a study was designed to answer the following four questions:

1. Does CEO background affect their preference for *financial* versus *non-financial* information from the MIS?

2. Does CEO background affect their use of the MIS for *decision-making* versus *performance evaluation*?
3. Does CEO background determine whether they use the MIS *diagnostically* or *interactively*?
4. What is the effect of the (different) uses of the MIS on the implementation of strategic policies aimed at *cost reduction* and *flexibility and quality enhancement*?

3. The empirical study

The strategic challenges that the medical industry in general [13,19], and hospitals in particular, face to improve quality, and efficiency at the same time [6,10,13,39] appears to affect the medical industry throughout the Western world. We chose to conduct our study in the Spanish public hospital setting, where the cited developments are especially prevalent and well documented [7,40,41]. Recently, the Spanish health care system has undergone several reforms that aimed at reducing bureaucracy, lower operational costs and

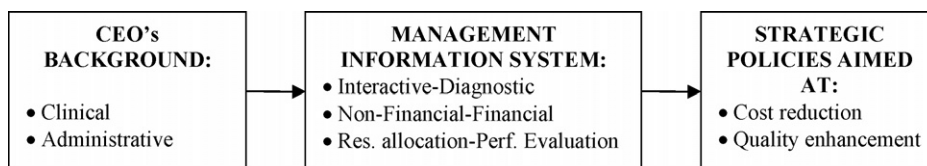


Fig. 5. The general model.

enhance quality and effectiveness [6,40,41]. Therefore, in line with Madorrán and de Val Pardo [7] we believed that a study in Spain would be informative for the research questions developed. For this reason also, we explore general hospitals, which are not specializing in any area of medicine or surgery, but offer care to patients with various needs [7].

The research method used for data collection was a mail survey, in which we followed the detailed procedures outlined by Dillman [42]. First, based on the extant literature, instruments were selected for the constructs, and a draft version was made of the integral questionnaire. Second, we tested this draft version of the questionnaire in different interviews with members of the target population, and made small adaptations based on the comments received. A total of 18 interviews were performed in four general hospitals. Through these interviews we refined the design of the study and the measurement of the constructs. Third, we chose an attractive layout for the questionnaire, assuring good quality of paper and printing, a professional overall impression, and the clear association with the two universities sponsoring the study. Fourth, the distribution and recollection procedures involved (1) sending a pre-notice letter announcing the survey; and subsequently (2) sending the survey package containing the survey, a cover letter, a pre-paid self-addressed envelope, and a pen with the names of the two universities carrying out the project, (3) a follow-up letter was sent to all respondents, reminding them of the survey and the importance of participating. Three weeks later (4) a second copy of the survey was sent to non-respondents. Finally, (5) 2 weeks later contact was made by phone to all non-respondents, who were personally invited to respond to the questionnaire. All initial and follow-up letters contained hand-written signatures, and personalized names and addresses. The appendix contains details of variables and questions included in the questionnaire.

4. Results

Before addressing the four research questions individually, we performed preliminary analyses of the descriptive characteristics of the sample and the measurements obtained from the sample. We established that, before performing any statistical test, the reliability

(Cronbach alpha) of every measured construct in the questionnaire exceeded 0.7, which we considered the minimum level required for reliable analyses. The response rate was a favorable 51.3%, with 112 useful questionnaires received out of 218 CEOs. We performed a test for non-response bias to minimize the chance that the results we report are affected by some unknown factor that systematically differs between respondents and non-respondents [43]. We compared average scores on two variables, hospital size and region, for early respondents, late respondents and non-respondents using both Chi-square tests and independent-samples *t*-tests. Hospital size was measured by the number of beds [21,41]. Hospital region was a dummy variable that distinguished hospitals in regions with a relatively long history of health care management autonomy from hospitals in regions with a more recent autonomy in health care management.¹ The results in Tables A1 and A2 in Appendix A show no sign of non-response bias. Table 1 shows the descriptive statistics and Table 2 shows the demographics characteristics of our sample of CEOs. These data show that the majority of CEOs is male (91.1%). CEOs' ages lie between 30 and 59 years, with 77.7% between 40 and 50 years and an average age of 44.2 years. Most CEOs spent between 3 and 10 years in managerial positions. Regarding CEO clinical and administrative backgrounds, all CEOs have a university master degree. The majority of CEOs had a dominant administrative background (56.2%), rather than a clinical background (43.8%).²

4.1. Analyses of the research questions

The first research question related to the type of information (financial versus clinical) that CEOs use for decision-making. We conducted correlation analysis to the scores obtained with the questionnaire, and report only on relationships that are statistically significant. We will report first the findings from our statistical

¹ A 2002 reform ensured that 10 Spanish regions obtained the same health care management autonomy that 7 regions (Andalusia, Canary Islands, Catalonia, Galicia, Navarre, Bask Country and Valencia) had obtained earlier.

² A CEO was classified as giving a dominant 'clinical' ('administrative') background if the total number of years of clinical (administrative) experience and education exceeded the total number of years of administrative (clinical) experience and education.

Table 1
Descriptives ($n = 112$)

Variable	Mean	S.D.	Theoretical range	Actual range
1. Clinical background	2.97	0.56	1.00–5.00	1.00–5.00
2. Administrative background	3.18	0.62	1.00–5.00	1.00–5.00
3. Non financial information	3.60	0.65	1.00–5.00	1.50–5.00
4. Financial information	3.30	0.66	1.00–5.00	1.26–5.00
5. Interactive use	3.07	0.60	1.00–5.00	1.33–5.00
6. Diagnostic use	3.84	0.53	1.00–5.00	2.00–5.00
7. Use for resource allocation	3.39	0.64	1.00–5.00	1.00–5.00
8. Use for performance evaluation	3.69	0.62	1.00–5.00	1.00–5.00
9. Flexibility-based strategy	3.21	0.59	1.00–5.00	1.20–4.40
10. Cost-based strategy	2.97	0.55	1.00–5.00	1.25–4.50

Table 2
Demographics of CEOs ($n = 112$)

	Mean	S.D.	Actual range
Age	44.2	4.4	30–59
Tenure at CEO position	3.2	2.6	1–16
Tenure at hospital	6.2	4.9	1–20
Male (female)	91.1% (8.9%)		
Clinical (administrative) CEOs	43.8% (56.2%)		

analysis, after that we elaborate on the material consequences of our findings.

As Table 3 depicts, we found the clinical background of CEOs to be positively related to the use of non-financial information, and negatively related to the use of financial information. Instead, the administrative background of CEOs appeared to be positively related to the use of financial information, and unrelated to the use of non-financial information. This means that CEOs with a clinical background emphasize different elements of the MIS than do CEOs with an administra-

tive background. This confirms findings from the upper echelon perspective in general, as well as our specific expectation about these differences in hospitals.

The second research question related CEO background to their use of the MIS for *resource allocation decision-making* and *performance evaluation* purposes. Table 3 reports the results. We observe that the administrative background of CEOs is positive related to the use of MIS for performance evaluation.

Regarding our third research question, Table 3 also reports on the relationship between CEO background and the management style in which they use the MIS. We observe that CEOs' administrative background is positively related to a dominant *diagnostic* use of MIS, whereas the clinical background is positively related to an *interactive* use of MIS. Overall, the results show that CEOs use MIS more diagnostically than interactively, in line with their dominant administrative background. In addition, Table 4 shows that the use of financial information, the use of MIS for performance evaluation and the use of MIS in a diagnostic way are correlated. This is also true for the use of non-financial information, the use of MIS for resource allocation and the use of MIS

Table 3
CEO background and the use of MIS

MIS characteristics	Administrative background	Clinical background
Financial use	0.174**	−0.153*
Non-financial use	0.098	0.204**
Performance evaluation	0.109*	−0.044
Resource allocation	0.073	0.095
Diagnostic use	0.189**	−0.092
Interactive use	0.106	0.217**

Pearson correlation coefficients ($n = 112$).

* Significant at 0.05 level (two-tailed).

** Significant at 0.01 level.

Table 4
Type of management Information and MIS use

MIS characteristics	Financial information	Non-financial information
Performance evaluation	0.319**	0.169
Resource allocation	0.189	0.202*
Diagnostic use	0.306**	0.145
Interactive use	0.129	0.373**

Pearson correlation coefficients ($n = 112$).

* Significant at 0.05 level (two-tailed).

** Significant at 0.01 level.

Table 5

Mean *t*-test for CEOs with a dominant clinical background (*n* = 49)

MAS use	Mean	<i>t</i>	<i>p</i>
Resource allocation vs. performance evaluation	0.117	2.007	0.108
Interactive vs. diagnostic	0.215	2.719	0.016
Non-financial vs. financial	0.343	3.848	0.007

in an interactive way. Although these correlations are far from one, they do suggest that administrative and clinical background impact the use of MIS in rather different ways.

To extend the previous analyses, we tested whether the scores for the use of MIS differ between CEOs with a dominant clinical background and CEOs with a dominant administrative background. We tested for differences of means between paired characteristics of MIS for the two subgroups of CEOs, those with a dominant clinical background and those with a dominant administrative background. The results of the paired-samples mean *t*-test are depicted in Tables 5 and 6, which show significant differences in the average scores for each of the three MIS use variables. These results are largely consistent with the previous correlation analysis.

Finally, we analyzed the effects of CEOs' use of MIS on the implementation of the two sets of strategic policies that we distinguished. Table 7 reports on the correlations between the three aspects of MIS and the extent of implementation of these policies. We find that cost-focused strategies are supported by both diagnostic and interactive use of the control system. They are supported by the use of MIS for making both resource allocation and performance evaluation decisions. These strategies are associated with a larger emphasis by CEOs on financial information as provided by the MIS. In contrast, the strategic policies aimed at flexibility and quality appear not to be related to the use of financial information. They, moreover, appear to be negatively

Table 6

Mean *t*-test for CEOs with a dominant administrative background (*n* = 63)

MAS use	Mean	<i>t</i>	<i>p</i>
Performance evaluation vs. resource allocation	0.188	2.753	0.019
Diagnostic vs. interactive	0.324	3.380	0.004
Financial vs. non-financial	0.435	4.027	0.000

Table 7

Relationship between style of using MIS and strategic policies

Strategy	Strategic policies focused on cost reduction	Strategic policies focused on flexibility and quality
Financial use	0.468**	0.044
Non-financial use	0.104	0.572**
Performance evaluation	0.345**	0.196
Resource allocation	0.274*	0.388**
Diagnostic use	0.568**	−0.215*
Interactive use	0.514**	0.442**

Pearson correlation coefficients (*n* = 112).

* Significant at 0.05 level (two-tailed).

** Significant at 0.01 level.

related to the use of MIS as a diagnostic control tool. These policies instead appear to be supported by interactive control, the use of non-financial information, and the use of MIS for resource allocation decision-making, rather than for performance evaluation.

5. Discussion and conclusions

The objective of this study was to provide evidence on the use of the MIS by hospital CEOs with different backgrounds, and to analyze the effect of CEOs' use of MIS on subsequent strategy implementation. As hospitals are reported to spend as much as 15% of their budget on gathering and using management information [44,45], understanding the use of MIS seems important, especially in situations where MIS may become vital in the implementation of strategic policies. Our analyses overall indicate that CEO background affects the use of MIS, which in turn appears to affect the strategic policies adopted by the hospital. CEOs with a dominant administrative background tend to use MIS more diagnostically than interactively, and seem to emphasize performance evaluation and the use of financial information more than non-financial (medical) information for decision-making. In contrast, CEOs with a dominant clinical background tend to use MIS more interactively than diagnostically, and also tend to use clinical information more than financial information. This suggests that clinical CEOs rather than administrative CEOs show behavior that is better aligned with normative statements about the roles of CEOs of today's hospitals. Schultz et al. [15], for

example, argues that hospitals are demanding a new role of clinical CEOs who should become more proactive and aiming at continuous improvement of a health care delivery. As the strategic management literature shows, this requires that CEOs use the MIS in a more interactive way to discuss available information on critical aspects of the hospital's strategy across hierarchical levels and functions. This will help hospitals to identify strategic uncertainties and to react appropriately and timely [30].

Our results also show that the findings in the broader upper echelon literature [14,22] apply in a hospital setting. We find that the use of financial versus clinical information is related to the type of decision take by CEOs. Although CEOs seem to make some use of both types of information for both types of decisions, we find a stronger connection between CEOs use of clinical information for resource allocation decision than for performance evaluation decision. The results also show that CEOs use financial information more for performance evaluation decision than for resource allocation decisions.

Regarding the effect of the use of MIS on hospital strategy implementation, the results show that both styles of using MIS have positive effects on strategy implementation, but that systematic differences exist between strategic directions. An interactive style seems beneficial to the implementation of both strategies focused on cost and strategies focused on quality and flexibility. A diagnostic style is related to the implementation of a strategy focused on cost. These results confirm earlier research that demonstrated that the participation of physicians in management appears beneficial in controlling costs, maintaining quality, and bringing about organizational change [20,21,28]. We also observe that the use of financial information has a positive effect on the implementation of a strategy focused on cost, but not on flexibility and quality. Reversely, the use of clinical (non-financial) information is positively related to the implementation of a strategy focused on flexibility but not on cost. In general, these results support that, in line with Schultz et al. [15], CEOs with a dominant medical background (regarding both experience and education) are more in tune with the needs of patients and therefore are more likely to make decisions that benefit the quality of care delivered to patients. The implication is that training in the administrative side of management may pay off

as it allows (clinical) CEOs to use typical management information in broader ways, than just determined by their education and functional experience alone. This is not only important for the CEO, but also for middle management staff. Indeed, being confronted with the administrative side of management earlier in the career will make clinical (top) managers more effective in building and using the management repertoire they potentially have.

This latter implication may also be considered to be highly important given the technical complexity of contemporary MIS, which often almost requires expert knowledge on its functional possibilities [44,45]. Clearly, our results indicate that the technical sophistication of MIS may be less important than 'alignment' with strategy that it allows. In turn, this means that CEOs should be made aware of the type of management information that has to be provided by MIS in order to enable strategic management for the hospital [16,29] and that serious investments in the accessibility of information may pay off. This is in line with the findings by Young et al. [14] that managers in more successful hospitals know how to use management tools and techniques more effectively. As this is not a competence that clinical backgrounds generally provide, we agree with Wyatt [45] who pointed out the need to empower and train clinical managers to improve the quality, relevance, and understandability of data [44,45]. Indeed, investing in the provision of management reports that are understandable to clinicians and administrators, such as through balanced scorecards that combine financial and operational indicators may complement such developments. Reversely, we conclude that the administrative background of CEOs may be beneficial for overall cost-reduction policies, but may render CEOs less equipped to engage in interactions about quality enhancement. This latter requires an ability to use of MIS interactively, and to bridge the gap between aggregate financial information and detailed operational (non-financial) information.

In sum, the practical implications of this paper can be summarized as follows. First, as CEO background affects the pursuit of strategic policies by the hospital through the use of MIS, CEOs appointed to implement such policies should be experienced or trained in the use of non-financial management information in an interactive and participative style. Second, CEOs appointed to implement cost-reduction policies con-

trol, should be experienced or empowered towards the typical ‘administrative’ ways of dealing with the MIS. Third, as these different backgrounds have such different implications, CEOs with a balanced background may be most effective to confront pressures towards both cost reduction and quality enhancement. This implies not only that CEOs obtain a larger repertoire in the ways they manage the organization, but also that the information provided by the hospital’s MIS supports this repertoire in full. Here, investment in additional reports that combine and integrate various kinds of clinical and administrative information may be beneficial. This in turn requires and allows, fourth, that clinical and financial information is used more at the various hierarchical levels within the organization, and in combined fashions as to integrate the clinical and administrative needs. In terms of general leadership, this may require that CEOs spur clinicians at other levels to understand and formulate their own information demands, and to clarify what these demands mean for the design of the hospital’s MIS. Thus, hospital’s top managers may have to actively stimulate dialogue among clinicians and administrators to ‘demystify’ the MIS and make it more broadly owned. This requires that CEOs apply a style of supervision that stimulates agreement with the relevant professional staff about desirable financial and non-financial controls for monitoring, which will not ‘erode’ professional (clinical) discretion unnecessarily, and that balances the need to provide management with performance feedback while establishing control boundaries within which professional discretion can be exercised [25,26,27]. This also requires that CEOs realize the importance of the relationship between information management and the accomplishment of the hospital’s strategic objectives [44,45]. All this, finally, may require that the hospital’s board of directors, who are responsible for appointing hospital CEOs, will pay increased attention to the proper balance between CEO characteristics and the strategic needs of the hospital.

Appendix A. Questionnaire items

1. Background of CEO’s:

- University degree and title.
- Years of education on health care issues after university (e.g. seminars, special courses, master, ...).

- Years of education on management and business administration issues after university (e.g. seminars, special courses, MBA).
- Years of experience as doctor at public hospital.
- Years of experience as manager at public hospitals.
- Years of experience as doctor at other health care organizations.
- Years of experience as managers at other health care organizations.

2. Style of use of MIS:

According to the following sentences, please indicate your general use of your MIS:

- Set and negotiate goals and targets.
- Debate data assumptions and actions plans.
- Signaling key strategic areas.
- Challenge news ideas and ways for doing tasks.
- Follow-up significant exceptions and deviations.
- Involve in a permanent attention with subordinates.
- Evaluate and control subordinates tightly.
- Follow-up preset plans and goals.
- Align performance measures with strategic goals.
- Learning tool.

3. Type of information used: financial and non-financial information:

Please indicate the extent to which you use the following indicators in your work (Tables A1 and A2):

- Environmental performance (waste under hospital’s responsibility).
- Number of claims against your service or staff.
- Cost per patient (GDR).
- Staff absenteeism.
- Cost reduction in your service or activities.
- Information from customer satisfaction surveys.
- Cost per service, activity or treatment.
- Discharge rate.
- Index of external debts charged.
- % Entrance and use of urgency service.

4. MIS and types of decision-making:

Consider the two descriptions of decisions A and B, and please answer the following questions about the use of your management information system. Use these key descriptions:

- *Decision A.* Concerns the distribution of monetary and non-monetary resources (e.g. material, human, time) of your area of responsibility

Table A1

Chi-square test based on governmental dependency and size of the original mailing list and survey respondents

	Total sample	%	Survey response	%
Region^a				
Regions with autonomy <2002	120	55.05	64	57.14
Regions with autonomy >2002	98	44.95	48	42.86
Total	218	100	112	100
Size^b				
Small (<250 beds)	99	45.41	51	45.53
Medium (250–600 beds)	64	29.36	36	32.15
Large (>600 beds)	55	25.23	25	22.32
Total	218	100	112	100

^a $\chi^2 = 7.393$; df = 7; $\rho = 0.389$.^b $\chi^2 = 1.381$; df = 2; $\rho = 0.501$.

Table A2

Chi-square test for governmental dependency and size comparing early and late respondents

	Early respondents	%	Late respondents	%
Region^a				
Regions with autonomy <2002	45	53.57	17	60.71
Regions with autonomy >2002	39	46.43	11	39.29
Total	84	100	28	100
Size^b				
Small (<250 beds)	40	47.62	16	57.14
Medium (250–600 beds)	26	30.95	9	32.14
Large (>600 beds)	18	21.43	3	10.71
Total	84	100	28	100

^a $\chi^2 = 5.378$; df = 7; $\rho = 0.406$.^b $\chi^2 = 1.528$; df = 2; $\rho = 0.563$.

among the different services and units under your management. The ultimate objective of this type of decisions is to make available resources for a defined purpose, person or place.

- *Decision B.* Concerns the monitoring and control of goal and target achievement of units or services under your supervision. The ultimate objective of this type of decisions is the performance evaluation of the units or services of your area of responsibility.

For every decision please indicate the degree of use of:

- *Use of your management accounting system*, considering it as the whole of management and control information and techniques.

- *Use of quantitative financial information*, considering it as the set of information elements expressed in the monetary metric, resulting from the measurement of past, present and future economic events.

- *Use of quantitative non-financial information*, considering it the set of other quantitative measures expressed in a metric other than monetary.

5. Extent of implementation of strategic policies:

Please consider the extent of the implementation of the following policies in your hospital:

- Decentralization of responsibilities.
- Customer participation in management.
- Continuous updating of staff's knowledge.
- Programs of enhancing budget performance.

- Cooperation with others units or departments inside hospital.
- Coordination and cooperation with others organizations relate to hospitals (e.g. social services, environmental services).
- Programs of harmonization and cooperation inside your department.
- Actualization and use of management information systems.
- Introduction and applying of cost models or programs by products or services lines.

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