Strategic Operations Management in Healthcare: A Reference Model for Cardiac Rehabilitation

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Abstract Although operations strategy has been recognised as a relevant topic for the healthcare sector, scarce attention has been devoted to understand how internal and external operations characteristics may interact each other affecting strategic decision-making process. On this premise, this paper introduces a framework built on current literature and further validated through a case study carried out in a Cardiac Rehabilitation department. It aims at identifying the key characteristics of operations for healthcare providers, linking them to the context where a hospital operates. The final framework suggests that internal characteristics are differently influenced by external factors and generate mutual relationships. In addition, they are affected by other internal factors, including variables describing hospital clinical context and hospital operations strategy.

Keywords Healthcare operations management · Operations characteristics Strategic decision-making · Cardiac Rehabilitation · Strategic framework Hospital operations strategy

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1 Introduction

In the healthcare sector, governments around the world are facing significant expenditure constraints, while at the same time trying to improve quality, customization and access to healthcare services for population [1]. Although the quality of medical care is improving for most types of illness, the attention to detail in business systems and processes that transform resources into healthcare services has not kept pace [2], resulting in long waiting times, patients lying on stretchers in hallways, overburdened and stressed medical staff [3]. In this context, while the appropriate use of traditional operations management (OM) concepts could be potentially of great help relying on the hypothesis that the healthcare sector can benefit from the lessons learned in the industrial sector [4], the use of methods, approaches and tools initially established for manufacturing companies has been proved to be challenging because of the differences between manufacturing and healthcare operations [5].

Existing studies in this area offer a collection of frameworks, models and classifications, providing some guidance on how to configure an operations strategy for healthcare providers [6, 7], but are insufficient to provide a complete and detailed picture of medical care delivery. In particular, most of the operations-oriented studies focus narrowly on specific issues [8, 9], with a few examples integrating long-term structural and intermediate operations decisions [4]. However, focusing on one decision area is not enough; on the contrary, developing a congruent operations strategy is the key to improve healthcare providers' performance [2]. Moreover, though many organizations flounder on internal factors, failure of execution can also be related to environmental features and their evolution [10].

On these premises, this study will address the following research questions: *Which are the main variables characterising healthcare operations management? How are the variables connected?*

Therefore, a framework providing a set of leverages for strategic Operations Management (OM) in healthcare will be proposed. The framework aims at capturing the key characteristics of operations for healthcare providers, linking such aspects to the overall healthcare system in which they function, including drivers for change and factors that influence decision-making.

In the next section, the research methodology is described. Section 3 presents the initial theoretical model. Section 4 is focused on the discussion of results from an Italian case study and on the novel model for Healthcare Strategic OM in the cardiac rehabilitation area. Section 5 closes the paper with contributions to theory and practice, outlining future research directions.

2 Methodology

Given the explanatory nature of the research ("how"-type of questions), the originality of the field, as well as the criticality of the context, a case study methodology was adopted [11]. In the first phase of the research, a conceptual framework was

developed based on a literature review in the following research field: Healthcare, Service and Manufacturing Operations Management and Strategy.

Research issues and interview questions were then developed and included in a research protocol. Then, an in-depth case study was carried out. The case, the cardiac rehabilitation (CR) unit of the "Ospedale Bolognini" (ASST Bergamo Est) in Seriate (Bergamo, Lombardy region, Italy), with 500 patients/year, supported in refining the theoretical model and in exploring how the context influence healthcare operations management characteristics. In particular, the cardiac rehabilitation services, defined as "comprehensive, long term programmes involving medical evaluation, prescribed exercise, cardiac risk factor modification, education, and counselling. These programmes are designed to limit the physiological and psychological effects of cardiac illness, reduce the risk for sudden death or re-infarction, control cardiac symptoms, stabilise or reverse the atherosclerotic process, and enhance the psychosocial and vocational status of selected patients" [12]. Multiple investigators and respondents have been used as a form of triangulation to handle the richness of the contextual data and provide more confidence in research findings. During two visits, six informants from the CR unit have been interviewed: head of the unit, a physician, the head of the physiotherapists, the head-nurse. In the third and final stage the theoretical framework was redefined and relationships between variables characterising healthcare strategic operations management were identified.

3 Literature Review and Definition of the Theoretical Model

The theoretical model is composed of two main dimensions, internal and external. It is intended to capture the general characteristics of healthcare operations strategy.

3.1 Internal Factors

Internal factors represent the structural and infrastructural characteristics that describe how operations are configured. Internal factors have been developed based on the framework proposed by Baines et al. [13], further tailored on healthcare distinctive features. Such framework represents a comprehensive model obtained from the analysis and synthesis of a wide literature on strategic operations management (Table 1).

3.2 External Factors

The external environment is defined as all of the political, economic, social and regulatory forces that influence on the organisation [20]. Drawing on the model developed by Swayne et al. [16], five main areas are included in the framework:

Table 1 Internal factors of the theoretical model

Process and technology	A process can be defined as the chain of operations that need to be performed to produce a particular service [14]. Vissers and Beech [14] provide an overview of the most important characteristics of care processes from an operations management point of view: emergency versus elective; level of urgency; length of the process (number of operations that constitute the chain); complexity (number of diagnostic and therapeutic procedures, necessity to consult another specialist, cyclic character); predictability (number of operations, durations, routing); decoupling point. Moreover, this factor entails also the range of technologies supporting the delivery of service
Capacity	This factor covers decisions related to the definition and allocation of key resources, such as personnel/specialist time (labour availability of physicians, nurses and other providers), accommodation/facility space (number of beds, treatment or examination rooms and clinics), supply and other resources (cafeteria, parking and support services), equipment and material (key medical technology and equipment) [2, 14, 15]. Such resources can be classified as: dedicated/shared; leading/following; bottleneck; continuous/intermittently available [14]. Capacity can also be distinguished between different types [14]: potential capacity (total amount of resources available of one resource type when all resources are used for production); available capacity (total amount of capacity available, in principle, for production); usable capacity (capacity normally available for production); utilised capacity (available capacity actually used for production). It includes both productive and non-productive purposes, such as set-up capacity
Facilities	In the healthcare field, "facilities" represent the physical environment in which health care is delivered [16]. Decisions concerning this category refer to facility location (in terms of accessibility, adaptability and availability) to achieve equitable healthcare access and efficient delivery [15]
Supply chain positioning	In healthcare, two main supply chain areas can be identified: care development (upstream) and care delivery (downstream). With this category, a healthcare actor can be positioned within the supply chain and its vertical integration degree can be described, intended as "those parts of the value network that belong to the company" [17]
Planning and control	As defined by Hans et al. [18], healthcare operations planning and control involves four key areas: medical planning (development of new medical treatments), resource capacity planning (dimensioning, planning, scheduling, monitoring and control of renewable resources), materials planning (acquisition, storage, distribution and retrieval of consumable resources), financial planning (how to manage costs and revenue to achieve organizations' objectives.)
Human resources	Healthcare organizations must be able "to gather resources, skills and knowledge in a unique way, coordinate diverse operational skills and integrate multiple streams of technologies" [16]. Therefore, this category describes the composition of the workforce, as well as how the workforce will be scheduled and paid. In particular: personnel mix (physicians, doctors, nurses, therapists, administration staff), competences (technical and non-technical), workforce planning recruitment, payment, training and rewarding [16]

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Table 1 (continued)

Quality control	Donabedian [19] proposes a framework for quality assessment and evaluation, that considers the quality of care into three fundamental parts: structure, process, and outcome. The variable 'structure' describes the setting in which care is delivered including hospital facilities and equipment, human resources and organizational structure. The variable 'process' refers to the transactions between patients and providers in which healthcare services and treatments are provided. Finally, the dimension 'outcomes' refers to the health status of patients and populations
Service range and new service introduction	The range of healthcare delivery service includes inpatient service, outpatient service, other community oriented activities (wellness program, fitness centres, pharmacy information systems, health promotion programs), and day care centres, as well as its specialization degree (generalist service, market specialist, service specialist, super specialist) [16]
Performance measurement	In healthcare, three categories can be useful for evaluating performance [20]: structural measures (assess the features of operations management in delivery organizations); process measures (assess the activities carried out to deliver healthcare services); outcome measures (assess the impact of the healthcare service on the health status of patients)
Stakeholder relations	Different needs of different stakeholders can affect the delivery of the final service [16]. More specifically, three main stakeholders' categories can be identified: internal stakeholders (actors who operate primarily within the organization, such as managers and employees, medical staff and corporate officers), interface stakeholders (who function both internally and externally) and external stakeholders (community, third-party payers, competitors, clinics which operate external the organization)

- *Legislative/Political/Regulatory*—defining how governments and legislation bodies intervene in the healthcare economy;
- *Economic*—related to healthcare economics;
- *Social and demographic*—describing gender, ethnicity, religious and cultural aspects, as well as health consciousness, population growth rate, age distribution, living standards and income level;
- *Technological*—including R&D activity, automation, technology incentives and the rate of technological change;
- *Competitive*—representing the strategic behaviour of competing actors.

4 Results from the Case Study

The description of the case using the theoretical model previously defined is presented in Table 2.

Table 2 Case description

External factors	
Legislative/Political/Regulatory	Italian National Health Service: principles of universal coverage and non-discriminatory access to the health care services. Beveridge model (healthcare is provided and financed by the government through tax payments). "Livelli essenziali di assistenza" (basic assistance level) defined at national level. Clinical aspects defined by Italian and European guidelines. Process standards defined by the Lombardy Region. Promotion of the integration between hospitals and the territory (general practitioner) (Regional law 23/2015)
Economic	For CR services provided by public hospitals (or by licensed private healthcare facilities), service delivery is reimbursed by the regional healthcare system based on bed occupancy
Social and demographic	Catchment area: 400.000 citizens (foreign citizen: 11%)/7 hospitals. Gender is not discriminating
Technological	Major technological trend of the last years: telemedicine for rehabilitation and remote monitoring
Competitive	Other cardiac rehabilitation unit in the territory (catchment area): Romano di Lombardia (public service/hospital for acute patients—no cardiology department); San Pellegrino (no acute patients); Gavazzeni (private structure—not specific for cardiac rehabilitation only); Trescore Balneario (private structure)
Internal factors	
Process and technology	Minimum duration: 7 days (defined by legislation). The duration is not deterministic (given the required minimum duration) because it depends on patient's pathology, clinical trend; general complexity level. Each day the therapy can be re-defined, based on patient's conditions. Therefore, the service delivery process is personalised. In order to reduce variability, similar patients are clustered into groups. After patient's stabilization (in average 1 week), the process continues with outpatient activities. If patients live far away from the hospital, they continue with inpatient activities. Telemedicine is extensively used for remote monitoring of patients' conditions (supporting function). Telemedicine technology provides physicians with a large amount and range of data (not related to cardiac aspects only). Such data could be used by general practitioners to manage the patients. To this end, the pilot project "Respirare" was launched a few years ago, involving 10 general practitioners with access to a platform containing patients' data from telemedicine (for selected relevant parameters). In 2015 "Respirare II" has been approved to further develop such delivery service, promoting integration between hospital and territory. Internal protocols (defined by the Quality Department) outline the service delivery process (clinical aspects defined by Italian and European guidelines)

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Table 2 (continued)

External factors	
Capacity	18 beds for inpatients; outpatient departments; two gyms; nursery room with tele-medicine control unit (12/18 patients can be tele-monitored). Additional 8 beds and 10 tele-monitoring units in another hospital controlled by Ospedale Bolognini (Gazzaniga). An additional outpatient department is going to be opened in Calcinate for patients' joint-management between the hospital and the general practitioner (actual number of beds: 10—Expected number of beds: 30)
Facilities	Activities are carried out in 2 different buildings, located in the hospitals (lower degree of synergies). Ospedale Bolognini is an urban hospital
Supply chain positioning	The cardiac rehabilitation unit moved to the Bolognini hospital (from Gazzaniga) 8 years ago as a strategic decision to have acute and post-acute treatments in the same hospital. Emergency medicine is also present to handle emergency situations. Moreover, there is a novel tendency to integrate CR activities carried out by the hospital with follow-up activities supervised by general practitioners. Therefore, a new unit is going to be opened soon (Calcinate—see Capacity) where the patients will be jointly managed
Planning and control	Planned access to the department: max 2 patients/day in the afternoon (from 2 p.m. to 5.30 p.m.)—1 additional patient/day in exceptional situations (in the morning). The head-nurse receives the requests (from cardiac surgery—mostly from the Bolognini cardiac surgery department and from Bergamo hospital; from general medicine and cardiology departments—from all the Bergamo province, with some patients coming also from the Brescia province) by phone or by fax. Planning meetings: –8.30 a.m.: physiotherapists with their head to organise morning activities; 2 physicians meet the night-shift nurse for updates. Physicians starts their inpatient visits; –12.00 a.m.: meeting with physicians, head nurse and nurses to plan acceptance/discharge activities; Planning the discharge (not only the acceptance) is very important: the patients need to set-up its social and living environment before being able to return to its home
Human resources	5 cardiologists; 5 physiotherapists (3 full-time and 2 part-time); 12 nurses (shared with 10 beds from the medicine department—usually patients having cardiac problems)—daily schedule: 4 part-time operators (2 for inpatient and 2 for outpatient departments) and 1 full-time operator (outpatient department); 6 supporting operators (4 full-time and 2

(continued)

Table 2 (continued)

External factors	
	part-time). Three shifts per day. All the workforce (including doctors for nutrition and psychological consulting) is employed by the hospital. There is a reward system for personnel based on parameters defined by the Quality Department. A cultural intermediary is also available (shared with other departments and made available by the hospital) to support foreigner patients
Quality control	Quality control parameters focus on process delivery aspects, based on hospital's certifications. Parameters cover inpatient activities only. Long-term quality control (post-discharge) is not implemented
Service range and new service introduction	The cardiac rehabilitation unit is responsible for managing a wide range of medical interventions, including nutrition and psychological consultancy. Moreover, support services to general practitioners will be available in the near future. Cultural intermediary service is provided to support communication between foreigner patients and institutional staff
Performance measurement	Measures related to process quality, defined by the Quality Department, related to economic incentives for the personnel
Stakeholder relations	The relationships with patients' relatives and community is fundamental (see planning and control). Integration of the hospital with the territory (general practitioners) is a key aspect introduced by legislation

5 Towards a Reference Model for Strategic Operations Management in Healthcare

The discussion on how both internal and external factors are connected (Table 3) was the key step for the definition of a reference model for Strategic Operations Management in Healthcare, with reference to cardiac rehabilitation.

From the analysis of the case studies, the following changes have been introduced in the initial model:

- "Capacity" has been split into two variables: *key resources* (types of resources for service delivery) and *capacity utilisation* (utilisation level of the resources);
- Internal context: including variables describing hospital clinical context (availability of health departments) and hospital operations strategy characteristics. The internal context influences: CR human/key resources, facilities, supply chain positioning and quality control.

Table 3 Relationships between internal and external factors

	Link with internal factors
External factors	
Legislative/Political/Regulatory	*Process&Technology:* for the definition of the minimum length of stay for CR services and the promotion of the use of innovative technologies. *Human resources*: for the definition of the number of nursing and supporting personnel based on several parameters (defined at national/regional level). *Stakeholder relationships*: for the integration of hospitals with the territory (general practitioners). *Quality control*: for the definition of quality standards (at regional/national level)
Economic	*Planning&Control*: related to the reimbursement of service delivery by the regional healthcare system. *Performance measurement*: for the definition of proper key performance indicators
Social and demographic	*Process&Technology*: patient's social and demographic characteristics influence the features of the delivery process and the use of the technology. *Stakeholder relationships*: patient's community/relatives characteristics have an influence on its relationships with the hospital
Technological	*Process&Technology:* the availability of new technologies on the market is a necessary condition for their adoption. *Service range and new service introduction*: the availability of new technologies on the market enables the introduction of new services or the process improvement of existing health solutions
Competitive	Not directly connected with internal factors. It is linked to the operations strategy of the hospital
Internal factors	
Process and technology	*Planning&Control*: process delivery characteristics and the adopted technologies influence planning and control choices. *Human/Key resources (capacity)*: process delivery characteristics and the adopted technologies influence the required human/key resources for its implementation. *Facilities*: in terms of decisions on facility location and types. *Supply chain positioning*: in terms of make or buy decisions
Capacity—Key resources	*Facilities*: where the key resources are allocated/installed. *Planning&Control*: related to the availability of key resources than can be allocated during planning activities
Capacity—Utilisation	It does not influence other internal factors
Facilities	*Human resources*: in terms of possible synergies within the same unit and also with other hospital departments
Supply chain positioning	*Human/Key resources (capacity)*: in terms of make or buy decisions for human/key resources

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Table 3 (continued)

	Link with internal factors
Planning and control	*Capacity utilization*: planning activities determine the level of utilisation of internal capacity
Human resources	*Planning&Control*: related to the availability of human resources than can be allocated during planning activities
Quality control	*Performance measurement*: quality control aspects drive the definition of proper key performance indicators
Service range and new service introduction	*Process&Technology:* the choice of service offering involves the definition of a proper delivery process and its characteristics (including technological aspects). *Supply chain positioning*: in terms of actors involved in service delivery
Performance measurement	*Human resources*: economic incentives are connected with performance
Stakeholder relations	Service range and new service introduction: services supporting the establishment of relationships with stakeholders (community and territory). *Planning&Control:* for discharge planning, patient's community and relatives should be ready for its homecoming

6 Conclusion

Nowadays, healthcare delivery actors have to face an increasing number of challenges to create operational efficiency being at the same time financially viable. Therefore, they must apply sound business and operations management, ensuring improvements in clinical and organisational performance. In this context, an integrated framework for strategic operations management was developed and then relationships between variables were defined through an in-depth case study of an Italian cardiac rehabilitation unit. The final framework is composed of internal operations strategy factors as well as variables describing the context, both external and internal. Moreover, it provides relationships between the identified variables and how they influence each other. Therefore, the framework can be used as a tool helping healthcare managers engineer and configure service delivery processes, considering both the external and internal context. It also supports decision-making processes, simulating how acting upon a specific variable or changes in the context affect the other components of the operations strategy. Nevertheless, several limitations and further developments can be outlined. Firstly, more case studies should be carried out to validate the model (selected variables and their links), both for other CR departments and other hospital units operating in different health systems. Then, a system thinking model can be developed for running simulations and scenario analysis to test and optimise configuration choices.

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