

# INTRODUCTION

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During the 70's of the last century, the Dean at SDA Bocconi School of Management suggested me to design and run programs for Healthcare management, in the belief that: "... *This is not going to be difficult, because functions such as strategy, planning, programming, budgeting, financial and management accounting, organization and HR management, finance, communication, marketing, information system and decision making are based on common knowledge and general skills and can be applied in any complex organization, private or public, manufacturing or service ...*".

My answer was always "... *You are half right and half wrong, half right because knowledge about all these functions you mention are a basic requirement. Half wrong because if we do not know the operations of a specific sector of activity, we cannot help participants to learn how to properly use management theory, methods, techniques, and tools. To be able to teach we need to do research and understand that health services are different from other services. Health services are related to life, death, suffering, and professionals have a complete autonomy and responsibility for prevention, diagnosis, cure, treat and rehabilitation ...*".

Stefano Villa, academically, has grown with a "SDA culture" that has provided the basis and framework of this book. Operations is his field of specialization which he approaches with a system-wide perspective taking into consideration the whole healthcare chain (hospital, diagnosis center, primary and intermediate care and other settings) with the final goal of improving the patient well-being (value based healthcare approach).

Appropriateness and effectiveness can be guaranteed only if operations are well managed.

To use Henry Fayol's definition of management, low efficient operations generate low levels of output and bad outcomes. Unfortunately, many health professionals, in the past and also today, have worked in the belief that the quality of healthcare delivery is related to their own clinical knowledge, expertise and their ethical approach to the patient. Clearly, such attitude is not enough because in complex organizations made up of

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dozens of units, hundreds and sometimes thousands of doctors, nurses, and other health professional and administrative staffs, processing of diagnosis activities, medical and surgical treatments need to be coordinated. Moreover, acquisition, distribution to unit and use of healthcare materials and technology must be aligned with nursing and clinical activities.

A third reason why focus on operations is critical has to do with the relation between “to know” (theory), “to know how to do” (methods) and “to know how to get things done” (practice).

Vision, mission, strategy, plans do not generate a health pattern for patient, they need execution, that means acting on operations. On the other hand, the analysis of weaknesses in the design and execution of operations can stimulate the introduction of programming, planning, organizational change, people motivation and other innovative processing in hospitals and in other healthcare delivery organizations.

Top and middle managers must be aware that every innovation must undergo an *ex ante* analysis of operations and an *ex post* evaluation of the actual impact on patients’ health.

In this book Stefano Villa draws on his previous researches and teaching experiences. The readers can find solid and rigorous scientific approach and cases that, from one hand, provide a clarification of the implication of theory and, from the other hand, can be used as teaching material.

Another peculiarity of the book, that should be underlined, it is not rooted in the rational choice framework (maximization/optimization) but in an institutional approach that pursues the rationalization of operations within the specific condition (often constrains) of the institution.

In designing operations management change strategies, it is critical to consider all the other relevant organization’s elements such as the culture and motivations of people, the features of the building, availability of technology and the actual investment opportunities.

Furthermore, it is a nonsense, an abstract optimization of operations, not considering patients’ perceptions and expectations.

Thus, Stefano Villa’s book can be included in the socioeconomic system framework rather than in the contingency approach. Operations analysis and improvement are proposed not with the prospective of sub-optimization of this function, but in the prospective of understanding interdependence with the other components of an organization.

Finally, the last key element that qualifies the book is the dynamic approach. Operational system must be continuously adapted to scientific knowledge development, technology innovation, people competences and motivation, delivery patterns (from cure to care, patient treatment, continuous care model, care networks, value based healthcare etc.).

Lastly, a comment on the structure of the book.

In the first chapter, there is a presentation of main theories of operations, to clarify the meaning of different terms, the differences between operation issue in manufacturing and services companies, especially in health care system.

In the second chapter, the patient flows are analyzed from admission to operating rooms, to discharge. Analytical content and implementation are provided.

The third chapter is dedicated to the supply chain of the materials. It focuses on the relation between external condition and internal processing of materials.

In the fourth chapter, methodologies and tools to manage operations are analyzed in more details. As already mentioned, in every chapter some case studies, from different countries, are included and they add a real international flavor to the book.

Milano – march, 26 2021



# Chapter 1

## **OPERATIONS MANAGEMENT IN HEALTHCARE: WHY, WHAT AND HOW?**

SUMMARY: 1.1. Health care management past, present and future. – 1.2. Process management. – 1.3. Specificities of healthcare production processes. – 1.4. Specificities of public sector. – 1.5. Managing variability in healthcare delivery organizations. – 1.6. Process improvement. – 1.7. Definition and evolution of Operations Management in healthcare. – 1.8. Logistical Drivers. – 1.9. Performance of Operations Management systems. – 1.10. Reengineering public sector production: the case of Boston Housing Authority.

### **1.1. Health care management past, present and future**

In order to fully understand the current evolution of the Operations Function within healthcare delivery organizations it is necessary to discuss a little about the evolution of management in the public and healthcare sector.

In the late eighties and early nineties public sector all around the world was invested by the so-called New Public Management (NPM) movement that, basically, argued for the necessity of introducing, in the public sector, organizational models, logics and managerial tools used in the private sector in order to improve the overall performance in the perspective of both efficiency and effectiveness (Dunleavy and Hood, 2009).

In this context, it must be noted that, in most OECD countries, healthcare is still a typical sector of public interest, with the State still playing a relevant role both in the provision (e.g. percentage of publicly owned beds) and in the funding of healthcare.

In the case of healthcare, the concepts of NPM have been implemented along three main dimensions:

1. Increased autonomy and responsibility to each single healthcare delivery organization with increased room for action by general directors;
2. Introduction, as reimbursement scheme, of the DRG (Diagnostic Related Groups) and the development of the so-called quasi-markets aimed to boost competition between providers (public and private);
3. Introduction of managerial models and tools typically used by private organizations such as: (i) budgeting control; (ii) pay-for-performance and (iii) more proactive and less bureaucratic human resources management systems.

This new stream of innovations has invested the traditional organization of healthcare organizations designed around the different clinical specialties (e.g. cardiology, neurology, general surgery and orthopedics). In this type of organizations, clinical directors have complete control over:

1. The use of financial and structural resources;
2. The diagnostic, nursing and clinical treatment of the patients;
3. The control of all the hospital production units (e.g. diagnostics, beds, operating rooms and ambulatories).

In other words, in this type of models there was definitely an abuse of the possessive adjective “my” uttered by the different clinical directors ... “my” beds, “my” operating rooms, “my” patients, “my” nurses and so on.

This old-fashioned model has been slowly torn down by a series of reforms summarized in Table 1.

First at the beginning of nineties, in different countries healthcare delivery organizations have begun to introduce budgeting systems: at the beginning of the year each clinical director was assigned a bucket of resources (structural, financial and human resources) and, at the same time, a set of goals to be achieved along different possible dimensions such as economics, volumes of production, clinical outcome and patient satisfaction.

The limit of this set of reforms is that the budget itself was considered a sort of panacea of all problems and, thereafter, the controller did not take up the challenge/responsibility to look into the production processes thus leaving, in this sense, to each clinical director complete autonomy and control over the actual organization of healthcare delivery processes.

At the beginning of the 2000s in Italy and in many other countries (first UK) scholars, managers and policy makers stressed the importance of controlling decisions and behaviours of clinicians which should have been aligned as much as possible to the evidence-based guidelines and protocols developed, at international level, by scientific associations and government agencies. In this sense, healthcare organizations have started to adopt and implement clinical pathways with the aim of standardizing clinical decisions and behaviours (see Paragraph 1.5).

Finally, in the very last decade, the new models of care tend to overcome the vertical organization based on clinical specialties to move towards more horizontal, flexible, and integrated models where production units are shared across different clinical specialties. To support this new stream of innovations the Operations Management function (the focus of this book) is very much critical.

As it will be explained more in detail in Paragraph 1.7 Operations Man-

agement in healthcare has to do with the management and control of production units where healthcare delivery processes take place with the goal of pursuing an efficient, timely and appropriate management of patients and supplies.

The shift to these horizontal and process-based organizations that occurred in the last decade has been triggered by a series of different elements.

Several studies (Aiken et al., 2002; Vissers and Beech, 2005; Litvak et al., 2005; Villa, 2012; Villa et al., 2014) and first-hand experience show that old-fashion specialty-based organizations do not perform satisfactorily under different dimensions likewise efficiency, productivity, timeliness and appropriateness.

Secondly, there was a growing distance between the vertical organization and the current change in epidemiology with a growing share of elderly patients, with chronic conditions and co-morbidities that need, by definition, a more holistic and integrated approach.

The call for more flexible production models was also urged by the mounting pressures for a more efficient use of resources in particular concerning beds, nurses, and physicians.

Finally, right when this book is going to press, we are in the middle of a worldwide healthcare emergency due to pandemic COVID-19. This emergency has dramatically outlined the drawbacks of the current fragmented and vertical organization of healthcare delivery organizations and calls for the immediate implementation of concepts and models inspired to Operations Management science such as (i) timelines and flexibility; (ii) multidisciplinary approach; (iii) capacity planning of hospital production units (e.g., Intensive Care Units), (iv) flows' separation and (v) focused hospital<sup>1</sup>.

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<sup>1</sup>A typical solution adopted to deal with the COVID-19 emergency has been the creation of facilities entirely dedicated to the management of COVID patients managed by multidisciplinary teams. This can be considered an example of focused hospital. The model of the focused hospital will be extensively described in Paragraph 4.4 of this book.

**Table 1.** Phases of innovation in the organization of healthcare production processes.

Phase/Period	Model/Tools	Aim
1. 1990-onwards	Budget/reporting systems	Assign to clinical directors a budget (in terms of financial, structural and human resources) and a specific set of goals.
2. 2000-onwards	Clinical governance Clinical audit Clinical Pathways	Standardize clinical decisions and behaviors following evidence-based guidelines and protocols
3. 2010-onwards	Patient flows logistics Patient-centred hospital care models Focused hospitals Lean management Value-Based Health Care	Overcome the rigid specialty-based organizational model and move towards a more horizontal, flexible and integrated model.

Source: author's elaboration.

The time frames indicated in Table 1 are merely indicative and they represent a sort of rough average. If you just look at the situation of Italy some healthcare organizations are now well into phase 3 while other organizations are still struggling with the introduction of a budgetary system (phase 1). However, the three moments briefly described above can be considered as a sort of timeline for a possible change plan to redesign healthcare delivery processes. For example, before changing the design and structure of productions models (the so-called “hard” part) moving to more innovative models such as lean or focused hospital it is crucial to work with clinicians for the implementation of clinical pathways (which can be considered the software of the organization).

## 1.2. Process management

The present work has the ambitious goal to illustrate tools and models to implement the OM function in healthcare delivery organizations. Before dealing with this major topic, however, it is important to start explaining the concept of process management; in fact, the OM function builds around the concept of production processes.

Almost all human activities can be represented as a process: eating dinner in a restaurant, assembling an automobile, approving a home mortgage application, and flying between two cities are all examples of processes that take place in real life.



A process is characterized by a

- sequence of activities that transform inputs into outputs;
- joint measurable output;
- outcome for a given client (that can be, either, internal or external);
- start and ending.

If we consider production processes taking place at organizations of any type, the sequence of activities usually go well beyond the boundaries traced by the organizational structure. In the case of a hospital organization we can think, for example, about the femur fracture process of care; in this case the process cuts across different units and departments such as (i) emergency department; (ii) radiology; (iii) operating room; (iv) orthopaedics, (v) rehabilitation and (vi) ambulatory care.

In healthcare, establishing the start and end of a given process is not such a straightforward task in fact, the interdependency between acute care, post-acute care and primary care has become increasingly tighter. Furthermore, in the case of chronic conditions the process of care tends to be endless.

In order to successfully managing processes, it is important to consider the special characteristics of healthcare production processes and the public status of many healthcare institutions. In this paragraph we focus on these specificities and outline the possible constrains in process re-engineering projects.

### *Quality of healthcare processes*

Throughout this text, we support the idea that process management and engineering should have, as a final goal, the improvement of quality of care provided to patients. In particular, we refer to the concept of quality as keenly detailed in the report issued by IOM (2001) (p. 37) where the authors have identified six different dimensions for quality improvement:

1. Safety  
Avoiding injuries to patients from the care that is intended to help them.
2. Effectiveness  
Providing evidence-base care capable of solving patient problems avoiding underuse and overuse.
3. Patient-centeredness  
Encompassing, in the provision of care, qualities of compassion, empathy, and responsiveness to the needs, values, and expressed preferences of the individual patient.

4. Timeliness

Reducing waits and sometimes harmful delays for both those who receive and those who give care.

5. Efficiency

Improving the ratio between inputs (resources used) and output (results produced) avoiding waste such as waste of equipment, supplies, ideas, and energy.

6. Equity

Providing care that does not vary in quality because of personal characteristics such as gender, ethnicity, geographic location, and socioeconomic status.

### 1.3. Specificities of healthcare production processes

At least, five aspects make healthcare production processes unique and different from any other production process in other industries, particularly:

1. Simultaneity between production and consumption;
2. High levels of variability;
3. Management of human lives;
4. Variety of processes and supplies;
5. Professional autonomy.

1. *Simultaneity between production and consumption*

In the case of healthcare, production and consumption occur simultaneously; patient and healthcare professionals need to be present at the same time in the same physical space. This circumstance implies that healthcare delivery organizations need to have the production capacity ready at any time even though the actual production delivery will occur only with the presence of the patient.

It must be said that, with the current technology (e.g. telemedicine) the patient does not need to physically show up at the physician's office but he/she can be virtually present: the recent COVID-19 pandemic has, for example, shown the effectiveness of virtual solutions such as the tele consultation or the tele rehabilitation.

In any case, this specificity implies, for healthcare managers, a double challenge: guaranteeing a certain level of flexibility in the design of production processes and reducing, wherever possible, the fluctuations in the services' demand.

## 2. *High levels of variability*

Healthcare is subject to three different sources of variability (Litvak and Long, 2000, Noon et al., 2003):

- (i) clinical variability linked to the presence of different diseases, severity levels and responses to therapy;
- (ii) demand variability due to the unpredictability of certain typologies of patient flows (e.g., emergency department flows);
- (iii) professionals' variability due to different behaviors, approaches, preferences and different levels of ability.

The presence of this variability deeply influences strategic decisions about the level of production capacity and the demand's planning.

As it will be extensively detailed in the Paragraph (1.5), it is important to identify that part of variability (the so-called artificial variability) which can be eliminated because linked to organizational problems or misbehaviors.

## 3. *Management of human lives*

Managing healthcare production processes is particularly challenging since we are dealing with human lives. For example, a possible stock out (namely the lack of supplies) might have very serious implications if we are talking about life-saving medicines. In this specific case, in fact, an inventory shortage implies the loss of lives and, consequently, the cost of the stock out is much higher than the costs of stocking excess inventory (Mazzocato, 2007).

As better outlined in Paragraph 3.1, exactly for these reasons, JIT models are less common within healthcare delivery organizations.

Secondly, mistakes in the design and execution of healthcare delivery processes such as operating rooms' scheduling or the distribution of medicines to the wards can cause direct harm to patients with possible dramatic events<sup>2</sup>.

## 4. *Variety of processes and supplies*

Within the healthcare sector there is a wide variety of production processes taking place; for example, production processes in units such as ICU (Intensive Care Unit) or ED (Emergency Department) display completely different managerial challenges compared to the delivery of care in other settings such as rehabilitation or ambulatory care.

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<sup>2</sup>Think, for example, to the case of over-dosage during chemotherapy. In some cases, this logistical error has brought the death of the patient (Bohmer and Winslow, 1999).

This circumstance implies the need to integrate different competences and different healthcare professionals.

Furthermore, different types of supplies and technologies call for different managerial and organizational models. For example, drugs' management requires specific competences and particular attention for example to the level of stock's temperature and to the expiration date (Villa, 2012).

Finally, both technology and supplies are subject to a constant flow of innovation (Jarret, 2006) which has proved to be above the average when compared with other industries.

### *5. Professional autonomy*

The implementation of change strategies is, finally, more difficult in the healthcare arena because of the traditional resistance and resilience mounted by clinicians.

As outlined by Ackroyd et al. (1989, p. 606), it is possible that senior doctors with leadership positions will adopt a 'custodial orientation': a form of management practice governed largely by professional interests and primarily focused on maintaining the status quo (as defined by the professional community).

In any case, clinical professionals often seem reluctant to respect organizational rules and procedures because they claim that their attention is devoted to patient management rather than to organizational performance and further they identify product standardization as jeopardizing the quality and personalization of treatment (Lega et al., 2013).

In some instances, there is no dialogue at all between managers and clinicians who, sometimes, even perceive the all-organizational machine as a useless system that prevent them to do their job in a proper and timely manner.

This lack of communication and integration between healthcare professionals and those who manage operations is often the cause of the failure of effective change plans in this area.

Because the education of clinicians is founded on science and they, therefore, tend to respond favorably to scientific, fact-based justifications for proposed changes (Freidson, 1988), one way to overcome this problem could be providing clinicians with empirical evidence showing how organizational and operational redesign will streamline processes, improve outcomes, and reduce expenses without lowering levels of clinical effectiveness.

In this perspective, the challenge for healthcare managers is to keep guaranteeing high standards of service with the main goal to ease healthcare professionals' activity saving time that could be more effectively dedicated to patients' care.

Finally, it must be noted that in a growing number of cases, doctors need also to accomplish teaching and research commitments. This element further influences the design and execution of healthcare production processes. For example, the OR scheduling needs to consider that, in some cases, the time of senior surgeons is dedicated to the training of junior staff while, sometimes, the daily beds' turns are delayed because of the time dedicated to the training of junior fellows.

#### 1.4. Specificities of public sector

In the vast majority of developed countries, a significant part of healthcare delivery organizations is publicly owned<sup>3</sup>. Managing public organizations is different for several aspects (Boyne, 2002, Borgonovi, 2005, Lega et al., 2013):

1. political constraints;
2. different stakeholders and different performance dimensions;
3. bureaucratic model;
4. absence of market price.

##### 1. *Political constraints*

Political dynamics result in frequent policy changes and the imposition of short-term horizons on public managers. Furthermore, politics is characterized by ambiguity, which is an asset in building and maintaining consensus. Clear goals may well prove unacceptable to some members of a political coalition. As a result, strategic goals tend to be fuzzy and to change frequently. Developing sound long-term operations strategies and innovation projects is therefore more difficult in this context (Zanjirani et al., 2009).

##### 2. *Different stakeholders and different performance dimensions*

Public organizations face a variety of stakeholders who place demands and constraints on their managers. The presence of different stakeholders (e.g. taxpayers and recipients of services, industrial groups or patients' associations) requires from public organizations to pursue different and sometimes conflicting objectives.

Furthermore, it has frequently been argued that public agencies have distinctive goals, such as ethics, equity or accountability that do not exist in

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<sup>3</sup> Furthermore, it must be noted that part of the private sector is “no-profit” with mission, goals and organizational models very similar to the public sector. Finally, the all-healthcare sector is deeply regulated with a significant role of the state in the funding systems.

the private sector (Flynn, 2007). However, as noted by several important authors (Moore, 2000, Borgonovi, 2001), the institutional mission of public organizations requires that they meet stakeholders' expectations. All of these broad considerations have a direct and significant impact on operations strategies and innovation projects within the public sector and may require the evaluation of broader dimensions which are typically related to the achievement of public interest goals and that can affect an organization's overall performance.

In the design and planning of hospital production assets (e.g. operating rooms or emergency departments), considerations about efficiency and productivity should be balanced with the need to guarantee access to care (even in remote and rural areas) and effective response in case of emergencies where timeliness and responsiveness are very much critical.

The current COVID-19 pandemic has shown that, in some cases, the excessive focus on efficiency and productivity has brought to situations where hospitals have been completely incapable to manage, from the very beginning, the peak of activities. In the case of healthcare, the trade-off between flexibility and efficiency needs to be managed carefully. For example, in the case of management of ICUs (the shortage of this type of beds has been highly debated in the current healthcare crisis), the operational goal should be to have a certain percentage of beds always available to accommodate emergency cases and NOT to reach a certain level of saturation.

Another example, in this sense, is the fact that governments often use procurement as a tool to promote a variety of important, broader public policy objectives (Arrowsmith, 1995, Harland et al., 2007) such as economic goals, social goals, and environmental goals and, in some cases, these goals might be in conflict.

In the case of logistics, outsourcing strategies, justified by the aim of pursuing efficiency, raise issues of equality and ethics when employees cease to be civil servants and become employees of a private external contractor (Moschuri and Kondylis, 2006, Bensa et al., 2010).

### *3. Bureaucratic model*

Public organizations are often designed and structured around the principles of the bureaucratic model. Public sector organizations have more formal, less flexible and more risk-averse decision-making procedures than their counterparts in the private sector (Farnham and Horton 1996, Bozeman and Kingsley, 1998).

For example, public contracts are often awarded following rules and principles that are intended to ensure equal supplier treatment, nondis-

crimination, and transparency and to reduce the risk of corruption. In addition, the use of spaces and all the scheduling processes need to respect different rules and procedures. In this sense, as outlined by Moore (Moore, 1995), in the case of publicly owned organizations often the value added has nothing to do with the actual result accomplished, but it is linked to the way the process itself is designed and executed. In this case, the compliance to laws and regulations, in the execution of the procurement process, is essential in order to accomplish relevant public goals (such as equity, accountability and legality).

In Chapter 1.10 we have included the only non-healthcare related case “Reengineering public sector production: the case of Boston Housing Authority” with the goal of highlighting the specificities of public organizations that limit possible OM change plans. In public housing, a strategic process is evidently the tenant’s selection process: in this case, the design of the process represents a key value driver to achieve important public goal such as equity, transparency, and non-discrimination.

The same concept can be applied in the case of management of waiting lists or in the pre-recovery process: the respect of clear and objective rules and procedures is an essential ingredient to achieve equity of access guaranteeing priority to the most severe clinical cases regardless the type of admission (e.g. private vs. public patients).

It must be noted, however, that the respect of the bureaucratic model may reduce efficiency and increase the overall throughput time of the production process (Doerner and Reiman, 2007). Furthermore, some rules and procedures do not make sense, they are the result of previous practices, and routines that should be eliminated since they represent a useless waste of time.

#### *4. Absence of a market price*

In the case of many public services, the price – at the point of access – is almost null; this circumstance introduces a problem of rationing the demand through systems such as waiting lists, waiting time or objective priority systems (e.g. color codes in the ED triage system). These considerations confirm previous findings on public healthcare delivery organizations where capacity is not demand-led; rather, public services organizations meet as much demand as their resources will allow (Walley, 2013).

### **Specificities vs defects of public organizations**

It is worth, in this context, to outline a difference between the four elements mentioned before that represent intrinsic specificities that physiologically influence the behavior of public managers and ancestral pathological

drawbacks that traditionally plague efficiency and functionality of public institutions such as:

- (i) lack of a culture of performance measurement and management;
- (ii) forms of nepotism in the human resources' management practices;
- (iii) little incentive for change and innovation;
- (iv) mere respect of the rules with no attention to the actual outcome achieved.

The difference might appear subtle but it is in reality very much relevant; in fact, while the specificities illustrated in the previous session cannot be removed and, somehow, represent the institutional framework that limits the room of action for public managers, the aforementioned defects should be eliminated to move to the next phase of reengineering of public production processes.

Despite these considerations, it must be outlined that there are some elements that make innovation easier in the public sector compared to the private one, particularly:

- (1) Public organizations are expected to collaborate and to share their knowledge and practices.  
Therefore, collaborative purchasing and network creation should be stronger within these organisations (Schotanus and Telgen, 2007).
- (2) Public organizations can push directly (through specific norms) or indirectly (through moral suasion) private sector organizations in participating in innovative projects (Borgonovi, 2005, Dimitri et al., 2006).
- (3) Public organizations, unlike private companies, are typically more willing to introduce drastic changes because they do not fear losing their market share and cannot file for bankruptcy (Borgonovi, 2005).

### **1.5. Managing variability in healthcare delivery organizations**

If we refer to the vast literature about process management (McLaughlin, 1996; Chase et al., 2006; Martone, 2007; Villa, 2012), a key driver for improvement is represented by standardization.

Standardization means that all activities within a certain organization – regardless of who is in charge of the process in that precise moment or the specific location where the process takes place – are performed in exactly the same way following specific procedures and guidelines.

It is, at this point, useful to understand whether standardization is an effective and workable strategy even for healthcare delivery organizations.