

**MAKING DECISIONS IN THE HOSPITAL'S SUPPLY CHAIN:
The New Look for Its Model of Management**

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ABSTRACT

The process of making decisions relies in the chance of choosing one or more of several possible actions. And to choose from the possibilities is based on a set of information that conduct the decision maker to calculate what his odds and chances of success would be like. Hospitals are essential to the community, greatly important in people's lives, and the management of these organizations present a complex character. Within this perspective, the main objective of this research is to develop a model to support decision-making and helping it to minimize waste based on the lean system. The proposed model was based on the concept of supply chain management and on the lean system. The methodology used is of exploratory and descriptive character. Expected that the proposed model can contribute in aid en route for decision-making to reorganize and succeed in the management process, generating profits and minimizing the identified waste by the Value Stream Map.

Keywords: *Decision-Making, Lean System, Supply Chain Management, Health Management.*

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1. INTRODUCTION

The organizations that provide health services are challenged to seek consistent and integrated models that could increase the maximum result and avoid the waste of their own or the government's resources, which are scarce. Moreover, trying continuously to maximize the collective well-being, that being the population's one, allowing therefore for creating an image of a technical competence, reliable procedures and humanizing the relationships with patients and families who are in situations of physical or psychological fragility. After all, the organizations providers of health services are directly associated with a life-saving image (Pucci and Cesar, 2014).

Analyzing the statistics of the Brazilian Hospitals Federation (FBH) from 2008 to 2012, there was a reduction of 12.7% of hospitals in Brazil (Machado et al. 2014). According to Moura et al. (2013) and Souza (2013), in healthcare providers the supply chain gets to be the responsible for consuming up from 25% to 40% of monthly financial resources. The management of supply chain is responsible for the biggest number of employees from a hospital, with the second largest payroll, as it incorporates all the supporting industries and essentially all streams of information and supplying materials regarding the hospital.

Goffnett *et al.* (2013), notes that inside this value chain, are inserted the demand forecasting procedures, purchasing, inventory management, warehousing costs, transportation, distribution, continuous distribution, deadline frame, quality, quantity, flow of information, materials, processes and so forth. The lack, delay or unconformity at some step or procedure, from the beforehand quoted cause huge bottlenecks, since the hospital is a service provider that needs to be available 24 hours a day, to all customers.

The activities from the healthcare field are complex, attached to a productive chain that incorporates series of defined actions for the making of its products and/or services (Dahlgaard et al., 2011, Guimarães and Carvalho, 2012). Each procedure requires a connection of specific activities from those products/services. Not only those products/services offered from healthcare organizations are complex that they involve high-skilled professionals, but also the inputs used in products/services are increasingly more sophisticated, with several high costs (Jahre et al., 2012).

Facing this situation, the healthcare providers and specifically their managers, need to know how to solve problems clearly and directly. Troubleshooting is a part of decision-making, which is a systematic process that has its focus on the analysis of a difficult situation or circumstance, solving problems always incorporates a decision-making step (Tanaka and Tamaki, 2012).

The process of decision-making is the main function of managers. There is no perfect decision, that's why their duty is to think about the advantages and disadvantages in each of the alternatives to choose the best one while always search for the best economic performance, taking into mind that there are also non-economic results such as the satisfaction of business partners and employees (Marquis and Huston, 2005, Almeida et al., 2011).

The decision-making or process of taking decisions can be defined as a selection between two or more alternatives that enables to achieve a particular result. It should be done with knowledge, rationality, competence and awareness, to result in the achievement of the expected goal or the closest to it. Its steps are: identifying problem, gathering data for analysis of causes and consequences of the problem, researching alternative solutions, evaluating alternatives, selecting the most appropriate solution, implementing the selected solution and evaluation of results (Almeida et al., 2011).

Decision-making is a process that consists in identifying the problem, the criteria, how to prepare, analyze and choose alternatives, checking the effectiveness of the decision. The act of decision-making can be an act of suffering, the great difficulty to make decisions often happens when there's not adequate knowledge of a particular subject or process.

The current research is detached into five sections, including this introduction, and following next the literature review that reports about supply chain, lean system. In the third section, the used methodology and the used articles' base. Moreover, in fourth section, the proposed model for decision-making in the supply chain and then closing the fifth section, the conclusion.

2. LITERATURE REVIEW

2.1 The Supply Chain

The supply chain is a group of procedures that encompasses interactions (products and/or services) with customers, mainly focused on sustaining customer needs. Essentially, whenever there are products or services directed to a target-buyer these involved procedures are named supply chain (Supply Chain Council, 2008).

The concept of Supply Chain originated in the manufacturing sector when companies began to organize in order to reduce the risk of lack of inputs for production (Baltacioglu et al., 2009; Segupta et al., 2006). The supply chain integrates a set of management techniques, performing the integration and coordination of business processes and strategic alignment throughout the production chain with the aim of satisfying target-clients from the supply chain and reduce costs (Mentzer et al., 2001).

In organizations providers of healthcare services, the tendency to weaken all supply problems is due to insufficient financial resources, on the other hand, the effects of lack of shortages are caused by problems in budget execution. However, waste and mismanagement of inputs and equipment, the scarce qualification of professionals from the supply area and lack of attention on logistical planning in healthcare companies are also notorious.

In the healthcare field, the management procedures of supply chain are considered complex. Each procedure requires a specific combination of products and services, their composition may vary between different organizations and even according to different types of patients and professionals of the same organization. Not

only those products/services offered from healthcare organizations are complex that they involve high-skilled professionals, but also the inputs used in products/services are increasingly more sophisticated, with several high costs (Jahre et al., 2012).

2.2 Lean System

The main challenge for organizations is the involvement and identification of value delivering for each individual customer and stakeholder. Meeting this challenge requires ability to be lean (Carvalho, 2012).

Lean system is also known as the Toyota Production System (TPS) as it was born from the car factory Toyota Motor Corporation, in the 50's. In this period, Japan suffered the effects caused by World War II, where it had been totally devastated (Reis, 2010). Lean system aims to improve the activities that add value to processes, services and customers, working for the elimination of all that does not add value and generates waste, focusing on time and motion what has changed the way of production in the world (Gapp et al., 2008).

For Womack and Jones (1998), it is lean because it is a way to do more with less and at the same time, offer customers exactly what they want. This means using less human effort, equipment, time, and space to increase the value and simultaneously minimize waste, such as overproduction loss, wasting time by waiting, per transportation, processing, for handling operations, imperfect products and by stock.

Agreeing with Maia et al. (2012), lean system is a perspective that can help in sustainable development. The correct use of lean tools such as VSM (Value Stream Map), 5S, Kaizen, TPM (Total Productive Maintenance), Pokka-Yoke, can benefit organizations in order to achieve their goals.

In the early 1990s, the sector of service providers realized that these concepts could also benefit them, and only after year 2000 these techniques began to be used in health services, so it has reported. According to Womack (2005), when compared to other industries, the hospital management has been considered slow to identify who really is the customer. Due to the complexity of health system, processes are often designed to meet the needs of internal customers - doctors, hospitals, insurance companies, government and employees. The author points out that it's extremely important that the main customer, the patient, sets the value.

The secret to the successful implementation of lean is transparency. This system will only bring benefits to the company, for employees and consecutively to customers by implementing a working team that understands this new culture, so that enables the use of this philosophy in the most optimized way possible (Brandi, 2012).

Shah (2009), Koning (2007), Jahre (2012), Shamah (2013) reported in their research that the lean tools help to identify and fight the discovered wastes. Also, emphasize that these tools contributed to the solution of problems and arranged for the healthcare-service providing organizations a different perspective, supporting the hospital's decision-making.

3. METHODOLOGY

For the development of this research, the model based on classification method defined by Lage Junior and Godinho Filho (2010) was adopted, adapting the empirical-analytical analysis, in order to do a scan in the literature regarding the keywords Supply Chain Management, Healthcare and Lean based on medias such as Emerald Insight, SciELO, in the main Brazilian and international scientific journals.

To achieve the aim of this paper was carried out a bibliometric analysis in 83 pre-selected articles initially. In the second phase, 23 selected articles are characterized as close to this study, considering the keywords Supply Chain Management, Healthcare, Lean. Within these set of articles, all were completely analyzed.

The literature analysis aims to study the bibliographic references and publications, as a basic instrument to judge the scientific production in a given area of knowledge and using quantitative synthesis, generating results to measure and support decision-making.

3.1 Bibliometric Analysis

This section presents studies in the literature review related to supply chain in healthcare area. There has been a variety of researches related to the supply-chain management field in health service providers, as shown in Table 1 below:

Table1: Bibliometric search results

AUTHOR	RESULTS
Aronsson et al. (2011)	Developed a model for the supply chain in healthcare, using the combination of the lean philosophy with supply chain management (SCM) and supply chain orientation (SCO), was working the issue of splitting process with sub-processes along with guidance as a whole, the model focus is teamwork and organizational transparency.
Agwunobi et al. (2009)	Uses commodity strategy and lean to improve the management of the supply chain with low volume of purchase, which benefited from the reduction of inventories. Streamlining supply chain layers and using the purchase volume to reduce prices can save money.
Bhakoo et al. (2011)	Used the lean implementation of e-business in the chain of supply of various companies. The lack of consistent patterns of global identification throughout the supply of health care, and the poor quality of data held by the project participants, were the problems encountered in this project.
Chen et al. (2013)	Proposed a model that demonstrates the interaction of a series of results that are relevant, in particular, the influence of confidence in the knowledge exchange is higher when a hospital faces uncertain environmental conditions.
Guimarães (2013)	Presents an attempted merger between outsourcing and lean, using practices of both outsourcing in health services which suggests an evolution.
Jahre et al. (2012)	Propose the use of simple tools to reduce inventory, lead time and on the other hand, there was the lack of product for winning product in stock. The use of simple tools such as lean, helped combat the lack of product in organization studies.
Kafetzidakis et al. (2012)	Conducted a survey in some hospitals in Greece, where it was observed that there was no structured SCM department. Despite the fact that the logistics departments or departments with similar structures, the model worked with implementation of partnerships and lean tools such as Just in Time, the adaptation of the methods above ratio remains at low levels according to the lean.
Koning (2007)	Uses several teams to identify and improve the management of a hospital in Israel, was used several tools but with greater focus on lean Six Sigma DMAIC and (Define, Measure, Analyze, Improve and Control), and the main tools of lean as 5s, MFV.
Kumar et al. (2008)	Used the model and redesign of the supply chain in a hospital in Singapore, in order to reduce the cost in the chain and the acquisition of medical supplies and drugs.
Montgomery e Schneller (2007)	Analyzed the strategies of hospitals in order to identify and model the behavior of doctors and the power of suppliers on the purchase of prostheses and special materials.
Virtue (2013)	Propose the use of simulation modeling with the tools and lean methodology to help health planners to map the processes by identifying the points of improvement.
Qrunfleh (2013)	Their study finds that the strategic partnership supplier mediates fully the relationship between a lean supply chain strategy and response supply chain, and that postponement partially mediates the relationship between an agile supply chain strategy and supply chain.
Shamah (2013)	Developed an instrument to measure the impact of lean thinking in the supply chain. This instrument can be used to examine the supply chain and thus increase the availability of value. Furthermore, noting the potential customers, competitors and suppliers, you can increase the performance of the supply chain.
Kim et al. (2006)	Some of the examples of applying the Lean principles are at the level of logistics and inventory management, the level definition of processes and the good or service production flow, the total time of production of a good or stay in service, continuous improvement processes, training and employee participation in problem solving, organization of space.
Poksinska, (2010)	Comments Lean proporcja an improvement of processes, elimination of waste and the reduction of lead time are some of the features that are most referenced studies.
Dickson et al., (2009)	We conducted a variety of Lean techniques in an effort to improve satisfaction and the teams and patients. The implementation followed a six-step process of Lean education, observation, flow analysis of patients, process redesign, new testing process and full implementation.

AUTHOR	RESULTS
Fossati et al., (2009)	The study shows that the application of lean principles in health services is possible, requires some changes, admits several degrees and has the potential to contribute to the solution of conflicts between quality and efficiency. The approach of medical language to language processes is necessary for the expansion of the lean mentalida this sector. It was observed that there is synergy between evidence-based medicine and lean thinking to promote a medical practice quality and efficient management processes.
Chadha et al., (2012)	The results of the authors reveal that the use of Lean releases capacity in the health system, providing the flexibility of response. The implementation of the lean-HealthCare model resulted in the following improvements, improved flow and increased process capacity, length of stay emergency department for all classes of patients decreased value stream mapping has been found to be useful in detecting opportunities to reduce patient turnaround and the bottleneck service could be identified and moved to where he could be more easily controlled by adhering to the principle of one piece flow.
Simon e Canacari, (2012)	The authors used the Lean methodology for the auxilair eliminate waste, optimize processes and redução costs. Lean helped in solving structured problems and be applied to any improvement projects of health care processes. The focus was on transformação through health care leaders can use a step-by-step approach to document processes and then identify problems and opportunities for improvement through a map value stream process.
Parks et al., (2008)	Lean Six Sigma methodology to identify reduction opportunities residence times in resuscitation trauma units was applied. These efforts were vital to maximize operational efficiency and reduce overcrowding in the occupied trauma centers working in their ability.
Jones e Mitchell, (2006)	The authors comment that Lean helps reduce errors, accidents and mistakes, resulting in better patient care; a better job is done sooner; with the same people, using the same equipment, are able to achieve more; there is a stable working environment with clear and standardized procedures in order to create the foundation for the constant improvement and where the enthusiasm of the staff is visible.
Hydes et al., (2012)	Lean transformation thought of not sedated UGI results via endoscopy to reduce the waiting time, reduced staffing needs and better patient flow and can form the basis of a path model that can be transferred successfully in alternative environments endoscopy with high patient satisfaction levels.
Cunha et al., (2011)	The implementation of Lean methodology in the work process of a hospital laundry. The result was the creation of a continuous flow, with the standardization of processes, allowing a reduction of inventories, increased productivity and reduced lead time. All the improvements directly impacted on reducing the costs involved in the main processing hospitalar.O clothing and higher gain is the change in behavior and attitudes of employees in an environment that allows everyone to express their skills to the fullest through a vision of continuous improvement.

Source: Author

Most frequently, the necessary knowledge for creation of productive capabilities is already available in the organization but the process for its mobilization is inefficient (Engeström et al., 2010). One justification for this is the lack of strategy for knowledge management, particularly with regard to its integration activities. One way to identify the knowledge within companies can be through lean tools, helping to enhance decision-making.

4. MODEL PROPOSED FOR DECISION-MAKING IN THE SUPPLY CHAIN

The management from health-service organizations aims to optimize the operation in order to obtain maximum efficiency regarding use of the products and services used to achieve the efficiency of processes and solving the identified problems. In this process, the manager uses information, techniques and procedures that allow conducting the operation of services towards the set goals.

Evaluation is an essential tool to support the management for its ability to improve the quality of decision-making. Nevertheless, its use is still incipient in health-service management.

The professional, social and organizational difficulty from healthcare companies brings a much higher condition regarding the creation of a management model that is seeking the involvement of all stakeholders. The difficulty lies mainly in the variety of interests that have been accommodated in the variety of technical specialties involved

in the life of a hospital in the permanent coexistence of humans with cultures, origins and completely different backgrounds.

However, if such changes occur, innovation is the key to an active management. In this sense, people are the main instrument for change and the differential for the implementation of lean, which aims to transparent management. The essence of an effective management is the constant search for innovation through technology and new methodologies to be leaned on results and cultural change from the organization (Drucker, 2003).

This research has as starting base, the use of lean principles (Machado et al., 2014). Which originated the following steps described in Table 2 below, focusing largely on people as the vehicle for new changes:

Table 2: Description of the steps from Proposed Model

STEP	OBJECTIVE	AUTORES
1-Customer Definition	As the first principle of lean seconds Womack and Jones (1998), is to determine what value to main customer is the patient.	Shah et al. (2008) McGrath et al. 2008 Shamah (2013) Chadha et al. 2012;
2-Lean Leadership	The implementation of a system of lean management business is demanded by a new leadership profile. Where decentralization of power should occur in organizations seeking sustainable growth.	Aronsson et al. (2011) Koning (2007) Shamah (2013) Fossati et al.(2009) Chadha et al. (2012) Simon e Canacari (2012) Parks et al. (2008) Cunha et al. (2011)
3-Planning and goal setting	The planning and establishment and monitoring of the company's goals and guidelines is crucial to achieve the proposed objectives. The Balanced Scorecard (BSC) is a methodology that allows overview of the organization, is based on four perspectives (customer, financial, processes and learning / growth), forming a logical and interdependent whole.	Agwunobi et al. (2009) Dickson et al. (2009) Jones e Mitchell (2006)
4-Focus on Value	This step is one of the main principles of "Lean Management", because it determines the connection, the organization's strategic focus to the processes and consequently to the improvement actions. The definition of value should always contemplate the prospects of "stakeholders" of the company, such as shareholders, customers, society, the environment and be well identified in the BSC. So that processes can be properly managed by the leader and his team equipe.Trabalho: The authors stress the importance of involving employees who work in the operation for successful deployments to the breakdown of resistance and cultural change. The involvement of doctors in the development of improvements is crucial to success. Another factor of great importance and the high participation manage are key factors for success (WOMACK et al. 2005).	Virtue (2013) Agwunobi et al. (2009) Aronsson et al. (2011) Koning (2007) Kafetzidakis et al.(2012) McGrath et al.(2008) Shamah (2013) Chadha et al. (2012)
5- Teamwork	The purpose of teamwork is a concerted effort to achieve goals, achieve the purposes and bring positive results for some groups of people. In addition to achieving goals and objectives, teamwork enables the exchange of knowledge, the formation of ideas and the generation of knowledge, regardless of role within the team, cada person has its value within the team.	Agwunobi et al. (2009) Bhakoo et al. (2011) Chen et al. (2013) Guimarães (2013) Jahre et al. (2012) Kafetzidakis et al. (2012) Kumar et al. (2008) Montgomery e Schneller (2007)
6-Mapping the current situation and development of proposals for improvements	The exercise of process mapping (VSM) team, provides the identification of waste and enables a proposal to minimize logical and compromised, since the area employees are committed. Perhaps this is the most powerful mechanism for the formation of the mental model of lean management, creating an organization able to learn continuously. It is through sharing skills and motivation of the people who work in the activities of a process that experiences the lean system.	Bhakoo et al. (2011) Chen et al. (2013) Guimarães (2013) Jahre et al. (2012) Kafetzidakis et al. (2012) Kumar et al. (2008) Virtue (2013)
7-Implementation of improvements and sustainability	The authors cite examples of implementation through kaizen events, action plans or projects. The standardization activities is a common practice found in lean. Another important point and system maintenance, with the definition of "owner" for each stream worked with the responsibility to maintain, review and change if necessary the activity worked.	Jahre et al. (2012) Shamah (2013) Montgomery e Schneller (2007) Qrunfleh (2013) Shamah (2013) Hydes et al (2012)
8-Continuous Improvement	After the implementation of improvement proposals specifies the unconditional domestic demand for excellence, where entire organization seeks continuous improvement of its processes, while releasing the creativity and self-discipline of all employees.	Guimarães (2013) Aronsson et al. (2011) Agwunobi et al. (2009) Jahre et al. (2012) Montgomery e Schneller (2007) Virtue (2013) Shamah (2013) Kim et al. (2006) Cunha et al. (2011) Poksinska (2010) Chadha et al. (2012)

Source: Author

The principle of continuous improvement must be supported by the organization and be one of the pillars of the system of recognition and motivation, always observing the convergence to the deployment of goals and keeping consistency with the focus on value.

Lean allows the hospital to minimize waste, reduce lead-time of patients and processed materials, increase productivity, capacity and consequently its profitability. According to Souza (2008), lean healthcare is gaining acceptance, not because it is a "new movement", but because it leads to sustainable results for these organizations and higher quality in services provided to customers.

5. CONCLUSION

Throughout this research, the concepts related to supply chain were presented with the lean system approach and how these are inserted in the hospital, highlighting examples in the literature. As previously mentioned, since 2000 lean is being introduced in healthcare providing organizations. Womack (2005) states that the first step in implementation of lean methodology in hospitals is the identification of his client, who is the patient.

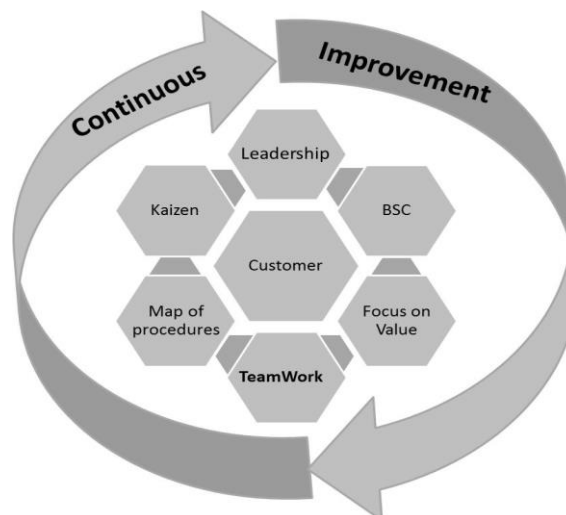
Regarding the bibliometric research, the authors (Aronsson et al., 2011; Guimarães, 2013; Jahre et al., 2012; Kafetzidakis et al., 2012; Koning, 2007; Virtue, 2013) conclude that the application of lean healthcare is not just a reality (Hydes et al., 2012; Cunha et al., 2011; Poksinska, 2010; Dickson et al., 2009), but also a success, so that the lean concepts are increasingly present in the daily lives of hospitals, reinforcing the studies of several researchers.

The application of lean techniques helps decision-making due to provide it better identification of waste generated in the processes (Simon and Canaçari, 2012; Kim et al., 2006; Chadha et al., 2012). Helping to elevate the weak points and the priorities to obtain changes, cost-reductions and a better quality for products and services.

The proposed objective of this research is to develop a model to support decision-making helping to minimize waste based on the lean system, which allows to quality improvement of service and reducing costs involved in the supply chain.

The proposed model aims to assist organizations that provide health services to make the best decision in order to identify what is important in the customer's view (patient) through changing organizational culture, being the main vehicle to the working-teams (doctors, nurses). The satisfaction from the final customer, the patient, is only possible if the entire supply chain is compromised and integrated into taking coherent and effective practices. And for that, working-teams have the need to make the best decision, both regarding the survival of the company as well as the customer's satisfaction.

Figure 1: Continuous Improvement Cycle and the main steps related



Source: Author

Figure 1 emphasizes the importance of customer's satisfaction, as the main objective of the hospitals. Through a lean management and strong bases such as a transparent leadership profile, clear planning and clear objectives (BSC), and working together as a team that has vision in improving continuously, the process as a whole gets benefitted.

So therefore, is necessary that hospitals get used to constant changes (Aronsson et al., 2011; Koning, 2007; Chadha et al., 2012; Hydes et al., 2012), revising its processes and modernizing its management models (Virtue, 2013; Shamah 2013), so that they can achieve the results that could ensure their continuity on promoting health for the community.

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