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LEAN HEALTHCARE SUPPLY CHAIN MANAGEMENT: MINIMIZING WASTE AND COSTS

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ABSTRACT

The purpose of this research is to investigate the management models applied in the supply chain providing services in healthcare organizations, considering the lenses of lean. The aim of this is to develop a model of supply chain management focusing on the identification and minimization of waste, assisting in decision making and contributing to the quality of services and as a consequence the reduction of the costs involved in healthcare supply chain. The philosophies of continuous improvement and lean techniques have a role to play in helping healthcare to provide quality service and support to reduce costs in the current budget constraints. In the supply chain of hospitals the financial costs can be around 40% of its budget (MASOUMI et al. 2012; SOUZA et al., 2013). This article sheds light on the improvement in decision making and the effect of reducing costs in the healthcare supply chain. In this sense, the research intend to expand knowledge related to supply chain management in the area of provision of healthcare services through the use of the philosophy of continuous improvement and lean principles, helping healthcare to provide quality service within their current budget constraints.

Keywords: Supply Chain Management, Lean principles, Healthcare.



1. INTRODUCTION

Nowadays is competitive market, changes occur very quickly and the performance of the companies alone is no longer enough to ensure their survival (KIPPER et al, 2011; BORH et al., 2012; GIBBONS et al., 2012). The alternative for business management cases include options beyond organizational frontiers, that is, companies feel the need to organize themselves in the form of chains or supply networks, due to that originated the expression supply chain, which emerged in the manufacturing, when companies began to organize themselves in order to reduce the risk of lack of production inputs (ASHBY et al., 2012).

Recent economic trends have created highly complex supply chains and supply design, organization, interactions, skills, capabilities and management of supply chains have become key issues (GOLD et al., 2009).

Organizations providing healthcare services are essential to the community, in special in peoples lives, and the management of these organizations offers uncommon character, there are few manufacturing processes as complicated as organizations providing healthcare services because of the relative risks to health. In this way these organizations must continually balance the need to assistance to their patients, along with an attention to financial constraints as the transfer of funds from private health plans and the Unified Health System (Sistema Único de Saúde - SUS) Brazilian public. The SUS is one of the largest public health systems in the world. It ranges from simple outpatient care to organ transplantation, ensuring comprehensive, universal and free to the entire population of the country access. Supported by a broader concept of health, the SUS was created in 1988 by the Brazilian Federal Constitution (Constituição Federal Brasileira), to be the health system of more than 180 million Brazilians.

Although demonstrating notable advances in technology and treatment, the healthcare industry is fraught with inefficiencies and errors (TANER et al., 2007).

According to the statistics of Brazilian Hospital Federation (Federação Brasileira de Hospitais - FBH) in 2008 was appointed 7,540 hospitals. Four years later in 2012 the FBH conducted further research and found that the number of hospitals in Brazil was 6,690 units. Analyzing the statistical data from 2008 to 2012 there was a reduction of 12.7% of hospitals in Brazil. According to Souza (2013), the



supply chain in hospitals may account for the consumption from 25% to 40% of monthly financial resources.

Therefore, hospitals should develop their own supply chains to deliver drugs and other materials coming from suppliers to their patients or clients. Consequently, the presence of two chains in the supply management of the health sector is observed: one external, one internal to the organization (RIVARD-ROYER et al., 2002).

Based on the assumptions reduction of 12.7% of hospitals in Brazil, the supply chain in hospitals is responsible for 40% of financial resources, the work was developed through exploratory and descriptive methodology in seeking to meet models management supply chain of adhering to lean, aiming to propose a model of supply chain management focusing on the identification and minimization of waste in the process aiding in decision making and contributing to the quality of services and as a consequence the reduction of costs involved in this chain.

This research is divided into eight sections, including this introduction, next section discussed the importance of the supply chain from the perspective of healthcare. Section 3 explains the lean principles, focus on the customer and teamwork, in section 4 explains the seven wastes in the area of healthcare, in section 5 explains the methodology used in the research. Section 6 explains the analysis of selected articles and the results found. Section 7 explains the proposed model and practice management for the process of change lean healthcare. Finally, the conclusion presents and findings of our research.

2. SUPPLY CHAIN IN THE HEALTHCARE PERSPECTIVE

The supply chain includes a set of management techniques, performing the integration and coordination of business processes and strategy alignment throughout the production chain in order to satisfy end customers in the supply chain and reduce costs (MENTZER et al., 2001).

In hospital organizations, the tendency to reduce all problems of supply is due to insufficient budgetary resources, although, in fact the effects of lack of shortages are caused by problems in budget execution. However, they are also notorious waste and misuse of supplies and equipment, the limited qualification of professionals in the



field of supply and little attention to logistics planning in service organizations in healthcare.

The procedures in healthcare are complex, layered on top of a supply chain that incorporates sequences of actions defined for the generation of their products and services. Each procedure requires a specific combination of products and services, their composition may vary between different organizations and even according to the different types of patients and professionals from the same organization. Not only the products offered in health care organizations are complex involving high-skill, but the inputs used in their production are increasingly sophisticated, with numerous high costs (JAHRE et al., 2012).

3. LEAN PRINCIPLES – FOCUS ON THE CUSTOMER AND TEAMWORK

The principal challenge for organizations is the identification and involvement of delivering value every customer and interested parties. Meet this challenge requires ability to be lean. (CARVALHO, 2012).

Is not new preoccupation of organizations with the efficiency and effectiveness of their processes. This begins in the studies of Taylor, focusing on the times and movements that changed the way the world production (GAPP et al., 2008). The same authors report that soon after, in Fordism had become a new revolution in the mode of production based on the series production. Currently the model of lean production also known as the Toyota Production System, using as proposed focus on minimizing waste, but that the organizational mentality should be expanded.

For Womack and Jones (1998), 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 minimize waste simultaneously. Five are the general principles of lean thinking as shown:

1. Specify value from the standpoint of the end customer by product Family
2. Identify all the steps in the value stream for each product family, eliminating whenever possible those steps that do not create value.
3. Make the value-creating steps occur in tight sequence so the product will flow smoothly toward the customer.
4. As flow is introduced, let customers pull value from the next upstream activity.



5. As value is specified, value streams are identified, wasted steps are removed, and flow and pull are introduced, begin the process again and continue it until a state of perfection is reached in which perfect value is created with no waste.

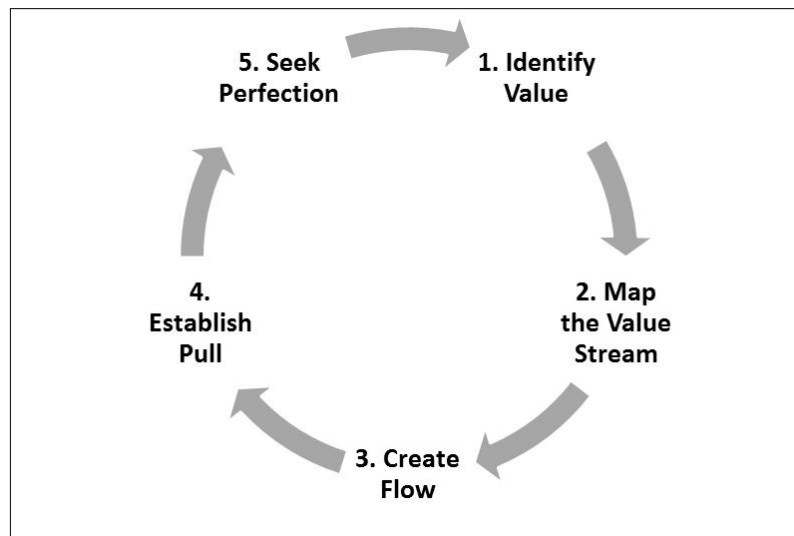


Figure 1: Five Lean Principles
Source: Adapted from Womack and Jones, 2004

According to Womack (2005), when compared to other industries, hospital management has been slow to identify who the customer really is. Due to the complexity of the health system, the processes are often designed to meet the needs of internal customers - doctors, hospitals, insurers, government payers. The author emphasizes that it is extremely important that the value will be set by the patient's primary customer.

The secret to successful implementation of lean system is transparency. This system will only bring benefits to the company, for employees and for customers consecutively through the implementation of a work team who understand this new culture, so you can use this philosophy in the most optimized way possible (BRANDI, 2012).

4. SEVEN WASTE IN THE HEALTHCARE

The basic concept of lean is to eliminate waste within companies. According to Ohno (1988), waste refers to all elements of production or service provision that only increase costs without adding value, that is, are the activities that do not add value to

the product from the point of view of the customer, but are performed within the production process.

According to Shingo (1996), classifies waste into seven types:

1. **Overproduction:** Is related to the fact that they produce more than the quantity demanded by the market. We can mention the health of testing beyond what is a necessary, unnecessary test for lack of preparation of the team.
2. **Transportation:** Regarding transport for distances greater than necessary, as an example of excessive transport patients, equipment and drugs operations.
3. **Processing:** Corresponds to processing activities that do not add value to the product. We can cite excessive treatment time by difficulty in establishing standard procedures, excessive corrections and inspections.
4. **Rework:** Corresponds to construct items out of specification. We can cite medication errors, infection of patients in hospital.
5. **Motion:** Related to the movement useless in the execution of activities, that is, the inefficiency of the operation itself. We can cite excessive movement by hospital healthcare professionals.
6. **Waiting:** Related to issues of synchronization of production or provision of high batch processing due to the high preparation time tasks, or failures in the information system of the organization. We can mention the patients waiting for diagnostics, treatments and surgeries.
7. **Inventory:** related to the existence of high stocks or lack of product. We can mention inputs and outputs in excessive or unnecessary.

In lean focuses primarily on minimizing waste, defined as everything that is not necessary in the production cycle of a product or service. Thus the understanding and identification of wastes within the hospital chain, will provide the alignment of value-generating activities, seeking to provide customers exactly what they need.

To achieve the goal proposed by the lean, it is necessary to apply some tools that will assist in achieving the results. In organizations management methodologies with more modern they are always real for it to turn knowledge into value need.



Therefore companies should take care that the knowledge generated in the organization is not dispersed. These tools are instruments used for the implementation of lean philosophy, which dictate "how to" follow its principles (FERNANDES et al., 2012.). According to the authors:

- **Value stream mapping (VSM):** is the identification of all activities / specific tasks that occur throughout the value stream for the product process. An example is the mapping of the input from the patient, all activities, procedures, diagnoses made until discharge from the hospital.
- **Total Productive Maintenance (TPM):** the basic concept of TPM is to redesign and improve the business structure from the restructuring and improvement of people and equipment, involving all levels of organizational change and posture, in order to achieve the goals of "zero breakdown", "zero defect" and "zero accident" (NOGUEIRA et al., 2012). Example is planning maintenance of equipment.
- **Takt Time (TT):** The takt time is the time available for work in a given period by the demand in that period (SANTOS et al., 2011.).
- **Just in Time:** is a set of activities aimed at high volume production using minimal inventories of raw materials, intermediate and finished goods inventory. Nothing is produced until it is needed (REBELATO et al., 2012).
- **5S:** The five senses that name the 5S program are derived from the initials of the Japanese words Seiri, Seiton, Seiso, Seiketsu, Shitsuke are known to the senses of use, organization, cleanliness, health and self-discipline. (GAPP et al., 2008).
- **Poka-Yoke:** Means "failsafe", and seeks to minimize the defects caused by failures by human and ideal distraction ever produce faultless. The poka-yoke in services is applied both for employees and for customers to avoid both commit human faults that generate losses in the process or rework (NADAE, 2009).
- **Kaizen:** Singles improvements made by frontline staff, targeted for certain occasions where there are losses in the process.



- **Visual Management:** Allows for quick and clear visualization of production progress so that management of the system more responsive, by presenting partial results in wall so that all employees can monitor the process.
- **Setup:** Aims to achieve reductions in the time required to perform the setup activities on machines or equipment that involve exchange of tools or materials and, therefore, imply the need to stop them (COSTA et al., 2012).
- **Kanban:** Is any mechanism to communicate the time to replenish or produce exactly what is being requested and the amount due, enabling the production flow is pulled (JUNIOR et al., 2008; SLACK, 2008).
- **Layout:** It's the best use of available space in a productive area resulting in the transformation of raw materials into finished product more effectively by lower distance traveled in the production plant in the shortest possible time, with the highest quality product, and mostly keeping the welfare and safety of workers.

According to the authors (SHAH, 2009; KONING, 2007; JAHRE 2012; SHAMAH, 2013) reported that lean tools help identify and combat waste found. The authors emphasized that these tools have contributed to the solution of problems and provided the organizations providing health services in a different view, helping to hospital decision making.

5. METHODOLOGY

The search procedure used in this paper was based on the method of classification defined by Lage and Godinho Filho (2010), adapting the empirical-analytical analysis, doing a scan in the literature with to the keywords supply chain management, healthcare and lean on periodic bases as Emerald Insight, SciELO.

To achieve the objective of this paper, a bibliometric analysis was performed on 83 selected articles, which are prioritized based on criteria: a) be the area of supply chain management and b) and be applied in healthcare. In the second phase analyzed, the 83 articles, which could be characterized as near this study, considering the keywords supply chain management, healthcare, lean, within these set of 20 items, which were all analyzed completely found.



6. ANALYSIS OF SELECTED ITEMS

As a result of the survey of the academic literature on supply chain in healthcare, there has been a variety of research related to the area of supply chain management in providing health services companies, as follows:

- Aronsson et al. (2011), developed a model for the supply chain in healthcare, using a combination of lean philosophy with supply chain management (SCM) and supply orientation (SCO) chain, was working the issue of splitting process with sub-processes together with the guidance as a whole, the focus of the model is the teamwork and organizational transparency.
- Agwunobi et al. (2009), uses the strategy of commodities and lean for improving the management of the supply chain with low purchase volume, which benefited from the reduction of inventories. Rationalization layers of the supply chain and using bulk buying to reduce prices can save money.
- Bhakoo et al. (2011), used the lean implementation of e-business in the supply chain of several companies. The lack of consistent patterns of global identification throughout the supply of healthcare, and poor quality of data maintained by the project participants, were the problems encountered in this project.
- Chen et al. (2013), the proposed model demonstrates a series of interaction results that are relevant, specifically, the influence of trust in the exchange of knowledge is greater when a hospital facing 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), the authors propose the use of simple tools to reduce inventory, lead time, and secondly, there was a 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 proposed model worked with partnerships and implementation of lean tools such as Just in Time, the relationship of the above methods of adaptation remains at low levels according to the lean.

- Koning (2007), using multiple teams to identify and improve the management of a hospital in Israel, several tools have been used but with greater focus on Lean Six Sigma and the DMAIC (Define, Measure, Analyze, Improve and Control), and tools as the main lean 5s, MFV.
- Virtue (2013), propose the use of simulation modeling along with the tools and methodology of lean to help health planners to map the processes of identifying where improvements.

It may be observed a different view with regard to seeking a closer relationship with the industries organs service providers in health, in order to reduce costs, particularly in the supply chain.

- Qrunfleh (2013), his study finds that the strategic partnership with supplier fully mediates the relationship between a strategy of lean supply chain and supply chain response, and that postponement partially mediates the relationship between a strategy of agile supply chain 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, we can increase the performance of the supply chain.

According Engeström et al. (2010), in most cases the knowledge required for the formation of productive capabilities now available in the organization, but the process for their mobilization is inefficient. One explanation for this is the lack of a strategy for knowledge management, particularly as it relates to their integration activities. One way to identify knowledge in enterprises can be through the lean tools such as value stream map.



7. MODEL – PRACTICE MANAGEMENT FOR THE PROCESS OF CHANGE LEAN HEALTHCARE

The changes with globalization efforts have been demanding for organizations in search of tools able to sustain their business. The supply chain in hospitals, as well as other types of organizations, is interconnected with all departments and has great influence on the results and processes. The change of culture arising from globalization has forced companies to live with suppliers, service providers and customers from all over the world, once tied to this new behavior, the pressure for results, best service, innovation and relationships is inserted.

To survive in this increasingly competitive market, companies must adopt mechanisms as prerequisites that determine the costs of activities that develop in order to grow administratively. In this sense, means managing costs control them and plan them, managing them in order to reduce those unnecessary and allocating them in those most important activities to achieve its mission.

Due to the lean philosophy, companies today rely on logistic results to offer competitive advantages, such as flexibility, price, quality, accuracy purchasing, inventory and distribution, so it attract investors and enhance the brand in the stock market.

It appears, however, that the professional, social and organizational difficulty of a hospital, brings a much higher requirement as regards the creation of a management model that seeks to secure the involvement of all stakeholders. The difficulty lies mainly in the multiplicity of interests that have to be accommodated in the variety of technical specialties involved in the life of a hospital, permanent coexistence of human beings with cultures, backgrounds and completely different backgrounds.

However, if such changes occur, it is crucial innovation with active management, in this sense; people are the main instrument for change, with the differential for the implementation of lean that aims transparent management. According to Drucker (2003), the essence of effective management is the ongoing pursuit of innovation through technology and new methodologies that is results-oriented and cultural change in the organization.



The largest portion of the methods employed have small improvement cycles based on mapping the current situation, development of future situation and creating an implementation plan for improvement. Deployments for improvement kaizen events and employee engagement are also frequently cited.

As a starting point, through the principles of lean yielded the following steps described below, focusing mainly on people as a vehicle for change:

1. **Definition of Customer:** As the first principle of lean seconds Womack and Jones (1996), is to determine what is value for main customer is the patient (SHAH et al., (2008); MCGRATH et al., 2008).
2. **Lean Leadership:** Aronsson et al. (2011), Koning (2007), cite the implementation of a lean management system business is sued by a new leadership profile. Where decentralization of power should occur in organizations seeking sustainable growth.
3. **Planning and goal setting:** The planning and setting and monitoring of goals and guidelines of the company is crucial to achieve the proposed objectives. The Balanced Scorecard (BSC) is a methodology that allows an overview of the organization, is based on four perspectives (customer, financial, process and learning / growth), forming a logical and interdependent whole.
4. **Focus on Value:** Fourth stage is one of the main principles of "Lean Management" as-if it determines the connection, the strategic focus of the organization with the processes and consequently to the improvement actions (VIRTUE, 2013). Setting the value should always contemplate the prospects of "stakeholders" of the firm, such as shareholders, customers, society, environment, and be well identified in the BSC. So that processes can be properly managed by the leader and his teamwork.
5. **Teamwork:** The authors (ARONSSON et al., 2011; KONING, 2007; KAFETZIDAKIS et al., 2012) emphasize the importance of involving employees who work in the operation to success deployments to break the resistance and cultural change. The involvement of physicians in the development of improvements is crucial to the success seconds McGrath et al. (2008). Another factor of great importance and involvement of top management are key factors for success (WOMACK et al., 2005).



6. **Mapping the current situation and development of the proposed improvements:** The exercise of mapping processes (VSM) on staff, provides waste and allows identification of a proposed logic minimization and committed way, since the employees are from the area committed. Perhaps this is the most powerful mechanism for the formation of the mental model of lean management, creating a learning organization continuously. It is through the sharing of skills and motivation of the people who work in a process that experiences the lean system activities.
7. **Deployment improvements and sustainability:** Jahre et al. (2012), Shamah (2013), cite examples of deployment through kaizen events, action plans or projects. The standardization activities are a common practice found in lean. Another important point and the maintenance of the system, with the definition of "owner" for each stream worked with the responsibility to maintain, review and change if necessary the activity worked.
8. **Continuous Improvement:** According to Guimarães (2013), Aronsson et al. (2011), Agwunobi et al. (2009) and Jahre et al. (2012), comment that after the implementation of the proposed improvements down the unconditional domestic demand for excellence, where the entire organization is focused on improving its processes, freeing both creativity and discipline of all employees. The principle of spontaneous continuous improvement should be supported by the organization and be one of the pillars of the system of recognition and motivation, always observing the convergence to the unfolding of goals and keeping consistency with the focus on value.

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

8. CONCLUSIONS

Throughout this research, the concepts related to supply chain approach to lean and how these are embedded in the hospital, highlighting examples in the literature were presented. In relation to 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 concepts of lean are increasingly present in the routine of hospitals, enhancing studies of various researchers.

The application of lean techniques helps to identify for the minimization of waste generated in the processes, ensuring greater productivity, and weak development of priority issues for change, lower costs and better quality products and services.

As proposed by the research goal is to develop a model of supply chain management focusing on the identification and minimization of waste aiding in decision making that enables the improvement of quality of services and reduce the costs involved in this chain.

The proposed model aims to assist hospitals to identify what is important in view of the customer (patient) through changing organizational culture, being the main vehicle teamwork (doctors, nurses). Satisfaction of the end customer, the patient, is only possible if the entire supply chain is compromised and integrated into coherent and effective practices.

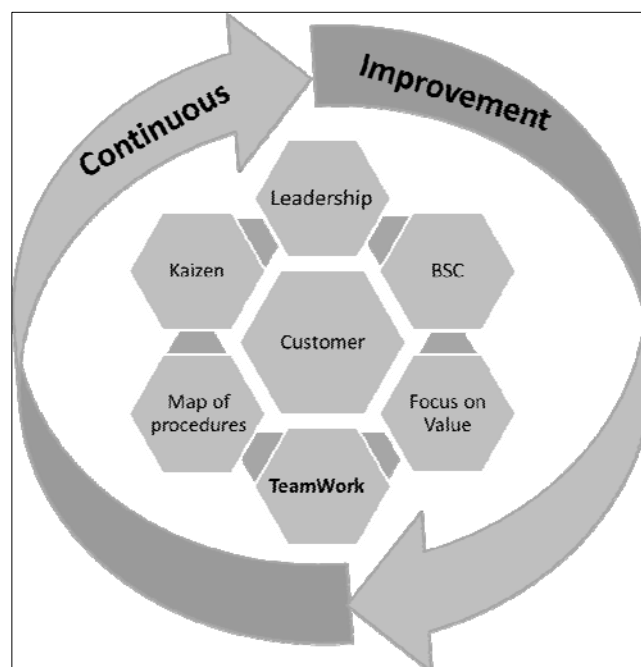


Figure 2: Proposed Model-Practice management for the process of change lean healthcare

Source: Author

The figure 2 emphasizes the importance of customer satisfaction, with the main objective of the hospitals. Through a lean management, with strong bases such as transparent leadership profile, planning and clear objectives (BSC), with teamwork with vision improvement continues assisting the process as a whole.

Thus, the lean becomes an important tool for the hospital environment, especially the supply chain that seeks sustainability of their supply chains through efficient management that aims at rationalizing flows, standardization of processes, which lead the company to reduce waste and costs and increasing the quality of services and hence customer satisfaction.

It is necessary, therefore, that hospitals are best suited to constant change (ARONSSON et al., 2011; KONING, 2007), reviewing their processes and modernizing their management models (VIRTUE, 2013; SHAMAH, 2013) so that they can achieve results that guarantee continuity by promoting health for the community.

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