

IMPROVING PROCESSES IN LONG-TERM CARE

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Abstract

Process improvement applied in healthcare is a subject that is reaching a large dimension over the years. Increasingly companies need to stay competitive and differentiate themselves from each other. Lean as process improvement arises as a solution to improve core processes and to gain competitiveness. In the healthcare area, arises as a cost reduction solution in the health sector and allows the rationalization of resources and a better practice of all processes inherent to the provision of the service, making the service an added value for the customer.

This dissertation aims to identify how can process improvement add value to the long-term care services, under the application of process improvement, namely Lean Thinking tools. Furthermore, a theoretical framework is provided in order to support the current investigation.

A methodology of dissertation with a case study is applied to the long-term care, namely in medium-term and rehabilitation care, in Santa Casa da Misericórdia de Alhos Vedros unit where direct observation, focus group and informal interview are performed with stakeholders of the service.

Value stream mapping and flowchart are applied to the process of medium-term and rehabilitation care. The customers of this service are identified as well as what is their value perception of service. Value-stream mapping allows to identify sources of waste, and possible improvement suggestions are presented.

The outcome of this research allows to improve the medium-term and rehabilitation process and consequently the service delivery, making the process more efficient.

Keywords: Process Improvement; Lean Thinking; Healthcare; Value Stream Mapping; Long-term care.

JEL classification system: M110 – Business Administration: Production management; I100 Health: General

Resumo

A melhoria de processos aplicada na área da saúde é um tema que está a atingir grande dimensão no decorrer dos tempos. As empresas cada vez mais sentem a necessidade de se manterem competitivas no mercado, distinguindo-se umas das outras. *Lean* surge como uma solução de melhoria dos processos principais de uma empresa, o que permite um aumento de competitividade. No setor da saúde, surge como uma solução de redução de custos e permite a racionalização de recursos, bem como melhores práticas relativas aos processos de prestação do serviço, fazendo do mesmo um serviço valorizado para o cliente.

Esta dissertação pretende identificar como é que a melhoria dos processos pode acrescentar valor aos serviços continuados de saúde, sob a aplicação de ferramentas *Lean*. Posteriormente, uma estrutura teórica é desenvolvida com o intuito de suportar a investigação.

A metodologia de dissertação com caso de estudo é aplicada aos serviços continuados de saúde, nomeadamente em média-duração e reabilitação na unidade da Santa Casa da Misericórdia de Alhos Vedros, onde observação direta, *focus* de grupo e entrevistas informais foram aplicadas com os *stakeholders* do serviço.

Value stream mapping e *flowchart* são aplicados no processo de media-duração e reabilitação. Os clientes do serviço são identificados bem como qual a sua perceção de valor do serviço. *Value stream mapping* permite identificar as fontes de desperdício e possíveis sugestões de melhoria são apresentadas.

O resultado desta investigação permite melhorar os processos da média-duração e reabilitação e consequentemente a prestação do serviço, tornando o processo mais eficiente.

Palavras-chave: Melhoria de processos; Pensamento *Lean*; Cuidados de saúde; *Value stream mapping*; Serviços continuados integrados de saúde.

Sistema de Classificação JEL: M110 – Business Administration: Production management; I100 Health: General

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List of Abbreviations

LTC – Long-term care

SCMAV – Santa Casa da Misericórdia de Alhos Vedros

RNCCI - Integrated National Continuing Care Network

VSM - Value stream mapping

1. Introduction

1.1. Introduction

In this chapter, an approach is taken to the problem that leads to the case study, its context and relevance. The specific objectives of the research are identified in order to achieve the general objectives and answer to the defined research question. Moreover, the scope of the research and its structure is identified.

1.2. Problem statement

Population ageing is a reality that Portugal has faced over the years. According to the Portuguese National Institute of Statistics (Instituto Nacional de Estatística, 2011), the proportion of young people in the total population decreased and the proportion of the elderly (population aged 65 or more) increased from 16,4% to 19,1% between 2001 and last censuses in 2011. According to the same Institute, the age proportion of the Portuguese population in 2011 was 128, which means that for every 100 young people there were 128 elderly. As a consequence of ageing, there are implications in terms of the population health. Almeida (2012) stated that ageing decreases functional capacity, which is a risk factor for the occurrence of accidents. LTC, according to the Organization for Economic Co-operation and Development, is defined as a set of services that help dependent people with low functional, physical and / or cognitive capacity in the basic activities of their everyday life (World Health Organization, 2015). Within this setting, according to Entidade Reguladora de Saúde (2015), with the ageing of the population, the demand for health care services is increasing, particularly, the demand for long-term care (LTC) services, which represents “*a range of services, including activities, meals, food to take home, laundry services, bathing and even assistance obtaining medication and attendance at primary care centres.*” (Simões et al., 2017:132).

LTC is provided, in Portugal, within the scope of the Integrated National Network of LTC (*Rede Nacional de Cuidados Continuados Integrados*, RNCCI), which was created by the Decree-Law 101/2006 (Ministry of Health, 2016) under the Ministry of Health and the Ministry of Labour and Social Solidarity. This network was created as a result of a clear lack of resources in long-term and palliative care and combines multidisciplinary teams of professionals in order to provide LTC services, social support and palliative care (Simões et al., 2017). The LTC network in Portugal includes health units of convalescence, medium-

term and rehabilitation care units, long-term and maintenance care units, and palliative care units (Entidade Reguladora de Saúde, 2015). In the Portuguese context, long-term care is defined as a set of sequential health interventions and / or social support in order to promote autonomy and improve the functionality of the person in a dependency situation (Ministry of Health, 2006).

As LTC in Portugal is more focused on the elderly population (Entidade Reguladora de Saúde, 2015), which are considered as persons aged 76 years and above (Instituto Nacional de Estatística, 2014), and the Portuguese elderly population tends to grow gradually (Entidade Reguladora de Saúde, 2015), it is relevant to follow and improve this area of health care services.

In order to provide the best possible service to the increasing number of patients requiring LTC in Portugal, there is a need to analyse LTC service processes and explore if it is possible to improve the service delivery so as to improve its efficiency without reducing its effectiveness. A possible solution is to adopt methodologies that focus on processes improvement.

With the objective of improving and adapting the long-term care to the patient, streamlining the use of resources and improving the perception of quality of long-term care customers, the opportunity arises to carry out an investigation using a dissertation.

1.3. Research question

Considering the point of view of different stakeholders involved in the LTC process – in this case, patients and health providers -, the following research question comes to light: *How can process improvement add value to the stakeholders of LTC services?*

1.4. Objectives

When answering the research question “*How can process improvement add value to the stakeholders of LTC services?*” this research will be based on process improvement methodologies in healthcare by attempting to demonstrate its potential benefits to LTC services. The main objective of this thesis is therefore to identify possible solutions to improve long term care service value without disregarding effectiveness.

To comply with the main objectives stated above, six specific objectives are identified:

- Map the LTC processes;
- Identify what is value to the stakeholders of the LTC services and which stages of the LTC delivery process add value and which do not;
- Identify potential improvement opportunities in the LTC processes;
- Analyse tools, methodologies and approaches that may be adequate for the improvement of health processes;
- Develop proposals to improve the LTC service delivery process;
- Compare the current LTC service delivery process and the new process with the proposal of improvements.

1.5. Methodology

According to Yin (2013), to choose the best structure of research, it is necessary to consider three aspects - the research question, the control of the investigator in the events and the focus on contemporary events rather than historical ones.

As the author referred *“in situations when the main research questions are “how” or “why” questions; a researcher has little or no control over behavioural events; and the focus of study is a contemporary (as opposed to entirely historical) phenomenon.”*, the case study research is the preferred methodology (Yin, 2013). Thus, for the current research the most indicated structure is the “dissertation”. Since there are not many studies in this area and none study was specifically found in the area of process improvement in LTC, the current investigation contributes to reduce the gap in the literature. Thus, the methodology to be followed will be dissertation with a case study. Another plausible justification is that the research question is a “how” question, so that the case study investigates phenomena in real-world context and allows retaining characteristic of real-life event (Yin, 2013). The current investigation will analyse the medium-term and rehabilitation care typology, which is within the scope of the real-world context required by Yin (2013).

According to Eisenhardt (1989), one of the limitations of case study research is that it focuses on a bottom-up approach, therefore results cannot be generalized. The results

obtained will be valid under the scope of this specific case study and cannot be globally generalised to other organizations and services.

A systematic investigation will provide data to improve the processes of the service described above and a qualitative research will be conducted. The qualitative research will be based on data collected through existing documents, direct observations, informal interviews and focus group. In an initial phase, LTC processes will be mapped. Then, given the needs of the LTC unit and considering the value-adding activities for LTC customers, opportunities for improvement will be identified. Afterwards, the opportunities will be proposed and analysed with LTC service providers in order to validate it.

1.6. Scope

The investigation will take place in Santa Casa da Misericórdia de Alhos Vedros. According to the objectives and research question previously referred, the current investigation will focus only on a particular type of LTC service, namely the medium-term and rehabilitation care typology. The research will lay attention on the processes that occur in the medium-term care and rehabilitation services from the moment the patient enters the service to the moment the patient departs. Thus, the processes to be analysed are related to the processes of health service provided in that typology.

1.7. Dissertation structure

The research is divided into five distinct parts, related to the different stages of study development:

Chapter 1: Introduction to research, which contextualizes the study to be developed as the scope, defines the objectives and the research questions and identify the methodology to follow in order to achieve the established objectives.

Chapter 2: Literature Review, in which a conceptual approach is made to the theoretical basis that supports the investigation, by exposing the concepts related to the topic to be addressed.

Chapter 3: Presentation of the methodology adopted for the current investigation, considering the chosen structure.

Chapter 4: Presentation of the case study as well as the identification of opportunities of improvement and possible solutions.

Chapter 5: Will disclose the discussion of the conclusions of the study, answer the research question, as well as discuss the fulfilment of the proposed objectives. It also highlights the limitations of the results obtained and formulates opportunities for future research.

2. Literature Review

2.1. Introduction

In this chapter, the theoretic framework that supports the research is carried out taking into account the main concepts related to Process Improvement. Process improvement is the focus of this investigation as the objective of this dissertation is to answer the question previously referred – “*How can process improvement add value to the stakeholders of LTC services?*”. An introduction to process improvement is provided considering the main methodologies used in the different industries and the most appropriate tool(s), methodology(ies), or approach(es) are identified for the current investigation. Considering the research question and objectives of this investigation, different applications of the tool(s) or approach(es) that is(are) identified as the most appropriate one(s), as well as its(their) applications in different service areas, are exposed.

2.2. Process Improvement

Competitiveness is a multidimensional concept and one of the great concerns of companies (Tamás, 2017). According to Ambastha and Momaya (2004), competitiveness is an ability to compete and can arise from the processes of an organization. Tamás (2017) declares that companies that carry out continuous improvement approaches are the ones that can stay competitive in the long-term.

Processes contain the transformation of inputs into outputs that add value to the customer (Goldkuhl & Lind, 2008; Melao & Pidd, 2000). Each process can be affected by events and it is the main concept used to model the business (Alotaibi & Liu, 2016; Capozucca & Guelfi, 2010). According to Tamás (2017), process improvement is a way of increasing the company's competitiveness and can be achieved through methodologies, tools and approaches. Bendell (2005:969) state that “*much organizational business process improvement activity is basic, consisting of simple process mapping and analysis, leading to greater process understanding ownership and some redesign*”. Particularly, process mapping, simulation and Lean Thinking are useful methods with numerous applications in different service areas.

Process mapping is a method used to analyse and identify the most efficient way to improve a process (Savory & Olson, 2001). Once the process is mapped, there is space for

improvement. The same authors declared that an effective way to study a system is to make a data flow diagram or flowchart, creating an “as is” process map. It is useful to develop a “should be” process map to identify the best situation for the process being tested and approved (Savory & Olson, 2001). According to the referred authors, one of the disadvantages of this methodology is the fact that it cannot be used to visualize quality. Process mapping is the key factor to apply reengineering to a better understanding and improving business process and bottom-line performance (Hunt, 1996).

On the other hand, simulation is a method mainly used to make a computer model on the basis of the real/planned events, for instance of production areas (Tamás, 2017). Carley (2001) describes simulation as a virtual experiment. In accordance with the same author, simulation distinguishes itself from all other approaches because it is the only one that can efficiently improve complex production systems. It focuses on the indicators of present and future production systems that are the most important for improvement and/or avoid possible failures (Carley, 2001). Process map simulation provides a *“means of measuring overall changes in the value (output) of an organization or system caused by specific changes you make to your processes; help decision makers understand complex operations through a relatively simple graphic representation; identifies utilization rates of activities, revealing bottlenecks or underutilized activities”* (Hunt, 1996:21). According to Carley (2001), simulation methods are mostly used for single family production processes.

According to Bendell (2005), organizations are applying other strategic process improvement approaches, such as Lean Thinking and Six Sigma. Lean is an approach with a set of principles and tools that aim at enhancing tasks that add value to a service and/or product (Womack & Jones, 1996). According to the same authors, actions that do not add value should be identified and eliminated in order to improve processes. Lean Thinking is an essential factor of a global methodology to workflow and efficiency improvement (Lee, 2016). Lee (2016) also refers that companies recognize in the market the appeal to use of Lean tools for the purpose of process improvement. Leite and Vieira (2015) refer that the use of Lean tools and principles have a quick response to the market and ensure quality. In parallel, on the health industry, Lean is a concept that is being increasingly applied. It is used not only to improve efficiency but also clinical outcomes, satisfaction, and safety for both staff and patients (D’Andreamatteo et al., 2015).

For the ongoing investigation and taking into account the objectives, the research question and the nature of the problem, the Lean and process mapping are the methodologies that better fit this study. Also, there is a wide range of application in several contexts and also numerous applications in the healthcare area (Hines et al., 2004; Moldovan, 2018; Laursen et al., 2003; Spear, 2005). Process mapping allows a better understanding of how the LTC process is. Afterwards, when the process is mapped, it is possible to find opportunities to improve the service through Lean Thinking. That is, in this investigation it seeks to identify the stages of the LTC process that add value to the client in order to improve the process. The current investigation intends to contribute to reduce the gap in the LTC process improvement literature, since no studies on LTC have been found, more precisely in medium-term and rehabilitation care.

2.3. Lean Thinking

The origin of the concept of Lean Thinking comes from the Japanese manufacturing philosophy of Toyota - Lean Production. Following World War II, Japan was starting to change the automotive business model, giving rise to the Toyota Production System, producing several models in small quantities, unlike in the United States of America (Ohno, 1988; Womack et al., 1990). According to Ohno (1988) and Womack (2002), automotive industry in United States of America used mass production with low diversity, so they could reduce production costs.

The few existing resources and the competitiveness of the automobile industry form the driving force behind the creation of the just-in-time production system and the Kanban method, tools of Lean methodology (Hines et al., 2004). The concept of Lean *“provides a way to do more and more with less and less— less human effort, less equipment, less time, and less space—while coming closer and closer to providing customers with exactly what they want”* (Womack & Jones, 2003:15) and described as *“the dynamic, knowledge-driven, and customer-focused process through which people in a defined enterprise continuously eliminate waste with the goal of creating value”* (Murman et al., 2002:90). According to Damle et al. (2016) the main objective of Lean Thinking is to maximize value-added while eliminating the expenditure of any resource needed.

Lean has both a strategic and an operational level (Hines et al., 2004; Rich et al., 2006). As stated by the same authors, the strategical level – Lean Thinking – consists in

value creation and understanding what customer value is through strategic alignment of the organization, while the operational level – Lean Production – is concerned with the shop-floor tools and the respective application. According to the Hines et al. (2004), understanding strategic and operational strategies and their differences is important to properly apply Lean techniques and tools.

Lean Thinking highlights the essence of the Lean approach into five principles that are critical to the elimination of waste (Hines et al., 2002). These five principles are linked together as “a way to specify value, line up value-creating actions in the best sequence, conduct these activities without interruption whenever someone requests them, and perform them more and more effectively” (Womack & Jones, 2003:15).

2.3.1. Lean Thinking Principles

There are five Lean Thinking fundamental concepts that can extend this methodology (Womack & Jones, 1996; Hines et al., 2002):

- Identify what does and does not add value from the customer’s perspective – **specify value**;
- Map the processes involved in order to identify the non-value-added activities – **value stream**;
- Sequence the activities that create value – **flow**;
- Follow a **pull** (or Kanban) strategy;
- Systematic identify and remove non-value-added activities in the pursuit of **perfection**.

2.3.1.1. Specify Value

The starting point of the Lean principles is specifying value. Lean Thinking should start with a conscious attempt to precisely define value. (Womack & Jones, 2003). According to the same authors, value is created by the producer and defined by the customer and it is only significant when expressed in a specific good, service, or both that met the customer’s needs. Furthermore, companies’ perspective of value is often very different from the customers’ point of view, which stresses the needed to define value from the customers’ perspective (Hines et al., 2002).

Womack and Jones (2003:19) state that “*specifying value accurately is the most critical first step in lean thinking. Providing the wrong good or service the right way is muda*”. According to Hines et al (2002), muda is anything that does not add value to product or service, which means waste. In order to identify and remove waste it is necessary to understand and satisfy customers by knowing what they value in the value stream and removing what they are not disposed to pay (Hines & Taylor, 2000).

2.3.1.2. Identify Value Stream

The value stream is the set of all specific necessary actions to carry a specific good or service (Womack & Jones, 2003). Accordingly, Hines and Taylor (2000) this second principle consists in the steps required to design, order and produce the product through the value stream.

Hines et al. (2002) defined four different types of activities when doing a value stream analysis:

- **Value adding** activity: activities that add value to the final product;
- **Future value adding** activity: activities that in the future will make the product more valuable to the customer;
- **Support activity** or necessary non-value adding activity: activities that do not add value to the final product but are necessary in order to accomplish it;
- **Waste** or non-value adding activity: activities that do not offer any value to the product and should be eliminated immediately such as waiting time and double handling (Hines & Rich, 1997).

As Womack & Jones (2003:19) stated “*identifying the entire value stream for each product is the next step in lean thinking, a step which firms have rarely attempt but which almost always exposes enormous, indeed staggering, amounts of muda*”.

2.3.1.3. Flow

Flow is the third principle identified by Hines et al. (2002) and Womack and Jones (2003). Flow comes after the value is specified, the value stream for a specific product mapped and wasted steps are eliminated so the activities can be performed without

interruptions or bottlenecks (Hines et al., 2002; Womack & Jones, 2003). While the first two principles focused on the elimination of *muda*, this third focuses on making value-creating activities flow (Womack & Jones, 2003).

Furthermore, by redefining the work of functions, departments and firms, employees will understand how they can add value to the value stream (Womack & Jones, 2003).

2.3.1.4. Pull

The fourth principle focuses on producing what the customer demands (Hines & Taylor, 2000). According to Womack & Jones (2003) it is possible to reduce lead times by letting the customer *pull* the product. The same authors state that *“it is because the ability to design, schedule, and make exactly what the customer wants just when the customer wants it means you can throw away the sales forecast and simply make what customer actually tell you they need”* (Womack & Jones, 2003:24). Furthermore, it can reduce inventory level as well as increase return on investment (Womack & Jones, 2003).

2.3.1.5. Perfection

Perfection is the fifth principle of Lean Thinking and should be the complete elimination of waste (Hines et al., 2002). This principle consists of the staff working together with the purpose of achieving better processes and solutions (Poksinska, 2010). An important aspect to take into account is transparency along the supply chain because it becomes easier to discover better ways to improve and therefore create value (Womack & Jones, 2003). *“Strive for perfection by continually removing successive layers of waste as they are uncovered”* (Hines et al., 2002:3).

2.3.2. Lean Thinking Waste

Lean process improvement focuses on adding value by eliminating the maximum waste (Krafcik, 1988). According to Hines et al. (2002), waste is something that does not add value from the customer's point of view. Womack & Jones (2003:15) defined *muda* as *“mistakes which require rectification, production of items no one wants so that inventories and remaindered goods pile up, processing steps which aren't actually needed, movement of employees and transport of goods from one place to another without any purpose, groups of people in a downstream activity standing around waiting because an upstream activity has*

not delivered on time, and goods and services which don't meet the needs of the customer” and stated that “*muda is everywhere*” (Womack & Jones, 2003:15).

Ohno (1988) identified the first seven wastes related to the Toyota Production System:

- Overproduction – producing more than necessary;
- Defects – quality problems;
- Unnecessary inventory – excessive storage;
- Inappropriate processing – use of inadequate procedures;
- Excessive transportation – excessive movement of goods;
- Waiting – inactive production periods;
- Unnecessary motion –workplace disorganisation.

“*In order to go Lean and stay Lean*” (Hines et al., 2008:5), the Lean leader Toyota identified muda, mura and muri as three types of waste that are important to look at (Hines et al., 2008). Hines et al. (2008) define mura as unevenness that sometimes leads to the existence of muda. On the other hand, muri is translated into overburden and the reason for its existence is often due to mura (Hines et al., 2008). Hines et al. (2008) refer that organizations should be vigilant to both muda, mura and muri when implementing Lean Thinking, so they can get succeed.

2.3.3. Lean Thinking Mapping Tools

As discussed previously, the goal of Lean Thinking is to maximize value-added while eliminating non-value-added activities (Damle et al., 2016). To create value through Lean Thinking, Rother & Shook (2003), Hines & Taylor (2000), Hines et al. (2002) and Hines & Rich (1997) identified the following tools:

- Value stream mapping (VSM);
- Process activity mapping;
- Supply chain response matrix;
- Production variety funnel;
- Quality filter mapping;
- Demand amplification mapping;
- Decision point analysis;

- Physical structure mapping.

Value Stream Mapping consists in mapping all the value added and non-value-added actions required to bring a product across the main flow to every product (Rother & Shook, 2003). *“Value Stream Mapping is a pencil and a paper tool that helps you to see and understand the flow of material and information as a product makes its way through the value stream”* (Rother & Shook, 2003:4). Value and wastes can be identified through following a product’s production path from customer to supplier while drawing a representation of every process in the material and informational flow. When the basis of an implementation map is completed, designing a map of how value should flow is the key to identify what is value, waste and sources of waste (Rother & Shook, 2003; Abdulmalek & Rajgopal, 2007). Value Stream Mapping is considered by different authors as the best tool to identify waste and improvement opportunities because it takes into account all the activities involved in the process as well as the resources needed (Piercy and Rich, 2009).

According to Rother and Shook (2009), applying this tool involves three steps:

- Selecting a product family: grouping products with similar characteristics in order to improve (Chen & Cox, 2012);
- Identifying the Value-Stream manager: identify a manager who is responsible for the Value Stream and has the ability to improve a product family’s value stream (Rother & Shook, 2003);
- Using the mapping tool: drawing the current state of the supply chain for a product family and use that information to develop and implement a lean future-state drawing (Rother & Shook, 2003).

Process activity mapping is a tool that includes the elimination of waste through affording high-quality products and services through information (Hines & Taylor, 2000; Hines et al., 2002). Supply Chain Response Matrix has the objective of reducing costs while maintain the service level of the supply chain and consists in evaluating the inventory and identifying lead times (Hines & Rich, 1997). According to Hines et al. (2002), the Production Variety Funnel allows to understand supply chain functions and where products become specific by the customer. The Quality Filter mapping helps to identify where quality problems may emerge during the fulfilment process (Hines & Taylor, 2000). Demand Amplification Mapping provides inventory details, such as quantities, scheduling and

policies, along the supply chain (Hines & Rich, 1997). According Hines and Rich (1997), the Physical Structure Mapping allows understanding how the industry operates through a visual representation that analyses the overall structure of the supply chain.

2.4. Lean Thinking in Service Areas

Although Lean Philosophy has been developed in an industrial environment, Womack and Jones (2005) refer that it is possible to apply it in other areas, be they production or services, as illustrated in Figure 1. Similar to the production area, there are seven types of waste identified in the healthcare area – delays, duplication, unnecessary movement, unclear communication, incorrect inventory, errors, and opportunity lost (Hicks, 2006).

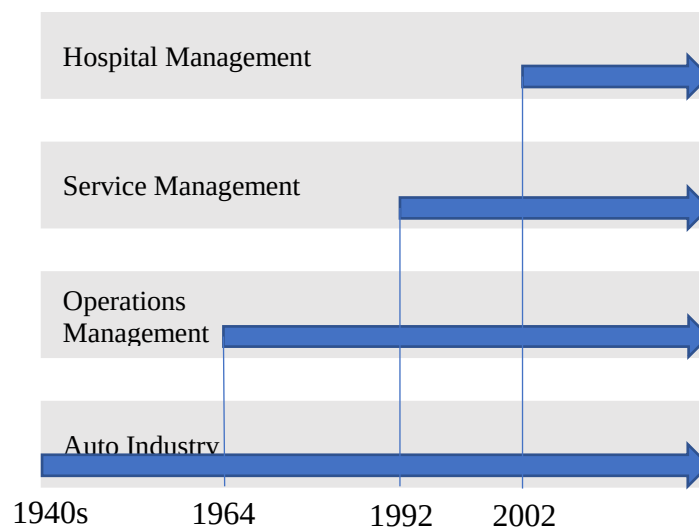


Figure 1 - Application of Lean Philosophy.

Source: Laursen et al. (2003).

The application of the Lean philosophy, in other sectors beyond the automotive industry, provides customer value and contributes to achieve the company's goals (Hines et al., 2004). One of the challenges of lean implementation in service companies is to believe in the lean methodology as an improvement tool and understand that the organization needs to undergo this process (Allway & Corbett, 2002; Atkinson, 2010). Maleyeff (2006) asserts that service companies usually combine physiological, exchange, informational, location and storage factors in order to apply Lean tools. Allway and Corbett (2002) and Radnor et al. (2012) stress that Lean Thinking should be implemented in every organization so that they become more efficient.

Some authors studied the application of the Lean Philosophy in services area. The majority of the applications of Lean in the service area focus the health area. La Ganga (2011), Leyer et al. (2015), Larsson et al. (2012), Cheng and Chang (2012), and The Boston Consulting Group (2009) conducted studies in the service area with the main objectives of increase efficiency and reduce wasting times and distances. Those studies had been carried out in the health area, specifically in the outpatient, emergency, and physical disabilities. In these studies, positive quantitative and qualitative results were obtained that answered to the purpose of the investigation. The authors have reported the need to further explore and implement Lean in the service industry.

2.5. Lean Thinking in Healthcare

According to Spear (2005), the investigation in Lean Healthcare has become a highly researched subject worldwide since the early of the 2000s. Healthcare professionals and managers are experimenting with Lean tools to improve efficiency, outcomes, satisfaction and safety for both staff and patients (D'Andreamatteo et al., 2015). Lean thinking in the health sector arises as a solution to improve patient safety and quality and to reduce waiting times and errors (Jimmerson et al., 2005; Aherne & Whealton, 2010). On the other hand, Bhakoo et al. (2012), Kamani (2004) and Kim (2004) refer that Lean also appears as a solution to reduce inventory costs without compromising the quality of service provided. Since the supply chain costs can account for 25-30% of the total costs of a health organization, there is an opportunity to address inventory management and methods of economic stock in order to reduce/eliminate waste and reduce supply chain related costs (Bhakoo et al., 2012; Kamani, 2004; Kim, 2004).

Some authors studied the application of Lean Thinking in the healthcare area. Bowen & Youngdahl (1998) and Bushell et al. (2002) carried out investigations in the diagnosis area. Under the objectives of waste reduction and efficiency improvement of the service delivery, Lean principles as perfection, flow achievement, value creation and pull, and Value Stream Mapping were applied. Heinbuch (1995) conducted a case study applying Lean philosophy in order to reduce the waste and flow establishment. By applying elements such as just-in-time inventory management system, consolidation of vendors, employee lay-off and weekly operative meetings between the departments it was possible to reduce costs in the healthcare department. Kim et al. (2007) applied Lean Thinking principles in radiation therapy in order to improve the process of delivering care to patients referred for bone or

brain metastases, through reducing waste and creating flow. They used value-stream mapping, one-piece flow, value as defined by the customer, and standardization to achieve the objective of the investigation. Deniz and Özçelik (2018) conducted a study in a public hospital's physical therapy and rehabilitation unit within the application of Lean techniques as mapping process diagram, value stream mapping, and process mapping. The results obtained focused on improving the service value through reducing over processing, transport, waiting, and motion type wastes. The authors referred that *“these results show that lean solutions are effective tools in solving efficiency problems in healthcare sector”* (Deniz and Özçelik, 2018:747).

Womack and Jones (2003) created a five-step framework for implementing and assessing Lean Thinking. According to the authors, this five-step framework can be applied in the healthcare area. First, it is the identification and specification of value based on the customer needs. An appropriate Lean tool and the most used in healthcare is the Value Stream Mapping because it enables to map the flow of customers through their different procedures and processes (Poksinska, 2010). The second step is to evaluate the value stream through identifying the value adding and non-value adding activities. This identification is needed to reduce or eliminate the non-value adding activities. The next step consists in creating a continuous flow by adding value at every stage. Lean tools are implemented when necessary and so the waste identified in the previous step is removed. The fourth step is establishment of Pull System that is, add value to activities only when the consumer requires. The last step is to seek perfection by repeating all the previous steps.

Concerning the evaluation of inventory management policies so as to reduce the waste in healthcare delivery processes, several studies have been found. Particularly, Neves (2009) compared different scenarios of Lean Thinking applications in diverse hospital units. Hospital de Santa Maria was one of the cases of Lean application. Under the objectives of reducing the average inventory, thus making all the processes of inventory management more efficient, an investment was made in the logistics processes with the objective of using Lean tools and principles. Under the same objectives, Narayanamurthy and Gurumurthy (2017) created a framework for lean assessment in healthcare institutions. With the purpose of reducing waste and improving efficiency in the hospital health domain, lean principles can be linked to implemented elements in healthcare institutions.

While there is a wide range of case studies applying Lean thinking in healthcare, none was found that addressed the issue of process improvement in LTC. Thus, the current investigation intends to contribute to the reduction of the gap in Lean thinking in LTC literature.

2.6. Summary

The empirical and academic contributions of Lean Thinking as well as the definition, principles, and its versatility through its applications in different areas were highlighted in this chapter. Lean Thinking, Process Mapping and Simulation were exposed as examples of methods of process improvement adopted by the organizations, with Lean and process mapping as the methodologies that better fit this study.

An analysis of Lean's application both in service and healthcare areas is provided in order to identify the positive results and the perception how Lean tools are being applied, and which are the most commonly used in the health sector. Organizations in this sector are increasingly adopting Lean Thinking, seeking to respond through a quality service, with different tools being applied for that purpose (see Table 1). The most used Lean tool in the health area is Value Stream Mapping, based on the principles of value stream and flow, which is summarized in Table 1.

As reviewed in this chapter, there are applications of Lean Thinking in services and healthcare area, but none was found applied to the LTC sector, which translates into a gap in the current literature. This investigation thus aims at filling the gap related to process improvement in the LTC sector in general, and also related to the application of Lean thinking tools for improving LTC delivery in Portugal.

Authors	Health Care Area/ Department	Purpose	Lean tools/ approaches	Application in LTC services
Bowen & Youngdahl (1998)	Diagnosis	Improve the delivery of services and reduce the waste	VSM; standardization	No
Bushell et al (2002)	Diagnosis	Improve the patient experience, care delivery and reduce the waste	VSM	No
Heinbuch (1995)	Many Departments	Reduce the waste and flow establishment	Just-in-time	No
Kim et al. (2007)	Radiation Therapy	Improve the process of delivering care to patients and reduce the waste	VSM; one-piece flow; value definition; standardization	No
Neves (2009)	Management	Reduce waste and improve efficiency	Kanban	No
Deniz and Özçelik (2018)	Physical therapy and Rehabilitation	Reduce waste	VSM, process mapping	No

Table 1 - Application of Lean in healthcare areas.

Source: Based on Bowen & Youngdahl (1998); Bushell et al (2002); Heinbuch (1995); Kim et al. (2007).

3. Methodology

3.1. Introduction

The present chapter has the objective of contextualizing the methodology adopted for the current investigation, taking into account the general and specific objectives and the research question. The case study methodology is characterized, as well as the design and research ethics. Furthermore, it is explained which research implementation steps will be followed and which data collection methods will be used in each one. Moreover, the tools selection is presented in order to identify which tools are going to be used in each research implementation step.

3.2. Case study methodology

To choose the structure that better suits this investigation, it is necessary to identify what is the type of research question, the control of the investigator has over the events, the focus on contemporary events rather than on historical ones (Yin, 2013), and the literature in this area. Regarding the research question previously defined as “*How can process improvement add value to LTC services?*” and considering Yin (2013) and the fact that no studies were found in this area, the research methodology that applies to this situation is the dissertation with a case study. In the current investigation, the processes of LTC delivery are going to be studied in order to identify opportunities of improvement and, afterwards, propose solutions to improve it. This investigation will take place in Santa Casa da Misericórdia de Alhos Vedros and the type of care under analysis is medium-term and rehabilitation. Therefore, to understand social phenomena and real-life events such as managerial processes, the appropriate methodology is the case study (Yin, 2009). Also, another issue that supports the choice of this methodology is the application of sources of evidence that distinguishes case studies from history: direct observation and interviews with people involved in the investigation (Yin, 2013; Eisenhardt, 1989). Thus, the most appropriate structure for this research is the case study structure, since the research question, social phenomena and real-life events, and the sources of evidence chosen lead to this type of structure.

This research is sustained by theoretical basis that helps to guide the data collection and analysis (Yin, 2013). On the other hand, the use of the case study research has limitations

(Eisenhardt 1989). The referred author emphasized the fact that results cannot be globally generalised, being relevant only to a specific case study research.

3.2.1. Case study characterization

When answering the research question formulated in the beginning of the investigation, and according to Yin (2013), there are two strategies that can be followed – descriptive or exploratory strategies. A descriptive strategy is followed to analyse patient flow in the LTC process and provide information about the value adding and non-value adding activities. An exploratory strategy is used to identify improvement opportunities through the application of Lean tools. Both these strategies will be adopted so that the objective of this research is achieved.

3.2.2. Case study design

According to Yin (2013) and Eisenhardt (1989), the present investigation can be classified as a single case study. The reason for being classified as a single case study is that only one type of LTC process is studied - medium-term and rehabilitation - and only one service unit is under analysis. The reason why only one type of process is analysed is because the way that service is provided is different from the one used for different types of LTC processes. The process that will be observed and analysed starts in the moment the patient enters the medium-term and rehabilitation service and ends when he/she leaves the service.

3.2.3. Research ethics

To develop the current dissertation in Santa Casa da Misericórdia de Alhos Vedros, permission was conceded by the Technical Director of the medium-term and Rehabilitation care provision area in November of 2017.

3.3. Steps in the research methodology

Considering as a basis the objectives and research question of this investigation, Lean Thinking Mapping Tools will be applied in the medium-term care and rehabilitation processes in order to create opportunities to improve the overall process and afford insights through the methodology's implementation steps:

- Identify what are the stakeholders and value perspective – based on what is value for customers, the value adding and non-value adding activities are identified;
- Map the overall medium-term care and rehabilitation care delivery processes using value stream mapping – the overall delivery process is mapped, and occurrence of possible problems is identified;
- Map the specific processes of medium-term care and rehabilitation overall processes using flowchart - the overall delivery process is mapped in three different moments (patient admission in SCMAV, hospitalization in SCMAV, and discharge of the patient in SCMAV);
- Identify and analyse the recognition of waste in order to find opportunities for improvement – the waste is identified based on value stream mapping, non-value adding activities, and flowchart;
- Propose and evaluate possible improvement solutions for LTC processes - considering the opportunities of improvement, proposals are presented with the objective of identifying the solution;
- Assess and validate the proposals of improvement – with SCMAV health providers, the improvement proposals are validated.

3.4. Data collection

For the current investigation, several information sources are used, in accordance with Yin (2013): documentary analysis, direct observations, informal interviews, and focus groups. The data collected through these methods will be used to find possible opportunities for improvement and will be compared with the documentary analysis conducted in the literature review. Data triangulation will be conducted to assure the quality of data collected.

Regarding the direct observations, data will be collected from the medium-term and rehabilitation service delivery. All the activities and resources needed to deliver the service will be observed in order to map the entire process from the moment the patient enters the hospital unit until he/she leaves the service. Therefore, direct observations will be used exclusively to map the process from the moment the patient enters the unit until leaving.

Informal semi-structured interviews will be conducted with both LTC health

providers and patients. Concerning the interviews conducted with providers, the objective is to identify the resources and number of health providers needed in each stage of the service, and also the difficulties they face during the different phases of service delivery. Interviews with medium-term and rehabilitation service providers – doctors, nurses, physiotherapist, sociocultural animator, auxiliaries, and administration - will be conducted during the investigation, whenever it is necessary to collect data related to the service delivery process that only they can provide. Regarding the interviews conducted with patients of the LTC services, these aim at identifying which stages of the process they recognize as adding value and which do not. An interview will be conducted with every patient considered by the institution as being physically and psychologically capable to be part of the study.

A focus group with persons responsible for the different areas/departments of SCMAV involved in the investigation will be conducted to identify possible process improvement opportunities to the medium-term and rehabilitation process. Focus group will be used to validate the suggestions and also to identify if the proposed improvements meet the needs of service providers of that service.

The documentary analysis will be based on industry reports, scientific papers and official statistics in order to understand all the LTC processes itself and environment.

Data collection in Santa Casa da Misericórdia de Alhos Vedros started in the beginning of April 2018 and lasted until the beginning of June 2018. Data treatment will be based on Microsoft Office tools.

3.5. Tools selection

Firstly, it is necessary to map the medium-term and rehabilitation service, through Lean thinking tools, from the time the customer arrives in the health unit until he/she leaves. The selection of Lean Thinking tools depends on the type of waste that organizations need to reduce or eliminate (Hines & Rich, 1997; Hines *et al.*, 2002). In order to “go and stay Lean”, the value stream mapping tool has been the most applied tool in investigations in the healthcare service area (Jimmerson *et al.*, 2005; Mazzocato *et al.*, 2010). The value-stream mapping of the overall process is based on the use of direct observation during the overall process delivery, as well as of informal interviews with health providers and documentary analysis. An overview of a “as-is” map provides the ability to look at the overall picture, as well as visual graphic representation of the process by highlighting wastes and its source

(Rother & Shook, 2003). After the overall process mapping, a descriptive analysis will be performed.

Then, the overall process of medium-term and rehabilitation will be divided into three different sub-processes - patient admission in SCMAV, hospitalization in SCMAV, and discharge of the patient in SCMAV. Flowcharts will be used and, consequently, allow identifying and analysing the recognition of waste. To make this mapping possible, direct observation of the service delivery, of the medium-term and rehabilitation service as well as informal interviews with healthcare staff will be used.

3.6. Summary

This chapter defined the structure of the methodology to be followed, the research implementation steps and the data collection methods and Lean tools that will be applied in the course of this investigation.

The structure of the methodology that better suits this investigation is the dissertation with a case study. Since there is little research in the area and no studies were found in LTC under this thematic, this dissertation intends to reduce the existing gap in literature. On the other hand, according to Yin (2013), the type of research question, the control of the investigation and the focus on events are also decisive factors in the choice of methodology.

Regarding the methodologies chosen for data collection, direct observations, informal interviews, focus group, and documentary analysis were the methods selected depending on the research implementation step. On the other hand, Lean tools were selected based on literature review. The data collection methods and tools by research implementation step are presented in the Table 2.

Research implementation step	Data collection methods and tools selected
Identify what are the customers and value in patients' perspective	Informal semi-structured interviews
Map the overall medium-term care and rehabilitation care delivery processes	Direct observation; Informal interviews; Value-stream mapping
Map the specific processes of medium-term care and rehabilitation overall processes	Direct observation; Informal interviews; Process mapping (flowchart)
Identify and analyse the recognition of waste in order to find opportunities for improvement	Based on value stream mapping and flowchart; Informal interviews
Propose and evaluate possible improvement solutions for LTC processes	Focus group
Assess and validate the proposals of improvement	Focus group

Table 2 - Data collection methods and tools selected.

Source: Own source.

4. Case Study

4.1. Introduction

Taking into consideration the research question presented in Chapter I, this Chapter IV aims at providing an analysis of LTC service delivery processes, under the investigation in the medium-term and rehabilitation service delivery processes in SCMAV.

First, a brief description of SCMAV is provided, and the medium-term and rehabilitation overall delivery process is described. Furthermore, customers of medium-term and rehabilitation will be identified, and its perception of value will be exposed.

Subsequently, the most appropriate Lean tool will be used to analyse the process in order to identify waste and associated opportunities of improvement. Since value and waste are identified, proposal of improvements will be suggested and quantified based on to the current processes.

4.2. Case study characterization

SCMAV is located in Moita and is part of Misericórdias Group, independent charity of community care services, and key-providers of LTC services in Portugal (Simões et al., 2017). Santa Casa da Misericórdia, founded in 1498, “*operates hospitals and facilities in the areas of rehabilitation, LTC and residential care for older people, people with disabilities and people with chronic illness*” (Simões et al., 2017:82). SCMAV, founded in 2011, has a facility integrated in the RNCCI (Unidade de Cuidados Continuados Integrados – Francisco Marques Estaca Júnior). This health unit has three typologies of LTC – medium-term and rehabilitation care, long-term and maintenance care and palliative care units. For the current investigation, the process to be analysed is the medium-term and rehabilitation service one since the provision of service diverges according to the type of health care.

The choice of the medium-duration and rehabilitation care unit relies on the fact that it is the unit that has a shorter average hospitalization time, which allows a more complete sample to be observed and studied. On the other hand, the decision was also accepted by the SCMAV since the patients of medium-duration and rehabilitation care are more physically and psychologically capable to collaborate and be part of the investigation.

The medium-term and rehabilitation unit in SCMAV has the capacity to accommodate 30 patients within the RNCCI and 4 patients at a particular level. The overall medium-term and rehabilitation process has an average duration of 90 days. The objective of this service is to provide care to people with loss of autonomy that require clinical care, rehabilitation, and psychological support. These situations are the result of, mainly, sequelae of cardio-vascular accident and bone fracture.

4.3. Identification of customers and value

Regarding the medium-term and rehabilitation process described in sub-chapter 4.3., two different customers can be identified: internal and external customers. According to McConnel (2010), every activity in any business has both external and internal customer identified. McConnel (2010) states that external and internal customers benefit from different things, i.e., external customers benefit most with the result of the process and internal customers from the unroll of the process itself.

Applied to the medium-care and rehabilitation process in SCMAV, the external customers are identified as the patients of this service as well as the RNCCI, and the internal customers are all the professionals of the institution itself – administration, doctors, nurses, social assistant, encouraging sociocultural, physiotherapist, speech therapist, and auxiliaries. As the output of the service is mainly focused on satisfying patients' needs for health and social care, the final purpose of the process is the patient's rehabilitation or partial rehabilitation and consequently the main objective of RNCCI.

For this purpose, and as mentioned in Chapter III, informal interviews were conducted considering questions about the service, namely which of the activities associated with process delivery do they consider as a value-adding and non-value adding activity, from their own perspective. Only 13 patients were interviewed – these are the ones that SCMAV considered able to do so. The activities of the medium-term and rehabilitation process that patient considered as a source of value creation are mainly physiotherapy and sociocultural animation.

Through informal interviews with the patients, it was noticed that the majority of patients' answers are focused on the activities that allowed their rehabilitation. This is, according to SCMAV doctors, the activities that promote their rehabilitation are physiotherapy, speech and occupational therapy, and sociocultural animation. Regarding

non-value adding activities, patients were not able to identify activities that did not create value.

4.4. Process description and mapping

The mapping of the overall medium-term and rehabilitation process was based on direct observation of service delivery and also semi-structured informal interviews with the service providers. On the other hand, a focus group was conducted in order to approve the process mapping designed. Direct observation was one of the methods chosen for this stage, since it allows the integral observation of how the service is provided. On the other hand, informal interviews were conducted to complete and/or confirm the data collection of the direct observation since it was sometimes not possible to perceive the human and material resources required at each stage. These interviews were conducted in all stages of the overall delivery service.

The medium-term and rehabilitation overall process includes three processes – patient admission in SCMAV, hospitalization in SCMAV, and discharge of the patient in SCMAV. For a simple understanding, Figure 2 represents the overall process. It starts with an admission in SCMAV, previously referred in RNCCI, then the patient is hospitalized to promote his/her rehabilitation capacities in approximately 90 days and, subsequently, the patient has medical discharged.

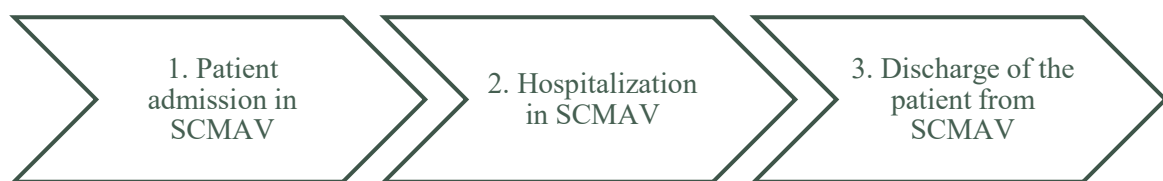


Figure 2 - Medium-term and rehabilitation process in SCMAV.

Source: Own source

Value Stream Map (Figure 3) was performed to enable an overview of the global medium-term and rehabilitation delivery service. Figure 3 thus illustrates the big picture of medium-term and rehabilitation process of SCMAV, where the information flows through the platform and disruptions occur throughout the different stages of medium-term and rehabilitation service (as depicted through the waiting time for patient and overlapping activities). There is no timeline underneath the illustration because it could not be measured, since it depends on the patient and mainly because the data were not provided by the SCMAV. In a general picture, the most time consuming process is the rehabilitation routine (included in the hospitalization in SCMAV process), since the patient is in SCMAV for 90 days approximately.

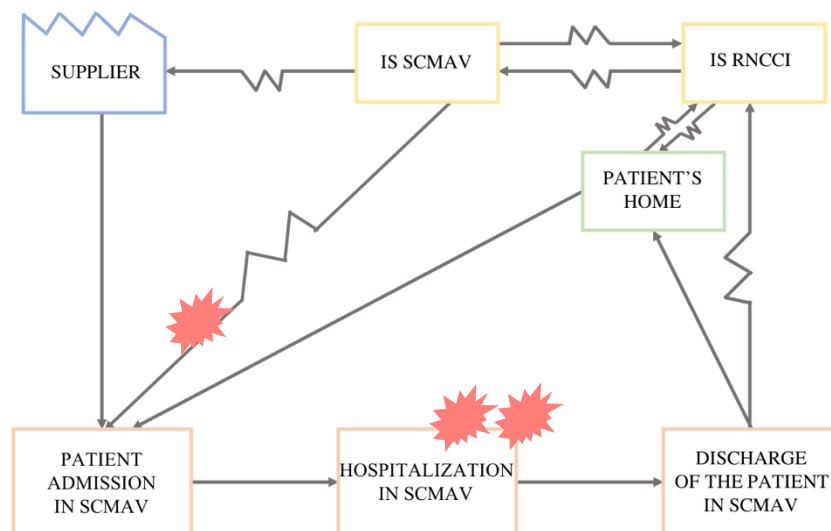


Figure 3 - Value-stream mapping of medium-term and rehabilitation process.

Source: Own source.

4.4.1. “Patient admission in SCMAV” process

Figure 4 provides the overall mapping of “patient admission in Santa Casa da Misericórdia de Alhos Vedros”. There are six actors involved in the process, of which three belong to SCMAV. The process starts with the sub-process “referencing the patient in the RNCCI”, this is, when the patient is referenced by a hospital or health care center where he/she is institutionalized. Once the referral of the patient is concluded, the hospital/health care center creates a list of health institutions to make it available to the patient to choose. The decision is introduced on the platform by the hospital/health care center and the RNCCI verifies if the information is correct/complete. If the information is not correct/complete, the RNCCI notifies the Hospital/ Health care center and the process is repeated from the moment

the list is made available to the patient. Otherwise, RNCCI notifies the hospital/health care center about the correctness of the information and the patient is informed that he/she is in the waiting list for vacancy. When vacancy is available, the patient is notified by the hospital/health care center about the institutionalization at SCMAV. If the patient does not accept the vacancy, the process ends. If the patient accepts the vacancy, the coordination team of SCMAV verifies the information. If the information is wrong, the RNCCI is informed and the patient is transferred to the appropriate type of care. On the other hand, if it is correct, hospital/health care center makes the contact between them, patient, and SCMAV, in order to schedule the admission of him/her. In a final phase, the patient is admitted and if the social assistant is at SCMAV, there is an appointment so that the patient signs the hospitalization contract. If the social assistant is not at SCMAV, the nurse team makes an initial approach and then the appointment with the social assistant is scheduled. The process ends when the patient signs the hospitalization acceptance contract.



Figure 4 - Process mapping of “Patient admission in Santa Casa da Misericórdia de Alhos Vedros”.

Source: Own source.

Figure 5 provides the mapping of “referencing the patient in the RNCCI” from Figure 4 and refers to the subprocess of “Patient admission in Santa Casa da Misericórdia de Alhos Vedros” process. This process is external to the activity of SCMAV since the patient is hospitalized in a hospital or health care center. The actors involved in this process are the hospital/health care center, the RNCCI, the patient, and the social security. This process starts when the local hospital or health care center coordinating team (a doctor, a nurse, and a social assistant) makes a necessary evaluation of the patient so as to decide on his/her referral to the RNCCI. The information about patient’s evaluation is submitted to the platform and after verified, the type of care is selected within the options “convalescence or short-term recovery”, “medium-term care and rehabilitation”, “long-term and maintenance care”, “palliative care”, and “day care and autonomy promotion”. Once this initial information is submitted, the RNCCI confirms if it is correct/completed. If the information submitted about the type of care selected is correct/completed, the RNCCI notifies the social security with the objective of verifying the patient’s income. The income will be taken into consideration when identifying the charges that the patient and the social security will have to support. After this verification, the acceptance term is elaborated with the purpose of the patient accepting it and being admitted in SCMAV. The process ends when the acceptance term is elaborated, and the patient accepts or reject it.

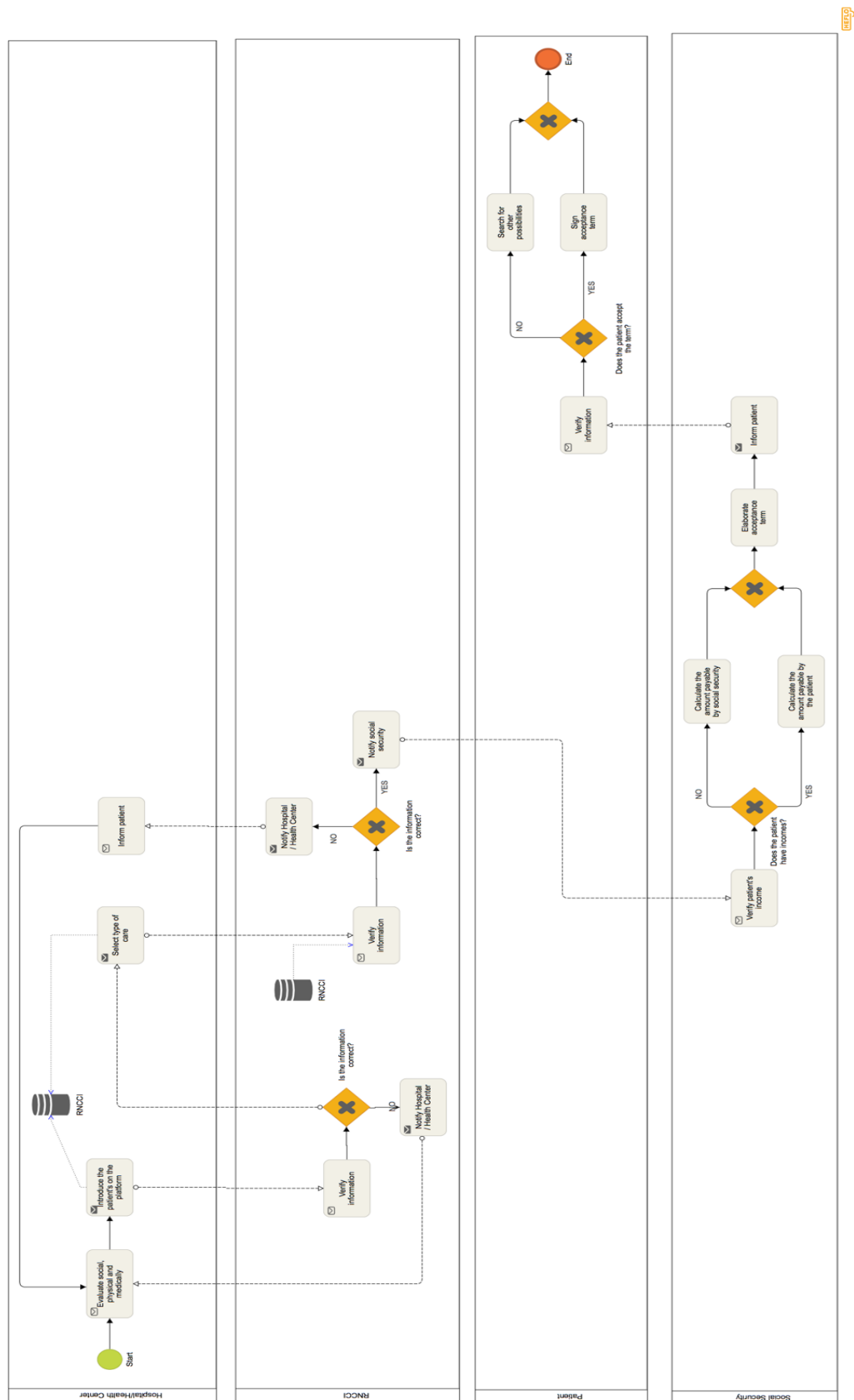


Figure 5 - Process mapping of "Referencing the patient in the RNCCI".

Source: Own source.

4.4.2. “Hospitalization in SCMAV” process

Figure 6 corresponds to the process of “hospitalization in SCMAV”. This process encompasses the rehabilitation of the patient during the 90 days of hospitalization. This process has a sub-process of “rehabilitation routine in SCMAV”, describing the patient’s daily life at SCMAV. There are five actors involved and they are all from SCMAV. This process starts when the coordination team makes a social, psychological and medical evaluation of the patient. This is performed only once (when the patient is admitted). “Hospitalization in SCMAV” involves physiotherapy, sociocultural animation, and rehabilitation routine (which is the sub-process “rehabilitation routine in SCMAV”). These activities are common to all patients engaged in the medium-term and rehabilitation process. Those patients who have prognosis related to sequelae of cardio-vascular accident, have speech and occupational therapy. The process ends when all the daily activities of the patient are performed.



Figure 6 - Process mapping of " hospitalization in SCMAV ".

Source: Own source.

Figure 7 illustrates the sub-process “rehabilitation routine in SCMAV” from Figure 6, thus making part of the process “hospitalization in SCMAV”. This sub-process represents the patient’s personal daily care. There are only two actors, which is the nurse and auxiliaries team. This routine process starts when nurses/auxiliaries wake up the patient and give them medication. Several activities related to medicating (if the patient needs), feeding, positioning (if the patient is bedridden), and hygiene are performed throughout the day. The process ends when the patient is resting in bed, after dinner.

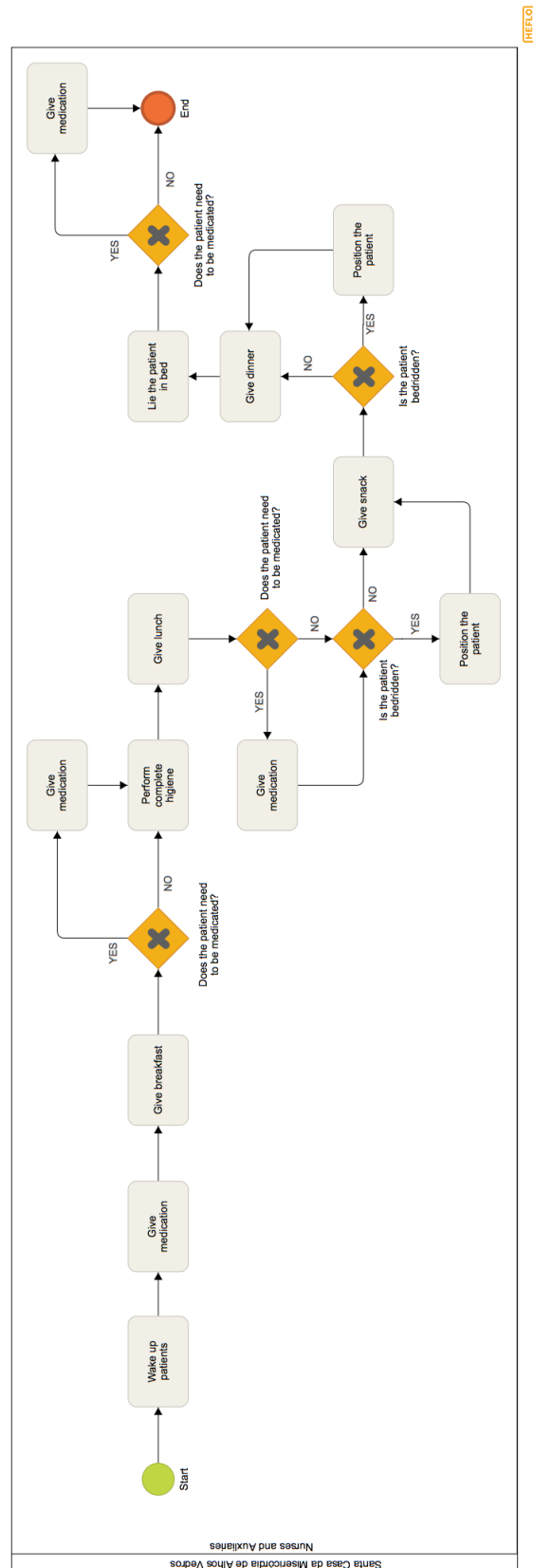


Figure 7 - Process mapping of "rehabilitation routine in SCMAV".

Source: Own source.

Figure 8 illustrates the inventory management process in SCMAV and is a necessary and transversal process to the hospitalization process, since it is necessary to have material for the service delivery process. In the inventory management process there are three actors, which are the head of nursing, nurses/auxiliaries and suppliers. Stock is divided into three categories: drugs, nursing and hygiene products. Orders are placed weekly, filling a table with the materials that need to be delivered that week by the nurses. Except for drugs that are required and replenished twice a week, the remaining supplies are only received once a week. The replenishment of the SCMAV is carried out through a warehouse located in the exterior of the SCMAV – internal supplier. This warehouse contains all materials properly stored under the necessary conditions. The supply of this warehouse is external, and is carried out monthly, except for the drugs that are made bi-monthly.

The process starts when the nurses/auxiliaries fill the material requirements table based on SCMAV inventory to deliver it to the head of nursing. This process is performed once a week, except drugs that are required twice a week. Once the head of nursing has the material requirement table, the materials are ordered, and the suppliers deliver it in SCMAV, respectively. The nurses/auxiliaries store and label the materials received in the outdoor warehouse of SCMAV. In SCMAV there are two warehouses – one inside of the health unit with the materials “ready to use”, and another one in the outdoor of SCMAV with the objective of SCMAV inventory buffer. The materials in SCMAV are counted and if there is a need for additional materials, the head of nursing replenish materials in SCMAV with items from the outdoor warehouse in SCMAV. The materials are stored in SCMAV by nurses/auxiliaries, and afterwards they are able to use it in the service delivery process. If there is not a need for materials, no replenishment is needed. When the material is used, the process of stock ends.

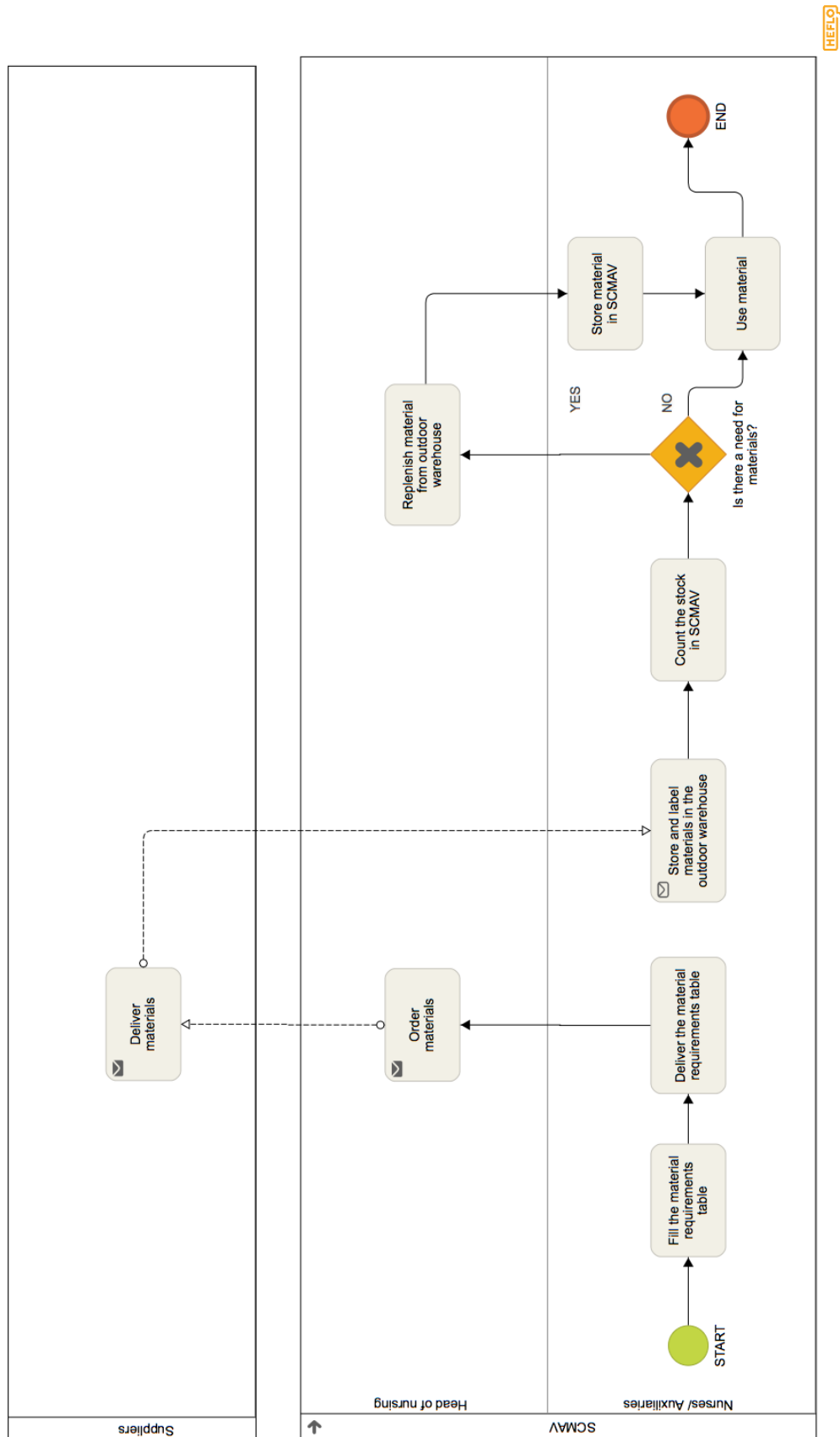


Figure 8 – Process mapping of "Inventory process".

Source: Own source.

4.4.3. “Discharge of the patient in SCMAV” process

Figure 9 corresponds to the “discharge of the patient in SCMAV” and is the last process of the medium-term and rehabilitation overall process. This process involves six actors of which four are from SCMAV. The discharge starts when the end of hospitalization is approaching. The first step is the verification of patient’s condition (verified several times during the overall process, but in the discharge of the patient process is verified when approaching 90 days of hospitalization). If the patient does not have discharge, the team who contributes to the rehabilitation writes down the list of features and the intervention plans so as to analyse if the patient should be transferred to another type of care. If the patient is transferred to another service typology, the process of “Patient admission in Santa Casa da Misericórdia de Alhos Vedros” (Figure 4) is performed. Otherwise, the process of “Hospitalization in SCMAV” (Figure 6) is performed. If the patient is already registered in SCMAV and in that type of care, it is not necessary to conduct the admission process again, that is, there is an extension of the 90 days of hospitalization. Otherwise, if the patient has condition to be discharged, the team who contributed to him/her rehabilitation writes the discharge note and delivers it to the social assistant. The social assistant compiles the information and submits it to the information platform (RNCCI) so the RNCCI is able to release the vacancy. The process ends when the patient receives a doctor’s prescription and medical discharge. If the patient goes to another health unit, he/she receives not only the doctor’s prescription and medical discharge, but also a duplicate one.

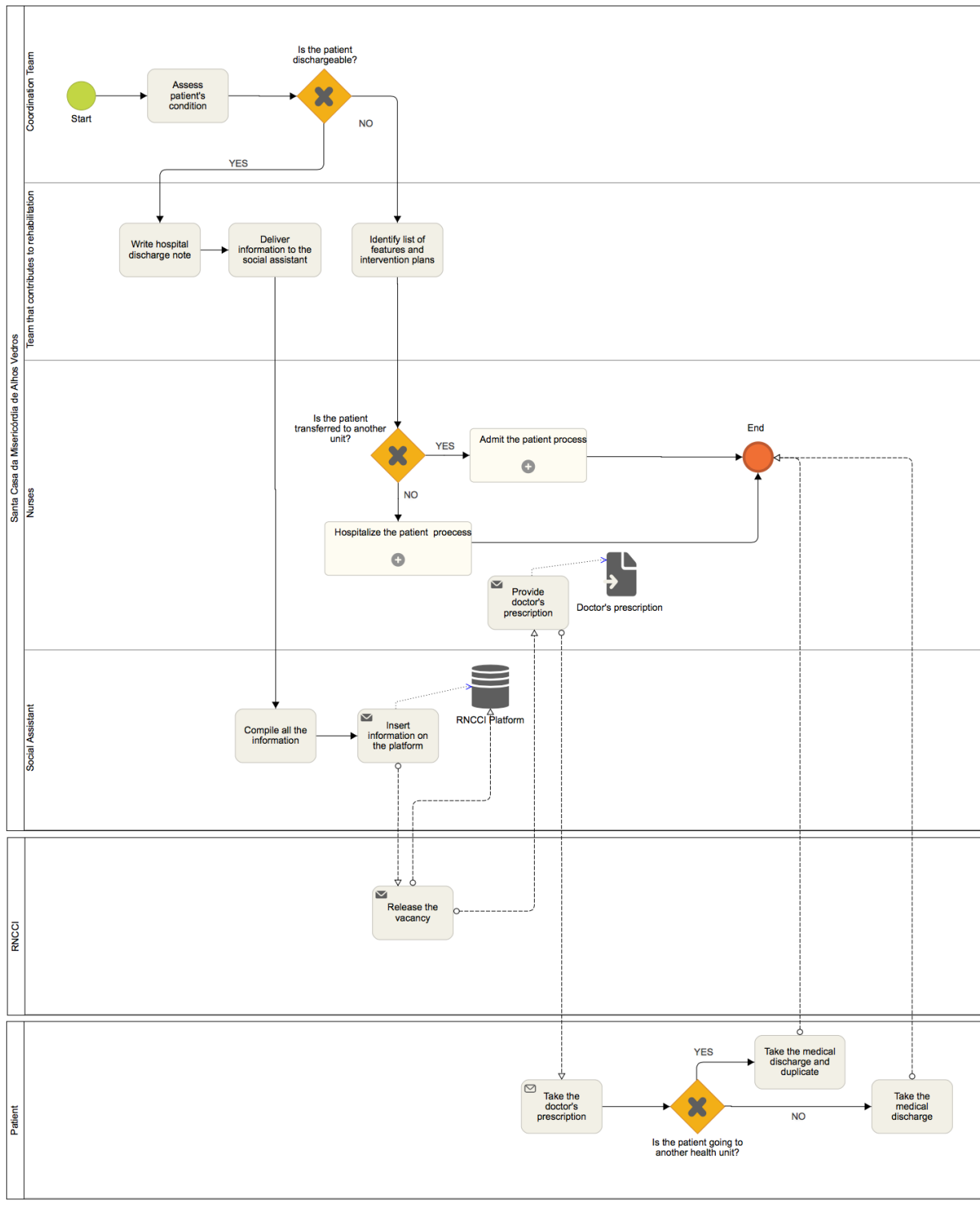


Figure 9 - Process mapping of "discharge of the patient in SCMAV".

Source: Own source.

4.5. Identification of opportunities of improvement

During the investigation, informal semi-structured interviews with patients and service providers, and direct observation of the medium-term care and rehabilitation process were performed with the objective of identify opportunities of improvement. Informal semi-structured interviews were conducted with medium-term and rehabilitation service stakeholders. The basis of these interviews were the questions:

- “What are the value-adding activities of the medium-term and rehabilitation service process?”
- “What are the non-value adding activities of the medium-term and rehabilitation service process?”

The course of the interviews depended on what the stakeholder it was, since the purpose was to keep a conversation more natural as possible. The interviews with the patient of this service were simplified since they were not able to answer properly, due to their weakened state. Through these data collection methods, three main opportunities of improvement are identified in the process of medium-term and rehabilitation care.

In a first stage, in the process of “referencing the patient in the RNCCI”, an inefficiency in introducing data in the RNCCI system was identified. This situation was identified through direct observation and informal interviews with “referencing the patient in the RNCCI” process responsible actor. This process is necessary for the patient to be accepted in the LTC network and includes the patient evaluation, data entry and verification/confirmation by the RNCCI. The inefficiency is related with the number of introductions of the necessary information, with this being subject to confirmation at various times by different actors of the RNCCI. This means that the information related to patient is introduced twice on the platform and the RNCCI needs to validate it two times. According to the health providers, this inefficiency may result in vacancy losses for patients that need to wait too much time for a free vacancy in the RNCCI due to these multiple confirmations. Considering the SCMAV perspective, this is over processing and results in waiting waste for patients. According to Ohno (1988), this waste is considered as waiting and duplication in a services perspective (Hicks, 2006).

Another opportunity for improvement is related to the “rehabilitation routine in SCMAV” process. Through direct observation, activities were analyzed in order to identify an opportunity for improvement and it was observed that not all patients can take part of all activities, since the activities are not planned in an integrated way, with some activities overlapping. This leads to a waste which, according to Hicks (2006) is defined as opportunity lost.

A third opportunity of improvement is related to inventory policies. Through informal interviews with the stock manager (management responsible), it was questioned and subsequently identified that the stock could be reduced in the SCMAV and consequently the space needed for inventory – unnecessary stock represents waste - since, in the SCMAV outdoor (outside the health unit), there is a warehouse with the necessary products, as shown in Figure 10. By reducing time between orders in SCMAV, the required stock level at the health unit would be lower and there would be a greater control of the stock, since the stock is reviewed more often. According to Hicks (2006) this leads to a type of waste that is represented as incorrect inventory.

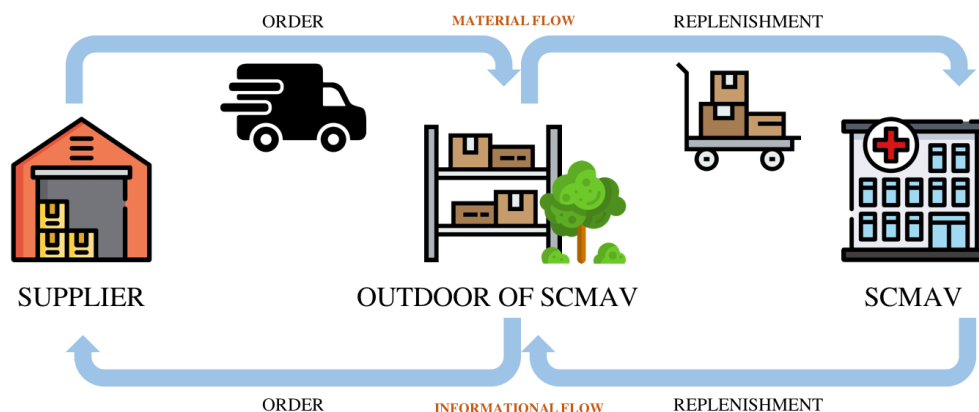


Figure 10 - Material flow of SCMAV.

Source::Own source.

Thus, there are three opportunities for improvement in different moments of the LTC service delivery in the SCMAV, and for each, a proposal of improvement will be described, as shown in Table 3.

Opportunities for improvement	Type of waste	Process	Proposal
Inefficiency in data introduction referring to the patient's referral in the RNCCI	Duplication	“Referencing the patient in the RNCCI”	1
Not all patients have access to all rehabilitation activities in SCMAV	Opportunity lost	“Rehabilitation routine in SCMAV”	2
Stock level can be reduced in SCMAV	Incorrect inventory	"Inventoryprocess"	3

Table 3 - Opportunities for improvement and types of waste associated.

Source: Own source.

4.6. Proposal and evaluation of improvement strategies

4.6.1. Proposal 1

In the “referencing the patient in the RNCCI” sub-process, with the main objective of admitting the patient in the medium-term and rehabilitation service, the information is introduced in the platform and later validated. This is an inefficient procedure because it is time-consuming as, in addition to introducing information on the platform, the patient also waits for a period of 4 to 6 weeks, which is the normal time period for a vacancy release with the purpose of occupying it afterward. One possible solution to reduce the period of the referral process is to reduce the data introductions (less data entries leads to reduction of time). Since it is not possible to reduce the waiting time for a vacancy, because it is related to the high level of demand for this service in Portugal, the objective should be to reduce the time between a patient leaving and another filling the vacancy, thus, making the process more efficient.

Therefore, it is necessary to analyse the referral process in more detail, specifically, which information needs to be introduced and validated. The information related to the patient is introduced twice on the platform and the RNCCI needs to validate it two times, namely, when i) the social, physical and medical evaluation is introduced on the platform, i.e., when the patient is registered; and ii) the type of care is selected.

In order to reduce the duration of this process, it is possible to reduce these two moments of information introduction and validation to one single moment (compile the information and introduced it at once).

This suggestion has both qualitative and quantitative results. The process becomes more efficient since the information is introduced in a single moment and RNCCI identifies incorrect information (if any). In this way, the number of introductions of information and respective verifications by the RNCCI and SCMAV reduces by 50%. The reduction in patient waiting for admission to the SCMAV may assume different values, since the verification of the information is the responsibility of the RNCCI and depends on the volume of patients who are in the same situation. So, the RNCCI is the only responsible for this single verification, while SCMAV no longer verifies the accuracy of the information previously introduced.

4.6.2. Proposal 2

Taking into consideration the informal interviews performed with medium-term and rehabilitation service patients' and health providers in SCMAV, the value-adding processes that are the most important for them are hospitalization and rehabilitation. The activities of physiotherapy and sociocultural animation were the only ones that patients recognise as value-adding activities, so there is a need to analyse them.

Since value-adding and non-value-adding activities are identified, there is an opportunity for improvement. Through direct observation and informal interviews with service providers from SCMAV, not all the patients have the possibility to participate in all the activities. This situation occurs because the activities are not organized and often overlap. The physiotherapy is the main activity and SCMAV schedules it. In order to improve the patients' participation in global activities and consequently their rehabilitation, the creation of schedules to organize the patient's daily activities arises as a possible solution. The schedules could be organized by two type of patients' groups, i.e., patients with bone fracture in one group, patients with sequelae of cardio-vascular accident in another group, and the remaining patients are joined with patients with bone fracture. The reason of dividing the patients into two groups is because they have different needs – all patients have physiotherapy and sociocultural animation, but patients with sequelae of cardio-vascular accident have also occupational and speech therapy. So, patients with “bone fracture” and

“other” are joined in one group because they have the same needs in terms of activities. In the moment of the current investigation, each group had 15 patients, making a total of 30 patients.

Three different scenarios are proposed to improve the participation in activities and promote rehabilitation:

- Scenario A: activities are organized considering current schedules for patient’s complete hygiene and families/friends visits, i.e., patients cannot perform activities when family/friends are visiting them;
- Scenario B: activities are organized considering schedules for patient’s complete hygiene and socio-cultural activities, i.e., patients cannot perform activities when they are at socio-cultural activities;
- Scenario C: activities are organized during all day, considering only schedules for patient’s complete hygiene.

The schedules are planned considering that:

- i) patients do not have physiotherapy, speech and occupational therapy every day, since there is no every day capacity for that;
- ii) The activities of physiotherapy can be performed between 9:00 a.m. and 5:00 p.m., i.e., when physiotherapists are at SCMAV;
- iii) Visiting time for families/friends are always from 3:00 p.m. to 6:00 p.m. This time cannot be changed because it depends on the availability of families/friends;
- iv) Socio-cultural activities have to be scheduled from 3:00 p.m. to 4:30 p.m. (before snack time), since the animator supports three areas – long-term and maintenance care, palliative care, and medium-term and rehabilitation care - and so these times cannot be changed;
- v) Patient’s complete hygiene has to be performed in batch (one patient after another - when the complete hygiene of a patient ends, the next patient is already waiting in line, in order to reduce unnecessary time) as it becomes

more efficient in this way. The only time of day where there is time available to perform all the hygiene of all the patients is during the morning. Also, complete hygiene is performed by group (bone fracture group and others and group "sequelae of cardio-vascular accident"). While one group is in complete hygiene, the other group is having physiotherapy. Thus, during the afternoon, patients will have time for other activities as well as eventual physiotherapy that has not been performed during the morning.

In short, the first scenario is not an option to be chosen since the objective here is for the patient to be present in the maximum number of activities possible to increase the level of physical and psychological rehabilitation. This happens because the hours of the visits overlap with the time of the animation activities, as shown in Table 4. One of the constraints of this first scenario is that, at the time of family/friends' visits, patients are fully available for these visits, so they would not be available to perform socio-cultural activities. The socio-cultural activities could not be rescheduled, since the socio-cultural animator is allocated to various types of care within the SCMAV. Therefore, this scenario is not an option because it is impossible to schedule all the activities in order to achieve the main objective of this proposal, which is maximize the patients' participation in activities in order to improve their rehabilitation.

Scenario A		
Hours	Activities	
8:00 a.m.	Breakfast	
9:00 a.m.	Complete Hygiene	Physiotherapy
10:00 a.m.		
11:00 a.m.		
12:00 a.m.		
1:00 p.m.	Lunch	
2:00 p.m.	Physiotherapy	Occupational and Speech Therapy
3:00 p.m.	Families/Friends	Socio-cultural Animation
4:00 p.m.		Snack
5:00 p.m.		
6:00 p.m.		
7:00 p.m.	Dinner	

Table 4 - Schedules for scenario A..

Source: Own source.

On the other hand, scenario B implies that hygiene schedules are maintained and that socio-cultural activities are prioritized. Similarly to scenario A, the schedules of activities are the same, but at the time of socio-cultural animation the patient is entirely dedicated to this activity, as shown in Table 5. This is, the patient does not “miss” the socio cultural animation activity, as it happens in the previous scenario. If the families/friends are in the health unit, they can be part of the activities together with the patients, making them more dynamic. Therefore, in this scenario the priority is the activities of animation because it is one of the factors that allows the rehabilitation of the patients, according to the professionals of the SCMAV.

Scenario B			
Hours	Activities	Activities in parallel	
8:00 a.m.	Breakfast		
9:00 a.m.	Complete Hygiene	Physiotherapy	
10:00 a.m.			
11:00 a.m.			
12:00 a.m.			
1:00 p.m.	Lunch		
2:00 p.m.	Physiotherapy	Ocupational and Speech Therapy	
3:00 p.m.	Socio-cultural Animation	Families/Friends	
4:00 p.m.			
5:00 p.m.	Snack		
6:00 p.m.			
7:00 p.m.	Dinner		

Table 5 - Schedules for Scenario B.

Source: Own source.

Unlike scenario A and B, scenario C considers all the activities without any restriction. However, there is a contradiction, since there must always be restrictions because hygiene must be carried out in batches and during the morning (which is when there is time available). It would only be an option if there are no capacity constraints on SCMAV. Without any restrictions to organize all the activities, scenario C becomes undoable.

Considering the three proposes scenarios (A, B and C) and also considering the objective of this proposal, which is to increase the participation of the patients in all activities in SCMAV and consequently, promoting their rehabilitation, scenario B is the most appropriate option. Considering the three scenarios described above, scenario B is the one

that has a schedule in which patients can participate in all activities, since the complete hygiene schedules are maintained, and the socio-cultural activities are prioritized.

4.6.3. Proposal 3

An analysis was made under the inventory thematic and, through informal interviews with the responsible of the area of management, it was possible to identify an improvement opportunity.

The opportunity for improvement consists in reducing the stock level at SCMAV. Possible solutions of improvement are reducing the time between orders since, as the SCMAV warehouse for inventory buffer is located in the same facilities, there are no supplier transportation costs (and so, no extra costs will be incurred due to the higher number of orders that will be placed) and the minimum order quantity is achieved, according to the responsible of management. Several scenarios were analysed, namely, placing orders: i) every two days, ii) every three days, iii) every four days, iv) every five days, and v) every six days. In order to select the best scenario option, Economic Order Quantity equations were used to find the optimal cycle length.

$$Q_o = \sqrt{\frac{2 \times RC \times D}{HC}}$$

$$T_o = Q_o \div D = \sqrt{\frac{2 \times RC}{D \times HC}}$$

Q_o = Economic order quantity
 RC = Reorder cost
 D = Demand
 HC = Holding cost
 T_o = Optimal cycle length

Since the data required for the variables are mainly cost-related, the demonstration of the application of the model is not presented since these are confidential data. The result obtained for the hygiene and nursing materials from the model was three days, that is approximately twice a week – an order every Monday and every Thursday to confirm that the patients have all the materials needed to the weekend. According to the SCMAV confidential information about stock, the quantities requested do not justify orders more often than every three days since the consumption level is low. Currently, orders are placed once a week, and the reduction of time between orders to six, five or four days does not justify. On the other hand, Economic Order Quantity equations were applied to find the optimal cycle length to drugs that actually are ordered and replenished twice a week (because

having a stock rupture is not an option for these materials, so there is a need for a greater control), should be ordered three times a week, that is approximately every two days, since they are primary materials and the quantities ordered allow this reduction of time between orders. One of the main advantages of these new inventories policies is that it is not necessary to have a high level of stock at SCMAV, since replenishments with this suggestion are performed more frequently.

In the same situation, the time between orders for the external supplier was also analysed – actually the orders are monthly for hygiene and nursing products and bi-monthly for medicines. It was asked if it would be possible to reduce the period between orders so as to reduce the average stock of the SCMAV outdoor warehouse. However, through a focus group with the stock manager it was verified that this option was not valid for SCMAV, since, by reducing the order period, the purchasing cost per reference would increase. The period of orders to the supplier of both types of materials remained, since increasing the periodicity would not be advantageous under those circumstances because in this type of service (health sector) it is necessary to have a great stock control in order to ensure that there is no stock rupture. On the other hand, reducing the periodicity it is also not an option, since it would imply having more space to store, and the probability of stock-out would be greater.

4.7. Summary

Considering the objectives and research question of this investigation, throughout the Chapter 4, the Lean tool that showed to be the most appropriated to the case study was applied - Value Stream Mapping. This tool allowed a more general view of the medium-term care and rehabilitation process in SCMAV.

In order to analyse the process in more detail, flowchart was used to map the different processes that are part of the overall process.

These tools, along with the informal interviews performed during the research to patients and service providers and direct observation of the process, allow to identify opportunities for improvement. Opportunities for improvement emerged at different points in the process - in the process of “referencing the patient in the RNCCI”, in the "rehabilitation routine in SCMAV" process and in a different theme, in the stock stored in the SCMAV

facilities. It is to be noted that incorrect inventory is considered as a type of waste, so after identified, it was analysed.

The improvements suggestions were discussed through focus group with the professionals of the SCMAV in order to validate them.

5. Conclusions

5.1. Global overview of the dissertation

The main objective of this investigation was to add value to the medium-term and rehabilitation process, through possible solutions to improve the service delivery. For this, a Lean philosophy was applied, considering the tools that best applied to this case study.

The process of medium-term and rehabilitation was selected within the different types of service care of SCMAV and was analysed using the value stream mapping and flowchart tools.

Proposals for improvement were presented, considering the positive results that were demonstrated in the efficiency of the process. Also, these suggestions were analysed in order to meet the main objective of this dissertation – add value to the customer, improving the delivery service process.

The following chapter present the final disclosures regarding the purpose of the dissertation, the research question, its validation, and limits. Finally, some considerations for future research alternatives are considered.

5.2. Objectives analyses

In Chapter 1, the main and specific objectives of this dissertation were defined. In order to assess if the current investigation was effective in attending those specific objectives, they will be reviewed.

- 1- Map the LTC processes – the objective was achieved in Chapter 4 – subsection 4.4.
- with the application of Value Stream Mapping and flowchart tools;
- 2- Identify which stages of the service delivery process add value to the customers and which do not in order to identify improvement opportunities – the objective was met in Chapter 4 – subsection 4.3.- through informal interviews with the patients of medium-term and rehabilitation service;
- 3- Analyse tools, methodologies and approaches that may be adequate for the improvement of health processes – the objective was achieved in Chapter 2, when the different applications of Lean tools in services area and healthcare were analysed;

- 4- Develop proposals to improve the LTC service delivery process – the proposals were identified based on direct observations of the overall process, flowchart, value-stream mapping and informal interviews and then, exposed in Chapter 4 – subsections 4.5. and 4.6. - in order to improve the overall process, so the objective was achieved;
- 5- Compare the current LTC service delivery process and the proposal for improvements – the objective was met when the impact of suggested improvements was presented in Chapter 4 – subsection 4.6..

Considering the objectives reviewed, it is considered that the specific objectives of this investigation were achieved throughout its development.

5.3. Research question

The current investigation attempted to provide an answer to the defined research question:

- *“How can process improvement add value to the stakeholders of LTC services?”*

The use of Value Stream Mapping Lean tool, flowchart, informal interviews and, direct observations proved to be an appropriate guidance to analyse and identify opportunities for improvement in medium-term and rehabilitation process. Value Stream Map, the Lean tool that most suits in the current case study, enabled the visualization of the big picture of the overall process in SCMAV.

Although the suggested improvements were not implemented, in Chapter 4 are represented the possible positive impacts of each one. The identified wastes can be reduced, and the value can be added through activities that patients considered as value adding activities. The wastes were not identified in informal interviews with patients but were identified with to professionals and through direct observations of the process.

Considering the main objective of this dissertation, stated in Chapter 1, *“identify possible solutions to improve long term care service value without disregarding effectiveness”*, it is possible to consider that the general objective was accomplished and affirm that LTC and rehabilitation service can be positively benefited by using Lean Thinking approach. Specific improvement opportunities were identified in the overall medium-term and rehabilitation

process and they were proposed in order to improve overall service delivery. These improvements were proposed for this specific service in SCMAV and cannot be generalized to other services. In addition, internal and external customer can benefit the use of this philosophy, since the process with the suggested improvements is more efficient and effective.

5.4. Limits to the findings

As acknowledged by Yin (2013) and Eisenhardt (1989), case study conclusions are generalisable to theoretical proposals and not to populations. As the findings of this investigation only consider one process – medium-term and rehabilitation process in SCMAV, the results of this dissertation cannot be generalised to other services in healthcare area. On the other hand, it can give useful information to other investigations in the area of health.

The informal interviews to the patients were not from a random sample, but a convenience one. In a total of 30 medium-term care and rehabilitation patients from the RNCCI, 13 patients were selected according to their physical or mental condition. It is a limitation, since, as the group of patients came mainly from the "bone fracture" typology (since the patients with the "sequelae of cardio-vascular accident" typology presented speech difficulties), the results were concentrated in the activities that they played. That is, as the patients of this typology have characteristics different from those of another typology, they also have different activities. The results were focused on the same answers. If patients in the "sequelae of cardio-vascular accident" typology were interviewed, the options of speech therapy and occupational therapy would be answers to be taken into account, since patients with that prognosis have needs of these activities.

On the other hand, another limitation is that the patients were not able, due to their weakened state, to identify the non-value adding activities of the medium-term care and rehabilitation service. These answers could have helped to identify sources of waste in the process. This limitation could be overcome by the family, but there was no access to them.

Relative to the times of each activity of the process is a limitation, since they were not timed. There was no access to such information, since complete hygiene is a personal activity of patients. No timings in processes implies an incomplete Value Stream Mapping,

which made it difficult to identify waste and also does not allow the calculation of quantitative impacts of suggested improvements.

5.5. Future research alternatives

This investigation contributed to fill the gap in the literature and to provide insights of Lean Thinking used at LTC. In addition, an implementation of the improvement suggestions according to the Lean approach should be attempted. Another possibility of investigation is to analyse from the perspective of Lean Thinking the other types of care of RNCCI - long-term and maintenance care- and to compare them.

Thus, since Lean Thinking has long extended to the service area from a theoretical perspective, understanding how the principles guiding the Lean philosophy can be achieved in the healthcare area, given its specific characteristics, could be relevant to increase its potential in LTC area. Since there are few studies in this area it would be relevant to create a framework for applying Lean Thinking to LTC services, a possible future research question comes to light:

- *What are the difficulties of implementing Lean Thinking in these services? And what are the improvements in efficiency and effectiveness under this application?*

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