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# Lean Thinking application in the healthcare sector

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**Abstract.** As years go by, companies operate in an ever-changing environment requiring strategic tools to provide effectiveness and efficiency. The Healthcare sector is not different, dealing with several challenges like increasing patient numbers and limited resources. Healthcare centers need to improve continuously while offering the best services to their patients. The lean thinking, which was initially a symbol of manufacturing process, has evolved over the years to reach the scope of service improvement. This paper exhibits a successful initiative of engaging lean thinking in the healthcare industry to develop more efficient and effective services.

**Keywords:** Lean Healthcare, Italy, Continuous Improvement

## 1 Introduction

Healthcare sector is facing the effects of globalization and major challenges that call for higher quality healthcare services [1]. In fact, the rapid growth of patients demand to higher quality expectations and fast responses collides with the limited available resources of the hospital, forcing the healthcare centers to find ways to innovate and improve utilizing scarce resources with efficient and effectiveness [2]. Specially, during scenarios of crises such as the COVID-19 outbreak, which has put to the test the resilience of healthcare systems all over the world [3].

Ever since its origin in the manufacturing sector, Lean methodology has proved to bring great results in operational performances, which enhanced its dissemination throughout different industries in the manufacturing and service [4] context during the last three decades [5]. In the healthcare sector, the first appearance of Lean was in the UK and Australia in 2001; and twenty years later, only few healthcare organizations specially in the USA, have managed to maintain results with Lean approach [6, 7]. Meanwhile, in Italy, there are only few examples of successful cases in the seek for operational excellence [8, 9] in the healthcare sector.

The objective of this paper is to present and discuss an empirical successful case of continuous improvement performed in an Italian healthcare company. The importance of this case relies in how a company in the healthcare sector can improve its visibility on the process flow and provide more efficient and effective services in benefit of the patients.

## **2 Company Overview**

The company is a leading hospital located in the north of Italy, and one of the points of reference of its region. The company is a health company that provides hospital services, for acute and specialized needs, and territorial services, for outpatient care, as a supplement to the previous ones. The company incorporates in its management a wide range of territorial poles situated in different locations of its city. Amongst them, there is one pole, which provides child neuropsychiatry, psychiatry and some territorial services such as legal medicine. The improvement case is focused on this particular territorial center, in particular, on the administrative processes between the company and the territorial center. A correct functioning of them is necessary to allow a good management of the territorial pole.

Furthermore, since most of the services provided require a payment, a system to track all the activities and control the economic flows of the company is needed. Therefore, to collect and control data about the visits made, the informative system of the hospital is used. It contains the agendas of all the doctors and specialists. However, often patients are exempt (e.g., under 18 years old). In those cases, the economic income is provided by the Agenzia di Tutela della Salute (ATS) but, in any case, the registration of the activity is necessary.

## **3 The Problem and Current Situation**

The main problem highlighted by the hospital was the inefficient management of the administrative processes characterized by few information and data. This prevented company's general management from efficiently monitoring and improving them. There were many problems that top managers were slightly aware of but had not yet been analyzed and improved.

The analysis of the current situation was based on the administrative processes, especially those regarding the first contact with the patient and the acceptance, in order to discover problems and find opportunities for improvement. Furthermore, the starting of the Covid-19 pandemic brought difficulties worldwide; in the conduction of the case at the hospital, it led to difficulties for the collection of data and delaying the start of the analysis. Nonetheless, once the data were available, the analysis was performed, identifying the most critical activities in the processes (for child neuropsychiatry, psychiatry, and territorial services) by considering those contributing to one or more of the 7 Lean Wastes. Those activities were then prioritized through a matrix considering two dimensions: Not-Value-Adding (NVA) time and severity of consequences. It was noticed that only the departments of child neuropsychiatry and psychiatry had activities with medium-high criticality, as presented in Fig. 1. Therefore, it was decided to develop an A3 framework on these two processes.

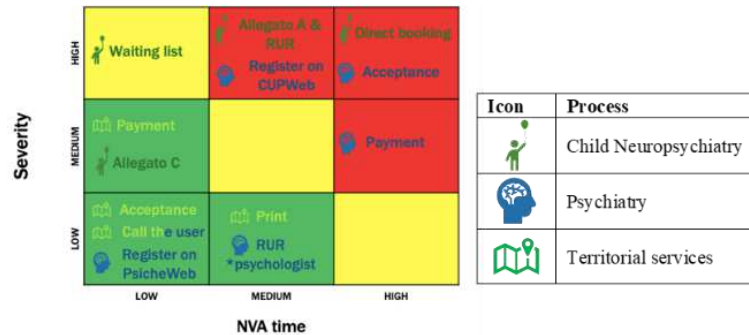


Fig. 1. Priority Matrix of Processes

#### 4 Child Neuropsychiatry

Considering the prioritization made according to severity and NVA time, it was decided to focus on the reduction of lead time in the Child Neuropsychiatry for direct booking, acceptance and registration processes. As must-have target, it was defined to reduce the NVA time of the two activities with high priority (“Direct booking” and “Fill Allegato A and RUR”) by 2.5 hours/week. Meanwhile, for the nice-to-have target, it was decided to act on “Update waiting list” activity, acting on both overprocessing and transportation times in order to achieve a reduction of 0.4 hours/week.

After setting the targets, a root cause analysis was performed initially on the basis of an Ishikawa diagram, later on analyzed through the 5WHYs method, as shown in the Fig. 2.

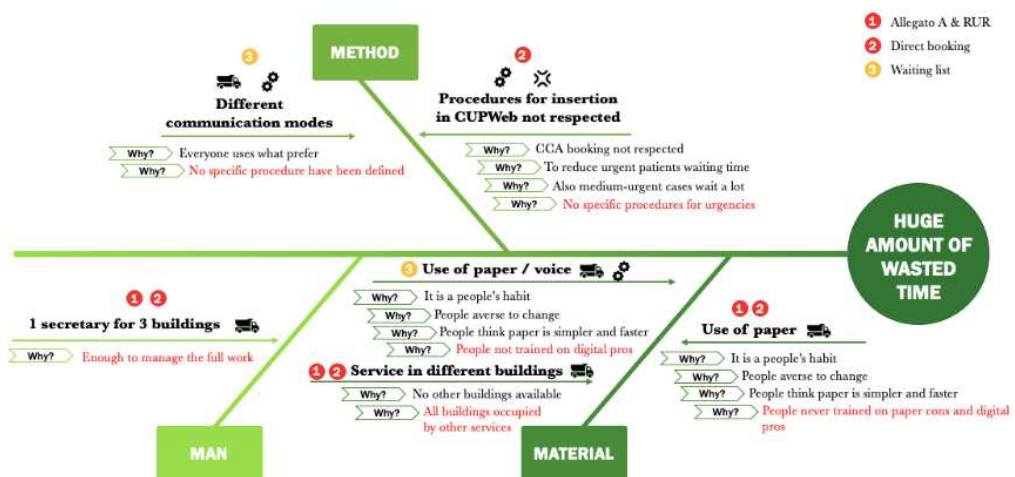


Fig. 2. Root cause analysis of Child Neuropsychiatry

From the analysis of the root-causes, the team developed a list of possible countermeasures, followed by a prioritization analysis, as shown in the Fig. 3 and Fig. 4, to identify the best ones to implement. The prioritization was based on the impact on the target and the effort in terms of both time and cost, with a scale up to 5. The final effort was calculated as a weighted average of time (60%) and cost (40%). And the final grade between impact and effort was computed as 30% and 70% respectively.

MAIN CAUSE	ROOT CAUSE	COUNTERMEASURE	IMPACT	EFFORT TIME	EFFORT COST	FINAL EFFORT	GRADE	CLASS
Use of paper	<i>People have never been trained on paper disadvantages and digital benefits</i>	1. Explanatory session	4	4	4	4	4	
		2. Digitalize "Allegato A"	4	5	5	5	4,7	
		3. Use digital prescription	5	5	5	5	5	
		4. Use mail as method of communication	2,5	5	5	5	4,25	
		5. Create info exchange function in CUPWeb	5	2	2	2	2,9	
Different buildings	<i>All buildings occupied by other services</i>	6. Reorganize Ippocrate to centralize neuropsychiatry in 1 building	2,5	1	1	1	1,45	
1 sec x 3 build	<i>Enough to manage the work</i>	7. Add 1 secretary for each building	2,5	2	2	2	2,15	
Procedures for CUPWeb not respected	<i>No specific procedures for urgencies</i>	8. Define a specific procedure for urgent cases	2,5	4	5	4,4	3,83	

**Fig. 3.** Countermeasures for must-have target of Child Neuropsychiatry

MAIN CAUSE	ROOT CAUSE	COUNTERMEASURE	IMPACT	EFFORT TIME	EFFORT COST	FINAL EFFORT	GRADE	CLASS
Different communication modes	<i>No specific procedure has been defined</i>	1. Define a standard procedure for communicating new patients to specialists	2,5	5	5	5	3,75	
Use of paper / voice	<i>People never trained on paper cons and digital pros</i>	2. Explanatory session	4	4	4	4	4	
		3. Use Excel for all the waiting lists	2,5	4	5	4,4	3,45	
		4. Add waiting list function to CUPWeb	5	2	2	2	3,5	

**Fig. 4.** Countermeasures for nice-to-have target of Child Neuropsychiatry

Due to pandemic situation, it was not possible to implement the countermeasures identified in the short term. In this sense, a set of KPIs has been developed to provide the company all the tools and procedures to implement and monitoring the countermeasures, as shown in the Fig. 5 and Fig. 6.

### Must-To-Have

COUNTERMEASURE	KPI NAME	KPI FORMULA	THRESHOLD	TIME SPAN	MEASURING FREQUENCY	OWNER	SOURCE OF DATA	IMPACT ON TARGET
Explanatory session	% of acceptance towards change	$\frac{\# \text{ positive answers}}{\text{Total questions}}$	< 60% 60-80% > 80%	1 month	Once a week	NPI primary	Administrative and Doctors	↑ staff accord
Digitalize "Allegato A" and RUR	Digitalization Rate	$\frac{\# \text{ digital communications}}{\# \text{ bookings for next visits}}$	< 50% 50-80% > 80%	1 month	Once a week	NPI primary	Administrative and Doctors	↓ Transport time ⌚ (Waiting time)
Mail as method of communication								
Define a specific procedure for urgent cases	% regular booking for first visit	$\frac{\# \text{ CCA accepted patients}}{\# \text{ first visits}}$	< 50% 50-80% > 80%	1 month	Once a week	NPI primary	CLP, Administrative and Doctors	↓ Overproc. time ↓ Transport time ⌚ (Waiting time)

Fig. 5. KPIs for must-have target of Child Neuropsychiatry

### Nice-To-Have

COUNTERMEASURE	KPI NAME	KPI FORMULA	THRESHOLD	TIME SPAN	MEASURING FREQUENCY	OWNER	SOURCE OF DATA	IMPACT ON TARGET
Define standard procedure for communicating new patients to specialists	% paper & voice used	$\frac{\# (\text{paper} + \text{voice}) \text{ commun}}{\# \text{ new patients}}$	> 30% 30-10% < 10%	1 month	Once a week	NPI primary	Doctors	↓ Transport time ⌚ (Waiting time)
Use Excel for all the waiting lists	% excel used	$\frac{\# \text{ Excel communications}}{\# \text{ new patients}}$	< 70% 70-90% > 90%	1 month	Once a week	NPI primary	Doctors	↓ Transport time ⌚ (Waiting time)

Fig. 6. KPIs for nice-to-have target of Child Neuropsychiatry

## 5 Psychiatry

From the prioritization made in Fig. 1, it was decided to focus on Psychiatry as a must-have target on the reduction of the 75% of the acceptance and payment time, which in the same time will bring benefit in customer satisfaction. Meanwhile the nice-to-have target was based on the problem of communication flow between the CPS (Centro Psicossociale) and the administrative offices. Therefore, the nice-to-have target was set as a reduction of 75% in the lost or postponed visits.

A specific root cause analysis was performed on the basis of the Ishikawa diagram and the 5WHYs method for each of the two targets, as shown in the Fig. 7 and Fig. 8. The analysis of the causes helped the brainstorming of proposed countermeasures, and applying the same methodology previously used for the "Child Neuropsychiatry", a prioritization analysis was performed, as shown in the Fig. 9 and Fig. 10.

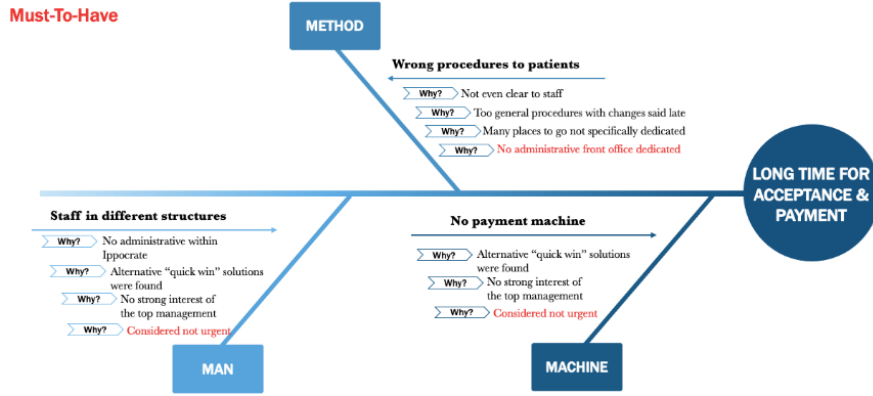


Fig. 7. Root cause analysis of Psychiatry for Must-have target

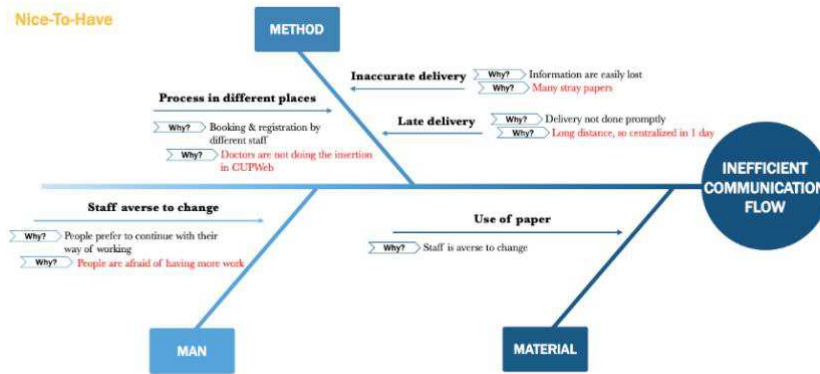


Fig. 8. Root cause analysis of Psychiatry for Nice-to-have target

MAIN CAUSE	ROOT CAUSE	COUNTERMEASURE	IMPACT	EFFORT TIME	EFFORT COST	FINAL EFFORT	GRADE	CLASS
Staff in different structures	<i>Considered not urgent</i>	1. Meeting with top managers	5	5	5	5	5	Green
		2. Share an existent administrative of Ippocrate	2	4	4	4	3,4	Yellow
		3. Add 1 administrative for psychiatry	4	4	3	3,6	3,72	Green
Wrong procedures to patients	<i>No administrative front office dedicated</i>	4. Create a front office in the CPS (pav 25)	5	2	2	2	2,9	Red
		5. Create a front office in pavilion 1	5	4	4	4	4,3	Green
No payment machine	<i>Considered not urgent because few cases require payment</i>	6. Meeting with top managers	5	5	5	5	5	Green
		7. Buy a new POS	4	4	4	4	4	Green
		8. Share the POS of territorial services	1	1	1	1	1	Yellow
		9. Add a Cash Machine	4	2	2	2	2,6	Red

Fig. 9. Countermeasures for must-have target of Psychiatry



MAIN CAUSE	ROOT CAUSE	COUNTERMEASURE	IMPACT	EFFORT TIME	EFFORT COST	FINAL EFFORT	GRADE	CLASS
Process in different places	Doctors are not doing the insertion in CUP	1. Have the doctors doing the insertion of 28/SAN in CUPWeb	4	4	4	4	4	
Staff averse to change	People are afraid of having more work	2. Explanatory session	5	4	4	4	4,3	
Inaccurate delivery	Many stray papers	3. Past papers in a unique folder	0	5	5	5	3,5	
		4. Use digital format (Allegato A and electronic prescription)	2	3	4	3,4	2,98	
Late delivery	Centralized in 1 day	5. Improve the number of deliveries	2	3	2	2,6	2,42	
		6. Send via digital	2	3	4	3,4	2,98	
		7. Create info exchange function in CUPWeb	2	1	1	1	1,3	

Fig. 10. Countermeasures for nice-to-have target of Psychiatry

The situation of the pandemic affected as well this part of the project, and it was not possible to implement the countermeasures defined. KPIs have been defined to monitor the countermeasures in the future, Fig. 11 and Fig. 12.

#### Must-To-Have

COUNTERMEASURE	KPI NAME	KPI FORMULA	THRESHOLD	TIME SPAN	MEASURING FREQUENCY	OWNER	SOURCE OF DATA	IMPACT ON TARGET
Meeting with top managers	% of acceptance towards change	$\frac{\# \text{ positive answers}}{\text{total questions}}$	< 60% 60-80% > 80%	1 day	Once	Top Management	Complex Structure Director	↑ Top mgmt. engagement
Add 1 administrative for psychiatry	% front office utilization	$\frac{\# \text{ accept patients in pav 1}}{\text{total 28 SAN visits}}$	< 70% 70-95% > 95%	1 month	Once a week	Administrative and Doctors	Complex Structure Director	↓ Acceptance & Payment time
Create a front office in pavilion 1	% new POS utilization	$\frac{\# \text{ paid visits with new POS}}{\text{total paid visits}}$	< 50% 50-80% > 80%	1 month	Once a week	Administrative and Doctors	Complex Structure Director	↓ Payment time

Fig. 11. KPIs for must-have target of Psychiatry

#### Nice-To-Have

COUNTERMEASURE	KPI NAME	KPI FORMULA	THRESHOLD	TIME SPAN	MEASURING FREQUENCY	OWNER	SOURCE OF DATA	IMPACT ON TARGET
Explanatory session	% of acceptance towards change	$\frac{\# \text{ positive answers}}{\text{total questions}}$	< 60% 60-80% > 80%	1 month	Once a week	Psychiatry primary	Administrative and Doctors	↑ Staff accord
Have the doctors doing the insertion of 28/SAN in CUPWeb	% of Registration on CUP	$\frac{\# \text{ registered 28 SAN visits}}{\text{total 28 SAN visits}}$	< 60% 60-80% > 80%	1 month	Once a week	Psychiatry primary	Administrative and Doctors	↓ Lost visits

Fig. 12. KPIs for nice-to-have target of Psychiatry

## 6 Conclusions

Despite the intense effort and level of resilience required during the data collection phase and the periods of uncertainty due to the pandemic, the case shows the applicability of the lean thinking in the healthcare industry, with the aim to reduce lead times and provide a better service to patients. The data collection phase necessary to depict the current situation involved employee at the hospital and the top management increased the attention on it, providing visibility on the severity of the inefficiencies as well as an increased commitment to change and improve. This application case allowed to engage the staff and actors in the Lean thinking approach, and to generate awareness on the importance of their collaboration for the hospital's Lean program. The increase of commitment reduced the resistance to change and the spread of Lean thinking in the company.

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