

**A Continuous Quality Improvement Project to Improve the Workflow and Patient  
Throughput at a Digestive Disease Institute**

By

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## **Abstract**

*Introduction.* The American health system urgently needs a comprehensive transformation focused on improving quality of care. The health system has had a successful yet limited application of Continuous Quality Improvement (CQI), as an organizational process to achieve a continuous flow of improvements to provide quality care for the population. In this quest for CQI, health organizations have effectively used the Lean methodology as a transformative management approach to improve quality of care.

*Objective.* The goal of this paper is to systematically evaluate a Continuous Improvement Lean-based project, as an approach to improve the quality of care in a Hospital setting.

*Methods.* A multi-disciplinary team was assigned to develop and implement a Continuous Quality Improvement (CQI) project at the Digestive Disease Institute that aimed to improve workflow and patient throughput by using the Lean Methodology. After the analysis of background and current conditions, the problem was defined as follows: Seventy percent of patients with 8:00 am appointments were roomed late. Root causes were determined, and the proposed countermeasures were tested in a three-months pilot project, modeled on a PDCA cycle methodology.

*Results.* After the implementation of the pilot project, the goal of increasing by 50% the number of patients with 8:00 am appointments that are roomed on time was successfully achieved.

*Conclusion.* The Lean methodology was a successful approach that provided a systematized yet flexible framework to improve the workflow and patient throughput at the Digestive Disease Center.

## Introduction

In the midst of the Affordable Care Act implementation, the American health system encounters a myriad of factors that determine the current conditions of the system and that need to be addressed effectively to assure improvements in the health of the population. Among those challenges, the health system faces constant advances in technology with a lack of preparedness to its safe and correct application, an aging population with leading morbidity and mortality from chronic conditions within a system still focused on acute care, persistent marked health inequalities along with limited access to health care, past and emergent threats, and a disorganized, uncoordinated and complex system that requires imminent fundamental changes (IOM, 2001). In this scenario, the Institute of Medicine (IOM) report *Crossing the Quality Chasm: A New Health System for the 21<sup>st</sup> Century* (2001) highlights the need to urgently change the American health system from a comprehensive quality perspective. This broad focus on quality has evolved to encompass integration across the continuum of care, emphasis on both individual and population outcomes, organizational accountability and public transparency, and coordination between health care and public health (Kelly, 2011; Honore & Scott, 2010). Likewise, a quality based health system transformation will entail committed visionary leadership and a prepared educated workforce (IOM, 2001). To build a more reliable, safer, coordinated, evidence-based health system with a higher level of quality, the IOM report (2001) defined six aims to address crucial areas for improvement. According to the report, health care is needs to be: safe, effective, patient-centered, timely, efficient, and equitable. Additionally, in the crusade for quality the IOM developed the *Learning Health System Series*, a series of quality

improvement and innovation in the health industry related publications to enable progress towards the development of a learning health system (IOM, n.d).

To understand the evolution of quality in the health system, it is essential to consider the visionary work of Berwick and the Institute for Healthcare Improvement (IHI) founded in 1991, which is focused on transforming the health system by eliminating waste, errors, delays, and excessive costs (IHI, n.d). Throughout three decades, the IHI has been a pioneer in the identification and implementation of best practices, the promotion of innovation and systems transformation, and the definition of the “Triple Aim” as a framework to optimize health care based on simultaneously implementing the interdependent goals of improving the experience of care, improving the health of the populations, and reducing the per capita costs of health care (Berwick, Nolan, & Whittington, 2008; IHI, n.d). In the context of the Triple Aim framework, it is crucial to highlight the definition of population health, as the health outcomes of a group of individuals and their distribution, within a comprehensive approach that includes the social determinants of health. Likewise, the IHI emphasizes the notion of population medicine as the processes involved in delivering high quality health services, in which health care delivery is focused around the needs of the population (Lewis, 2014). In this setting, population medicine and population health converge in a broader systems approach, in which organizations must acknowledge the social, environmental, and behavioral determinants of health to achieve the Triple Aim goals (Lewis, 2014).

From the President’s Commission on Consumer Protection and Quality in the Health Care Industry report *Quality First: Better Health Care for All Americans* (AHRQ, 1998), to the passage of the Affordable Care Act, calls for action have highlighted the crucial role of integrating all segments of the health care industry into a coordinated approach to quality (HHS,

2008; Honore & Scott, 2010). The Affordable Care Act emphasis on prevention and health promotion both at the individual and population level, underscores the need for a systems-based approach that combines health care and public health quality efforts to improve the health of the population (Honore & Scott, 2010; Honore et al., 2011). *The Consensus Statement on Quality in the Public Health System* provided a frame to define quality in public health as well as a set of characteristics to guide the implementation of quality improvement initiatives in public health (HHS, 2008). To enhance the coordinated approach to quality, the Public Health Quality Forum developed the *Priority Areas for Improvement of Quality in Public Health* report (Honore & Scott, 2010). The definition of quality and its characteristics in public health and the identification of priority areas with impact across the public health system, created a comprehensive framework to promote standardization and identify gaps in the development, implementation, and evaluation of quality initiatives in public health, as well as align and coordinate local, state and national goals (Honore et al., 2011).

### **Continuous Quality Improvement in the Health System**

The industrial process known as Total Quality Management (TQM) developed into Continuous Quality Improvement (CQI) as it was adapted into the realm of health care. In this setting, CQI is defined as a systematized, coordinated organizational process that engages the health system workforce in developing and implementing a continuous flow of improvements to provide quality care for the population (Sollecito & Johnson, 2013).

Originally applied in the Japan manufacturing industry during the post World War II era, the Continuous Quality Improvement (CQI) movement in the U.S can be traced back to Donabedian who defined structure, processes of care, and outcomes as the essential components

to measure quality (Kelly, 2011). Likewise, in 1980, W. Edwards Deming ignited the flame of quality by proposing a systems management-based perspective focused on processes, and centered on the statistical analysis of data and a continuous cycle of improvement (Sollecito & Johnson, 2013). Over the decades, CQI has evolved to encompass fundamental ideas like the importance of transforming changes into improvements, a customer focus, the value of teamwork, and the notion of a constant cycle of improving processes that requires learning, multi-level participation, and visionary innovative leadership (Kelly, 2011; Sollecito & Johnson, 2013).

The process of acceptance and wider application of CQI and its implementation in the health care industry is based on the common notion of adding value on services or products to customers shared by manufacturing and commercial industries. Important examples of this cross-disciplinary translation is the use in health care and public health of the Plan, Do, Study, Act (PDSA) cycle developed by Shewhart, and the fishbone or Ishikawa cause-and-effect diagram (Sollecito & Johnson, 2013). In health care, the definition of quality evolved from the basic concept of ensuring high quality care, to a broader approach that integrates the notion of adding value. Built on the ideas of Crosby (1979) of diminishing value associated with waste, CQI now includes the concept of minimizing costs and increasing value, while providing quality care (Sollecito & Johnson, 2013). As described by Berwick, Nolan, and Whittington (2008), to achieve high quality care for the population, efforts are likely to be focused on pursuing the “Triple Aim” goals of improving the experience of care and the health of the populations, as well as reducing the per capita costs of health care.

In the context of a culture of quality improvement based on enhancing value within the health setting, health organizations are likely to transform their processes based on specifying,

defining, and planning their activities and decisions in advance, designing mutually reinforcing microsystems within the organization, prioritizing measurements and oversight, and promoting a culture of organizational knowledge and innovation that supports self-study and stimulates learning among dissenting opinions (Bohmer, 2011). This transformative process ideally will result in a learning organization, where people are encouraged to expand their capacities toward common goals, innovative thinking is exalted, and learning becomes a personal and a shared productive experience (Sollecito & Johnson, 2013).

Currently, CQI is embraced and applied across the various sectors of the health industry, extending its spectrum from patient care and hospital performance to disease prevention and population health promoting initiatives (Sollecito & Johnson, 2013). However, although CQI aims to improve the quality of care, its implementation faces limitations like the time and cost it demands from individuals and organizations, the need for committed leadership and a trained workforce, the importance of a solid measurement and data system, the role of inter-discipline relations and teamwork, as well as cultural acceptance of the process (Weiner et al., 2006).

Additionally, deficiencies in CQI implementation in public health include the lack of knowledge of best practices and evidence-based strategies, insufficient standards for measuring practices, deficiencies in the workforce training and education, limitations in data collection, and financial restrictions (HHS, 2008; Honore et al., 2011).

### **Lean Methodology**

The Lean methodology is a valuable approach to address the need of the health system to improve the quality of health care while controlling costs. Lean is a quality improvement set of principles and tools designed originally by the Toyota Motor Company, and promoted by

Womack and Jones, that has transcended the manufacturing boundary to currently be widely used in the health industry (Clark, Silvester & Knowles, 2013). Lean in health care can be defined as an organizational teamwork-based, innovative and transformative management approach, focused on applying the scientific method to develop, implement, and continuously improve the work of an organization, and that ultimately will reflect on measurably increased value for the internal and external customers and optimum patient care (Toussaint & Berry, 2013). This paper aims to describe and systematically evaluate the application of Lean as an approach to improve the quality of care in a hospital setting.

The main notion of Lean is to maximize value for customers, minimize waste, and reduce costs (Simon & Canacari, 2012), and it is centered on six essential principles: 1) attitude of continuous improvement;; 2) value creation for the patients and health care stakeholders; 3) unity of purpose, as it guides a complex system into clarifying and prioritizing goals; 4) respect for the people who do the work, usually front-line workers, along with leadership by example; 5) visual tracking, as a common practice to promote communication and innovation; and 6) flexible regimentation, to standardize processes to improve performance (Toussaint & Berry, 2013).

In the health system, Lean principles are applied to improve workflow by reducing waste, where waste is defined as anything that adds no value from the customer perspective (Simon & Canacari, 2012). Based on enhancing value for both internal and external customers, services are improved in terms of quality, cost, and timeliness, increasing the time available to focus efforts on value-added initiatives (Simon & Canacari, 2012). Value-added work is defined as activities that generate something that the customer cares about, and non-value added work could be both required non-value added work with no value for the customer but cannot be avoided, and pure waste where resources are consumed but no value for the customer is added (Pelletier, n.d).



Waste activities include waiting, unnecessary movement, avoidable transportation, defects or time spent on errors, over processing, and overproduction (Simon & Canacari, 2012; Pelletier, n.d). The Lean management system focuses on systematically evaluating and continuously improving end-to-end processes, by identifying and addressing underlying root causes and removing waste, to ultimately standardized processes to increase value for the customers (Clark, et al., 2013).

The IOM report (2001) underlined the main role of timeliness as one of the six aims for improving the quality of health care, as well as underscored how patients spend a substantial amount of time waiting to receive their health services. Moreover, patients satisfaction is strongly linked to the amount of time experienced waiting to receive health care (Rondeau,1998). In a patient-centered scenario, efficient and timely health services are likely to be focused on reducing waits and avoiding waste. Besides negatively impacting patient satisfaction, clinic wait is inextricably linked to health care costs, workforce dissatisfaction, and organizational commitment. In this setting, to increase patient satisfaction, health organizations need to focus quality improvement efforts on decreasing waiting times, which equals reducing waste that adds no value for the customers, and improving patient flow (Potisek et al., 2007).

Lean improvement efforts have expanded from the health care setting to public health. Currently, the crude reality is that public health agencies face unprecedented and constant changes, while performing with scarce resources (Harrison, 2012). The broad public health spectrum, that encompasses from population surveillance and intervention, health promotion, to disease-prevention, highlights the need to incorporate CQI methods to improve efficiency and agency performance, promote voluntary accreditation, and ultimately result in better health outcomes for the population (Riley et al., 2009; Harrison, 2012). In this scenario, the Lean

methodology could be an effective approach to identify and reduce waste, while optimizing available resources (Smith et al., 2012). The application of Lean tools will guide the agency workforce to identify gaps in performance, prioritize and focus on necessary activities, redesign processes, generate change measurements, make evidence-based decisions for improvement, all of which along with committed leadership, will enhance the overall agency performance (Harrison, 2012; Sollecito & Johnson, 2013).

Even though the Lean methodology has been successfully used in the health industry, it is pertinent to highlight barriers to its implementation, like the competition from other projects, the lack of leadership commitment, and a variable limited availability of human, material, technical, and economic resources (Steed, 2012). The use of Lean tools is not enough to guarantee a more efficient, high-quality, safer, patient-centered care; instead, organizations are likely to embrace a comprehensive cultural transformation based on Lean principles, with a shared vision of a patient-centered approach, and supported by committed leadership (Kaplan et al., 2014).

### **Continuous Quality Improvement and Leadership**

A quality-based organizational change is inextricably linked to a committed, transformational, visionary leadership (Kaplan et al., 2014; Steed, 2012). Transformational leaders define and share a vision, which is embraced by the all the organization and translates into a culture of excellence, based on commitment to innovation, change and quality improvement (Sollecito & Johnson, 2013). In this setting, as Deming highlighted, the establishment of a constancy of purpose for all in the organization towards a shared vision of continuous improvement, is a leaders' most important task within an organization (Clark, et al., 2013; Sollecito & Johnson, 2013).

In CQI, a balanced interrelation between leadership, organizational culture, and teamwork, determines the success of the transformational process. In this context, a culture of CQI demands the effective integration between a top-down leadership approach that supports a shared vision for improvement, with a bottom-up approach where leadership is present at all levels within a team (Sollecito & Johnson, 2013; Mann, 2009). As Deming highlighted, “There is no substitute for teamwork and good leaders of teams to bring consistency of effort along with knowledge” (Deming, 1986, p.19). In CQI, teamwork involves empowerment and consequently high levels of motivation among team members; however, to enable this process, leaders must build trust and promote a climate of innovation (Sollecito & Johnson, 2013).

Additionally from traditional leaders, in CQI leadership expands to include opinion leaders, champions, and boundary spanners, who at different levels of the organization have the power to promote and encourage participation and influence peers to support the innovation process (Sollecito & Johnson, 2013).

The Lean philosophy demands a shift from leadership competencies based on a hierarchical autocratic model, to leaders that become mentors, coaches and role models that recognize the value of educating and providing their team with the best skills and training (Toussaint & Berry, 2013). In the CQI context, it is essential to acknowledge the importance of leading by example, where leaders have an active participation in the improvement effort and project their commitment to CQI to their team (Sollecito & Johnson, 2013). In the Lean scenario, leaders support front-line workers or improvers by visiting their worksite or “Gemba”, and first-hand experiencing problems and barriers for improvement (Toussaint & Berry, 2013). The Japanese term Gemba translates into “the real place”, where action happens (Mann, 2009). The Gemba walking is a periodic visit to the work area, where leaders are able to personally look at

the process and talk with the people involved. These visits reinforce the lean practices and promote experiential learning (Mann, 2009).

The Lean methodology contemplates leaders able to face the important task of coordinating and establishing governance interactions that surpass divisional boundaries, holding their team accountable, and who are responsible for promoting and sustaining the common vision of value-producing processes, and a patient-centered organization (Mann, 2009). Moreover, leading in the CQI setting, requires perseverance to counteract setbacks and resistance, and humility to deal with problems and promote a culture of respect (Toussaint & Berry, 2013). In Lean management, leaders are responsible for transforming commitments to change into realities, and for promoting and supporting the transition from projects to ongoing transformative processes (Mann, 2009). Moreover, leaders are in charge of encouraging and sustaining a Lean culture of continuous improvement within the organization (Mann, 2009).

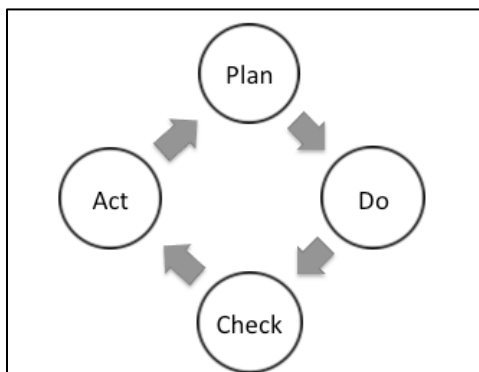
## **Methods**

### **Study Setting**

The Clinic is a multi-specialty medical center that includes clinical and hospital care along with research and education, with the mission to “provide better care of the sick, investigation into their problems, and further education of those who serve” (Cleveland Clinic, 2014). The Clinic’s Digestive Disease Institute comprises the Departments of Colorectal Surgery, Gastroenterology, and the Bariatric and Metabolic Center, all of which share the same desk.

After the Transplant Program started at the Clinic in 2013, transplant patients were added to the Digestive Disease Institute's desk, which increased the load of patients, and accentuated inefficiencies in patient throughput. The Clinic assigned a mission-oriented multi-disciplinary team formed by physicians, nurses, administrative and managerial personnel, to develop and implement a Continuous Improvement effort that aimed to improve workflow and patient throughput at the Digestive Disease Institute based on the application of Lean procedures. The team was assigned to perform an analysis of utilization of clinical assets, which included providers' time, room usage, and patients' waiting time.

During intensive coached CQI workshops, the team was trained on the application of the Lean methodology to the CQI project. Advances of the project were discussed in weekly team meetings. Based on the Lean methodology, the team used the A3 Tool, a problem-solving tool that structures the thinking process, represents the PDCA cycle, and summarizes the problem and its solution. Additionally, the A3 works as a shared communication tool between the team participants (Pelletier, n.d.) (Figure 2). Also, the team used the PDCA or Shewhart management and learning cycle, which is the foundation for the A3, and represents the process of identifying problems, countermeasures, improvements, and monitor implementation (Pelletier, n.d.) (Figure 1).



**Figure 1. Shewhart PDCA cycle.**

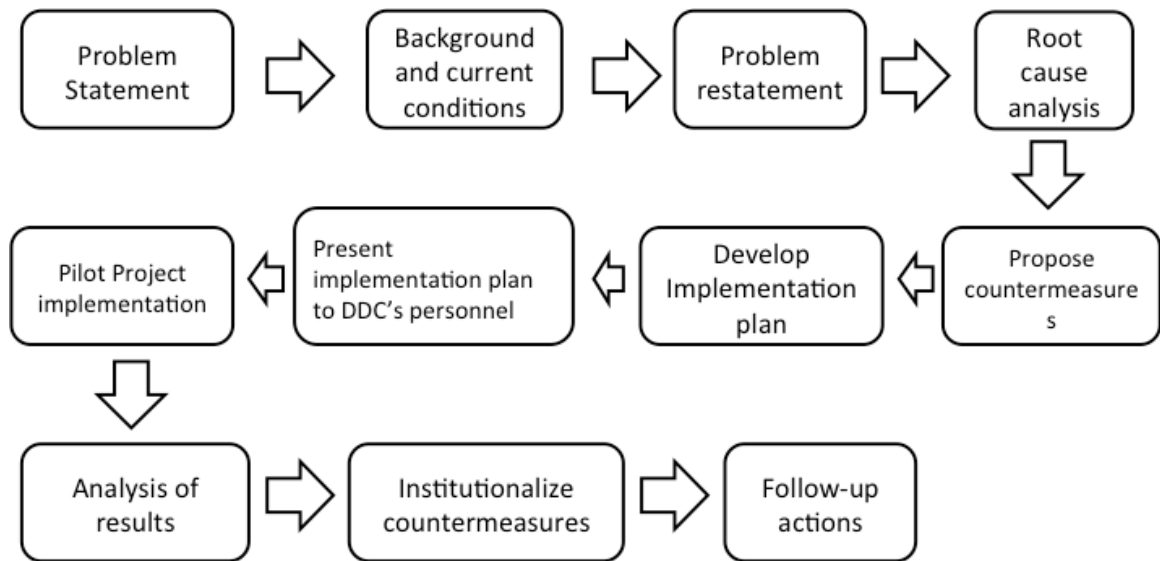
### A3 Title

<b>Problem / Business Case</b> 70% of patients with 8 am appointments at desk 21-22 are roomed more than 5 minutes after the time of their appointment	<b>Countermeasure(s)</b> <b>What alternatives could be considered?</b> 1.) Redesign physicians schedule templates to increase the number of 8am 15 min appointments and reduce the number of first time appointments 2.) Assign a group of nurses to arrive by 7:45 am that are available to room 8am patients. 3.) Change nursing roles by not assigning them to a specific physician.
<b>Current Conditions</b> Workflow delays, overtime, delays in answering encounters.	<b>Planning and Implementation</b> <ul style="list-style-type: none"> <li>• <b>Data Sample:</b> Team will collect manual data to understand what time patients hit the scale. We are also evaluating what reporting functions can tell us when the physician reaches the patient(epic notes sign on /off)</li> <li>• <b>Meeting with Department Physician Chair for approval</b></li> <li>• <b>Simulate countermeasures and validate results.</b></li> <li>• <b>Institutionalize countermeasures.</b></li> </ul>
<b>Goal</b> Room 80% of patients with 8 am appointments on time on desk 21-22	
<b>Analysis</b> The root causes of the problem include: <ul style="list-style-type: none"> <li>• Nurses and physicians arrive at 8 am(too late)</li> <li>• Nurses are assigned to a specific physician(impedes flexibility)</li> <li>• Physician schedule most first time appointments at 8 am. These appointments have longer times.</li> </ul>	<b>Follow-up: (Measure &amp; Evaluate, Standardize &amp; Share, Recognize &amp; Reflect)</b> <b>Measurement:</b> We will create a long term measurement system that will allow us to see the impact of our improvement and sustain results.

**Figure 1. A 3 Tool**

The CQI project aimed to encourage a culture of Continuous Improvement within the organization, promote coordinated multidisciplinary teamwork, apply the Lean process to a Continuous Improvement project, enable improvements in workflow and patient throughput, improve patient satisfaction by reducing waiting times, and enhance workforce satisfaction by reducing overtime.

The project activities included: problem statement, analysis of background and current conditions, analysis of root causes, definition of goals and scope, proposal of countermeasures, development of an implementation plan, a Pilot Project implementation, and the analysis of results and definition of follow-up actions (Figure 3).



**Figure 3. Project Flow Chart.**

### **Problem Statement**

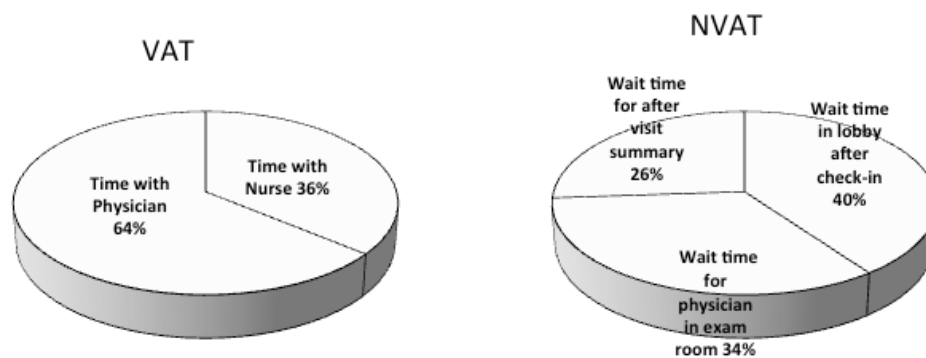
On 2013 the Clinic started the Transplant Program. Patients from the Transplant Program were added to the Digestive Disease Institute's desk. The CQI project initially aimed to address the additional patient volume produced by the integration of the Transplant Program, which increased inefficiencies in patient throughput. The initial problem statement was: The Transplant Department added additional patient volume to the Digestive Disease Institute's desk, which increased inefficiencies in patient throughput.

### **Background and Current Conditions**

Initially, the team developed and analyzed the Patient Flow Chart, which outlined the process of care at the Digestive Disease Institute's desk, and allowed the measurement of the time spent in each phase of the patient visit to the Clinic. Later, the team defined Value Added

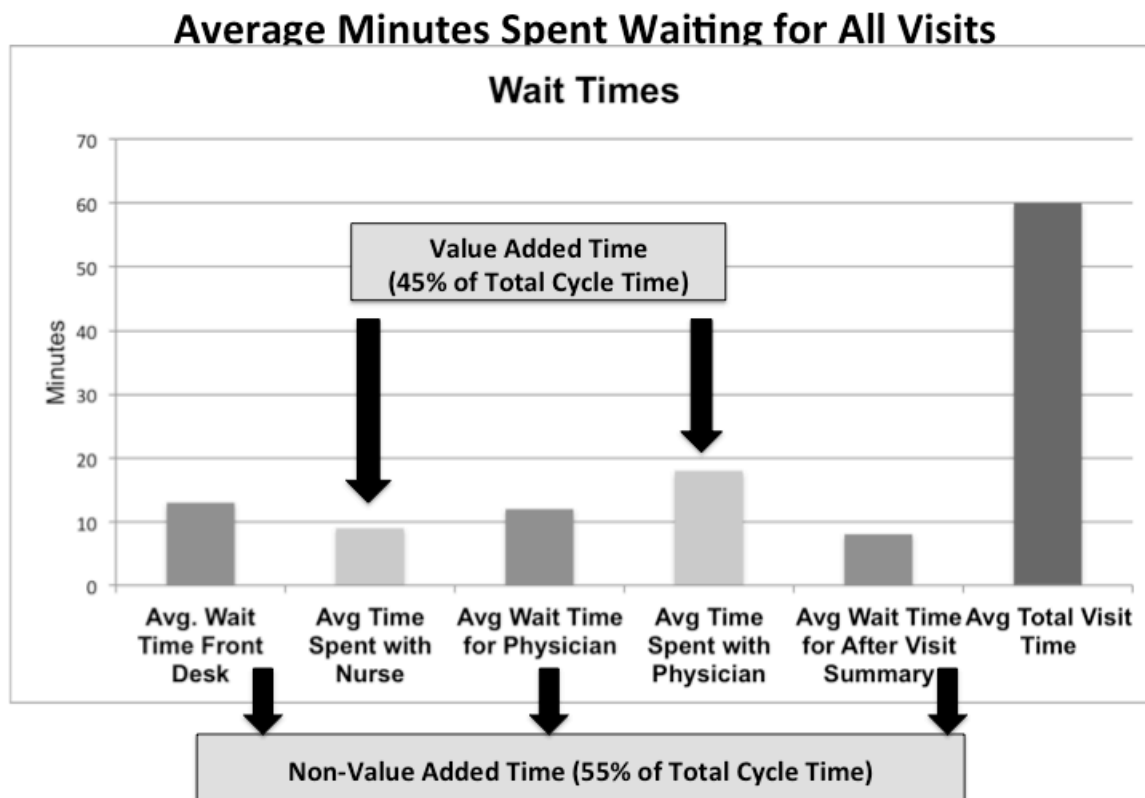
Time (VAT) as the time spent face-to-face with the nurse and physician, and Non Value Added Time (NVAT) as the time spent in the lobby, time spent waiting for the physician in the exam room, and time waiting for the after visit summary (AVS). Data were collected from 143 patients to determine VAT and NVAT; these data included: minutes spent by the patient in the lobby waiting to be taken to the exam room, minutes spent with nurse, minutes waiting for the physician in the exam room, minutes spent with the physician, and minutes waiting for the after visit summary (Figure 4).

The analysis of the data showed a large amount of Non Value Added Time, especially NVAT represented by minutes waiting for the physician at the exam room. (Figure 5). Additionally, data showed the clinic day usually started late (after 8:00am). The combination of these 3 factors led to inefficient exam room turnover and long cycle times.



**Figure 4. Value Added Time (VAT) and Non-Value Added Time (NVAT).**





**Figure 5. Analysis if VAT and NVAT**

The team visited the worksite or “Gemba”, and after interviewing nurses and physicians about why patients spent large amount of time waiting for the physician, they reported three main reasons: physicians’ tasks between patients are variable, physicians’ practice behaviors are inconsistent, and there was consensus about starting the day late. Additional analysis of the data showed that from ten patients with 8:00 am appointments, 90 % of patients were checked-in at the front desk on time, 70% of patients were roomed five minutes after the time of their appointment, and most of the appointments were 30-minute appointments. Additionally, nurses and physicians highlighted that they had the same daily schedule, arriving all at 8:00 am. (Figure

6). From the analysis of these data the team concluded that the problem was not the overload of patients checking-in at the front desk, but the gap for improvement was the fact that nurses and physicians arrived at 8:00 am, which is the same time of the first appointment of the day, so it was technically impossible to have the patient roomed before 8:00 am. The delay in rooming the first patient, translated into cumulative overtime throughout the day.

- Of the ten 8:00 am appointments:
  - 9 out of 10 checked in before 8am
  - 7 out of 9 entered the exam room after 8:05am
  - 7 out 10 patients were 30-minute visits
- Nurses and providers have the same daily schedule: 8:00am – 5:00pm with lunch from 12:00pm – 1:00pm

**Figure 6. Analysis of 8:00 am appointments**

### **Problem Restatement**

The analysis of the background and current conditions of the Digestive Disease Institute desk resulted in restating the problem. The new problem statement for the CI project was: Seventy percent of patients with 8:00 am appointments at desk 21-22 are roomed more than 5 minutes after the time of their appointment.

Along with the problem restatement, the team decided to narrow the scope of the project and limit the subsequent analysis to the Department of Gastroenterology. In this Department, formed by ten physicians, each physician works with a specific nurse during the Clinic hours. This nurse was in charge of rooming the patient, processing the paperwork, and answering patient messages only to the specific physician she was assigned to.

Also, it is important to mention that the Gastroenterology physicians' appointment templates consist of 15-minute blocks for follow-up appointments and 30-minute blocks for new patients.

### **Analysis of Root Causes**

After restating the problem, the team identified three root causes to address at the Department of Gastroenterology: nurses and physicians arrived at the same time, 8:00 am; nurses were assigned to a specific physician, which impedes flexibility; and physician scheduled most first time (30-minute) appointments at 8:00 am (Figure 7).

The goal of the project was defined to achieve an increase by 50% in the number of patients with 8:00 am appointments that are roomed on time.

### **Countermeasures**

After reviewing the problem, current conditions, and root causes, the team used brainstorming to evaluate possible countermeasures, and prioritize them using an impact vs. effort matrix, where impact represents how close the countermeasure gets to the goal and effort represents how much will it take to implement and sustain it. Each countermeasure was assigned a number from a 1 to 10 scale for impact and for effort, and the product (impact x effort) determined the final score. The countermeasures with the highest score were likely to be the best countermeasures. The team identified three countermeasures: 1) assign a group of nurses to arrive by 7:45 am that are available to room 8:00 am patients; 2) change nursing roles by not assigning them to a specific physician; and 3) redesign physicians' schedule templates to increase the number of 8 am follow-up (15-minute) appointments and reduce the number of first time (30-minute) appointments.

## **Implementation Plan**

Considering the application of the Shewhart PDCA cycle, the team started the planning (Plan) process by developing an Improvement Implementation Plan, where specific tasks and timelines were assigned to each member, and which was modified and updated according to the progress of the project. The Implementation Plan progress was reviewed in the team weekly meetings. The project was presented to the Digestive Disease Institute personnel, nurses and physicians, to obtain their feedback and define the pilot program.

## **Pilot Program Implementation**

Subsequently, and representing the “Do” of the PDCA cycle, the team designed a three-month Pilot Project focused on the implementation of the three proposed countermeasures. A first step included the implementation of the two initial countermeasures; first, nurses’ roles were changed by not assigning them to a specific physician; instead rotating pools were created with specific responsibilities like rooming patients and answering encounters; and second, a group of nurses were assigned to arrive at 7:45 am and be available to room 8:00 am patients. The next step was to redesign physicians schedule templates to increase the number of 8:00 am follow-up (15-minute) appointments and reduce the number of first time (30-minute) appointments.

## **Results**

After the implementation of the first step of the three-month pilot program, that included changing the nurses’ roles and assigning a group of nurses to arrive early, data was collected to evaluate the initiative’s impact and determine gaps for improvement. This step corresponds to “Check” of the PDCA cycle. Data collected from patients with 8:00 am appointments at the

Digestive Disease Center included: type of appointment (30-minute or 15-minute), availability of nurses before 8:00 am, time of check-in at front desk, time of patient roomed by nurse, and physicians' arrival time to the exam room (Table 1).

Patient	Date	Hour of Appointment	Type of App.		Nurses Before 8:00AM	Front Desk Check-in	Patient Roomed by Nurse	Physician Arrival Time
			30 min	15 min				
1	2-Sep	8:00 AM	X		YES	7:56 AM	8:05 AM	8:18 AM
2	2-Sep	8:00 AM	X		YES	*8:32 AM	8:37 AM	8:40 AM
3	2-Sep	8:00 AM	X		YES	*8:44 AM	8:48 AM	8:59 AM
4	3-Sep	8:00 AM	X		YES	7:41 AM	7:56 AM	8:12 AM
5	3-Sep	8:00 AM	X		YES	7:45 AM	8:00 AM	8:05 AM
6	5-Sep	8:00 AM	X		YES	7:50 AM	8:00 AM	8:12 AM
7	5-Sep	8:00 AM	X		YES	7:53 AM	8:02 AM	8:08 AM
8	5-Sep	8:00 AM	X		YES	7:53 AM	8:05 AM	8:07 AM
9	5-Sep	8:00 AM	X		YES	*8:09 AM	8:16 AM	8:24 AM
10	5-Sep	8:00 AM	X		YES	*8:13 AM	8:25 AM	8:30 AM
11	30-Sep	8:00 AM	X		YES	7:36 AM	8:02 AM	8:10 AM
12	30-Sep	8:00 AM	X		YES	7:45 AM	8:03 AM	8:11 AM
13	30-Sep	8:00 AM	X		YES	7:58 AM	8:05 AM	8:15 AM
14	1-Oct	8:00 AM	X		YES	7:35 AM	7:54 AM	8:18 AM
15	1-Oct	8:00 AM	X		YES	7:28 AM	8:04 AM	8:08 AM
16	1-Oct	8:00 AM	X		YES	7:53 AM	8:05 AM	8:10 AM
17	1-Oct	8:00 AM	X		YES	8:00 AM	8:07 AM	-
18	3-Oct	8:00 AM	X		YES	7:53 AM	8:05 AM	8:14 AM
19	3-Oct	8:00 AM		X	YES	*8:13 AM	8:19 AM	8:30 AM
20	3-Oct	8:00 AM	X		YES	*8:08 AM	8:15 AM	8:28 AM
21	3-Oct	8:00 AM	X		YES	*8:08 AM	8:16 AM	8:25 AM

\* Patient arrived at front desk check-in after 8:00AM

**Table 1. Pilot Observation data.**

Regarding the evaluation of the initial two countermeasures, the data showed that 100% of days a group of nurses arrived at 7:45 am, and was available to room patients with 8:00 am appointments. Additionally, all 8:00 am appointment patients were roomed by nurses before 8:05 am, except those who arrived late (after 8:00 am) at the front desk.

The team visited the nurses “Gemba” to obtain personal observations concerning the measure of changing their roles tied to an exclusive physician, and the designation of rotating pools with specific responsibilities. Initially, some nurses were concerned about their new roles, and skeptical about the pilot program implementation, in particular new nurses that were afraid

to face demands from different providers as they felt they were not trained to do so. However, by the end of the three-month period all of the nurses reported improvements in the workflow, with increased personnel availability to room patients and answer messages. Likewise, the countermeasure of having a group of nurses to arrive at 7:45 am proved to be successful for having patients with 8:00 am appointments ready to be evaluated by the physician before 8:05am. The team also had a post pilot program implementation meeting with the physicians, and all of them reported improvements in the workflow and patient throughput, as well as improvements in the availability of nurses to answer messages. After the analysis of the data, and obtaining observations from nurses and physicians about the pilot program success, the team will take the next step to implement the third countermeasure of redesigning physicians schedule templates to increase the number of 8:00 am follow-up (15-minute) appointments and reduce the number of first time (30-minute) appointments.

After the initial phase of the Pilot Program implementation and observing improvements in workflow and patient throughput after changing the nurses roles by not assigning them to a specific physician and assigning a group of nurses to arrive by 7:45 am, the team decided to present the Project to the Institution authorities with the objective of implementing a similar Pilot Project in other Departments with inefficient workflow like Endocrinology, and eventually institutionalize the countermeasures across the organization. Likewise, additional measurements will be performed to track the project and identify gaps for improvement. Considering the application of the PDCA cycle throughout the project, the institutionalization of the Project represents the “Act, and the need for additional measures denotes the new “Plan”, which highlights the value of applying the cycle as many times as needed to sustain the improvement effort and obtain the desired result (Pelletier, n.d).

## **Discussion**

In the health care setting, the constant rising costs of health services, increasing patient loads, and a higher demand from internal and external customers for quality care and satisfaction, mandate a focus on improving clinic processes to enhance efficiency and improve quality (Skeldon et al., 2014; Upenieks, 2008). The Continuous Improvement project developed and implemented at the Digestive Disease Institute is an example of how continuous improvement efforts can be applied to reduce waste and improve workflow and patient throughput. Likewise, the use of the Lean Methodology along with the PDCA cycle, provided a structured yet flexible framework that enabled the transformation of the project's focus by defining processes and clarifying priorities for action, while prioritizing the value for the customers and minimizing waste. The goal of increasing by 50% the number of patients with 8:00 am appointments that are roomed on time on the Digestive Disease Institute's desk was successfully achieved, with data collected after the pilot program implementation showing that 100 % of 8:00 am appointment patients were roomed by nurses before 8:05 am, except those who arrived late (after 8:00 am) at the front desk.

Important components of CQI proved to be useful tools for the improvement effort, like the development and analysis of the Patient Flow Chart. As highlighted in preceding studies, the Patient Flow Chart is an effective tool to collect data specific to different stages of a process, identify gaps for improvement, and evaluate the effects of interventions (Potisek et al., 2007). Equally, the definition and measurement of Value Added Time (VAT) and Non-value Added Time (NVAT) with the evidence of an increase amount of NVAT, highlighted a gap for improvement and waste reduction; as several studies have reported, longer waiting times are

associated with decreased patient satisfaction (Potisek et al., 2007; Camacho et al., 2006; Leddy et al., 2003). Additionally, the analysis of current conditions underscore data that were not the initial focus of the project, for example, that 70% of 8:00 am appointments were not roomed on time, and that nurses and physicians arrived at the same time. In this setting, and based on the Lean principle of Flexible Regimentation, by which ongoing efforts are focused on improving standard processes (Toussaint & Berry, 2013), the team narrowed the scope of the project and restated the problem to address the large amount of 8:00 am appointments that were not roomed on time, which ultimately resulted in end of the day overtime.

The analysis of root causes, a key step of the Lean Methodology (Toussaint & Berry, 2013), identified that a major factor to address was that nurses were assigned to work with a specific physician, which led to less flexibility to perform different duties and improve the overall workflow. Because nurses are an essential component of hospital's operations, improving their practices is a key approach to improve the hospital performance (Upenieks, 2008). As underscored in related literature, many efforts to address quality in health organizations have focused on redesigning nurses' roles (Upenieks, 2008). After implementing the countermeasure of creating rotating nursing pools with specific responsibilities, the team visited the nurses "Gemba" or worksite to obtain their feedback. By periodically visiting the Gemba, the team applied the key Lean principle of respect for front-line workers and value for their opinion (Toussaint & Berry, 2013). At the end of the pilot project, all of the nurses reported improvements in the workflow, more available time to answer messages, and less wasted time. As reported in the literature, nurses ideally wish to spend more time providing quality care to patients or value-added activities, and less time on non-value added activities (Upenieks, 2008).



The project countermeasure resulted in increase time for value-added care, thereby enhancing the workforce satisfaction and eventually improving patients' outcomes.

Limitations to the CI project include a small sample size (n=21) to measure the impact of the pilot program, and the need after the pilot program implementation to use additional indicators to track the programs performance in the Digestive Disease Institute. Likewise, the study would have benefit from the addition to the patient time metrics of patient satisfaction indicators throughout the process. Additionally, besides opinions and observations from visiting the worksite, internal customers feedback, that include nurses, physicians, and administrative personnel, should also be assessed through anonymous questionnaires, which will standardize the questions answered among the workforce.

The Digestive Disease Center CI project based on the Lean methodology was a successful approach to analyze the utilization of clinical assets to optimize value added times, and minimize non-value added periods for patients during their clinic visit. However, this is a positive first step which will have the greatest impact only if it is repeated and becomes part of an ongoing improvement process; the ideal scenario contemplates the extension and sustainability of a culture of continuous quality improvement throughout the Hospital.

## **Conclusion**

A mission-oriented multi-disciplinary team effectively developed and implemented a Continuous Improvement effort at the Digestive Disease Center that improved workflow and patient throughput. Based on the application of the Lean methodology, the team was able to identify a problem, determine the root causes and develop effective countermeasures to address

them. After the pilot project implementation the goal of increasing by 50% the number of patients with 8:00 am appointments that are roomed on time on desk 21-22 was successfully achieved.

The Lean methodology is a useful approach with limitless opportunities for its application throughout the Hospital. Nevertheless, its value and success is inextricably linked to a comprehensive quality-based cultural transformation.

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