Original Article

Improving the Workflow Efficiency of An Outpatient Pain Clinic at A Specialized Oncology Center by Implementing Lean Principles

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ABSTRACT

Objective: Adult outpatient oncology pain clinics face many challenges due to the increased number of patients, the restriction of electronic appointment systems, overcrowding, waiting time, and patient dissatisfaction. This project aimed to improve clinic time efficiency, decrease clinic waiting time, and improve patient satisfaction. **Methods:** Lean thinking concepts and their tools, for example, value-stream mapping and value added (VA)/non-VA (NVA) analysis were used. Electronic appointment system slots were stratified based on patient visit type. A total of 187 patients were included in a time-motion survey at three different occasions: preintervention (n = 67) and two consecutive quarter postintervention time points (n = 64, n = 56). Simultaneously, patient satisfaction was reported quarterly by a quality management office. **Results:** The pain clinic workflow became more efficient; the mean clinic waiting time decreased from 72.5 min at preintervention to 19.5 and 21 min at the two postintervention quarters, respectively. Moreover, patient satisfaction improved from 75% at the preintervention to 100% and 96.7% at the two postintervention quarters. **Conclusions:** Redesigning the process of an electronic appointment system using lean thinking considerably decreases patients' waiting time, improves patient satisfaction, improves resource utilization, allows proper scheduling based on patient visit types, eliminates unnecessary waste processes, and reallocates health-care providers' time toward direct, individualized patient care.

Key words: Lean principle, pain clinic, patient satisfaction, quality, waiting time, workflow

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Introduction

Cancer is a major disease burden worldwide; the GLOBOCAN 2018 estimates of cancer incidence and mortality produced by the International Agency for Research on Cancer state that there will be an estimated 18.1 million new cancer cases and 9.6 million cancer deaths in 2018.[1] According to the Jordan Cancer Registry[2] in 2014, 8716 new cancer cases occurred in Jordan,[2] and 4293 cases received oncology treatment at King Hussein Cancer Center (KHCC) in 2015.[3] Pain associated with oncology treatment is very common; the pain prevalence rates were 39.3% after curative oncology treatment, 55% during active oncology treatment, and 66.4% during disease progression and terminal stage.[4]

Pain should be managed to enable oncology patients to practice their daily life activities, and an individualized pain treatment plan should be developed based on their needs. The KHCC pain management team's mission is to lead a good practice in oncology pain management, relieve patient pain, restore patient physical functioning, and decrease the psychological impact of pain on oncology patients, which adds value to the health-care system from the patient perspective.[5]

The pain management team serves adult oncology patients in an outpatient setting. The clinic is covered by one clinical pain nurse coordinator and two anesthesiologists, with an average of 50 patient visits per day. The clinic statistics for 2016 showed a 14% increase in the number of patients who visited the pain clinic. Therefore, an increased patient demand with constrained pain clinic resources leads to many challenges in terms of patient dissatisfaction, long clinic waiting time, and uncomfortable patient experience despite the high cost of the clinic service.

Health-care systems worldwide make efforts to reduce service costs, improve service quality, reduce waiting time, and improve patient satisfaction. One of the most promising resources for further improvement of health-care management is the lean method and its principles.[6,7] Lean as a terminology, which refers to a concept for the management of production, is widely used in the literature and was developed in the Toyota automotive company.[8] "Lean" was used in contrary to "buffered."[9] Moreover, lean methodology is the techniques and tools utilized to eliminate and reduce the waste in a process while improving the productivity and effectiveness in the flow of work.[9-11]

In the health-care system, waste could be anything that does not add value to its service from the client perspective. Therefore, it is necessary to identify all health-care service-related activities that clients perceive as value added (VA) from non-VA (NVA) activities. For example, diagnosing disease, providing treatments, and conducting diagnostic tests are VA activities, while waiting time, delay in treatment, and unnecessary preparation are NVA activities.[8]

Implementation of lean principles plays a vital role in improving health-care departmental operations.[12] Moreover, lean methods could be effective in the health-care system.[13] Furthermore, the results of successfully implemented lean projects will increase the emphasis on the value of a redesigned system and preparedness to meet client health needs and demands while improving service quality and patient safety and reducing the wasted time;[7] therefore, lean adaptation and implementation has become common in health-care organizations.[14,15]

There are a growing number of publications over the past years reflecting and sharing the experience of health-care systems with lean methodology. The patient is the main concern and focus of health-care organizations, and time and comfort are included in most of the applied lean projects as indicators for the quality of care provided.[5] Several challenges may affect the quality of care provided; overcrowding is considered one of the most common challenging components, especially in outpatient settings.[16] Moreover, overcrowding and an increase in demand with limited resources, such as electronic appointment systems and waiting area capacity, may negatively impact the patient experience and increase their suffering.[16,17] In addition, numerous articles have studied the effectiveness of lean methods in decreasing waiting time and improving workflow by eliminating wasted processes and redesigning the booking system.[5,12,16-19] Coelho *et al*.[16] found that applying lean principles by redesigning the process has led to improved quality of care, a significantly increased number of time slots to serve more patients, and an increased capacity. Another study conducted in an outpatient ophthalmology clinic to improve the efficiency of workflow revealed that applying lean principles to improve the pathway and processes led to a decrease in the mean flow time by 18% and significantly improved patient and staff satisfaction.[17] This result is similar to the results of the study conducted in outpatient gynecologic oncology clinics, which showed improvement in workflow efficiency and decreased waiting time.[11] Applying lean principles improved patient satisfaction in the outpatient clinics from 5.7 to 8.5 on a 10-point scale, and it was useful in the clinics that served chronic patients who needed more frequent and repeat visits, such as pain clinics.[20,21] The long waiting time to access pain relief services may have a negative impact on a patient's pain trajectory, suffering, and disability.[22] A study conducted in an emergency department showed that patients may be more likely to receive analgesics in crowded waiting areas and those with prolonged waiting time.[23] The

percentage of patients who have their pain well managed has increased after implementing lean strategies (postlean) in comparison with the prelean status.[24]

Methods

This project was conducted at the outpatient oncology pain clinic in KHCC in Jordan and aimed to apply lean principles and its tools by health-care providers at the pain clinic to decrease clinic waiting time and improve patient satisfaction. KHCC is a nonprofit organization that provides specialized comprehensive oncology treatment to patients. The pain management service runs ten adult clinics per week, with approximately 50 patients/day, all of whom have regularly scheduled pain clinic appointments and who were considered the target of this project.

This lean project has been accepted as part of hospital strategy for continuous improvement and hospital top management initiative to focus on identifying and eliminating different types of wastes. A lean thinking concept and their tools, including value-stream mapping and VA/NVA analysis, were utilized to describe the preintervention pain clinic workflow. Value-stream mapping presented a visualization of the preintervention pain clinic workflow processes. It was drawn based on observation and engagement of a data collection team regarding the pain clinic workflow processes, and team and project charters were identified in May 2017. Team members discussed areas of the hand-drawn value-stream map, an agreement was reached, and the map was recreated in Visio, 2010. Data were categorized using VA/NVA analysis, and waste activities were detected.

A total of 187 oncology patients were included in a time-motion survey at three different time points: preintervention (n = 67) and two consecutive quarters postintervention (n = 64, n = 56). A time-motion survey was conducted to map up the various workflows and work processes of the pain clinic (preintervention, n = 67) during June 2017, and a medical record technician was trained on data collection who tracked the pain clinic workflows and process. The data collection excel sheet was developed by the project team, which included the following checkpoints: (a) time of pain clinic registration at the medical record technician station, (b) time in to see the physician at the clinic, (c) time out from physician clinic, (d) time of departure after getting next appointment slip, (e) reason for patient needs to visit pain clinic, and (i) the participants' demographics and characteristics. Subsequently, the team identified the total clinic time, the actual clinic time, waiting time, and the mean clinic time per visit type. Moreover, based on these findings, the visit type was sorted into three different types: new case, follow-up, and prescription refill [Table 1].

Table 1: The average actual pain clinic time per patient type (value added time in minutes) for the baseline (preintervention) data (n=67)

Appointment type	Mean (SD) min
New referral	28.75 (3.86)
Follow-up	18.64 (6.1)
Medication refill	9.4 (2.2)

SD: Standard deviation

Ethical approval

This study was approved by the institutional review board at King Hussein Cancer Center (Approval No. 18 KHCC 98).

Preintervention phase

The pain clinic electronic appointment system was built and identified only one clinic with 15-min appointment slots scheduled equally per patient, regardless of their needs, as a maximum of only 12 patients with definitive appointment times can be booked. Furthermore, the electronic appointment system allows medical record technicians to electronically add an additional 18 patients per clinic per day without a definitive appointment time; thus, a total of thirty patients can be booked through an electronic appointment system. In addition, the pain nurse will manage a manually added on list on an external hard copy with a maximum of 20 patients per clinic per day without a definitive appointment time. Thus, the total number of patients who could be seen in daily clinics was 50 patients [Table 2]. Therefore, patients were instructed to come for their clinic appointment at the beginning of the clinic time to obtain a serial number to be seen on a first-come, first-served basis to make patients come as early as possible [Figure 1].

Two key performance indicators were set as project objectives: average pain clinic waiting time and patient satisfaction. The data were analyzed, and the project team identified the wasted areas in the process. They brainstormed to eliminate the NVA processes and maximized the VA processes due to time-motion preintervention survey findings. The average waiting time, actual clinic time, and the VA and NVA were identified subsequently by project team members from related disciplines, including physicians, nurses, medical record keeping, and quality management. The team agreed to redesign the electronic booking system with a maximum number of accepted patients per day, to create more appointment slots with definitive appointment times and to reallocate the clinic time according to the visit type. Therefore, the pain clinic was re-built using an electronic appointment system as three clinics: the new patient clinic, which allows for comprehensive patient assessment by a

Table 2: Pre- and postintervention pain clinic electronic appointment system stratification

Electronic appointment system	Number of clinics defined in the system	Type of patients	Appointment slot time (min)	Number of patients with specific appointment time	Number of patients without specific appointment time	Number of manual add-ons
Preintervention (old design)*	1	Not specified	15	12	18	20
Postintervention (new design)**	3	Refill	10	30	0	0
		Follow-up	15	16	0	0
		New	30	4	0	0

*Total number of patients=50/day (only 12 appointment slots with specific times were allowed), **Total number of patients=50/day (fixed slot for each patient type without add-on)

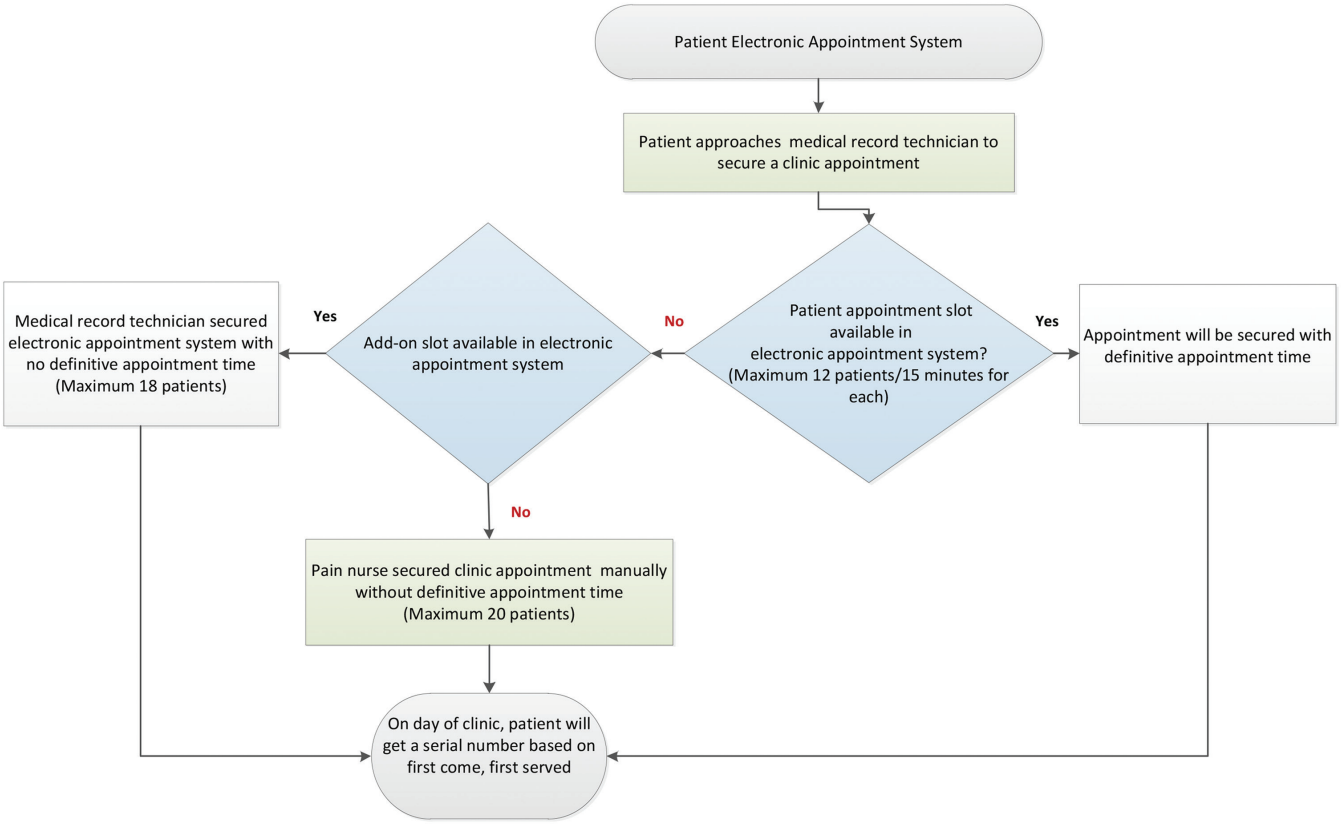

Figure 1: Pain Clinic Electronic Appointment System Process (Preintervention)

physician; the follow-up clinic for those patients who need reevaluation to modify their treatment plan or manage other symptoms; and the refill clinic to refill prescribed regular medications without further management or treatment plan.

The new electronic appointment system was redesigned to set a definitive clinic time slot for all patients in the pain clinic [Figure 2]; subsequently, patients were instructed to come 15 min prior to their clinic appointment time; the time needed for slots was reallocated in the clinic according to the visit type: 30 min for a new referral, 15 min for a follow-up, and 10 min for medication refills [Table 2]. The intervention phase took place during the third quarter of 2017.

Two sets of postintervention data were collected during the last quarter of 2017 and the first quarter of 2018. Simultaneously, patient satisfaction was measured and reported with regard to waiting time in the pain management clinic and was reported on a quarterly basis by a quality management office, and the survey included two questions related to the purpose of this project. Patients were asked to rate their satisfaction level on a 4-point Likert scale (very satisfied, satisfied, not satisfied, or not satisfied at all) regarding waiting time. In addition, patients were asked to rate their overall satisfaction with the pain clinic services from 0 to 10, as 0 means not satisfied at all and 10 means very satisfied. The patient satisfaction questionnaire was developed by a team of experts including nurses, physicians, quality coordinators, and researchers to measure patient satisfaction with the health-care service. This tool is used by the quality office for all patients at KHCC; content validity through the use of content experts was tested, and the experts reported that the tool is valid. Institutional Review Board approval was obtained, and the confidentiality of the collected data was protected and maintained throughout the project period.

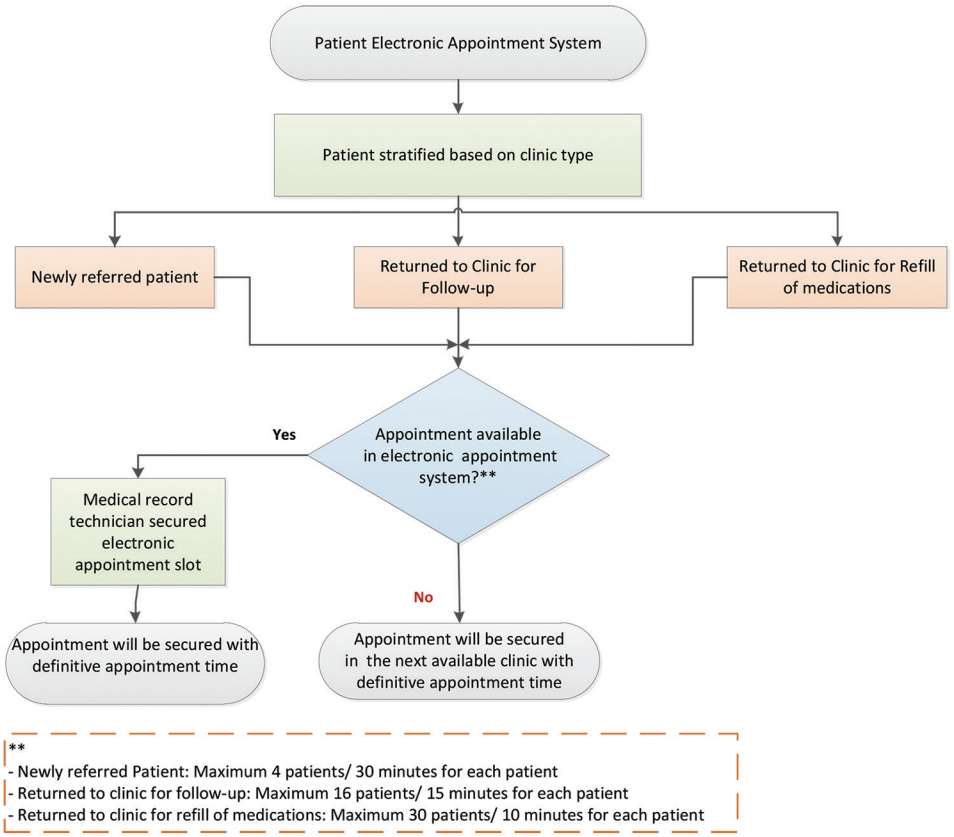

Figure 2: Redesign of the Pain Clinic Electronic Appointment System Process (Postintervention)

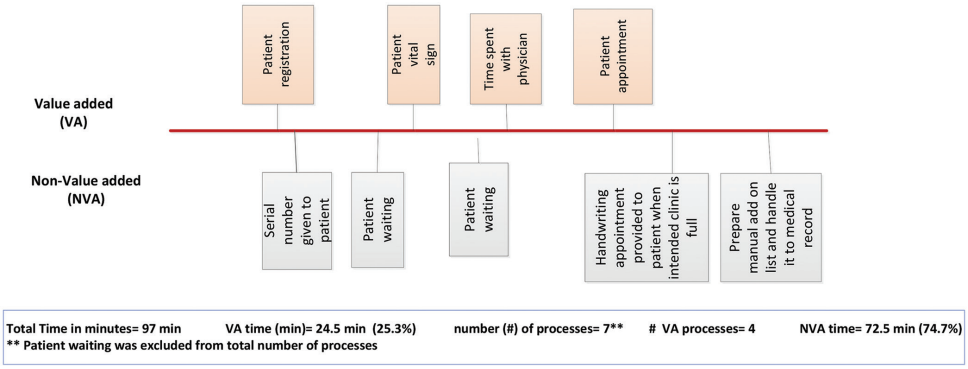

Figure 3: Stream Mapping and VA/NVA Analysis for Pain Clinic Patients' Journey

This project was conducted over a period of 10 months; analysis was performed at baseline (preintervention) and at two time points (postintervention) to monitor the improvement and its sustainability. Value-stream mapping was performed to analyze the preintervention phase of the pain clinic electronic appointment system processes, and VA/NVA analysis was performed of the patient's journey from arrival until leaving the clinic and booking the next appointment [Figure 3]. The mean, frequency, and standard deviation were used to compare the pre- and postintervention data for the total clinic time and waiting time pre- and postintervention, and the percentage of time reduction was calculated. Quarterly, data analysis was conducted by the quality office to report the satisfaction results. The database was developed by the clinic team, and the Statistical Package for the Social Sciences software version 21 (IBM SPSS® software, Chicago, Illinois, United States) was used for the analysis.

Results

A total of 187 patients were included in the time-motion survey at three different sets of times: preintervention ($n = 67$)

and two consecutive quarters postintervention (n = 64, n = 56). Table 3 shows the demographic characteristics of oncology patients who visited pain management clinics. The mean age for patients was 56 years, and a total of 103 (55%) patients were male. Detailed demographic information of the study sample is presented in Table 3.

Table 1 shows the average time from the preintervention data (n = 67) of the actual clinic time (VA) spent with physicians in the pain management clinic. Patients who visited the pain management clinic as new referrals spent approximately 28.8 min in the clinic on average, while patients visiting the clinic for follow-up purposes spent approximately 18.6 min in the clinic. In addition, patients who came for medication refill/renewal purposes spent approximately 9.4 min in the clinic.

Table 4 presents the mean, standard deviation, percentage of decrease in the mean of the total clinic time and the average waiting time for all three sets of data (preintervention and two sets for postintervention). The average time spent by patients starting from registration until departure from the clinic was approximately 97.2, 38.8, and 37 min for the preintervention and the first and second sets of postintervention data, respectively. The percentage of decrease in the mean total clinic time was 60% and approximately 61.9% for the first and second sets of postintervention data, respectively, with reference to the preintervention data.

Furthermore, the average waiting time that patients spent in the waiting area was calculated in minutes, and the results showed that the patients' mean waiting time was 72.5 min at baseline in the preintervention data. The mean was decreased to 19.5 and 21 min in the first and second sets of data postintervention, respectively. This means that the percentage of decrease in the mean waiting time was 73.1% and 71% for the first and second sets of postintervention data, respectively, compared with the preintervention data.

Table 5 shows patient perception toward waiting time in a pain management clinic, which is related to efficient time with a physician in the clinic. Patient satisfaction increased from 75% at preintervention to 100% and 96.7% for the first set and second sets of data postintervention, respectively.

When the patients were asked to rate their satisfaction on a scale from 0 to 10 to measure their overall satisfaction in the pain management clinic, the results showed an increase in the satisfaction level from 6.81 at preintervention to 8.78 and 9.15 at the first set and second postintervention time points, respectively, as shown in Table 6.

Table 3: Patient clinical and demographic characteristics

Variables	Mean (SD) *F* (%)
Age, mean (SD) (years)	56.05 (13.5)
Gender, *n* (%)	
Female	84 (45)
Male	103 (55)
Cancer diagnosis, *n* (%)	
Head and neck	17 (9.1)
Breast	31 (16.6)
Lung	12 (6.4)
Gastrointestinal	25 (13.4)
Genitourinary	35 (18.7)
Blood	41 (21.9)
Other types	26 (13.9)

SD: Standard deviation

Discussion

The pain team provides a comprehensive, specialized, and advanced level of care for patients to coordinate the provision and delivery of pain management care to patients who are consulted or referred to the pain service. However, the increasing number of patients who are referred to the pain clinic causes many problems to patients as well as care providers and contributes significantly to patient dissatisfaction and wasted time of caregivers on nonpatient-related work, which decreases the time spent with the patient accordingly. Therefore, the conduction of this project using lean concepts was aligned with the organization's strategic plan to improve clinic efficiency, decrease outpatient oncology pain clinic waiting time, and improve patient satisfaction.

The project was conducted at the outpatient pain clinic in KHCC, and a review was performed to identify the adult outpatient pain clinic preintervention state. After that, 187 patients who attended the adult outpatient pain clinic were engaged in a time-motion survey at three different time points to evaluate the clinic's efficiency, the outpatient clinic waiting time, and patient satisfaction. Finally, an intervention was performed by hosting ten adult outpatient clinics per week.

Table 4: Average total time and waiting time pre- and postintervention

Indicators	Preintervention Q2 2017, mean (SD)	First set of data: Postintervention Q4 2017		Second set of data: Postintervention Q1 2018	
		Mean (SD)	Percentage of decrease	Mean (SD)	Percentage of decrease
Total clinic time (min)	97.2 (56)	38.84 (21.3)	60	37.05 (21.7)	61.9
Waiting time (min)	72.5 (55)	19.5 (14.1)	73.1	21 (15.1)	71

SD: Standard deviation

The current project outcomes showed that the decrease in total clinic time and waiting time added value to the patient experience. These outcomes are similar to the findings of previously conducted projects, which revealed improved performance by decreasing waiting time during comprehensive service for patients and their families.[16] In addition, the results showed improved patient satisfaction regarding waiting time spent in the pain management clinic. This result was consistent with the finding of many projects that have shown that applying lean project methods in outpatient settings enhances patient satisfaction.[11,17,25] Moreover, this result was consistent with the findings of a study conducted among 350 patients in the emergency department of Aseer Central Hospital in Saudi Arabia, which showed that waiting time during patient treatment and effectiveness of the system to handle the patient's complaints led to improved patient satisfaction.[25] Furthermore, the result of this project was consistent with the findings of two studies that were conducted to evaluate the ability of lean methodology to enhance the efficiency and quality of care for patients in outpatient clinics. These studies found that lean methodology improved efficiency and patient care in clinical settings.[11,26] In addition, the result of the current study was consistent with the findings of the study conducted using the tools of lean thinking to evaluate our current scheduling system, remove wasteful processes and procedures, and implement a more efficient and effective system. Applying the lean thinking model led to an increase in the value for our patients by allowing them to benefit from more timely access to care and to experience greater satisfaction.[27]

It is important to reflect positively on the treatment journey and experience of oncology patients, to set an example for health-care providers for how the health-care system might be able to utilize different quality improvement approaches, such as lean principles, to support the improvement process of patient scheduling and clinic workflow and additionally to improve clinic resource utilization, promote proper scheduling, reduce the waiting time needed in the clinic, and improve the patient experience.

Some limitations must be considered when interpreting the results of this project. First, the sample size was relatively small; therefore, the results are not easily generalizable to the overall outpatient settings or pain clinics in the health-care industry. Thus, further projects and studies are needed with larger sample sizes. Furthermore, there was a limitation in the study design, as it shadows the patients in a cross-sectional way by providing a snapshot in a particular point, which means that the comparison made in this project over the three time points was among different groups of patients. In addition, the lack of a control group for comparison could limit the ability to accurately evaluate the causal relationships. The Hawthorne effect may affect the results after being aware of the working team that changes had been implemented in an attempt to increase clinic efficiency. Another limitation of this project is that we did not collect patient satisfaction measures throughout the process, and we relied on data collected simultaneously by the quality office.

Table 5: Patient satisfaction regarding waiting time

Indicator	Preintervention Q2 2017	First set of data: Postintervention Q4 2017	Second set of data: Postintervention Q1 2018
Waiting time	75	100	96.7

Conclusion

Redesigning the process of an electronic appointment system based on patient demands and needs considerably decreased the waiting time and improved patient satisfaction and experience, while providing better resource utilization and proper scheduling. This implementation not only eliminates unnecessary waste processes (NVA) but also reallocates health-care providers' time toward direct, individualized patient care and provides patients exactly the care they want (VA). Adding the lean principle to pre- and postgraduate curriculums is highly recommended to increase awareness of this effective method. Finally, integrating and utilizing the lean principles in health-care systems may lead to improved efficiency of the care provided. Moreover, the clinic time became more efficient.

Acknowledgments

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Table 6: Overall patient satisfaction

Indicator	Mean (SD)		
	Preintervention Q2 2017	First set of data: Postintervention Q4 2017	Second set of data: Postintervention Q1 2018
Overall patient satisfaction from 0-10	6.81 (1.87)	8.78 (2.19)	9.15 (1.2)

SD: Standard deviation

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Conflicts of interest

There are no conflicts of interest.

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