Innovative Strategies for Decreasing Blood Collection Wait Times for Patients in Early-Phase Cancer Clinical Trials

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Abstract

Purpose

Long wait times are a primary source of dissatisfaction among patients enrolled in early-phase clinical trials. We hypothesized that an automated patient check-in system with readily available display for increasing awareness of waiting intervals would improve patient flow and use of our rooms, with decreased turnover time and increased throughput.

Methods

We recorded in-room wait times for patients seen in our clinic and observed the logistics involved in the blood collection process to delineate causes for delays. We then implemented a three-step strategy to alleviate the causes of these delays: (1) changing the collection of materials and the review of faxed orders, (2) improving our LabTracker automated database system that included wait time calculators and real-time information regarding patient status, and (3) streamlining lower complexity appointments.

Results

After our intervention, we observed a 19% decrease in mean wait times and a 30% decrease in wait times among patients waiting the longest (95th percentile). We also observed an increase in staff productivity during this process. Modifications in LabTracker provided the biggest reduction in mean wait times (17%).

Conclusion

We observed a significant decrease in mean wait times after implementing our intervention. This decrease led to increased staff productivity and cost savings. Once wait times became a measurable metric, we were able to identify causes for delays and improve our operations, which can be performed in any patient care facility.

INTRODUCTION

Long wait times for patients are common throughout the health care system, but enrollment in clinical trials should not add to these wait times. Patients with advanced cancer are under considerable stress, and

long wait times further contribute to anxiety and distress; furthermore, shorter wait times will bring efficiency and lower cost to performing clinical trials.¹⁻³ Excessive appointment delay is identified consistently as the primary source of

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patient dissatisfaction among the general medical population⁴⁻⁷ as well as among oncology patients.⁸⁻¹² We sought to implement a tracking system in our outpatient treatment center that would identify the causes of excessive wait times for blood collection and to use that information to improve this metric. We chose to focus on blood collection because it is an important step in early-phase clinical studies. We hypothesized that an automated patient check-in system with readily available display for increasing awareness of waiting intervals would improve patient flow and use of our rooms, with enhanced turnover time in throughput. We created a touchscreen integrated system with barcoding, with immediate capture at the point of care. The system is called ARMADA (Advanced Research Management And Data Analysis), and it includes a LabTracker feature that provides real-time accounting for all research specimens. For this study, the objectives were to identify the causes of delays in blood collections, to implement new processes with the goal of decreasing delays, and to compare wait times after the implementation of the new processes.

METHODS

Assessment of Wait Times

In our clinic, the common standard work procedure starts with a received order from the research nurse about the type of blood collection needed for each patient. The patient is scheduled, and on arrival the collection order is checked. If the order is complete and the appropriate sample collection kits are available, blood collection will proceed. After blood collection, the sample is sent to the laboratory, where it is processed according to the patient's protocol. A detailed schematic of this workflow is found in Appendix Fig A1 (online only).

During a 3-month observation period, we recorded in-room-to-collection time, which was the time lapse between a patient being placed into a treatment room and their first blood collection. The resulting wait times were considered baseline values for subsequent analyses. During this time, we also observed the logistics involved in the blood collection workflow to delineate the causes for each wait time. Waiting times were again assessed after implementation of each intervention and were compared with baseline values. Statistical analysis was performed with paired *t* tests using MiniTab statistical software, Release 14 (State College, PA).

Identification of Issues Affecting Patient Wait Times

Identification of issues affecting wait times for patients and the resulting intervention occurred iteratively over a 3-month

observation period. The team used a variety of quality tools, including value stream mapping,¹³ a fishbone (Ishikawa) diagram¹⁴ (Fig 1), and Pareto analyses (Fig 2), to understand the process and to assess possible causes.¹⁵ Initially, a fishbone diagram was created to visualize our process and to identify and categorize potential issues. Value stream mapping was then performed to determine which interventions would be put into place and the order in which they would be implemented. The Pareto analysis also helped determine which interventions would have the greatest impact on the wait times. As a result of this decision-making process, we chose to perform three interventions in no specific order. These interventions are now discussed in greater detail.

Intervention 1: Collection Materials and Faxed Orders

The first intervention was to increase the availability of materials needed for proper blood collection. To improve this process, we implemented a change in which clinic staff reviewed faxed orders the night before the appointments and tallied the number and types of collection materials needed for the next day. The overnight staff was given the responsibility of retrieving the materials before the start of appointments in the morning. This change allowed the staff sufficient time to check blood collection materials to ensure they were adequate and available for use, before the patient arrived to the clinic.

Intervention 2: LabTracker Improvements

The second intervention was to update the LabTracker database, an Oracle-based component of the ARMADA system that tracks patient information regarding sample collections. We determined that LabTracker could be modified, and we implemented the following interventions, which we hoped would improve wait times by making the database more informative and user friendly: an automatic wait time calculator was added to inform the staff of wait times in real time; staff were required to enter into the database the reason for patient delay if the wait time was > 30 minutes; staff were required to enter a field indicating if the patient rescheduled the appointment for another time; staff entered an appointment category field to indicate the type of patient visits, to inform the staff which services would be needed for each patient.

Intervention 3: Streamlining Lower-Complexity Appointments

The third intervention was to remove nurse assessment from lower complexity, level 1, clinic visits. Level 1

FIG 1. Fishbone (Ishikawa) diagram categorized by what we can influence. CIT, clinical investigation technologist; CPB, cancer prevention building; IV, intravenous.

appointments are for patients who require blood collections at fewer than four different time points on a particular day. Level 1 appointments were usually screening and follow-up visits, which required 30 minutes or less to complete.

RESULTS

Intervention 1: Collection Materials and Faxed Orders

We were able to measure that personnel were spending 175.7 minutes per week on the phone in the baseline period, and 113.8 minutes after the intervention, for a savings of just more than 1 hour per week. We also noted a trend of a 4.2-minute (7.4%) improvement in the mean (from 55.9 to 51.7 minutes, $P = .129$) and a 17-minute (13.9%) improvement in the 90th percentile in-room-to-collection times from the baseline period (from 119.5 to 102.5 minutes; Table 1). There was a slight improvement in the standard deviation of the mean wait time, from 66.6 to 62.5 minutes ($P = .123$).

Intervention 2: LabTracker Improvements

We noted an incremental 8.8-minute (17.1%) improvement in the mean (from 51.7 minutes to 42.9 minutes, $P = .009$) and a 20.5-minute (20.0%) improvement (from 102.5 to 82 minutes) in the 90th percentile in-room-to-collection times from the collection materials and faxed orders intervention results. The standard deviation decreased by 28%, from 62.5 to 44.9 minutes ($P < .001$).

Intervention 3: Streamlining Lower-Complexity Appointments

Although no improvement was observed in the blood collection wait times of the overall patient population during this phase, the focus of this intervention was on changing the process for level 1 patients only. In these patients, we observed a trend of an incremental 11.6-minute (23.2%) improvement in the mean blood collection wait time (from 50.0 minutes to 38.4 minutes, $P = .102$) and a 51.2-minute (42.8%) improvement (from 119.5 to 68.3 minutes) in the 90th percentile

FIG 2. Pareto analysis by reason codes. CIT, clinical investigation technologist; CTRC, Clinical and Translational Research Center; IV, intravenous.

in-room-to-collection times for low intensity (level 1) visits. The standard deviation decreased by 45%, from 71.6 to 39.4 minutes ($P < .001$).

Overall Turnaround Time

The t test shows that after the implementation of all three interventions, there was an 10.9-minute time difference in mean blood collection wait times compared with the baseline period (from 55.9 to 45.0 minutes, $P < .001$). The standard deviation decreased by 28%, from 66.6 to 48.2 minutes ($P < .001$). The 90th percentile improved by 28%, from 119 minutes to 86 minutes, and the 95th percentile improved by 30% from, 171 to 120 minutes.

Impact of Staffing Levels

We were able to measure the impact of staffing levels on blood collection wait times using LabTracker, although it was not an original objective of the study. We quantified the clinical investigation technician/technologist staffing levels as the primary issue affecting the in-room-to-collection times. Furthermore, during the course of the project, the workload

(measured in number of times blood was collected) increased by 54%, from 884 per month in the baseline period to 1,345 per month in the final stage of the project. A productivity measure of time points per clinical investigation technologist (CIT) hours worked increased by 74%, from 0.9 in the baseline to 1.6 in the final stage of the project (Table 1).

DISCUSSION

Our study demonstrated a reduction in patient wait times between check-in and initial blood collection. Improvements to LabTracker provided the biggest reduction in wait times (a 13-minute decrease from baseline and an 8.8-minute decrease from the previous intervention). The ARMADA data management system, of which LabTracker is a component, has provided the ability to automate the many activities occurring in the clinic, successfully addressing the challenges, such as complex appointments, scheduling, and diverse protocol activities (eg, pharmacokinetic and pharmacodynamic testing), encountered in an early-phase clinical trials unit.

Our results may also be interpreted in terms of cost savings, an important aspect of providing quality cancer care. The reduction

Table 1. Patient Wait Times After Baseline Analysis and Each Subsequent Intervention

Intervention	No	Mean (min)	90th Percentile	Standard Deviation	Comparison With Previous Stage		Comparison With Baseline		Ratio of Time Points to CIT Hours Worked
					Mean Difference	t Test P	Mean Difference	t Test P	
Baseline	1,019	55.9	119	66.6	N/A	N/A	N/A	N/A	0.9
Collection of materials and faxed orders	430	51.7	102	62.5	4.2	.129	4.2	.129	1.3
Laboratory tracker improvements	411	42.9	82	44.9	8.8	.009	13.0	.000	1.2
Laboratory tracker updates (level 1 patients only)	66	50.0	119.5	71.6	N/A	N/A	N/A	N/A	1.2
Streamlining lower complexity appointments	619	45.0	86	48.2	−2.1	.763	10.9	.000	1.6
Streamlining lower complexity appointments (level 1 patients only)	376	38.4	68.3	39.4	11.6	.102	N/A	N/A	1.6

Abbreviations: CIT, clinical investigation technologist.

in patient wait time achieved in our study represents an overall average reduction of 10.9 minutes per patient appointment. Because our clinic serves an average of 23 patients per day, we estimate the potential net reduction in patient wait time to be 250.7 minutes per day across the 23 patients. The mean total level 1 appointment time per patient is now 30 minutes and the net reduction of 10.9 minutes represents time for three additional patient appointments per day. On the basis of our estimated average cost of \$85 for a level 1 appointment in the clinic, and the total available clinic treatment days per year of 260 days (excluding weekends and holidays), we estimate an annual increase in revenue for three additional patients per day is \$66,300. With an increase in the number of patients seen each day, the cost of each appointment may be reduced, which could lead to lower costs in conducting early-phase cancer clinical trials and decreased prices of newly approved therapies. There was relatively no cost to implementing the three interventions; however, we did accrue costs previously, when designing and implementing our unique ARMADA computer system with its LabTracker component. It is our goal to commercialize this system and to do a cost analysis to provide potential users with the cost of implementation and upkeep.

As in previous reported studies on reducing patient wait times in clinical settings,¹⁶⁻¹⁸ the first step in our study was to identify the factors affecting wait times, followed by implementation of improvements to address the contributing factors; however, our study is unique in its focus, initial

blood collections, as opposed to an analysis of the entire clinic appointment. Because appointments at our clinic are diverse and often complex, focusing on one aspect allowed us to properly identify the causes of the associated wait time. Now that we have a system of identifying and addressing wait time concerns, we can focus on other aspects of appointments in future analyses. The use of automated tools such as LabTracker allowed us to make substantial improvements to one of the main contributors to patient dissatisfaction, while increasing efficiency and decreasing costs. Our next steps are to identify the causes of overall appointment wait times and patient dissatisfaction in our clinic, using the same quality tools, and to further develop our unique clinical trials' automated system, ARMADA, and its LabTracker component. It is our hope to have a system that can be used in any clinical trials unit in our institution and eventually in other institutions. **JOP**

Authors' Disclosures of Potential Conflicts of Interest

Disclosures provided by the authors are available with this article at jop.ascopubs.org.

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Appendix

FIG A1. Workflow of clinical trials unit. LSC, lead service coordinator; RN, registered nurse; pt, patient.