

Basic Original Report

Using a real-time location system to measure patient flow in a radiation oncology outpatient clinic

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Abstract

Purpose: Common performance metrics for outpatient clinics define the time between patient arrival and entry into an examination room as “waiting time.” Time spent in the room is considered processing time. This characterization systematically ignores time spent in the examination room waiting for service. If these definitions are used, performance will consistently understate total waiting times and overstate processing times. Correcting such errors will provide a better understanding of system behavior.

Methods and materials: In a radiation oncology service in an urban academic clinic, we collected data from a patient management system for 84 patients with 4 distinct types of visits: consultations, follow-ups, on-treatment visits, and nurse visits. Examination room entry and exit times were collected with a real-time location system for relevant care team members. Novel metrics of clinic performance were created, including the ratio of face time (ie, time during which the patient is with a practitioner) to total cycle time, which we label face-time efficiency. Attending physician interruptions occurred when the attending is called out of the room during a patient visit, and coordination-related delays are defined as waits for another team member.

Results: Face-time efficiency levels for consults, follow-ups, on-treatment visits, and nurse visits

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were 30.1%, 22.9%, 33.0%, and 25.6%, respectively. Attending physician interruptions averaged 6.7 minutes per patient. If these interruptions were eliminated, face-time efficiencies would rise to 33.2%, 29.2%, 34.4%, and 25.6%, respectively. Eliminating all coordination-related delays would increase these values to 41.3%, 38.9%, 54.7%, and 38.7%, respectively.

Conclusions: A real-time location system can be used to augment a patient management system and automate data collection to provide improved descriptions of clinic performance.

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Introduction

Clinical operations seek to minimize the natural tension that exists among the needs of patients, clinicians, and health care managers. From the patient's perspective, increased waiting time degrades the clinical experience, whereas increased time with the clinician ("face time") improves the experience.¹⁻³ From the clinician's perspective, delays add pressure to stay on schedule, and this time pressure decreases job satisfaction.⁴ From a clinic manager's perspective, the inefficient use of costly labor leads to unplanned overtime and greater utilization of other capital resources, which ultimately leads to an increase in operating costs.⁵ Thus, 3 principal agents in the system all benefit from reduced delays and increased efficiency.

Two key elements in virtually all prior studies on the efficiency of outpatient clinics are that the time between patient arrival and entry into an examination room is referred to as waiting time and that all time spent in an examination room is referred to as productive time. However, this characterization systematically ignores time that a patient spends waiting for service in the examination room. The purpose of this study is to demonstrate the use of novel technologies to help dissect patients' time in clinic and elucidate unproductive room time.

The setting for our efforts was a large-scale academic radiation oncology service. This clinic is particularly difficult to study for several reasons. Both patient mix and patient flow are relatively complex in these types of services.⁶⁻⁸ This clinic accommodates at least 4 different types of visits with multiple attending physicians in parallel, in a shared space, and spread across multiple floors. Additionally, the clinic provides patient care and resident education simultaneously. Consequently, clinicians juggle competing demands during the course of a typical clinic session. For example, a clinician may have to interrupt a patient examination to go to another part of the clinic to approve the start of stereotactic radiation therapy for a different patient. Not surprisingly, the resulting interruptions contribute to delays while patients wait in examination rooms, and these delays ripple through the system to affect clinic operations.

To provide the detailed information needed for this analysis, we used a previously dormant real-time location system (RTLS) as a tool for data collection. We combined the RTLS data with information from a separate patient information system (Mosaik) to create a more complete depiction of system behavior. We also provide an

illustration of how such information can be used to predict improvements in performance metrics stemming from changes in behavior that can lead to lower waiting times, reduced operating costs, and increased efficiency.⁶ In the process, we provide novel metrics of system performance and explain why common measurements of waiting times and processing times are inadequate and misleading. We hope that applications of our approach can be used to improve understanding of clinic operations.

Methods and materials

Our data were collected from an outpatient service within the Department of Radiation Oncology and Molecular Radiation Sciences at an urban academic clinic.⁹ Within the clinic, we focused on the gastrointestinal service for detailed study because it had a physician champion and its operations were representative of other services within the department. The project was undertaken by a multidisciplinary project team consisting of clinicians and managers from the Department of Radiation Oncology and faculty from the business school. The care team in the gastrointestinal service consists of 1 attending physician, 1 resident physician, and 1 nurse in addition to a nurse practitioner who also provided other services independently.

We focused on patients scheduled to be seen in a defined area of 4 examination rooms. Over an 8-hour day, the appointment schedule included 15 to 20 patients. Appointment types included initial consultations; follow-ups; on-treatment visits for weekly symptom evaluation during the course of radiation therapy, and nursing visits, which address issues such as symptom management, review of information related to medications, and handling of consent forms. Follow-up visits consisted of either post-treatment follow-up visits or re-evaluations after a delay between the initial consultation and subsequent radiation treatment (eg, for systemic therapy). For consultations, follow-up visits, and on-treatment visits, patients were typically seen by a resident physician and/or a nurse prior to the attending physician.

Patient flow, MOSAIQ[®], and real-time location system data

We collected de-identified data on all appointments for our clinical team during the period of March 14, 2016 to

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