ORIGINAL ARTICLE

Time Is Not on Our Side: How Radiology Practices Should Manage Customer Queues

SA-CME

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Abstract

As health care shifts toward patient-centered care, wait times have received increasing scrutiny as an important metric for patient satisfaction. Long queues form when radiology practices inefficiently service their customers, leading to customer dissatisfaction and a lower perception of value. This article describes a four-step framework for radiology practices to resolve problematic queues: (1) analyze factors contributing to queue formation; (2) improve processes to reduce service times; (3) reduce variability; (4) address the psychology of queues.

Key Words: Queue, wait time, process improvement, variability reduction

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INTRODUCTION

Wait time is a critical metric for determining patient satisfaction [1-3]. Patients are more likely to repeatedly patronize a medical practice that has shorter wait times than one that has longer wait times [1]. Waiting for service has become an unfortunate inevitability in medicine, and radiology is no exception. Salazar et al found that 20.2% of their radiology department's patient complaints stemmed from delays, and delays were the most common of the specified complaint classifications over a 10-year period [4]. Rosenkrantz and Pysarenko analyzed 3,675 patient feedback reports (both positive and negative feedback) at their institution over a 3-year period and showed that 11.9% of patients commented on wait times or delays, second in frequency to staff behavior and communication comments (74.5%) [5]. The patients' message to radiologists is clear: Timeliness of their service is important!

What's more, medicine's wait time problem is becoming more intense. After passage of the Affordable Care Act in 2010, the percentage of uninsured Americans decreased from 16% in 2010 to 8.8% in the third quarter of 2016, representing an increase of approximately 20.4 million insured people [6]. With more insured individuals seeking medical care, demand for services has disproportionately increased relative to the growth of the health care system, resulting in longer wait times [7].

Recent federal legislation further emphasizes the importance of wait time management. The Medicare Access and CHIP Reauthorization Act of 2015 highlights the shift from volume to value, because it heavily focuses reimbursement on quality metrics. The patient and caregiver experience is one of the primary quality domains within the Medicare Access and CHIP Reauthorization Act of 2015, and this metric is typically assessed via a patient survey, such as the Consumer Assessment of Healthcare Providers and Systems (CAHPS) surveys. The CAHPS surveys specifically inquire about patients' wait time experience. For example, in CMS' CAHPS survey for Accountable Care

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Organizations (2016 ACO-9 Survey Version), question 13 asks "Wait time includes time spent in the waiting room and examination room. In the last 6 months, how often did you see this provider within 15 minutes of your appointment time?" [8]. These survey questions measure an organization's perceived performance and directly affect Medicare reimbursement.

The goal of this article is to introduce queue management to radiologists. We will explain four key steps that all radiology practices should consider when faced with problematic wait times: (1) analyze factors contributing to queue formation; (2) improve processes to reduce service times; (3) reduce variability; (4) address the psychology of queues. By following these four steps, radiologists will understand why queues form at their practices, and they will learn strategies to effectively decrease wait times and improve their patients' perception of the practice's overall service quality. To facilitate this discussion, we will reference a fictitious radiology organization, Radiology Company A (RAD-A). RAD-A owns and operates a multimodality outpatient imaging center. Over the past several months, patients have filed frequent complaints regarding long waits for their examinations. Some patients have waited over an hour beyond their scheduled appointment times! RAD-A radiologists seek to address these long queues.

STEP 1. ANALYZE FACTORS CONTRIBUTING TO QUEUE FORMATION

At a fundamental level, a queue is a line that forms whenever a server is busy upon customer arrival. Depending on the point of view, examples of queues in radiology include patients waiting for registration, referring providers waiting for imaging reports, and imaging examinations awaiting radiologist interpretation. To optimize workflow, medical practices may employ mathematical or computer simulation models to calculate wait times and to test operational improvement strategies [9,10]. A mathematical model frequently discussed in the operations literature is Kingman's formula [11]: $W = T_s \times [U / (1 - U)] \times [(CV_a^2 + CV_s^2) / 2]$, where W = mean wait time, T_s = service time, U = utilization rate, CV_a = coefficient of variation regarding customer arrival, and CV_s = coefficient of variation regarding service time of the servers.

Service time refers to the time required to complete a task (eg, a CT technologist requires 10 minutes to complete a head CT). *Utilization rate* refers to the amount of work that a server is providing relative to its capacity. For example, a CT technologist is capable of performing six head CTs per hour, whereas she is actually scanning three head CTs per hour (U = 50%). *CV* indicates the degree of variability of a measured value, and it is calculated as the standard deviation of a set of values divided by the mean of those values. In queue management, common sources of variability include customer arrival times and service times, hence the focus on these two values in Kingman's formula. When comparing the efficiency of two service lines, the service with a higher *CV* has more process variability than the service with a lower *CV*. For example, RAD-A mammography service has a CV_s of 0.53, and its competitor, Radiology Company B (RAD-B), has a CV_s of 0.16. This comparison indicates that, in regards to service time variability, RAD-B is more streamlined than RAD-A. RAD-A should consider mimicking RAD-B's best practices or implementing other operational improvements.

Realistically, radiology operations are complex, and queues are multifactorial. Consequently, radiology practices wishing to accurately model their operations should consider a computer simulation rather than a single mathematical formula, because computer simulations are able to account for many more specific variables contributing to the entire workflow. Nonetheless, several key points can be drawn from Kingman's formula for a theoretical understanding of queues. First, wait times are directly proportional to service time, which is intuitive. Second, wait times increase exponentially with utilization rate (Fig. 1). Third, wait times are directly proportional to variability in customer arrival and service times. In addition to simple strategic modeling, Kingman's formula is helpful in creating a framework to understand the factors that contribute to patient wait times. To illustrate the application of these abstract concepts, we will use an example from RAD-A.

RAD-A Example of Step 1

RAD-A's patients have frequently complained about the long waits for a breast biopsy. To fully understand the breast biopsy service line, RAD-A management performs a "gemba walk," an operations management strategy where managers personally observe a problematic process from beginning to end to explicitly understand its steps [12]. Using their gemba walk observations, the radiologists create a value stream map, which outlines and times each step of a patient's breast biopsy from entering the facility to completing the procedure (Fig. 2). This value stream map suggests that patients