



Lean service operations: Reflections and new directions for capacity expansion in outpatient clinics

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ABSTRACT

This field research in outpatient service operations examines original quantitative data on appointments and analyzes a lean process improvement project that was conducted to increase capacity to admit new patients into a healthcare service operation system. Analysis of 1726 intake appointments for the year preceding and the full year following the lean project showed a 27% increase in service capacity to intake new patients and a 12% reduction in the no-show rate as a result of the transformation of service processes achieved by the lean project. This study's action research methodology leverages the researcher's involvement in redesigning a service system that greatly improved performance and led to reflection on traditional operations management (OM) approaches to appointment scheduling. The study generates insights about effective alignment of resources, develops new strategies for service operations to respond to no-shows, reveals time-related variables that have been overlooked in appointment scheduling research, and challenges traditional OM scheduling performance measures. We provide recommendations for effective and appropriate use of overbooking and identify avenues for future research to continuously improve and increase the capacity of service operations.

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1. Introduction

Service operations face the continuing challenge of matching consumer demand with provider supply, and healthcare services in particular have been the focus of much concern and attention. Timely access, responsiveness to patient needs, and availability are high priorities among healthcare system improvements that were called for by the Institute of Medicine (2001). Delays in obtaining healthcare appointments lead to patient dissatisfaction, higher costs, and possible adverse clinical consequences (Green et al., 2007). Longitudinal studies confirm that delayed access to care is associated with worse outcomes (Fontanarosa et al., 2007). Also contributing to higher costs are patients who have appointments but fail to show up for them. One clinic documented a total of 14,000 missed appointments in a year, causing estimated losses over \$1 million (Kim and Giachetti, 2006). No-shows are a realistic consideration in clinic operations (Kaandorp and Koole, 2007), where they interrupt the flow of patient care and reduce clinic productivity. Another study estimated that resulting revenue shortfalls could constitute 3–14% of total clinic income (Moore et al., 2001). These two factors emphasize the importance of appropriate scheduling and resource allocation to meet healthcare demand

(Brewer, 2008; Dolan, 2008; Green and Savin, 2008). This study analyzes a real healthcare organization's service operations, reflects on new scheduling approaches that emerged from the organization's first lean process improvement project, and develops new directions to expand service capacity. The study uses action research methodology in which the researcher, who analyzed appointments at six clinic sites within the mental health center organization, was directly involved in the action that realigned system resources, changed operations, and developed new approaches to increase appointment scheduling effectiveness beyond those used in prior research. The lean process improvement project, rapid improvement capacity expansion (RICE), achieved dramatic results in expanding access to services. Analysis of 1726 intake appointments for the year preceding and the full year following the lean project showed a 27% increase in service capacity to intake new patients and a 12% reduction in the no-show rate as a result of the transformation of service processes achieved by the lean project. From here on, we refer to the recipients of the mental health center's services as consumers rather than patients to conform to recovery-oriented language used in outpatient community mental health care. This paper is organized as follows. The next section presents the background of the initial service capacity problem, which motivates the use of leaner practices. A summary of prior lean practices in healthcare provides context for migrating lean approaches from inpatient to outpatient healthcare settings. The third section discusses our research methodology, provides a description of the service

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operations where it occurred, analyzes appointment data, and diagrams the flows of the scheduling and appointment processes. The fourth section reports the results of the lean implementation, measured in the year following the startup of the reconfigured system, and describes feedback from participants and consumers. The fifth section reflects on insights developed in the lean project to realign resources and expand capacity, reveals variables that have been overlooked in prior appointment scheduling research, and considers the need to examine and revise the traditional emphasis of appointment scheduling research and its performance metrics. We conclude with a summary and identify new directions to continuously improve and increase the capacity of service operations.

2. Service capacity problems, solutions, and reactions

The problem of balancing patient wait time and provider idle time has received considerable research attention for decades (Bailey, 1952; Cayirli and Veral, 2003; Gupta and Denton, 2008; Ho and Lau, 1992; Klassen and Rohleder, 1996). Such studies have focused on managing the variability in appointment service times. However, many providers have told us that they had significant control over the duration and variance of service times, but had less control over patients' attendance. In healthcare, no-show rates vary widely from as little as 3% to as much as 80% (Rust et al., 1995). A 50% no-show rate was reported in a hospital outpatient clinic (Kim and Giachetti, 2006). During our outpatient tracking activities, we found approximately 30% of scheduled patients did not show up for their appointments.

In outpatient clinics, matching doctor capacity to uncertain daily demand has been studied through alternative appointment scheduling techniques. These include allocating capacity for open access through short-term and same-day scheduling (Kopach et al., 2007; Liu et al., 2010; Qu et al., 2007; Robinson and Chen, 2010), handling walk-ins (LaGanga and Lawrence, 2008b), and the investigation of overbooking to mitigate the effects of patient no-shows (LaGanga and Lawrence, 2007b). Such appointment scheduling has emphasized the allocation of existing capacity. However, for the most part, these models have not fully addressed the pressing need to expand capacity to increase patient access to services. In the next sections we consider approaches that target capacity expansion more directly and are further developed through this study.

2.1. Overbooking

When there is a significant chance of patient no-shows, overbooking can be an important strategy for improving patient access and stabilizing revenues (Muthuraman and Lawley, 2008). Overbooking models have been studied extensively in airline and other transportation applications in the context of revenue management (Barnhart et al., 2003; Lieberman, 2004, 2005; Toh and Raven, 2003; Van Ryzin and Talluri, 2003; Weatherford and Bodily, 1992). More recently, LaGanga and Lawrence (2007b) developed an overbooking utility model to capture the trade-off between the expected benefits of serving additional patients and the costs of patient waiting times and provider overtime.

Controversy about overbooking medical appointments is related to concerns with achieving both customer service and managerial efficiency (Kimes, 1994) and to customers' perceptions of fairness (Wangenheim and Bayón, 2007). When customers' perceptions of service fall short of their expectations, this gap leads to a negative perception of service quality (Zeithaml et al., 1990). Suggestions for making the practice more acceptable to customers include educating customers (Kimes and Noone, 2002) and compensating patients for excessive waiting time (Dolan, 2008). The theme of fairness was repeated often among 32 on-line responses

from patients and doctors (WSJ.com Forums, 2008) to a Wall Street Journal article (Brewer, 2008) that critiques the practice of overbooking. Next we consider how lean process improvement can help resolve this controversy and improve healthcare services.

2.2. Lean process improvement in healthcare

Quality management practices such as continuous quality improvement, total quality management, six sigma, and the Malcolm Baldrige National Quality Award have been adapted from manufacturing and implemented successfully in healthcare (Gowen et al., 2006). Many of these traditional quality improvement practices focus on improving processes, reducing variability, and identifying root causes of problems. Lean practices focus on patient flow, value-stream mapping, and kaizen events (Bernstein, 2008). The focus on the reduction or elimination of waste (unproductive effort that does not create value for the end customer) led to the term *lean* to describe systems that consumed fewer resources and delivered superior results (Womack et al., 1991).

Although lean principles were developed and applied initially in manufacturing, they are being used successfully in healthcare. Lean approaches are included in the quality improvement recommendations for organization-wide system transformation in public health (Riley et al., 2010). There are many documented cases of successful lean projects conducted in hospitals since the 1990s to improve patient care by reducing errors, waiting times, and costs while improving interdepartmental interaction and employee satisfaction (Grabau, 2008). However, only a few prior studies have been found that refer to lean principles in improving outpatient service operations.

The migration of lean principles from manufacturing to healthcare settings was demonstrated by hospitals such as Denver Health Medical Center (Nuzum et al., 2007). In 2006, the hospital saved about \$2.8 million without reducing staffing or patient care (Shanley, 2007). ThedaCare, a hospital system in Wisconsin, also initiated its lean improvement by studying manufacturing systems and saved \$10 million in 2005 due to its lean programs (Matzek, 2006). Lean approaches have produced other measurable improvements such as shortened time to admit patients at Prairie Lakes Healthcare (Homolo and Fuller, 2008). Three successful lean applications at the University of Pittsburgh Medical Center improved patient flow in an emergency intake process, an outpatient foot-and-ankle clinic, and the discharge of cancer patients from inpatient to ambulatory services (Martin et al., 2009). Lean approaches at St. Luke's Hospital in Houston, Texas, reduced variability, standardized healthcare, and improved quality by meeting national standards of care 100% of the time (Cook, 2008).

In this study, lean techniques are applied to improve the scheduling and delivery of outpatient services in a mental health center. Through January 2010, the mental health center conducted nine lean rapid improvement events. The resulting lean improvement projects include improvement goals focused both on direct clinical services and on indirect processes that support service delivery. For example, one of the projects increased access to services by streamlining administrative elements of the intake process and significantly reducing clinical services and documentation that did not provide value for consumers or payers (LaGanga and Lawrence, 2009). The center's first lean project, rapid improvement capacity expansion (RICE), is described in the sections below.

3. Methodology

This field research uses original data from the mental health center's service operations to study the impact of the organization's first lean process improvement project. The methodology is

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