

Optimizing efficiency and operations at a California safety-net endoscopy center: a modeling and simulation approach

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Background: Improvements in endoscopy center efficiency are needed, but scant data are available.

Objective: To identify opportunities to improve patient throughput while balancing resource use and patient wait times in a safety-net endoscopy center.

Setting: Safety-net endoscopy center.

Patients: Outpatients undergoing endoscopy.

Intervention: A time and motion study was performed and a discrete event simulation model constructed to evaluate multiple scenarios aimed at improving endoscopy center efficiency.

Main Outcome Measurements: Procedure volume and patient wait time.

Results: Data were collected on 278 patients. Time and motion study revealed that 53.8 procedures were performed per week, with patients spending 2.3 hours at the endoscopy center. By using discrete event simulation modeling, a number of proposed changes to the endoscopy center were assessed. Decreasing scheduled endoscopy appointment times from 60 to 45 minutes led to a 26.4% increase in the number of procedures performed per week, but also increased patient wait time. Increasing the number of endoscopists by 1 each half day resulted in increased procedure volume, but there was a concomitant increase in patient wait time and nurse utilization exceeding capacity. By combining several proposed scenarios together in the simulation model, the greatest improvement in performance metrics was created by moving patient endoscopy appointments from the afternoon to the morning. In this simulation at 45- and 40-minute appointment times, procedure volume increased by 30.5% and 52.0% and patient time spent in the endoscopy center decreased by 17.4% and 13.0%, respectively. The predictions of the simulation model were found to be accurate when compared with actual changes implemented in the endoscopy center.

Limitations: Findings may not be generalizable to non-safety-net endoscopy centers.

Conclusions: The combination of minor, cost-effective changes such as reducing appointment times, minimizing and standardizing recovery time, and making small increases in preprocedure ancillary staff maximized endoscopy center efficiency across a number of performance metrics. (Gastrointest Endosc 2014;80:762-73.)

Abbreviations: FTE, full-time equivalent; SFGH, San Francisco General Hospital and Trauma Center.

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There has been a dramatic increase in the request for GI specialty care and, in particular, endoscopic services in the past decade.¹⁻³ This increase has been most notable in safety-net hospitals whereby GI specialty care is the most frequently requested specialty service.² At the same time, access to specialized GI care can be challenging within specific health care systems. For example, medical directors at safety-net hospitals report exceedingly difficult access in obtaining specialized care for their patients compared with patients with private insurance.⁴ Such disparities highlight the need for creative and innovative ways to increase access to GI care for underserved patient populations in light of increasing demand for such services.

One potential method for addressing this inequality in care is to develop more efficient endoscopy centers that can provide increased, high-quality endoscopic services and at the same time maximize patient and provider satisfaction. Although the study of efficiency has been the cornerstone of many industries, it has not been until recently that incorporating efficiency models into health care has emerged. Anesthesia has been at the forefront of improving efficiency in health care through the re-engineering of operations and processes in the operating room with notable improvements in patient care and quality.⁵⁻⁹ Using time and motion studies (eg, direct and continuous observation of a task) in conjunction with discrete event simulation modeling (eg, modeling the operations of a system) has been pivotal to this success.

Yet, there is a dearth of information on the study of efficiency in endoscopy centers. Of the scant medical literature available, there are varying conclusions about how to improve endoscopy center efficiency with no clear consistent message. Some studies have focused on altering staffing specifically focusing on the endoscopist¹⁰⁻¹³ and by using additional staff in the preprocedure process.¹³ Although such changes improve physician efficiency and use, it does so at a cost of impairing nonphysician staff use, suboptimizing facility use, and increasing patient length of stay.¹² By using simulation modeling, others have discovered that identifying bottlenecks such as patient recovery,^{14,15} reducing room turnover time,^{10,14} modifying patient arrival schedule,^{11,16} or re-engineering patient scheduling^{16,17} can improve efficiency and decrease patient stay. However, there are a number of limitations to many of these studies; they are small, examine efficiency solely from a physician perspective with minimal to no input from other staff members, examine a limited number of time stamps within the endoscopy center, and all are set in an ambulatory endoscopy center or tertiary referral service. Given these deficiencies and with changes to the health care system occurring in the United States, with more underserved patients being served, it is imperative to better understand endoscopy centers in such settings and to learn how to improve efficiency within them.

Take-home Message

- Time and motion studies and analysis of simulation models can be used to better understand weekly endoscopy center patterns and provide insight into what changes can be beneficial and cost-effective within an endoscopy center.

Our first objective was to conduct a time and motion study of clinic staff at work and to use these data in simulation modeling to study changes in scheduling, staffing models, and changes in the preprocedure and postprocedure process. Our secondary objective was to build a simulation model to understand the bottlenecks limiting the endoscopy center's current operational performance and, in turn, to identify opportunities to improve patient throughput while balancing resource use and patient wait times.

METHODS

Study design, setting, and population

There were 3 phases of the study. Engineers first conducted a time and motion study of the San Francisco General Hospital and Trauma Center (SFGH) endoscopy center in order to better understand its operations and processes. Second, by using information from the time and motion study, a discrete event simulation model was created to assess proposed changes to the endoscopy center in order to improve efficiency within it. The final phase of the study involved implementing some of the proposed changes at the SFGH endoscopy center and examining the impact of these changes on a number of performance metrics. The study was conducted between November 2011 and December 2013.

SFGH is a safety-net institution (ie, provides a significant level of care to low-income, uninsured, and vulnerable populations) affiliated with the University of California, San Francisco. Patients are ethnically diverse (20% African American, 20% Asian/Pacific Islander, 25% white, and 30% Hispanic), and many are immigrants with more than 20 different languages spoken by patients. Approximately 36% of outpatients at SFGH lack insurance, 34% have MediCal (California's Medicaid program), 16% have Medicare, and 14% report commercial payers or other sources. The SFGH Gastroenterology Division receives 7200 referrals annually for a wide spectrum of GI-related conditions.

The SFGH endoscopy center is hospital-based and performs both outpatient (82.1%) and inpatient (17.9%) endoscopic procedures. The endoscopy center performs standard endoscopic procedures (colonoscopy, upper endoscopy, flexible sigmoidoscopy), advanced procedures (ERCP, EUS, single-balloon enteroscopy), capsule endoscopy, and esophageal and anal motility and manometry. The majority of the endoscopy center's time is devoted

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