# Using efficiency analysis and targeted intervention to improve operational performance and achieve cost savings in the endoscopy center CME

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**Background:** With an increasing demand for endoscopy services, there is a greater need for efficiency within the endoscopy center. A validated methodology is important for evaluating efficiency in the endoscopy unit.

**Objective:** To use the principles of operations management to establish a validated methodology for evaluating and enhancing operational performance in the endoscopy center.

**Design:** Biphasic prospective study with pre-intervention and post-intervention efficiency data and analysis.

**Setting:** Tertiary-care referral teaching hospital.

**Patients:** Scheduled outpatients undergoing endoscopy.

**Intervention:** Determination of the rate-limiting step, or bottleneck, of the endoscopy unit and reducing inefficiencies.

**Main Outcome Measurements:** Staffing costs and a novel performance metric, True Completion Time (TCT).

**Results:** Data were prospectively recorded for 2248 patients undergoing a total of 2713 procedures (phase I: 255 EGD, 305 colonoscopy, 91 EGD/colonoscopy, 375 EUS, 44 ERCP, 75 EUS/ERCP; phase II: 243 EGD, 328 colonoscopy, 99 EGD/colonoscopy, 335 EUS, 38 ERCP, 109 EUS/ERCP). The bottleneck of the operation was identified as the 10-bed communal pre-procedure/recovery room. On-time procedure starts increased by 51% ($P < .001$), and TCT was reduced by 12.2% ($P < .001$) across all cases studied. Overtime and per diem nursing costs were reduced by 30%, whereas full-time employee staff was reduced by 0.85. Annual cost savings were calculated as $312,618 or 11.02% of total operating expenses.

**Limitations:** This study is not directly tied to quality outcomes, and inpatient procedures transported to the endoscopy unit were not directly studied.

**Conclusion:** Room turnover time and room-to-endoscopist ratio are not necessarily the driving parameters behind endoscopy unit efficiency. A focus on developing a methodology for identifying factors constraining operational efficiency can improve performance and reduce costs in the endoscopy center. (Gastrointest Endosc 2014;79:637-45.)

*Abbreviations: CDDC, H.H. Chao Comprehensive Digestive Disease Center; MAC/GA, Monitored anesthesia care/general anesthesia; TCT, True Completion Time.*

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In recent years in the United States, the volume and complexity of endoscopic procedures has increased dramatically. An increasingly aging patient population, an emphasis on preventative care and surveillance, and new technologies for both diagnostic and interventional procedures have contributed to an increased demand for endoscopy.[1] Over 25 million endoscopic procedures are performed annually at a cost of nearly $142 billion per year. These account for 12% of all inpatient procedures and 31% of all ambulatory procedures performed across all medical specialties.[2]

In any setting, whether in a large-scale tertiary-care hospital or a community ambulatory surgery center, there are significant financial costs to operate endoscopy units.[3] As reimbursement for endoscopic services declines, and the costs associated with providing these services increase, there is a greater need to increase efficiency within the endoscopy center.[4] By managing efficient endoscopy centers, quality endoscopic care can be delivered while healthcare spending on this technology is controlled.[5,6]

Several studies have searched for metrics for evaluating endoscopy units that can be generalized. Previously, one of the established metrics for evaluating efficiency has been endoscopy room turnover time, as noted by Zamir and Rex[7] in 2002. Additionally, Boix and Lorenzo-Zúñiga[8] and Harewood et al[9] assert that a 2-room-per-endoscopist model can increase efficiency of the unit. However, these approaches focus mainly on individual solutions in each endoscopy unit studied, and as such, results of endoscopy center analysis would not necessarily generalize across all cases. To date, there is no established methodology for evaluating the endoscopy unit itself that may actually generalize across institutions, even with the variability that exists between them.

Furthermore, operational data in the endoscopy center are usually maintained internally within the unit's management rather than published in peer-reviewed journals. To date, there is no published large-scale database for endoscopy center operational data.

In this study, we analyzed the endoscopy center by using the discipline of Operations Management. Operations Management is the application of business principles such as efficiency and resource utilization in order to solve problems related to workflow. This methodology is useful because it allows businesses to understand how key resources and dollars are spent. In the endoscopy unit, a fundamental methodology rooted in these concepts can be useful in determining how to make these units more efficient and cost-effective.

Our primary goals were to publish a methodology that can be used to analyze endoscopy unit efficiency, implement targeted interventions to operational protocols, and assess the effectiveness of these changes on resource utilization and overhead costs. We also define a novel performance metric in our center, the True Completion Time (TCT). We define the TCT as the time interval from the scheduled time of the procedure to the time the endoscopy team exits the procedure room after completing the case. We chose this metric because it serves as a benchmark for efficiency and timeliness. We also aimed to create a large-scale publically available endoscopy center database for efficiency analysis purposes.

**Take-home Message**

- The authors present a generalizable methodology for conducting a formal efficiency analysis of the endoscopy center and implementing interventions designed to improve efficiency.
- The authors also introduce a novel performance metric, True Completion Time, and publish the largest publicly available operational dataset for efficiency analysis purposes.

The study was conducted at the H.H. Chao Comprehensive Digestive Disease Center (CDDC) at The University of California, Irvine Medical Center, a tertiary-care academic teaching hospital. Endoscopy procedure volume is over 6000 cases per year, consisting of a wide variety of GI procedures. Cases are performed under both monitored anesthesia care and/or general anesthesia (MAC/GA) and moderate sedation. The institution also provides postgraduate training for gastroenterology fellows.

## ENDOSCOPY CENTER SETUP

The CDDC consists of 6 total endoscopy rooms. Three of these rooms are reserved for interventional procedures such as EUS and ERCP. Two rooms are used for diagnostic EGD and colonoscopy. The remaining room is used for either EUS or endoscopy, depending on the need.

The CDDC is staffed by a combination of full-time employees and a variable number of per-diem nurses. The per-diem nurses are hired based on workload needs determined by the unit nursing manager. A circulating nursing manager is present on the floor in the pre-procedure and/or recovery area to oversee workflow and manage any issues that may arise during the course of the day.

### Endoscopy center workflow

Patients are registered by a receptionist in the front lobby and are admitted to a 10-bed area, which serves as the pre-procedure and recovery room. In this area, there is no definitive bed allotment or distribution for pre-procedure versus recovery patients. Once in this area, patients undergo a brief nursing assessment, and an intravenous infusion is placed. Informed consent by the endoscopist and anesthesiologist (for MAC/GA cases) is obtained here as well. From there, patients are transported to the endoscopy room.

Once the patient is in the endoscopy room, the procedure staff typically consists of the endoscopist (an attending physician with or without a fellow), an anesthesiologist or