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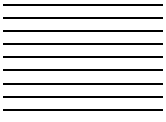

GROW THE PIE: INTERDEPARTMENTAL COOPERATION AS A METHOD FOR ACHIEVING OPERATIONAL EFFICIENCY IN AN EMERGENCY DEPARTMENT

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☐ **Abstract—Background: Despite sufficient literature analyzing macroscopic and microscopic methods of addressing emergency department (ED) operations, there is a paucity of studies that analyze methods between these extremes. Objective: We conducted a quasi-experimental study incorporating a pre/post-intervention comparison to determine whether interdepartmental cooperation is effective at improving ED operations by combining microscopic and macroscopic concepts. Methods: We performed an analysis of operational and financial data from a cooperative investment in imaging transport personnel between the emergency and radiology departments. Our primary outcome, order to table time (OTT), measured imaging times by modality (computed tomography [CT], ultrasound [US], magnetic resonance imaging [MRI]). These were compared for statistically significant change before and after the intervention. Our secondary outcome, gross profit, was calculated using the revenue generated from gained outpatient studies minus the associated direct personnel costs. Results: Transporters improved OTTs by decreasing median imaging times from 132 min to 116 min ($p < 0.0005$). Efficiency improved for CT scans with median time decreasing from 142 min to 114 min ($p < 0.0005$). Transport hires had adverse effects on US, with an increase in median OTT from 91 min to 99 min ($p < 0.018$). MRI experienced a similar trend in OTT, as median times worsened from 215 min to 235 min ($p < 0.225$). The investment in transporters generated a gross profit of $1.03 million for the radiology department over 9 months. Conclusions: Interdepartmental cooperation is a broadly applicable macroscopic method that is effective at achieving microscopic, site-specific gains in ED efficiency. Transporters provided operational gains for the ED and financial gains for the radiology department.**

☐ **Keywords—radiology; imaging; operations; management**

INTRODUCTION

The problem of inefficiency in emergency departments (EDs) has been widely recognized with related downsides in care, outcomes, and cost (1–6). Taking broad strokes, there are two study types in the literature that address ED operational efficiency: macroscopic and microscopic. Macroscopic papers apply broad concepts of operations management in order to provide a framework for addressing change (7–10). While very useful in providing a general framework for analysis that accounts for the high degree of diversity with respect to patient populations and resources, these frameworks may be difficult to apply in practice, as they leave the work of problem identification and change implementation to the practitioner. Conversely, microscopic papers detail specific changes that departments have made in order to address inefficiency and overcrowding (11–15). These

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papers are powerful in addressing common themes, such as frequent utilizers, triage practices, laboratory turn-around times, information technology, and other operational systems. However, while helpful in identifying areas of change, organizational specifics of the reporting institution may prohibit application to the diverse range of ED practices. Thus, after reviewing the literature, we find there is a large gap with regard to the methods that address common operational themes in the ED using broadly applicable concepts.

Given this background, we sought to determine whether interdepartmental cooperation could be a broadly applicable method that is effective at achieving site-specific gains in ED efficiency. To achieve this, we performed a quasi-experimental study incorporating a pre/post-intervention comparison analysis of operational and financial data from a cooperative investment in imaging transport personnel between the emergency and radiology departments. Our hypothesis was that this cooperative endeavor would decrease the time to obtain advanced imaging in the ED, while also increasing profits for the radiology department.

METHODS

Study Design and Patient Population

This study attempts to analyze whether interdepartmental cooperation is effective at increasing operational efficiency in EDs. We performed a quasi-experimental before-and-after analysis of operational and financial data resulting from a joint emergency and radiology intervention in patient flow within ED imaging between November 2012 and July 2014. This analysis was certified as exempt from Institutional Review Board review and was conducted at UC San Diego Health System, an academic urban tertiary care hospital with 42,360 and 43,872 ED visits in 2013 and 2014, respectively, and an admission rate of 21%. Our radiology department serves both inpatient and outpatients with 190,129 total encounters (48,165 ED encounters) in 2013 and 206,006 encounters (54,351 ED encounters) in 2014.

Project Description

During need-finding surveys, it was estimated that radiology technicians, who operated ultrasound (US), computed tomography (CT), and magnetic resonance imaging (MRI), spent roughly 20% of their time transporting ED patients to and from the sites, which resulted in marked machine idle time. In addition to slowing the turnover between patients, which hindered ED patient flow, this idle time also resulted in foregone radiology profits, which primarily took the form of foregone outpatient studies. As separate and independent from emergency imaging, these outpatient studies are billed separately and constitute an independent revenue stream for the radiology department. Of note, although radiographs constitute a major ED imaging modality, these were excluded from the intervention due to ED operational specifics. In our ED, radiographs are obtained within the ED physical plant using portable machines taken to patient rooms or in an on-site suite. Patients do not need to be transported out of the department to obtain these studies, as is the case with US, CT, and MRI.

Having identified a mutually beneficial area for improvement, the ED partnered with the radiology department and received approval from the Executive Office to hire two full-time imaging transporters to shuttle patients between the ED and imaging sites: CT, US, and MRI. In theory, this move would decrease equipment downtime by allowing the technician to remain in the imaging suite as transporters moved patients. During the 3 months of implementation time, from August 2013 through October 2013, brief biweekly meetings were held between the two departments in order to smooth processes and address any issues. Transporters were scheduled from 8:00 AM to 4:30 PM and 3:00 PM to 11:30 PM, giving a total coverage of 15.5 h/d, Monday through Friday, and this structure was maintained for the duration of the intervention.

Definitions and Operations

To determine the effect of the transport hires on ED operations, we evaluated both primary and secondary outcomes. Order to table time (OTT), which measured the time from study order in Epic's electronic medical record to the time the patient arrived in the imaging suite, was directly influenced by transporter hires and was the primary outcome measured. OTTs were collected in total and aggregated by study modality (CT vs. US vs. MRI) to account for differences in demand, throughput, and capacity between the imaging lines of operation. OTTs were then tracked on a monthly basis for the 9-month pre- and post-implementation periods. In order to evaluate the overall effect on ED operations, we calculated length of stay (LOS) as a secondary outcome. LOS was defined as period of time from patient "check in" in the waiting room to disposition order (admission or discharge), and was aggregated between admitted, discharged, and total patients. Of note, in order to remove the influence of special circumstances from biweekly oversight and operational adjustments, the 3-month implementation period was omitted from comparative analysis.

Finance

In order to analyze the wider effect of transportation hires on interdepartmental and executive incentives, we chose