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Badge sign-in and report cards improve first case start times in gastrointestinal endoscopy: A prospective quality improvement study

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ABSTRACT

Background and study aims First case start (FCS) time is often a key metric used to gauge efficiency in an endoscopy suite. There are limited data on tools and methods to improve the FCS time in the endoscopy suite.

Methods A prospective observational cohort study was conducted in an academic tertiary care endoscopy suite examining the effect of badge sign-in (Period 2) and badge sign-in coupled with report cards (Period 3) compared to an initial observational period (Period 1).

Results After the badge sign-in reader was introduced in P2, the unit experienced a mean time savings of 5 ± 18 minutes in FCS delays compared to P1 ($P = .03$). In P3, an 8 ± 17-minute time savings in FCS time delay was observed compared to P1 ($P = 0.0006$). Sign-in compliance significantly increased for the overall unit between P2 and P3 (49 % vs. 59 %, $P = .002$). Increases in first case on-time start (FCOTS) rates compared to P1 were observed for the unit, with a 14% absolute increase in P2 ($P < .0001$) and a 17 % absolute increase in P3 ($P < .0001$). FCS delays for on-time badge sign-ins were significantly lower compared to FCS delays for missed badge sign-ins and late badge sign-ins ($P < .0001$).

Introduction

The demand for endoscopic procedures has been steadily increasing over the past decade. This can be attributed to an increased demand for screening procedures and an increased demand in interventional procedures that minimize the need for surgery [1, 2]. To meet this demand, it is important that endoscopy units are run efficiently with minimal delays. This will not only allow for completion of an acceptable number of procedures to meet the demand, but also minimize costs. Procedural room costs are one of the main drivers of hospital spending, such as hourly staff wages for nursing, anesthesia, and technicians.

However, to improve efficiency in an endoscopy unit, the metrics of unit efficiency need to be calculated to identify the area(s) for improvement. It is important to note that more than one area or measure of efficiency may need improvement and thus several metrics for endoscopy unit efficiency have been studied. These include non-endoscopy time, total procedure time, and first case on-time starts (FCOTS) [2]. The non-endoscopy time can be further broken down into room exit time, time from patient exit to next patient entrance, anesthesia ready time (time from patient entrance to sedation of the patient), and endoscopist ready time (time from successful sedation to endoscope insertion). In our tertiary academic medical center, we used process mapping to understand areas of opportunity to increase efficiency. We identified first case start (FCS) delays to be a top contributor to overall unit inefficiency. The top reason for the delay was physician tardiness as recorded in the patient's electronic chart by the admitting nurse. Other institutions also have suboptimal first case starts. Yang et al. recently showed that 54 % of all cases had a first case start time delay in addition to delays caused by non-endoscopy time [2]. Yong et al. also reported physician-related delays as driving 70.5 % of delays in their endoscopy unit. Additional studies have also found physician-related delays are among the top contributors to FCS delays [3–5].

Improving FCOTS is important because delays have a negative domino effect on the procedure schedule for the rest of the day [6]. FCS delays have also been associated with poor patient and provider satisfaction, and higher operating costs in the surgical literature [7]. As a result, there has been research that has focused on increasing FCOTS rates. Tools studied include educational interventions, financial incentives, and operating room (OR) scheduling improvements [8]. Within endoscopy units, quality improvement initiatives have improved FCOTS using methods common in business and industrial engineering, such as time-in-motion studies and process mapping [6, 9]. A recent surgical study showed that surgeon sign-in to the perioperative area via text message or badge sign-in was shown to improve OR FCOTS percentage and FCS delays [5].

To date, there have been no studies examining the effect of badge sign-in or report cards in the endoscopy unit. Physician report cards have been shown to be an effective method to drive physician performance. Multiple studies have demonstrated improved colonoscopy quality measures using report cards [10–12], but using report cards to improve FCOTS have been not studied, to our knowledge. The aim of this quality improvement study was to examine the effect of: 1) a period of physician badge sign-in and; 2) a period of badge sign-in with a monthly report card on the metric of FCOTS rates and FCS delays in an endoscopy unit within an academic tertiary care medical center.

Methods

Setting

This is a prospective quality improvement study at an academic tertiary medical center between October 2017 and January 2021. The study was approved by the Institutional Review Board at the Zucker School of Medicine at Hofstra/Northwell. The endoscopy unit has five procedure rooms and 13 recovery bays. Of the five rooms, there are two interventional endoscopy rooms, two general gastrointestinal procedure rooms, and one motility room.

An identification badge sign-in reader (Kronos, Weston, Florida, United States) was located at the entrance to the endoscopy suite (▶ **Fig. 1**). Swiping of the badge recorded the time when the physician arrived to the endoscopy suite prior to consenting the patient for the procedure. Cameras were installed in each procedure room (as standard of care even prior to the study) to record when the patient entered the room, the

▶ **Fig. 1** Identification badge sign-in reader (Kronos, Weston, Florida, United States) located at the entrance to the endoscopy suite.

time out process, and when the patient left the room as part of our standard of care. Remote video auditing was performed by a third-party vendor (Arrowsite, Katonah, New York, United States) that recorded all timings. The auditors had no knowledge of the study protocol or details. Video streams were blurred to prevent personal identification of any party (provider, patient, etc.) and audio was not recorded. Individual team members or patients were not identified during audits and thus consent to record was not required. All recordings were stored in an encrypted virtual private network accessible only by the auditors during the audit process. On audit completion, the recordings were deleted within 24 hours. Nursing also recorded the badge sign-in and FCS metrics prospectively in the endoscopy reporting system (Surgical Information System, Alpharetta, Georgia, United States).

Definitions

Sign-in compliance was defined as the proportion of a physician's FCS where a badge sign-in was recorded. An on-time sign-in was defined as a badge sign-in occurring at least 20 minutes prior to the scheduled FCS, whereas a badge sign-in recorded less than 20 minutes prior to the scheduled FCS was considered late. A 20-minute period was chosen arbitrarily as it was discussed that this was the time needed to consent the patient, place orders, fill out paperwork, and discuss equipment needs with the staff, etc. Without this being completed, the patient cannot enter the room at the scheduled time. When no badge sign-in was recorded for a FCS, it was counted as missed.

A FCS was defined as the first case scheduled in a procedure room per day. An on-time FCS was defined as a case in which the time the patient arrived in the procedure room was at or before the scheduled start time.

Study periods

Our analysis included three study periods. Physicians who had at least two FCSs in each study period were included in our analysis.

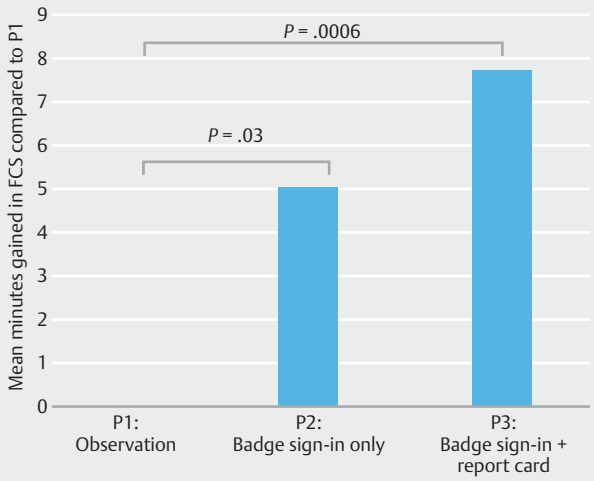
Period I – Observation (P1): From October 2017 to December 2018, FCS metrics were analyzed to obtain baseline data. FCS metrics were not provided to individual physicians during this period. Endoscopists were unaware of the observation period.

Period II – Badge Sign-in Only (P2): From January 2019 to December 2019, a badge sign-in reader was installed on the unit. Endoscopists were informed of the requirement to badge sign-in at least 20 minutes prior to their FCS. However, they were unaware of the specific badge sign-in compliance metrics and FCS metrics that were collected during this time period. Endoscopists were not provided feedback on their badge sign-in or FCS metrics.

Period III – Badge Sign-in + Report Card (P3): From January 2020 to February 2020 and August 2020 to January 2021, individual physician report cards were distributed to each physician on a monthly basis by the Director of Endoscopy. There was a pause in report card distribution between March 2020 and July 2020 when the endoscopy unit was closed due to the coronavirus disease 2019 (COVID-19) pandemic. The report cards included individual physician's trends in badge sign-in compliance, on-time sign-in compliance, block utilization, volume, and patient experience metrics (**Supplementary Fig. 1**). The report cards included the individual's year-to-date averages compared to the unit averages and goals. The report cards also had a chart showing the unit average FCS delay times for on-time sign-in versus late and missed sign-ins for the month. The Director of Endoscopy would share individual report cards with physicians monthly via electronic mail, adding personalized comments highlighting positive trends. There were no penalties or financial incentives imposed on physicians who were late or on-time.

Statistical analysis

The continuous variables (FCOTS minutes gained, FCOTS rates) were summarized using means and standard deviations. Non-continuous variables (overall, on-time, and late badge sign-in compliance) were reported as a percent change between the observation period and the study periods, P1 and P2. A two-sample *t*-test was used to test for a significant difference between the observation period and the study periods (P1-P2, P1-P3). All statistical analyses were performed using SAS Studio version 3.8 (SAS Institute Inc., Cary, North Carolina, United States).



▶ **Fig. 2** Minutes gained in first case start compared to P1 for the overall unit.

Results

Data on 20 physicians were included in the analysis (with at least two first case starts) for a total of 1,808 FCSs. Thirteen physicians were full-time faculty attendings (n = 1,333 FCSs) and seven were voluntary faculty (n = 475 FCSs).

The endoscopy unit had a FCS time delay of 21 mins during the observation period (P1). After the badge sign-in reader was introduced in P2, the unit experienced a time savings of 5 ± 18 minutes in FCS delays compared to P1 ($P = .03$). In P3, individual report cards were provided to physicians which resulted in a time savings of 8 ± 17 minutes in FCS time delays compared to P1 ($P = .0006$) (▶ **Fig. 2**). In subgroup analysis, full-time faculty gained 6 ± 18 minutes in P2 ($P = .01$) and 8 ± 16 minutes in P3 ($P = .01$) (▶ **Table 1**). For voluntary faculty, the mean time gained in P2 was 2 ± 17 minutes ($P = 0.6$) and 6 ± 19 minutes in P3 ($P = 0.01$) (▶ **Table 1**).

Increases in FCOTS rates compared to P1 were observed for the unit, with a 14% absolute increase in P2 ($P < .0001$) and a 17% absolute increase in P3 ($P < .0001$) (▶ **Table 1**). This improvement in FCOTS was seen for full-time faculty, but not voluntary faculty. For full-time faculty, FCOTS rate was 10% in P1, increased to 29% in P2 ($P < .0001$) and 32% in P3 ($P < .0001$). In contrast, voluntary attending FCOTS rate began slightly higher at 13% in P1, but did not improve significantly in P2 (14%, $P = .81$) or P3 (18%, $P = .28$) (▶ **Table 1**).

Sign-in compliance significantly increased for the overall unit between P2 and P3 when the report card was introduced (49% vs. 59%, $P = .002$) (▶ **Fig. 3**); the improvement was significant for full-time faculty (58% vs. 68%, $P = .004$) but non-significant for voluntary faculty (24% vs. 31%, $P = .16$) (▶ **Table 1**). Increases in on-time sign-in rates were observed for the unit between P2 and P3 (38% vs. 53%, $P < .0001$) (▶ **Fig. 3**); Furthermore, the increase was significant for both full-time faculty (41% vs. 53%, $P = .0001$) and voluntary faculty (17% vs. 53%, $P = .0003$) (▶ **Table 1**). Late sign-in rates decreased non-significantly between P2 and P3 for the unit (62% vs. 47%, $P = .30$), full-time faculty (59% vs. 47%, $P = .50$) and voluntary faculty (83% vs. 47%, $P = .30$) (▶ **Table 1**).

FCS delays for on-time badge sign-ins were significantly lower compared to FCS delays for missed badge sign-ins and late badge sign-ins ($P < .0001$) (▶ **Fig. 4**). In P2 and P3, FCS time when a physician did not badge sign-in (missed badge sign-in) was –20 ± 17 minutes and –18 ± 16 minutes delayed, respectively. When a badge sign-in was late, the FCS time delay was lower compared to a missed badge sign-in, with –15 ± 14 minutes delayed in P2 ($P = .001$) and –13 ± 12 minutes delayed in P3 ($P = .004$) (▶ **Fig. 4**). FCS time for physicians who had an on-time badge sign-in was –3 ± 18 minutes delayed in P2 and –4 ± 17 minutes delayed in P3 (▶ **Fig. 4**).

Discussion

Endoscopy unit efficiency has become increasingly important as procedure volume and costs continue to rise. Several studies have reported barriers to efficiency in endoscopy units, including FCS times, case duration and non-endoscopy time [1, 2, 13]. Our hospital identified delayed FCS due to physician tardiness as one of the primary drivers of unit inefficiency and conducted a quality improvement study. In this prospective observational study, we have shown that both endoscopist badge sign-in and badge sign-in with report cards are associated with decreased FCS delays and improved FCOTS rates, with an incremental benefit with the addition of report cards over badge sign-in alone. We have also shown an association between badge sign-in compliance and FCS delay time. Physicians with badge sign-in on time had the lowest average delay times, followed by those who had a late badge sign-in, and finally those who did not badge sign-in at all.

To our knowledge, this is the first study examining the effect of endoscopist badge sign-in and report cards for improving efficiency in the endoscopy suite. We find these simple tools can increase efficiency in the unit measured by FCS time. Although these interventions improved the FCOTS rates (28% in P3 vs. 11% in P1) and physician on-time badge sign-in (53% in P3 vs. 38% in P2), overall FCOTS rates were still low. Thus, there likely are other factors contributing to late starts, and not only physician tardiness. Other known factors of FCS delay include patient late arrival and process delays such as delayed transport to endoscopy for inpatients, equipment delays, and difficult intravenous access [6]. Other areas our unit is exploring to improve FCOTS rates include factors associated with patient tardiness and nursing delays.

Other studies have investigated ways of minimizing FCS delays. In 2014, Tomer et al. decreased FCS delays from 17 minutes to 10 minutes ($P < 0.01$) through physician education, email communication to faculty, and monthly faculty meetings [6]. Pashankar et al. improved first case start times in a OR setting by setting up the room for the first case the day before, a postoperative care nurse was brought to the preoperative area to facilitate the first case, and surgeons received automated text messages [14]. Harewood et al. analyzed and compared procedures prospectively to identify ways of improving effi-

▶ **Table 1** Mean FCS minutes gained, first case on-time start rate, and badge sign-in compliance in the observation (P1), badge sign-in only (P2) and badge sign-in + report card (P3) periods.

	P1: Observation	P2: Badge sign-in only	P3: Badge sign-in + report card	*P* value
Unit overall	**n = 709**	**n = 689**	**n = 410**	
Mean FCS minutes gained from P1 (Standard Deviation)	–	5 (18)	8 (17)	.03 (P1-P2) .0006 (P1-P3)
FCOTS rate	11 %	25 %	28 %	< .0001 (P1-P2) < .0001 (P1-P3)
Absolute change in FCOTS	–	14 %	17 %	
Badge sign-in compliance	–	49 %	59 %	.002
On-time badge sign-in	–	38 %	53 %	< .0001
Late badge sign-in	–	62 %	47 %	.30
Full-time	n = 509	n = 516	n = 308	
Mean FCS minutes gained from P1 (SD)	–	6 (18)	8 (16)	.01 (P1-P2) .01 (P1-P3)
FCOTS rate	10 %	29 %	32 %	< .0001 (P1-P2) < .0001 (P1-P3)
Absolute change in FCOTS	–	19 %	22 %	–
Badge sign-in compliance	–	58 %	68 %	.004
On-time badge sign-in	–	41 %	53 %	.0001
Late badge sign-in	–	59 %	47 %	.50
Voluntary	n = 200	n = 173	n = 102	
Mean FCS minutes gained from P1 (SD)	–	2 (17)	6 (19)	.60 (P1-P2) .01 (P1-P3)
FCOTS rate	13 %	14 %	18 %	.81 (P1-P2) .28 (P1-P3)
Absolute change in FCOTS	–	1 %	5 %	–
Badge sign-in compliance	–	24 %	31 %	.16
On-time badge sign-in	–	17 %	53 %	.0003
Late badge sign-in	–	83 %	47 %	.30

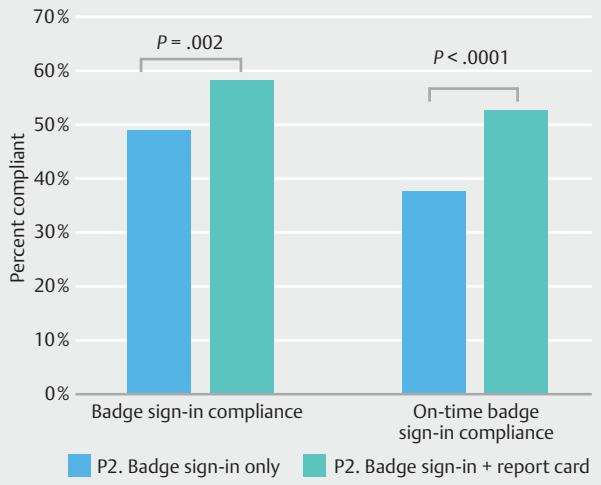
FCS, first case start; FCOTS, first case on-time start; SD, standard deviation.

ciency [9]. Improvements that could improve FCS times were having separate personnel to consent the patient and to obtain intravenous access.

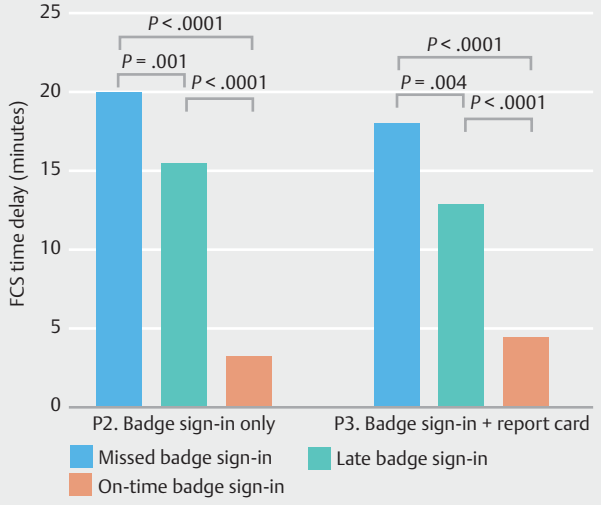
The benefits to starting the first case on time include: 1) patient satisfaction; 2) no delay in subsequent cases; and 3) financial ramifications. Cost analysis has shown that the cost of running a procedural room can be as high as $37 a minute [15]. In addition, the faster a room finishes, the less likely a room is to run late with cost savings in overtime pay to nursing and anesthesia staff.

In our study, we found that full-time faculty were more responsive than voluntary faculty in regard to signing-in. Full-time faculty had a statistically significant increase in compliance with badge sign-in between P2 and P3, whereas voluntary faculty did not. This was reflected in the FCOTS rates in that full-time faculty saw a significant improvement from P2 to P3 whereas voluntary faculty did not. The reasons behind the differences in motivation between full-time faculty and voluntary faculty for arrival on time are unclear. A possible explanation is that full-time faculty may feel more responsibility to senior endoscopy leadership to arrive on time, and thus be more responsive to individual feedback on the report card and personalized electronic mail each month.

We hypothesize that reasons for the positive impact of the report cards include that: 1) monthly report cards allowed individuals to track their performance over time; 2) brief, personalized positive feedback on the individual's trends from the Director of Endoscopy may have encouraged improvement; and 3) the report cards related on-time badge sign-in compliance to lower FCS delays, highlighting why swiping-in on-time was relevant to the individual. Thus, consistency in reporting and feedback, as well as showing the direct impact of results, may



▶ **Fig. 3** Comparison of badge sign-in compliance and on-time badge sign-in compliance rates between P2 and P3 for the overall unit.



▶ **Fig. 4** Impact of badge sign-ins (missed, late, on-time) on FCS delays.

contribute to report card effectiveness. It is important to note that our hypothesis underscores how physician report cards work as a behavioral intervention and that individual behaviors are influenced by feedback. As suggested above, the endoscopists in this study may have improved their performance with report cards because they knew they were being monitored (Hawthorn effect). Altered performance may have also been influenced by ego or competitive nature upon receiving individual metrics in comparison to the unit. In 2013, Kahi et al. found positive impacts of physician report cards on colonoscopy quality measures and suggested the physicians may have been driven to improve due to competition or pride [12].

Our study has the following strengths. It is a prospective study in which timings and badge sign-ins were prospectively recorded. In addition, the interventions were compared to an observation period in which the endoscopists were unaware of the data collection. The study occurred in a large endoscopy suite with 20 endoscopists (both full-time and voluntary), which makes the results generalizable. Finally, the study period was long, which allowed for more robust results. This study has limitations. Our study was interrupted when our endoscopy unit was closed between March 2020 and July 2020 due to the COVID-19 pandemic, which may have impacted unit efficiency. However, average badge sign-in compliance and on-time badge sign-in compliance were consistent between February 2020 and August 2020, suggesting the impact was minimal, if any. Another limitation is that our study is an observational single-center study in a tertiary care center, and thus, our results may not be generalizable to other settings (ambulatory settings or community hospitals). Finally, our study focused on one aspect of endoscopy unit efficiency (FCOTS), as this was an issue in our unit. It does not evaluate other metrics of endoscopy unit efficiency such as non-endoscopy time delays between cases.

Conclusions

In summary, both physician badge sign-in and report cards were associated with increased FCOTS and reduced FCS delays. Further study of the effects of these interventions in other endoscopy settings, such as ambulatory surgical centers and physician offices is needed to determine if improvements are generalizable among all endoscopy sites.

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Competing interests

Dr. Trindade is a consultant for Olympus America and Pentax Medical and has received research support from Ninepoint Medical.

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