Surgical pit crew: initiative to optimise measurement and accountability for operating room turnover time

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ABSTRACT

Background and objectives Turnover time (TOT), defined as the time between surgical cases in the same operating room (OR), is often perceived to be lengthy without clear cause. With the aim of optimising and standardising OR turnover processes and decreasing TOT, we developed an innovative and staff-interactive TOT measurement method.

Methods We divided TOT into task-based segments and created buttons on the electronic health record (EHR) default prelogin screen for appropriate staff workflows to collect more granular data. We created submeasures, including ‘clean-up start’, ‘clean-up complete’, ‘set-up start’ and ‘room ready for patient’, to calculate environmental services (EVS) response time, EVS cleaning time, room set-up response time, room set-up time and time to room accordingly.

Results Since developing and implementing these workflows, measures have demonstrated excellent staff adoption. Median times of EVS response and cleaning have decreased significantly at our main hospital ORs and ambulatory surgery centre.

Conclusion OR delays are costly to hospital systems. TOT, in particular, has been recognised as a potential dissatisfier and cause of delay in the perioperative environment. Viewing TOT as one finite entity and not a series of necessary tasks by a variety of team members limits the possibility of critical assessment and improvement. By dividing the measurement of TOT into respective segments necessary to transition the room at the completion of one case to the onset of another, valuable insight was gained into the causes associated with turnover delays, which increased awareness and improved accountability of staff members to complete assigned tasks efficiently.

INTRODUCTION

Turnover time, or the time between surgical cases in the same operating room (OR), can often give the impression of being too long without clear reason. Delay in turnover time can cause meaningful disruption to perioperative operations, and as such, turnover time serves as a key quality process measure at countless institutions.1–4 In addition, turnover delays impact case-start times, which can be a source of patient distrust and dissatisfaction, as additional wait time can create additional stress to patients who are already anxious.5 Ideally, it is an institutional goal to minimise the time between surgical cases in order to support surgical demand and growth, as well as to improve revenue and profits.

In attempts to shorten turnover time, others have tried implementing mobile applications,6 designated specialised OR teams,7 turnover task cards,8 remote video auditing with real-time feedback,9 and other published process improvement initiatives.10–14 However, despite these and other attempts, turnover time continues to be a frustratingly difficult problem to solve at many if not most institutions. To our knowledge, this is the first study at a multisite quaternary academic medical centre to describe a novel method for measuring OR turnover.

The processes that occur during turnover can be complex, variable and at times seemingly nebulous and/or chaotic; however, they all come down to what needs to get accomplished in order to complete and clean up after the previous case (primary process owners: environmental services (EVS)), and then to setup and prepare for the case to
follow in the same OR (primary process owners: surgery technicians and nurses). At many institutions, including the study institution, turnover is measured as one block of time—with therefore little specific insight into which process or processes are responsible for turnover delays. As a result, it becomes difficult to hold teams accountable without measurable, granular data to elucidate the specific causes of increased time.

With the aim of optimising and standardising OR turnover processes and potentially improving perioperative efficiency by reducing turnover time, we developed an innovative and staff-interactive method for measuring the time in between surgical cases. By dividing overall turnover time into parts based on processes or workflows, we hypothesised that we could achieve more accurate measurements of turnover time components, hold-specific teams accountable for their processes within each component, and ultimately decrease turnover time delays.

METHODS
This study was conducted at a suburban regional academic health system, which is composed of two acute care hospitals housing 51 ORs. The EHR used at this institution is Epic (Verona, Wisconsin, USA). A process improvement workshop was held to address the topic of OR turnover time, which was attended by end-users from multiple perioperative teams involved in turnover processes.

For our intervention, we divided OR turnover into task-based segments and created clickable buttons on the EHR default prelogin screen for appropriate staff workflows to collect more granular data. We defined ‘turnover time’ as the time between ‘wheels out’ of the previous case to ‘wheels in’ of the case to follow (figure 1)—case tracking events that are usually recorded in the EHR by the circulating nurse in the OR. We created new case tracking events in between these that include ‘clean-up start’, ‘clean-up complete’, and ‘set-up start’, to allow the calculation of EVS response time, EVS cleaning time, room setup response time and room setup time accordingly.

Given not all staff members (including EVS) have access to log into the EHR at our institution, we made the new buttons readily available on the room-specific prelogin status board located on the home screen of all computers in the ORs to be clicked by appropriate staff members at the time of initiation and completion of clean-up and setup processes. Education was provided on the location of the buttons and other fields (for those with EHR access) as well as best practices for standard work for utilisation of the buttons within existing staff workflows.

Timestamp measurements are stored within the EHR for each case, and are extracted on a weekly and/or monthly basis to be displayed on team-based dashboards created in Microsoft Excel, using data from the EHR timestamp measurements, and sent to team managers via email for accountability and to keep track of progress over time. Overall and location-specific data are displayed on the dashboards in the same presentation as the results figures below. Descriptive statistics, including median time and utilisation percentages, were performed using these data to assess the impact of our intervention. This manuscript was structured based on the Standard QUality Reporting Excellence (SQUIRE) guidelines for quality improvement (QI) studies.

RESULTS
Since developing and implementing these workflow interventions (table 1), the study institution has seen excellent adoption by staff members (figure 2A–C). EVS utilisation of the ‘clean-up start’ speed button is stable at 90% of cases with subsequent cases to follow at all main OR locations. Utilisation of the ‘set-up start’ speed button is stable >80% of cases with subsequent cases to follow at all main OR locations. Utilisation of the ‘room ready for patient’ speed button is stable >85% of cases. Of note, ‘room ready for patient’ is a speed button that was not newly created for this project, as it existed previously to help designate to the preoperative and anaesthesia teams that the room is ready for the patient to be brought back.

We have also seen the median duration of EVS response times (‘wheels out’ → ‘clean-up start’) and cleaning times (‘clean-up start’ → ‘clean-up complete’) decrease substantially over time at our main hospital ORs (figure 3A,B). Median response time remains consistently under 4 min (previously greater than 5 min) and cleaning time remains consistently below 10 minutes.

![Figure 1](https://example.com/figure1.png) Operating room turnover time measurement timeline. EVS, environmental services.
(previously greater than 15 min). These trends appear to correlate with greater adoption of the EHR functionality intervention.

Median setup response time (‘clean-up complete’ → ‘set-up start’), set-up time (‘set-up start’ → ‘setup complete’), and time to room (‘set-up complete’ → ‘wheels in’) have not significantly decreased and display variability across locations as well as over time (figure 4A–C). Overall, turnover time has not significantly decreased over time and remains consistently above target at all locations (figure 5).

**DISCUSSION**

Delays in the OR can be costly to hospital systems, and one area where known delays occur is during room turnover. One study describes each minute of time running an OR in California hospitals costing approximately US$37 for inpatient settings and US$36 for ambulatory settings.\(^\text{15}\) Another study describes a methodology for surgical centres to calculate potential reduction in staffing costs as a result of decreases in OR turnover times.\(^\text{16}\) OR turnover can be a seemingly nebulous time between surgical cases. There are certain tasks that need to be accomplished once the previous patient’s case was completed to prepare for the case to follow in the same OR. Much like a motor racing pit crew, many different personnel are involved in many distinct, yet potentially overlapping processes during this OR turnover time. While traditionally the measurement of these tasks has been lumped together into one turnover time metric, this study demonstrates an alternative method to help guide efficiency and accountability for the individual tasks that occur during OR turnover.

There can be some variability in tasks during turnover based on the type of operation to be performed, individual staff preferences, patient factors and more.\(^\text{17}\)\(^\text{18}\) Among this variability arises one constant universal theme when discussing OR turnover time: ‘Why did it take so long?’ Turnover time, in particular, has been recognised as a potential dissatisfier and cause of delay in the perioperative environment.\(^\text{13}\) It also has the potential to erode the goals of efficiency and safety within the perioperative environment. A previous study has shown that perceptions of turnover time may be skewed by staff member role and factors perceived as contributing to the time, and suggest for OR managers to reference timestamp data on turnover time length rather than relying on surgeon or anaesthesiologist ‘expert judgement’.\(^\text{19}\) While there is access to EHR data of the overall length of OR turnover time, the data were not sufficient to answer this universal question, a question that plagues hospitals and surgical centres across the globe.

**Figure 2** (A) EVS utilisation (percentage of cases) of clean-up start button in the OR over time, (B) utilisation (percentage of cases) of set-up start button in the OR over time, (C) utilisation (percentage of cases) of room ready for patient button in the OR over time. EVS, environmental services’ OR, operating room.
Viewing turnover time as one finite value or entity and not a series of necessary tasks by a variety of team members limits the possibility of critical assessment and improvement. In this study, in order to provide a more reliable and detailed measurement system to answer this question, OR turnover time was divided into three main phases or components based on the staff and processes that occur accordingly—the respective segments necessary to transition the room at the completion of one case to the onset of another. While that sounds simple, like the flip of a switch, to use to shorten turnover time, in this study we demonstrate this is not so simple and that turnover is comprised of several interconnected and often-times interdependent components of a larger whole.

This project demonstrated the successful implementation of a new staff-interactive timestamping system, as demonstrated by the high utilisation rates of the buttons created in the EHR. Both staff engagement and the sharing of performance metrics have been shown to be key to enhancing OR efficiency.20 With this new process in place at the study institution, staff are now leaving more accurate, room-specific and case-specific, timestamps in the system in order to more precisely pinpoint when components of turnover are being initiated and completed. The time being spent on each of these components can be accurately quantified, assessed and addressed accordingly.

A notable decrease in time for the EVS workflow was observed in this study. It was confirmed with team management that there were no additional significant process changes (eg, new faster drying cleaning solution) that took place during this time that would account for

Figure 3  Median (minutes) EVS response time (A) and cleaning time (B) over time. EVS, environmental services.

Figure 4  Median (minutes) set-up response time (A), set-up time (B) and time to room (C).
Figure 5  Median turnover time (minutes) by location over time.

the time decrease otherwise. In conjunction with high utilisation rates by EVS, this tells us that our intervention has provided an accurate measurement tool for our EVS teams’ efficiency that is successfully holding times below target, an achievement we continue to sustain and celebrate.

While we have not yet seen similar notable decreases in set-up and overall turnover time, significant progress toward this goal has been made now that a more accurate and detailed measurement system is in place. We acknowledge and are limited by the fact that there will always be significant variability in set-up time given different services or different cases require a greater amount and/or greater complexity of equipment that requires set-up time accordingly.

Another limitation identified based on these results is that technology changes alone are not sufficient for process improvement. Focused staff-based and process-based education is required for successful implementation of a new system, as well as for sustainable change to occur. An added benefit of this project is that a transparent system of accountability for staff teams was implemented, providing more awareness of each team or staff member’s contribution.

Future directions include further service line-specific analysis of case set-up time to identify potential areas of improvement while accounting for service line-specific variability (eg, amount of case equipment). Additionally, standard work for the teams responsible for bringing the patient to the room once the room is set up or ready will be developed and implemented. This will include a standardised messaging system to the anaesthesia providers assigned to the case so they do not have to wait and multitask while attempting to predict when the room might be ready for the patient to come back. Lastly, this system is reliant on individual human entry of case tracking event data, which could be improved by automation such as through wireless sensors and radio frequency identification device technology.3,22

Efficiency-based QI initiatives have been cited to potentially include feelings of pressure to produce a fast result, which may in turn compromise a high-quality result. Other investigations have found no negative impact on patient safety and quality of care resulting from gradual implementation of a methodologically structured efficiency-based QI initiative in a perioperative environment.23,24

While it is not possible to attribute specific patient safety and outcomes data directly to this particular QI initiative, to our knowledge, there was no significant change in the number of complications since the implementation of this system.

CONCLUSION

By dividing our measurement of turnover time into the processes that need to be completed: ‘clean-up’ and ‘set-up’, we were able to gain valuable insight into the components of turnover and turnover delays and increase awareness and accountability of staff members to complete assigned tasks efficiently without compromising quality and patient safety.

Contributors NHG helped plan, conduct and submit the study, and is the guarantor responsible for the overall content. RLS helped plan and conduct the study. RM helped construct the implementation tool. AG helped construct the implementation tool. EM helped plan and conduct the study. LPR helped plan the study. RSW helped plan the study. KLM helped plan the study. BC helped plan and submit the study. MM helped plan and submit the study.

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