

Improving Operating Room Turnaround Times with Automated Alerts and Mobile Communication

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I. Abstract

Operating Rooms (ORs) are a hospital's most costly operational area. When run efficiently, they can be a source of solid revenue, but when run inefficiently, they cause operational and fiscal heartburn. Much focus is centered on turnaround times, which is identified as a primary source of problems. Operating room turnaround time is the time between a patient "Wheels Out" (WO) and when the subsequent patient "Wheels In" (WI), and is important to a surgery center's performance but difficult to manage well. Minimizing this time is critical but delays often occur which cause fewer surgeries to be completed resulting in less revenue. New technology implemented at a hospital with multiple operating rooms has successfully reduced some of the overall turnaround inefficiencies. The technology employs a powerful combination of RFID (to track the real time location of patients, assets and staff) and automated alerts and statuses via a mobile communication platform, providing hospital management with the information they need for advanced planning and in-the-moment course corrections throughout the day.

Critical to prompt operating room turnaround times is the environmental services (EVS) function. The new communication platform alerts EVS to an upcoming room cleaning, and once initiated, tracks the progress of EVS and other staff so that the room can be turned over and the next patient can be moved into the OR as soon as possible. This has resulted in improved performance and patient satisfaction of the surgery service. The results are particularly significant because the ORs were already performing with time shorter than most surgery centers.

II. Introduction

A well-run surgery department is like a dance. People are moving back and forth in a tightly coordinated manner. If staff, the equipment they use, or the patients they serve are not where they should be at the right time – quality and cost suffer – and the dance is not a success.

Every minute an OR sits unutilized due to lack of insight into room status may have a significant negative financial impact. It cascades into other problems – late surgery finishes, long patient wait times, reduced patient satisfaction and other metrics the hospital is assessed on¹. The standard room turnaround process involves multiple steps by various people who need to coordinate with others. As a patient is prepped in Pre-Op, the charge nurse typically must walk over to the assigned OR room to see if it's clean and ready to go and/or makes multiple phone

¹Adams, Rella, et al. "Decreasing turnaround time between general surgery cases: a six sigma initiative." *Journal of Nursing Administration* 34.3 (2004): 140-148.

calls or visits to assure that staff, equipment and the patient are in the right place at the right time. At surgery completion, there is usually no visibility for ancillary teams (such as transporters, EVS, etc.) to assess whether that patient has finished their procedure and is now in Post-Op without physically walking over to the room to check or waiting to receive a phone call for clearance. Ancillary teams often make multiple trips from their workstation to see if the surgery is complete. They may or may not get a call with updates from the Charge Nurse.

A recent implementation of the TAGNOS OR Patient Flow Solution (as described in the next section) has made it possible to better manage patient and staff flow in orchestrated, precise ways. The goal is to minimize the amount of time an operating room is idle between Wheels Out (WO) of the patient and Wheels In (WI) of the subsequent patient. In order to fully utilize operation rooms, focusing on patient flow capture and the associated turnaround times is key in order to create and/or maximize surgical capacity. Otherwise, fewer surgeries may be completed on a given day, inefficient patient flow occurs, staff overtime may be incurred, and patient satisfaction is reduced. In summary, a provider loses potential revenue streams, patients may receive a lesser quality of care due to poor throughput and attentiveness from existing manual communication patterns. Surgeons generally consider room turnaround time to be the most important indicator of OR performance.²

Delays in the turnaround process are related to two primary items. First, not having the right resources in the right place when needed. Secondly, the lack of cross-departmental communication between those delivering care (clinical staff) and those supporting care delivery (ancillary teams such as EVS, transporters, biomedical technicians). When there is communication between these departments, it is a manual, foot-step heavy process. Delays in the turnaround process are often due to not having the right resources in the right place when needed. Transportation must be located correctly to move one patient out and another in. Equipment and supplies must be moved out and new equipment and supplies moved in to the operating room by a biomedical department staff member. Of course, during each OR sequence flow step, appropriate clinical staff and the patient must be ready. Often a challenging element is having EVS in place with their supplies to initiate the first step of room turnaround-cleaning. To orchestrate all these departments is a huge feat, and communication is a manual hurdle in communicating patient flow to improve overall throughput. There is an abundance of clinical communication platforms, but tying in other supporting departments such as EVS, transport and biomed is an additional hurdle.

It is the author's experience that operating room turnaround is the most often mentioned problem in conjunction with performance in hospitals generally and has been so for a long time. One OR manager said, "Turnaround time has been a problem since cave-man times". That may be an overstatement, but it is certainly a very common challenge.

III. TAGNOS Solution

²Vitez TS, Macario A. Setting performance standards for an anesthesia department. J Clin Anesth 1998; 10: 166–75.

In terms of operating room turnaround time, many events must properly occur before and after WO. It is not enough merely to have the new surgery patient ready to move in after the prior patient moves out – although that is important too. Often communication is the biggest challenge. The events at Adventist Health White Memorial Medical Center, as in most hospitals, include:

PRE-OP EVENTS:

1. Patient and staff, including nursing, surgeon(s), anesthesiologist, ancillary staff and technicians, are located at the hospital *
2. Preop procedures are done on the patient; sometimes there is a “huddle” with the staff involved in the surgery itself to assure all necessary work is done before the patient is moved into the OR. This is also done to assure that all the necessary staff are present and that everybody understands their role.
3. Surgical supplies, procedure equipment and surgery cart are identified and prepared to be moved into the operating room *
4. Transport staff is alerted that patient movement will be needed *

PROCEDURE:

1. EVS is alerted that an operating room’s surgery will end soon, preferably with a time estimate when the operating room will be available for cleaning. Additionally, relevant staff is alerted using shortcuts on mobile device to show surgery is coming to an end *
2. Patient WO triggers automated alert to EVS to clean the room. See Figure 2. *

POST-PROCEDURE

1. BioMed, EVS and Nursing teams change over the associated equipment and supplies required for the next patient
2. EVS arrival time captured upon entry into room (with TAGNOS, EVS was in the room before WO 65% of the time, and within the room after WO within 1 minute 46 seconds (on average) *)
3. EVS cleans the room. The time for this task varies based on the size of the room and what is in it - but the task generally takes between 12 and 15 minutes (but is dependent upon surgery complexity).
4. EVS uses shortcut on mobile device to state that the room has been cleaned *
5. Nursing and other staff prepare the room for the next surgery including locating surgery carts and associated equipment into the room for the upcoming surgery *
6. Pre-Op is notified that the patient can be moved into the room*
7. The subsequent patient is transported to the OR and wheeled into the room*

It is important for OR management to know time and location for these steps and TAGNOS can capture and report each of the steps marked with an “*”.

There is no national standard for ‘acceptable’ room turnaround time, but time ranging from 15 minutes to 1.5 hours and more are commonly reported. WMMC is currently at around 28 minutes but wishes to reduce their room turnaround time.

Taking steps to achieve that goal, WMMC³ has recently implemented the TAGNOSⁱ OR room turnaround module in which all communications are enabled through a Zebra TC-series touch computer⁴ that hosts the TAGNOS app. WMMC has 6 primary Operating Rooms in their Main Surgery center that performed 5,930 surgeries in 2018 – a mix of inpatient and outpatient surgeries. The TAGNOS software leverages RFID (radio-frequency identification) technology – a small tag (or chip) is placed on a patient’s wrist, see Figure 2, which captures vital patient flow data. The Zebra TC-series phone utilizes an RFID tag which enables staff locating and time capture and required minimal change to existing workflows and processes. The Nursing team, Anesthesia Tech and EVS team carried the Zebra touch-computers for this study.

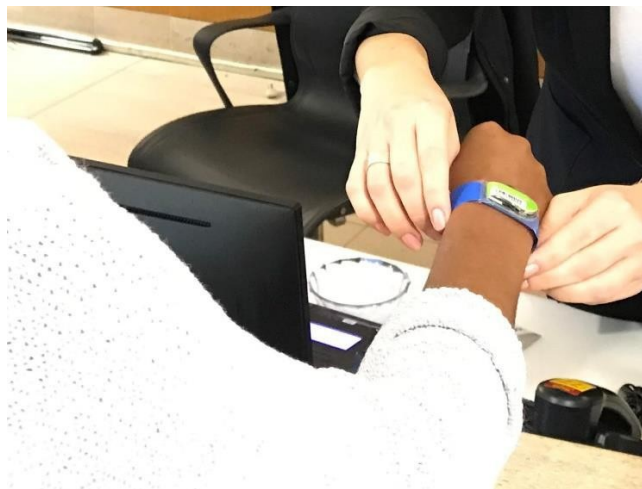


Figure 1. RTLS wristband is given to the patient

³ White Memorial Medical Center, Los Angeles, CA

⁴ Zebra Technologies, Lincolnshire, IL

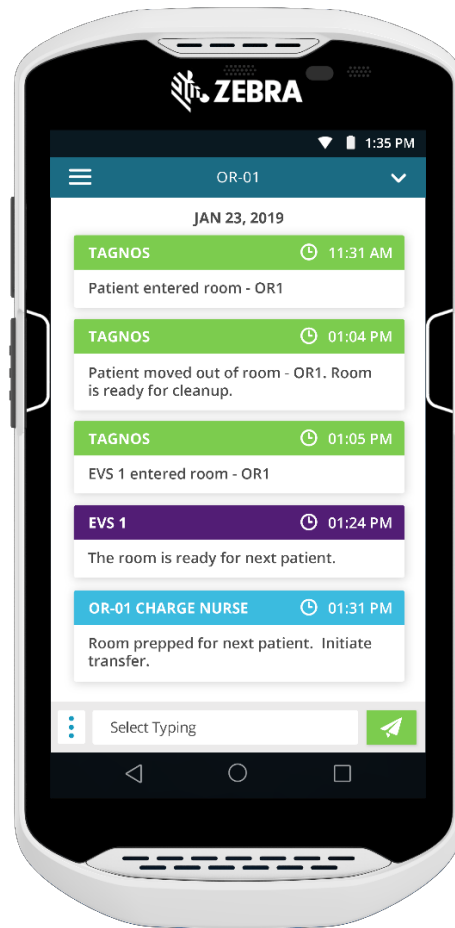


Figure 2. Smart phone menus are used to broadcast status and requests.

RFID is the most popular hardware used for electronic patient tracking. This technology is also referred to as RTLS (Real-time Location System) which encompasses designs using various electronic technologies combined with software to analyze and present the information. RFID uses an electronic microchip to store data. Various versions of it are used to tag items for identification and location information. Like most electronics, their cost has been decreasing to \$4 or less for single-use active RFID tags as their capabilities have increased. Patient tracking can also be done by staff entering patient information and location data into a computer system, but RFID provides the advantage of automatically capturing key events in the patient flow without interrupting patients or staff.

Having both RTLS on the patient and the smart phones for staff locating and timestamps adds synergy to the system. Such comprehensive information has resulted in very prompt turnaround time, particularly regarding EVS workflows. Previously, EVS would get into the room within 3-15 minutes. Now, on average, they arrive about the time the patient wheels out. The arrival time averages one minute before the patient wheeled out and 65% of the time they arrive on or before wheels out time. See Figure 3.

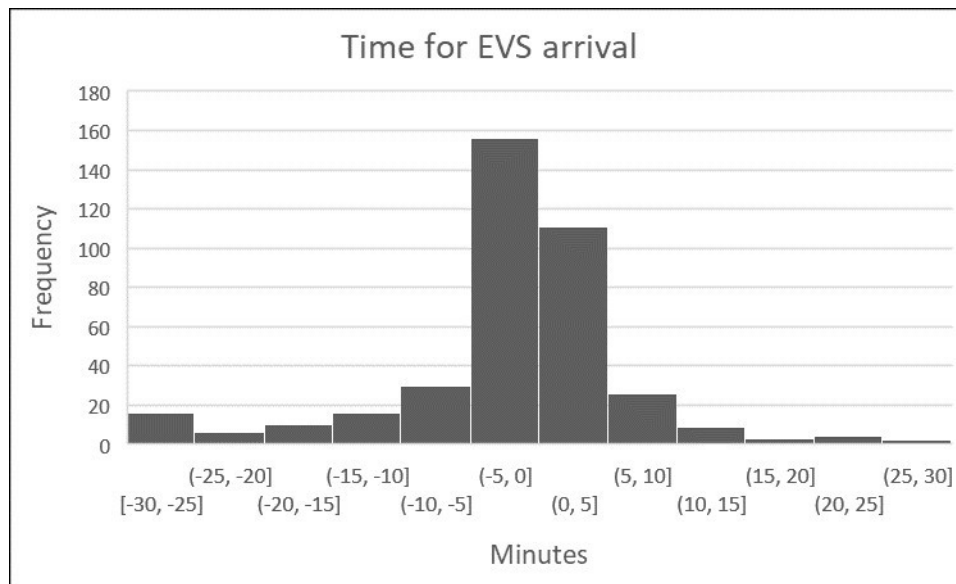


Figure 3. Time between patient wheeled out & EVS arrival. Negative time occurs when the EVS worker arrives before wheel out.

IV. Impact at the hospital – from an EVS perspective

The EVS function alone is one of many steps during room turnaround, but a very important one as it initiates the entire turnaround cycle. EVS steps include removing trash, wiping surfaces, cleaning the floor and other areas as necessary. Operating rooms can be large with lots of equipment so that the effort is more than just cleaning a ‘simple’ inpatient room. Nevertheless, the procedure for such cleaning is well established and the cleaning time is generally predictable and consistent. The primary constraint on this step is getting the EVS staff to the right OR as soon as it is available or cleared for cleaning. This means alerting EVS that a room is soon to be available for cleaning so they should gather necessary supplies and head to the room as close to WO as possible. Sometimes EVS can begin even before wheels out occurs.

Usually the most common delay related to EVS is not getting the appropriate EVS staff to the OR when needed. Hospitals have used various strategies. Increasing the EVS staff is one way but that is an added cost. Some hospitals add separate EVS supervision for the surgery areas and some have EVS staff dedicated to only surgery. That depends on if the number of ORs is large enough to support dedicated EVS staff and supervision. Based on this streamlined process, WMMC has required just 2 EVS staff members per shift for efficient turnaround in their main surgery units.

Probably the most cost-effective way to reduce turnaround time, yet requires minimal disruption to workflow and processes, is to provide prompt information to EVS that cleaning will soon be needed. Also, being able to capture and monitor the results of this timing is helpful in managing the turnaround process. EVS workflow event timing is usually not captured. However, with this technology application we can gain key insight into EVS patterns. More

importantly, it provides WMMC with hard metrics that they can track and benchmark going forward in their room turnaround improvements.

The data on room turnaround times after more than 4 months of implementation shows that the time of WO to WI is very short, under 30 minutes, for an urban acute care hospital with the mix of patients seen.⁵ The hospital reports that the measured turnaround time now averages three minutes shorter than previously and is decreasing.

The economic benefit can be determined based on the time saved. Surgery is a particularly expensive activity and can be looked at on a per minute⁶ basis. The resulting savings can be calculated.

Assuming the improvement reduces the turnaround time by 3 minutes
5 room turnarounds/day x 3-minute reduction x 6 operating rooms = 90 minutes/day
22 working days/month x 12 months x or 264 days
Using \$41 per minute means (90 x 264 x 41) = \$974,160 as the annual savings
resulting from use of TAGNOS device to improve room turnaround for EVS

V. Potential future impact

Having the ability to know the location of where all people and equipment are located creates opportunity for many future improvements in various room turnaround steps – including Anesthesia and BioMed workflows related to room turnaround, to name a few. Having an accurate and complete record of the time and location of staff, equipment and patients makes it possible to significantly improve and plan surgeries.

In terms of OR turnaround, EVS is a key element and deployment of this new communication platform removes EVS as a constraint and enables them to be a part of efficient turnaround operations. Many surgery and EVS managers believe a room cleaning of 15 minutes is regularly possible. OR turnaround can thus approach nearly 15 minutes by planning and coordination of the other elements. This provides a substantial benefit for the surgery function in reduced cost and substantially increased revenue from being able to do additional surgeries. While the goal of improving room turnaround is ultimately to create additional surgical capacity, streamlining something as simple as EVS “speed to room” allows them to end the day on-time and prevents additional use of labor and facility resources, including overtime charges.

¹ TAGNOS, 15 Enterprise Ave, Aliso Viejo, CA 92656

⁵ Overdyk, Frank J., et al. "Successful strategies for improving operating room efficiency at academic institutions." *Anesthesia & Analgesia* 86.4 (1998): 896-906. Reports about 50 minutes but of course the time depends on the mix of specialties served.

⁶ Childers, Christopher P., and Melinda Maggard-Gibbons. "Understanding costs of care in the operating room." *JAMA surgery* 153.4 (2018): e176233-e176233. They reported \$37 to \$37 in 2014 thus added for inflation.



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Dr. Belson has held positions in management and in consulting for over 30 years. He has held management positions with Ernst & Young, IBM and Universal Studios. He has been a member of the faculty in the USC Epstein Department of Industrial and Systems Engineering, The Price School and in the School of Cinema-Television. He has taught at UCLA and in several European universities.