Sentinel Effect in OR and IR

Stephen Lindley, M.S, M.B.A

Deisell Martinez, PhD

Deisell Research Institute and Consultants
Miami, Florida
USA

Robert Sumter, PhD
Executive Vice President and Chief Operating Officer
Regional Medical Center at Memphis
Memphis
Tennessee
USA

1.Introduction

When addressing organizational behavior in healthcare, the silos within the institution, the multiple layers of highly skilled professionals, and the diverse patient populations make improving productivity problematic. This challenge is exacerbated because many of these highly skilled professionals work in relative isolation with little interactions or understanding of other professions within the organization. These difficulties are magnified by a defined hierarchy within the institutions with physicians holding the highest clinical positions. With this hierarchical advantage and performance pressures, some physicians have developed behaviors that are disruptive to the functioning of the organization. Left unchecked these behaviors can manifest in a number of different ways. Disruptive behaviors have manifested in abuse of nurses (Higgins & MacIntosh, 2010; Holloway & Kusy, 2011), difficulties with patient care (Holloway & Kusy, 2011; Rosenstein & O'Daniel, 2005), derogatory comments about colleagues or with chronic lateness (Samenow, Worley, Neufeld, Fishel, & Swiggart, 2013). Disruptive behaviors in the healthcare organization are not limited solely to physicians, 50% of nurses reported abuse by other nurses (Felblinger, 2009). Organizationally, disruptive behaviors like these have been met with zero tolerance policies and Human Resources procedures for reporting and managing such behaviors. One disruptive behavior that has been observed but has not severe enough to warrant corrective actions is delays caused by physician timeliness. These time delays cause patients, nursing, and ancillary staff to wait for long periods of time before treatments can be performed, if the physician leading the treatment or procedure is not timely in arrival. Some delays are unforeseen or unavoidable because they are directly related to emergent patient cases, complications with previous patient procedures or misalignments in scheduling. Ultimately, all of these delays result in multiple layers of lost personnel productivity, equipment underutilization and decreased room utilization.

One scenario in which external causes for physician delayed can be minimized is with the first cases of the day. These first cases of the day are known as first case starts. First case starts are not influenced by backlog of patients, complications with cases in queue, or multiple layers of scheduling conflicts. The advantages to having a timely first case start is that it allows lag time between patients and allows for scheduling maneuverability of patients and procedures throughout the day. Conversely, a late first start utilizes all possible lag time before the first case has been initiated. If the scheduling was aligned for an early first case start and the physician is late, then nursing, ancillary staff and the treatment rooms were unproductive during this waiting period. This waiting time is an unnecessary cost for the hospital or health care organization.

To improve productivity, many have looked to the Hawthorne studies for a rapid solution or a quick win. The series of experiments from 1924 to 1933 at the Western Electric Company Hawthorne Plant provided several influential outcomes on the effect of working conditions and worker productivity, but the most enduring of these findings was the sentinel effect. The sentinel effect, sometimes known broadly as the Hawthorne effect, is the bias that occurs when people know that they are being studied (Borkowski, 2011) or watched.

This bias or change in behavior alluded by the sentinel effect has been noted in a number of different industries, including healthcare. One of the main areas that behavior has been changed in healthcare and has been attributed to the sentinel effect is with hand washing or hygiene (Erasmus, Daha, Brug, Richardus, Behrendt, & Vos, 2010; Kohli, Ptak, Smith, Taylor, Talbot, & Kirkland, 2009; Mertz, Dafoe, Walter, Brazil, & Loeb, 2010). The implications of the sentinel effect during data collection cannot be ignored (Erasmus, Daha, Brug, Richardus, Behrendt, & Vos, 2010) and may diminish over time (Mertz, Dafoe, Walter, Brazil, & Loeb, 2010) but could be useful if compliance is sustained (Kohli, Ptak, Smith, Taylor, Talbot, & Kirkland, 2009) with the proper feedback loops.

The findings in our study were an unexpected outcome when implementing departmental Six Sigma interventions within a 631-bed urban hospital with a level one trauma unit. Both the operating room (OR) and Interventional Radiology (IR) were experiencing separate delays with first case starts for their respective areas. Their common goal was to beginning patient treatments or interventions at 7:30 a.m. daily. When performing the structured data-driven Six Sigma Define, Measure, Analyze, Improve, Control (DMAIC) approach, both areas had reached or exceeded their goals of first case starts before Six Sigma improvements were implemented. These improvements in productivity can be traced back to the sentinel effect made popular by the Hawthorne Studies.

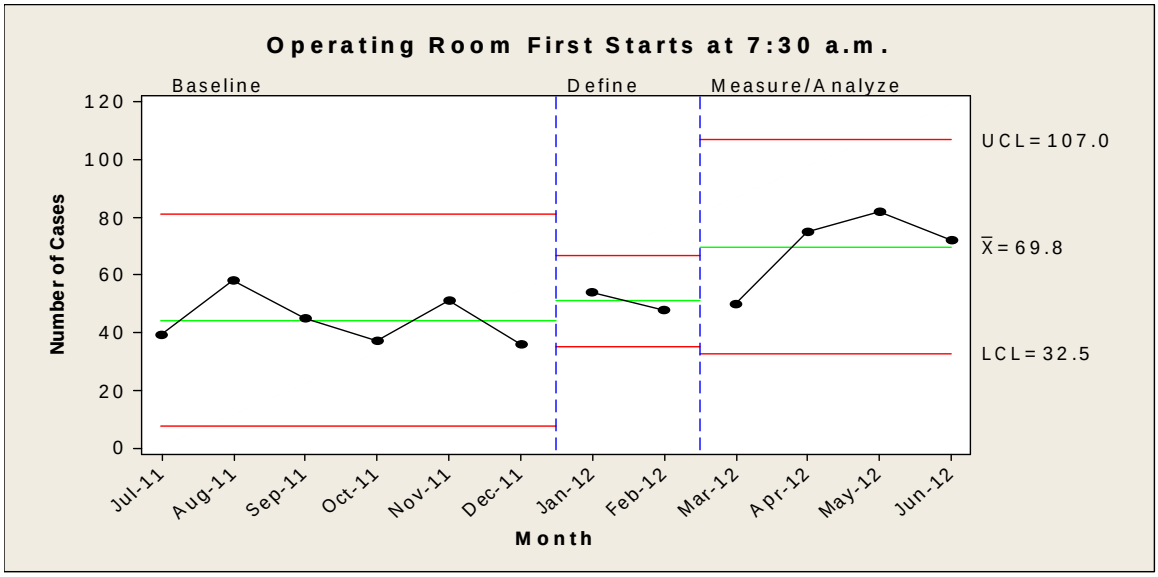
2.Findings

As described above, the hospital in which both of these Six Sigma interventions were being undertaken was The Regional Medical Center at Memphis, TN - a 631-bed community hospital that has numerous specialty clinics and was a level one trauma center. The Six Sigma interventions for OR and IR were initiated in January and July of 2012, respectively, using DMAIC for each of the areas. Historical data for the critical factors were evaluated and cause and effect relationships were explored. Baseline measurements for operational baselines were gathered and critical areas were identified for process improvement. Prior to implementation of these process improvements, continued measure of their critical to quality metric (i.e. first case start time) began to change substantially.

2.1 Operating Room

Normality testing of first case start data indicates the data is normally distributed for the twelve month interval (AD = 0.427, p = 0.261). Further evaluation of the number of 7:30 a.m. first starts in the OR, the ANOVA (α = 0.05) indicates a significant difference (F = 7.26, p = 0.013) between the Six Sigma phases. A control chart of these phases is presented in Figure 1. Post Hoc testing using the Tukey Method indicates there is no statistical difference between the Baseline (mean = 44.33, SD = 8.76) and the Define phase of Six Sigma (mean = 51.0, SD = 4.24). This is not surprising since during the define phase the focus is on team development, establishing high level processes and establishing the 'voice of the customer' through proactive and reactive mean. In the Define phase, there is little direct measurement being taken of the processes under question. In this case, first case starts.

Figure 1: Control Chart of 7:30 a.m. First Starts for the Operating Rooms

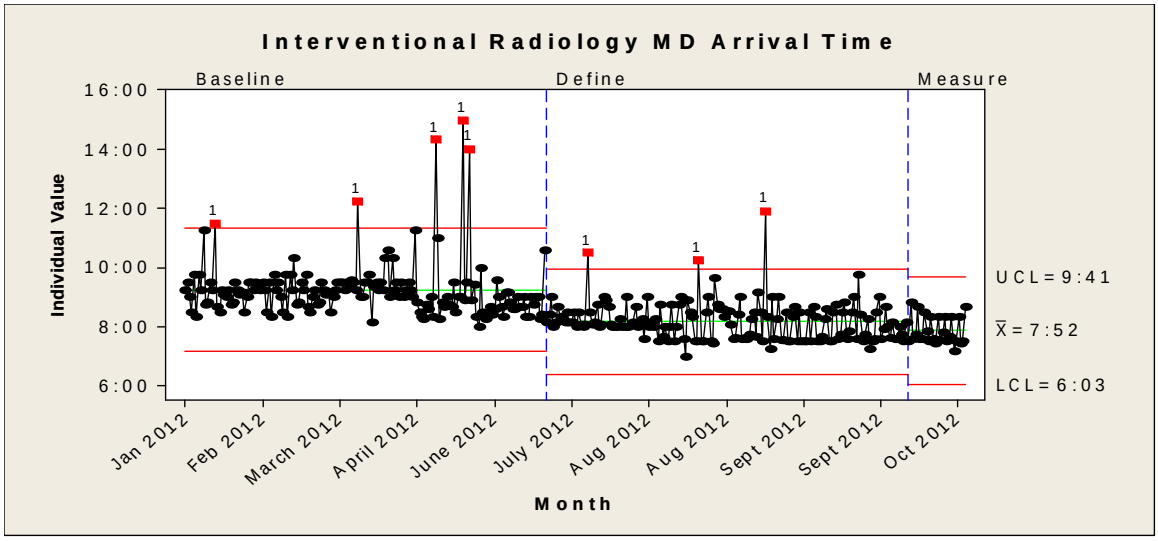


Conversely, during the Measure and Analyze phases the process is held up to increasing scrutiny without implementation of improvements. Post Hoc testing of the first case start data indicates that there is a statistical difference between the Define phase and the Measure and Analyze phases (mean = 69.75, SD = 13.82) with an individual confidence level of 97.91%. This was an interesting development since there was no implementation of improvements. The only change during this period was feedback on raw data for surgical starting time to the physicians via a communication board outside the employee entrance to the OR.

2.2 Interventional Radiology

Statistical evaluation of the time of first starts for IR using an ANOVA indicates there is a significant difference ($F = 12.16$, $p < 0.001$). The Baseline starting times (Mean = 9:14 a.m., SD = 0:25 min), Define (Mean = 8:10 a.m., SD = 0:31 min), and Measure (Mean = 7:52 a.m., SD = 0.020) phases of Six Sigma. The control chart for these three phases indicate that there were several points at which the first case start process was approaching the upper control limits or had exceeded these limits during the Baseline time period (Figure 2). The frequency of approaching or exceeding the upper control limits had diminished during the Define phase, even with the decrease in the control values. Once the project had reached the Measure phase, the control limits had shifted downward again and the first case start process had been stabilized with no points exceeding the control limits.

Figure 2: Control Chart for Time of First Starts in Interventional Radiology



Further evaluation using Tukey Method for grouping (simultaneous confidence level = 99.95%) indicates the Baseline time of first start was significantly later than the Define phases of Six Sigma. There was no statistical difference between the Define phase, Measure phase (Mean = 7:52 a.m., SD = 1:42 hrs), Analyze phase (Mean = 7:42 a.m., SD = 0:39 min), and Improve phase (Mean = 7:40 a.m., SD = 0:50min). However, there was a significant drop between the above Six Sigma phases and the Control phase (Mean = 7:18 a.m., SD = 0:28 min).

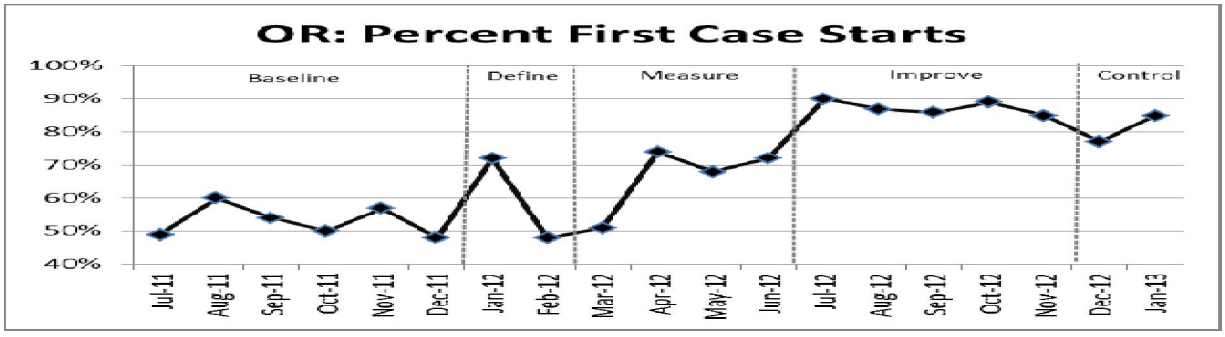
3. Discussion

Both OR and IR had a significant change in number and time, respectively, for first case starts before any Six Sigma process improvements could be implemented. This change can be attributed to the sentinel effect described in the Hawthorne Studies. Once the physicians understood that their performance was monitored on a daily basis, their behavior quickly changed to comply with established guidelines. The viewing of OR performance indicators by colleagues and staff influenced behavioral change prior to process improvements could be implemented. For the IR, the only change noted during the Measure phase was lab work was scheduled the night before the procedure, the physicians were assured that staff would be allocated for their first case starts before 7:30 a.m., and that the time for first case starts were being monitored. These were the only changes noted for either Six Sigma project during the initial phases of each project. Therefore, the significant changes were not due to major process improvements within the systems, so the changes were due to other forces. These other forces can be attributed to the sentinel effect. The remaining question is whether these improvements can be maintained without slippage.

The interaction between administrator's social influence, the physician identification with the hospital organization and the physicians' identification with other physicians can influence a new work behavior (Hekman, Steensma, Bigley, & Hereford, 2009) and may be provided through the use of viewed performance measures. Since passive observation alone may lead to habituation and decreased change behavior, feedback is needed to maintain adherence (McAteer, et al., 2007). Feedback loops on performance measures are built into the Six Sigma Control phase and can be the driver for the maintenance of improvements and habituation to the new level of performance. These feedback loops cannot be solely monitored by the administration, since physicians tend to view administrators as more interested in the business aspects of the organization rather than the patients. Public or staff consumption of this information may be a simple driver of change disruptive behavior demonstrated by physicians. The solution may be as simple as any activity of intervention that raises a physician's self-awareness about lapses in professional behavior (Samenow, Worley, Neufeld, Fishel, & Swiggart, 2013).

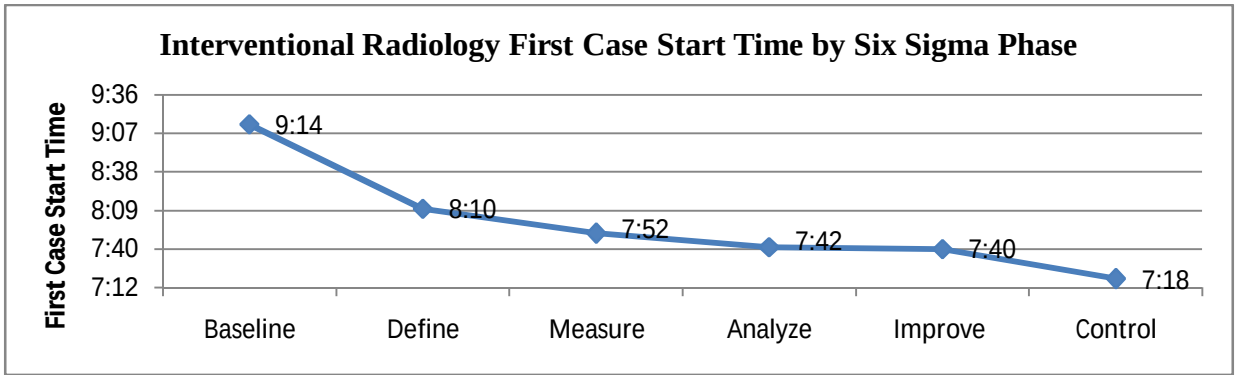
In our study, maintaining first start time level and increases in physician compliance has continued in both of the projects into the control phases. When evaluating the percentage of OR first case starts, the percentage has increased from a Baseline of 54% to the Control phase metric of 81% (Figure 3). The rapid rise of first case starts in the Measure phase had peaked in the Improve phase and has been sustained with minimal slippage in the Control phase. This could indicate that the control phase of Six Sigma could be used as a practical mitigation for the theoretical long-term sustainability of the sentinel effect (Kohli, Ptak, Smith, Taylor, Talbot, & Kirkland, 2009). The feedback loop the OR initiated was posting weekly and longitudinal first case start data for each physician and the cumulative data for each physicians group on a bulletin board at the staff entrance to the OR suites. This performance data became a topic of discussion and a motivating factor for many physicians and physicians groups through competition and the awareness that they were being scrutinized. Later know as by physicians and staff as the "wall of shame", the performance data has continued to be a motivating factor for compliance with 7:30 first case starts.

Figure 3: Percentage of OR First Case Starts before 7:30 a.m.



Interventional Radiology has also been able to sustain their improvements and have exceeded their initial goal of maintain a 7:30 a.m. average for first case start (Figure 4). The initial baseline of 9:14 a.m. had decreased to 7:40 a.m. by the Improve phase of Six Sigma. Through continued monitoring and feedback to the physicians, the first case start time has decreased to 7:18 in the Control phase. Since no further adjustments have been made to the process, this additional decrease can be attributed to the monitoring of the process, the feedback to the physicians and the sentinel effect.

Figure 4: Average First Case Start Times by Six Sigma Phase



4. Conclusion

Disruptive behaviors by physicians cause many levels of discord within the hospital environment. These disruptions manifest as aggressive and passive aggressive behaviors. Many of the aggressive behaviors have been successfully remediated through administrative and educational controls, but one of the passive aggressive behaviors that have been overlooked by administrators is chronic lateness. In the implementation of Six Sigma projects in a major regional hospital, a phenomenon known as the "sentinel effect" was noted in two projects where chronic lateness was an issue. As the physicians became aware that they were being monitored for timeliness of starting their first cases of the day in the Operating Room and in Interventional Radiology, compliance with goals for 7:30 a.m. first case starts began to align. Although the significant change in compliance could not be directly related to the interventions provided through Six Sigma, the feedback loops provided in the Control phase of Six Sigma has maintained improvements to the system and minimized diminishment over time (Mertz, Dafoe, Walter, Brazil, & Loeb, 2010) and sustain gains (Kohli, Ptak, Smith, Taylor, Talbot, & Kirkland, 2009). These findings suggest that Six Sigma projects may provide an added sentinel effect for physician performance and allow for controls to maintain this performance beyond the medical process within a hospital setting.

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