Implementation of an Operating Room Efficiency and Analytics Program in an Established Ambulatory Surgery Center: Improving Workflow Efficiencies

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INTRODUCTION:

The operating room (OR) is a major driver of revenue within hospital systems, and the primary revenue stream for ambulatory surgical centers (ASC). Inefficiencies within the OR contribute to scheduling delays, poor resource utilization, and excessive expenditures, thus reducing value to both the patient and the healthcare industry. The purpose of this study was to evaluate the implementation and continued use of an OR Efficiency and Analytics Program (OREAP) on surgical throughput and metrics of OR efficiency.

METHODS: This was a secondary analysis of time-stamped surgical workflow data collected by a cloud-based OREAP of all unilateral total hip (THA: n=106) and total knee arthroplasty (TKA: n=214) cases performed by a single, high-volume surgeon at an established ASC between October 3rd, 2023 and April 30, 2025. Three epochs were identified: a diagnostic phase whereby surgical procedures were timestamped in the OREAP (October 2023 through January 2024), a working phase where OREAP data was assessed and an efficiency improvement program was implemented (January 2024 through August 2024), and a follow-up phase (August 2024 through April 2025). Efficiency metrics of interest included total OR time (wheels-in to wheels-out), incision to implant, incision to close, wheels-in to incision, OR turnover, and surgeon turnover times. Total OR time was plotted across time and a logarithmic line of best fit was applied. Efficiency metrics were compared between diagnostic and working and diagnostic and follow-up phases with an independent samples t-test. To adjust for multiple comparisons, statistical significance was established at $p<0.0025$.

RESULTS:

For TKA there were significant differences in OR time between the diagnostic and follow-up phase (50.0±6.7 vs. 43.5±6.0 min, $p<0.0001$), but not the diagnostic and working phase (50.0±6.7 vs. 47.4±7.6 min, $p<0.0964$, Figure 1). Significant differences were found between the diagnostic and follow-up phases for incision to implant (23.9±3.9 vs. 19.1±4.0 min, $p<0.0001$), incision to closing (24.6±4.0 vs. 20.6±4.0, $p<0.0001$), wheels-in to incision (10.8±3.9 vs. 8.6±2.7 min, $p=0.0003$), and surgeon turnover time (32.7±25.1 vs. 20.0±10.6, $p<0.0001$). For THA, there was a non-significant trend for shorter OR time in the follow-up phase compared to the diagnostic phase (45.7±7.3 vs. 39.4±9.4 min, $p=0.0051$, Figure 2). Wheels-in to incision (10.8±2.6 vs. 7.7±2.4 min, $p<0.0001$) and surgeon turnover (27.4±8.6 vs. 8.3±13.3 min, $p=0.0023$) times were significantly less in the follow-up compared to diagnostic phase.

Figure 1. Scatter plot of wheels-in to wheels-out TKA times (blue) across diagnostic (A), working (B), and follow-up (C) phases with the line of best fit (red).

Figure 2. Scatter plot of wheels-in to wheels-out THA times (blue) across diagnostic (A), working (B), and follow-up (C) phases with the line of best fit (red).

DISCUSSION AND CONCLUSION: The use of timestamped surgical data coupled with OREAP compliance was associated with a reduction in OR time of approximately 6.3 to 6.5 min in THA and TKA, respectively, by a high-volume surgeon at an established ASC. Additionally, surgeon turnover times decreased by approximately 19.1 min and 12.7 min in THA and TKA, respectively. The primary drivers of efficiency in this study were linked with the adoption of parallel workflows among the surgical team, streamlining intra-operative procedures, and a decreased administrative burden in pre-operative holding. Future research is necessary to evaluate the sustainability of the program and determine the plateau in proficiency associated with an OREAP.