

# Use of multidisciplinary positive deviance seminars to improve efficiency in a high-volume arthroplasty practice: a pilot study

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**Background:** Positive deviance (PD) seminars, which have shown excellent results in improving the quality of surgical practices, use individual performance feedback to identify team members who outperform their peers; the strategies from those with exemplary performance are used to improve team members' practices. Our study aimed to use the PD approach with arthroplasty surgeons and nurses to identify multidisciplinary strategies and recommendations to improve operating room (OR) efficiency.

**Methods:** We recruited 5 surgeons who performed high-volume primary arthroplasty and had participated in 4-joint rooms since 2012, and 29 nurses who had participated in 4-joint rooms and in at least 16 cases in our data set. Three 1-hour PD sessions were held in February and March 2021: 1 with surgeons, 1 with nurses, and 1 with both surgeons and nurses to select recommendations for implementation. The sessions were led by a member of the nonorthopedic surgical faculty who was familiar with the subjects discussed and with PD seminars. To determine the success of the recommendations, we compared OR efficiency before and after implementation. We defined success as performance of 4 joint procedures within 8 hours.

**Results:** Eleven recommendations were recorded from the session with nurses and 7 from the session with surgeons, of which 11 were selected for implementation. During the month after implementation, there were great improvements across all time intervals of surgical procedures, with the greatest improvements seen in mean anesthesia preparation time in the room (4.51 min [26.3%]), mean procedure duration (9.75 min [14.0%]) and mean anesthesia finish time (5.78 min [44.0%]) (all  $p < 0.001$ ). The total time saved per day was 49.84 minutes; this led to a success rate of 69.0%, a relative increase of 73.8% from our 2012–2020 success rate of 39.7% ( $p < 0.001$ ).

**Conclusion:** The recommendations and increased motivation owing to the individualized feedback reduced time spent per case, allowing more days to finish on time. Positive deviance seminars offer an inexpensive, efficient and collegial means for process improvement in the OR.

**Contexte :** Les séminaires de déviance positive (DP), une approche qui a déjà donné d'excellents résultats en termes d'amélioration de la qualité des pratiques chirurgicales, recourent à la rétroaction sur le rendement individuel pour identifier les membres des équipes dont le rendement excède celui de leurs pairs; les stratégies associées à tout rendement exemplaire servent à améliorer les pratiques des membres des équipes. Notre étude visait à utiliser la DP comme approche pour les chirurgiennes et chirurgiens et le personnel infirmier spécialisés en arthroplastie afin d'identifier des stratégies et des recommandations multidisciplinaires pour améliorer l'efficacité des blocs opératoires (BO).

**Méthodes :** Nous avons recruté 5 spécialistes dont le volume d'interventions pour arthroplastie primaire était élevé et qui œuvraient dans des blocs à 4 interventions chirurgicales depuis 2012, et 29 membres du personnel infirmier ayant participé à la même cadence d'interventions et à au moins 16 cas de notre ensemble de données. Trois séances d'une heure ont eu lieu en février et mars 2021 : 1 avec les chirurgiens, 1 avec le personnel infirmier et 1 avec les 2 équipes pour choisir les recommandations à mettre en œuvre. Les séances étaient animées par un membre de la Faculté de chirurgie (non orthopédique) qui connaissait les sujets abordés et les séminaires de DP. Pour déterminer la réussite des recommandations, nous avons comparé l'efficacité des BO avant et après leur mise en œuvre. La réussite se définissait par la réalisation de 4 arthroplasties en 8 heures.

**Résultats :** Onze recommandations ont été dégagées de la séance avec le personnel infirmier et 7 de la séance avec les chirurgiennes et chirurgiens; 11 ont été retenues en vue de leur application. Durant le mois suivant leur mise en œuvre, la durée des interventions s'est grandement améliorée; les améliorations les plus marquantes concernaient la durée moyenne de la préparation de l'anesthésie au bloc opératoire (4,51 min [26,3 %]), la durée moyenne des interventions (9,75 min [14,0 %]) et le temps de réveil moyen (5,78 min [44,0 %]) (tous  $p < 0,001$ ). Le temps total gagné quotidiennement a été de 49,84 min; le taux de réussite a donc été évalué à 69,0%, correspondant à une augmentation relative de 73,8% par rapport à notre taux de réussite en 2012–2020 de 39,7% ( $p < 0,001$ ).

**Conclusion :** Les recommandations et la motivation accrue découlant de l'exercice de rétroaction individualisée a réduit le temps requis pour chaque cas et a permis de terminer plus de journées à temps. Les séminaires de DP sont une façon peu coûteuse, efficace et collégiale d'améliorer les procédés au bloc opératoire.

**D**elivery of health care is coming to an inflection point in regard to supply and demand, with joint replacement demand in Canada increasing from 2014 to 2019 by 20.1% for hip replacement and 22.5% for knee replacement.<sup>1</sup> Increasing demand, combined with delays related to the COVID-19 pandemic, has created a large backlog of surgical procedures, especially in countries with universal health care like Canada and the United Kingdom, where efficient delivery of health care is even more critical.<sup>2–4</sup> Prolonged surgical wait-lists are further compounded by systemic inefficiencies: in North America, health care functions at a productivity level of about 43%; in the surgical care setting, inefficient use of time and space accounts for 30% of costs.<sup>5</sup>

To address this, various initiatives to increase throughput, such as high-efficiency operating rooms (ORs) and parallel processing with anesthesia block rooms, have been suggested.<sup>6</sup> At our institution, to address wait times and increasing demands, 4-joint rooms were instituted in 2004, but successful completion of 4 joint replacement procedures within the assigned OR time (i.e., 4 joints between 0730 and 1530) has been inconsistent.<sup>7</sup> This lack of efficiency, with overtime and lack of improvement, can lead to staff disengagement, fatigue and a sense of impossibility of the task at hand.<sup>8</sup>

To foster self-improvement and staff engagement to work as a team, various models of team efficiency have been developed using the Lean method, Six Sigma and process mapping, which can be quite effective but very resource intensive.<sup>9,10</sup> An alternative approach that has shown excellent results in improving the quality of individual surgeon practices is positive deviance (PD) seminars,<sup>11,12</sup> which use individual performance feedback to identify team members who outperform their peers. The strategies from those with exemplary performance are used to both motivate peers and improve the practices for all. Positive deviance has been effectively used in health care, public health, education and the private sector.<sup>13</sup> Positive deviance seminars focus on individual strengths and resources already present, instead of negatives that require improvement. Implementing the strategies is feasible and sustainable, as they are already in place and successful.

To our knowledge, PD seminars have not been studied in a multidisciplinary setting to improve OR performance and efficiency. Our study aimed to use the PD approach with arthroplasty surgeons and OR nurses to identify multidisciplinary strategies and recommendations to improve OR efficiency in running a single room to perform 4 primary joint replacement procedures within an 8-hour window.

## METHODS

### *Study design and setting*

Three 1-hour PD sessions were held in February and March 2021: 1 with surgeons, 1 with nurses, and 1 with both surgeons and nurses to select the recommendations for implementation. We recruited 5 surgeons, including P.E.B., who performed high-volume primary arthroplasty and had participated in 4-joint rooms since 2012. The 29 nurses selected for the study were those who had participated in 4-joint rooms and in at least 16 cases in our data set (prospectively recorded surgical records). The sessions were led by a member of the nonorthopedic surgical faculty (A.J.E.S.) who was familiar with the subjects discussed and with PD seminars to allow for a moderated discussion and avoid conflict.

Performance based on historical data for finishing on time (i.e., by 1530) as well as specific time intervals were shared with the respective individuals. The sessions first identified the PD strategies using provider-specific reports. Afterward, a confidential group interview gave all participants the opportunity to discuss the strategies they used that led to their success. At the end of the sessions, all the recommendations were voted on, and those with a unanimous vote were selected for implementation. The recommendations were implemented in the week after the last PD session.

### *Measures*

The time interval data were recorded by the circulating nurse using the Surgical Information Systems. In addition,

patient demographic characteristics (age, gender, body mass index, American Society of Anesthesiologists class), adverse events, nurse, anesthesiologist, 90-day readmissions and type of anesthetic used were collected. The time intervals used to determine OR efficiency were a modified version of those defined by the Association of Anesthesia Clinical Directors:<sup>14</sup> anesthesia preparation time; patient in room to anesthesia ready, surgical preparation time; anesthesia ready to procedure start, procedure duration; (procedure start time to procedure finish), anesthesia finish time; procedure finish to patient out of room, and turnover time; start of room cleanup to patient in room. The anesthesia preparation time immediately follows turnover time, as no delays are expected once the room is ready for the next case.

After the recommendations were implemented, the surgeons and nurses completed a survey on each 4-joint day to determine compliance with the recommendations and give feedback on their perception of the usefulness of the recommendations.

### Statistical analysis

To determine the success of the PD sessions, we tested the strategies as a hypothesis in the prospective cohort. We determined whether the strategies improved time efficiency by comparing the time intervals observed in the prospective cohort to those previously observed. We used a paired *t* test to compare differences in mean interval times and rate of success in finishing on time between the pre- and postintervention groups.

### Ethics approval

The Ottawa Health Science Network Research Ethics Board granted an ethics review exemption given that the project was considered to fall under continuous quality improvement rather than human subject research, as per Canada's Tri-Council Policy Statement on Ethical Conduct for Research Involving Humans.<sup>15</sup>

## RESULTS

A total of 11 recommendations were recorded from the nurses' session and 7 from the surgeons' session (Box 1). Of the 18 recommendations, 11 were selected for implementation based on the combined session with nurses and surgeons:

- Recommendation 1: As a team, take time at the beginning of the day (at 0745, led by orthopedic staff or fellow) to go over the basics of the day's 4 cases.
- Recommendation 2: For 4-joint days, have a nursing team familiar with 4-joint rooms who have received total joint training. The team lead (care facilitator) should have adequate time for registered nurse training and administration (mechanism to be determined).

### Box 1. Suggested recommendations from sessions with surgeons and nurses

#### Surgeons

- Be there from positioning to patient transfer from the table.
- Have a standardized/protocolized approach for each type of procedure.
- Anticipate next steps, calling for instruments/implants.
- Assist with turnover and putting away instruments, but in a way that is supported by nurses.
- Institute an incentivization for the entire team to be done by 1530, and that would drive efficiency.
- Bring the patient into the room for spinal preparation such that instruments may be opened simultaneously (in parallel rather than in series).
- Anesthesia does the blocks and spinals in the procedure room.

#### Nurses

- Have an engaged, familiar team working together.
- Have equipment ready to go before the patient enters the room.
- Whole team (nursing, surgery, anesthesia) is present during turnover.
- Begin putting away instrumentation during closing.
- Have experienced, knowledgeable scrub nurses who know the steps to the procedure and will know when certain instruments (implants) are needed.
- Have attendants available to help with turnover.
- Ensure nurses in the room have received total-joint training.
- Minimize telephone call interruptions from the pre- and postanesthesia care units during the case.
- Ensure attending available for prepping. Make use of free staff in room when prepping/positioning. Ensure no revision of surgical positioning.
- Team lead must have adequate time for training and administration.
- Ensure improvements in efficiency do not come at the cost of patient outcomes.

- Recommendation 3: Surgeon should be there for each case, from positioning to patient transfer from the table.
- Recommendation 4: Adopt a standardized approach for each type of procedure.
- Recommendation 5: Surgeon to review all 4 cases in advance to avoid last-minute changes on the day of surgery that require additional instruments that were not ordered.
- Recommendation 6: Bring the patient into the room for spinal preparation such that instruments may be opened simultaneously in parallel rather than in series with anesthesia preparation. However, ensure surgery and anesthesia have reasonable expectations of nurses during this period and have communicated with nurses.
- Recommendation 7: Anticipate next surgical steps. Call for instruments/implants in advance (and ensure fellows are doing this as well).
- Recommendation 8: Augment and facilitate putting away instruments during closure in the most efficient manner possible. Surgeons are encouraged to offer assistance with putting away instruments in coordination with the nursing staff.
- Recommendation 9: Change culture of multiple telephone calls to surgical team in the OR with questions. Have fellows contact the pre- and postanesthesia care units between cases to minimize need for telephone calls during cases.

- Recommendation 10: Have the whole team, including OR attendants, present in OR during turnover.
- Recommendation 11: Attendants should close communication loop with nursing team to ensure equipment (e.g., general equipment in the room, suction available, correct bed, extension cord for the bed) is ready to go at the start of each case.

During the month after the recommendations were implemented, there were great improvements across all time intervals of surgical procedures (Table 1). The greatest improvements were seen in mean anesthesia preparation time in the room (4.51 min [26.3%]), mean procedure duration (9.75 min [14.0%]) and mean anesthesia finish time (5.78 min [44.0%]) (all  $p < 0.001$ ). Although each improvement seems small, the improvements totalled an average of 12.48 minutes per case, or 49.84 minutes per day. The total time saved was substantial, as it led to a success rate of 69.0%, a relative increase of 73.8% from our 2012–2020 success rate of 39.7% ( $p < 0.001$ ).

**Compliance and feedback**

All 5 surgeons and 18 nurses completed the survey. The recommendations were all well received by the participants.

**Recommendation 1**

Team members did not follow this recommendation consistently. The only feedback was that this recommendation is redundant when the same operations are being performed consistently.

This really doesn't impact on a 4–primary-joint day, as all team members know what is being done as we do over a thousand of these each year. So, meeting to say we are doing 4 primary joints is a bit redundant in my opinion and won't make the day run any faster. (Surgeon [success])

Not for the 4 cases but the nurses know what to do when we have to do 4 joints with [the surgeon for these cases]. (Nurse [success])

**Recommendation 2**

All participants agreed that having nursing staff members who are familiar with the intricacies of total joint replacement was highly valuable. Participants indicated that it facilitated better teamwork in the OR, which led to everyone feeling less rushed.

**Recommendation 3**

Having the surgeon present in the room while the patient was being positioned was appreciated by nursing. On a day when the nurse had to call the surgeon for every patient to be positioned, the day did not finish on time.

**Recommendation 4**

Recently at our centre, as part of another initiative, we reduced the number of instrument trays to speed up the process in the OR and reduce waste (SLIM study<sup>16</sup>). Nursing felt this initiative improved efficiency in the OR substantially. In addition, on days on which all 4 patients were positioned the same (i.e., lateral decubitus), it simplified preparing for the case and positioning the patient.

**Recommendation 5**

Participants indicated that, on days on which cases were not reviewed in advance or were not relayed to the whole team, the day did not finish on time. Last-minute changes led to having the wrong equipment available, which led to delay in retrieving and opening a new equipment tray.

**Recommendation 6**

The most common feedback was regarding parallel processing; this was mentioned 11 times in the comments. On days on which parallel processing occurred, participants felt less rushed, and the days consistently finished early. Even on days with unexpected delays, parallel processing allowed for the day to finish on time. An issue with parallel processing is that anesthesia and nursing need to work as a team to allow this process to happen. On 1 instance, a lack of communication with anesthesia and nursing led to delays in patients' entering the room. There was no

**Table 1. Observed changes in operating room performance after positive deviance sessions\***

Facet of performance	Mean		Variance		Pooled variance	Hypothesized mean difference	df	t stat	p (T ≤ t) 1-tail†	t critical 1-tail
	After	Before	After	Before						
Success rate, %	0.65	0.40	0.23	0.24	0.24	0	792	3.74	<b>0.83</b>	1.65
APT, min	36.51	39.33	129.08	414.74	394.54	0	792	-1.03	0.15	1.65
APT in room, min	12.42	16.28	100.29	56.92	59.99	0	792	-3.63	<b>0.00</b>	1.65
SPT, min	12.63	14.39	54.12	28.79	30.58	0	792	-2.32	<b>0.01</b>	1.65
Time per case, min	59.62	69.33	154.36	296.15	286.12	0	792	-4.17	<b>1.67</b>	1.65
SFT, min	5.15	5.48	5.58	16.30	15.54	0	792	-0.62	0.27	1.65
AFT, min	7.30	13.25	15.08	50.15	47.67	0	792	-6.27	<b>2.99</b>	1.65
Turnover, min	26.64	24.21	63.09	69.60	69.14	0	792	2.12	<b>0.02</b>	1.65

AFT = anesthesia finish time; APT = anesthesia preparation time; df = degrees of freedom; SFT = surgical finish time; SPT = surgical preparation time.  
 \*Number of observations = 57 after, 737 before.  
 †Bolded numbers indicate significant values.



coordination between the anesthesia procedure room and the OR; thus, the patient would wait for some time outside the OR, which led to delays and potential issues with the spinal dosage. In addition, 1 nurse mentioned the difficulty in properly teaching orientees while assisting with anesthesia with induction.

On days on which parallel processing did not occur, the surgeons felt more rushed. There were more perceived delays and idle time between cases.

I had the most efficient anesthetist at our campus, and my OR surgical times from start to finish were all under an hour, at 53, 59, 56 and 54 minutes for the 4 cases. With all of that, we ended the day at 3:25 pm, leaving a whole 5 minutes to spare!! (Surgeon [success])

#### **Recommendation 7**

Participants indicated that next surgical steps were anticipated on most occasions. There was no feedback specific to this recommendation.

#### **Recommendation 8**

Participants noted that surgeons always assisted with cleaning up after cases. Although the assistance of surgeons in cleanup was appreciated, the fewer and slimmed-down instrument trays reduced the requirement for additional assistance for cleanup.

#### **Recommendation 9**

Participants indicated that the need for telephone calls during cases was minimized on most occasions; on other occasions, they were unsure.

#### **Recommendation 10**

Participants noted that the whole team, including OR attendants, were present in the OR during turnover 3 out of 8 times (38%). On 2 of the days when the whole team were not present, the day finished late. Several participants mentioned great appreciation for the presence of more nurses.

Having a minimum of 3 nurses (2 circulating, 1 scrub) is essential. (Nurse [success])

It was nice to have 2 RNs and 1 RPN scheduled in the 4-joint day. (Nurse [success])

#### **Recommendation 11**

Participants indicated that attendants always closed the communication loop with the nursing team to ensure that equipment was ready to go at the start of each case.

### **DISCUSSION**

Positive deviance seminars are a simple yet effective and inexpensive means to facilitate collaboration across multiple

disciplines in order to improve a process by learning by top performers, in our case, a high-volume arthroplasty practice. Our pilot study showed promising improvements in efficiency in the OR with the use of recommendations derived from PD seminars. Every stage of the surgical procedure except turnover showed substantial improvements compared to our mean performance in the previous 8 years. In addition to generating recommendations, the seminars gave participants the opportunity to review and reflect on their performance. Improved efficiency is not only relevant financially but also shortens wait times, since longer wait times are associated with prolonged recovery and decreased patient satisfaction,<sup>17,18</sup> as well as poor health care provider experience.<sup>8,19</sup>

Quality delivery of care involves many processes and can be assessed and improved through 3 sequential and interrelated dimensions: structures, processes and outcomes.<sup>20</sup> As health care is always evolving, with advances in technology, procedures and medical knowledge, the need for a “plan, do, study, act” cycle is necessary whereby data can be analyzed and feedback provided constantly in order to continuously revise and improve.<sup>21</sup> The plan, do, study, act cycle forms the basis for continuous quality improvement, which encompasses processes associated with providing a health care outcome.<sup>22</sup> In this study, the PD approach fit well as a continuous quality-improvement initiative in which we structured a planning approach to evaluate current structures and processes of joint arthroplasty care in the OR to improve them and thus achieve the desired outcome and vision, i.e., finishing within an 8-hour OR shift.

Many of the current best-practice articles in the OR efficiency literature involve a thorough process analysis, which entails mapping the entire process of the OR, from the patient entering the hospital to exiting the hospital.<sup>9,10,23</sup> Unlike those initiatives, PD focuses on the positive outliers: what is being done optimally, not what could be improved. In merely 3 hour-long sessions, participants were able to derive effective strategies, which would have otherwise taken many months if being derived by analyzing the complete process. All the new measures were taken from practices and resources already in place, which made for simple implementation: the measures were implemented within a week after the seminars were completed. In addition, implementing solutions that are not already in place can create unintended consequences, and the solutions are often unsustainable in the long term.<sup>13</sup>

When surgeons are not involved with various stages of a study, they often choose not to participate.<sup>24</sup> Positive deviance seminars gave team members the opportunity to collaborate in many stages of this study, including data analysis, by determining who the best performers were, and discussing and creating new recommendations. With team members engaged in multiple stages of the study, almost all were enthusiastic to participate and improve

their practices. Positive deviance works particularly well with surgeons, as they are independent in practice and decision-making. Kim and Choi<sup>25</sup> identified that the most important factor in discovering innovative behaviours is the degree of independence that individuals have. Having independence allows employees to accept social risk by standing for their own ideas and disagreeing with coworkers in a positive manner.

We have previously reported that success rates of 4-joint rooms vary among surgeons, anesthesiologists and nurses.<sup>7</sup> By reviewing the practices of their peers, the participants in that study were able to identify gaps in their own practices and improve in the areas requiring focus. In addition, the present study shows that quantifying performance leads to improved motivation, as participants can understand how the time intervals of their practices compare to those of their peers and which areas of their practices require improvement. For example, a surgeon may perform a procedure faster than their peers but have the slowest positioning time. Identifying this issue might lead to the surgeon's placing more focus on ensuring that they are present in the OR during that time.

Although the morning huddle may feel redundant, its effectiveness is evident. Wright and colleagues<sup>23</sup> found that a common reason for delay of the first case was surgeon and anesthesiologist unavailability. By implementing a morning huddle, they were able to increase the rate of on-time starts from 53% to 69%.

### Limitations

This study has several limitations. It was carried out during the third wave of the COVID-19 pandemic, which led to cancellation of elective surgical procedures 1 month after the recommendations were implemented. In addition, during the monitoring period, the unique constraints of the pandemic may have led to a surgical environment that was not necessarily comparable to that before the pandemic. Some of the perioperative disciplines declined to participate in the seminars; full involvement of all disciplines would have improved the impact of the PD initiatives.

As in any study, the short time frame of monitoring is subject to confounding by the Hawthorne effect (a type of reactivity in which individuals modify an aspect of their behaviour in response to their awareness of being observed). As the nature of PD seminars does not allow for blinding, our studies could have not been designed in a way in which the participants were unaware of monitoring. However, this constant awareness likely contributed to increased motivation and effort. When we examined the results by individual surgeon, only 2 of the 5 surgeons showed an improvement in their success rates (64% to 81%, and 8% to 71%, respectively). Two surgeons did not perform any 4-joint rooms during the monitoring period, and 1 surgeon did not have any successful days.

One nurse shared that they felt rushed and that implementing all recommendations was unsustainable and too physically demanding. However, the overall consensus was that the recommendations made for a better team environment. Given the short duration of the monitoring period, a follow-up audit of OR efficiency would determine the sustainability and effectiveness of the recommendations.

### CONCLUSION

The recommendations generated by the participating nurses and surgeons in the PD seminars, together with increased motivation owing to the self-performance feedback, reduced time per operation significantly, which increased the daily success rate. Positive deviance seminars offer an inexpensive, efficient, collegial and positive means for process improvement in the OR setting.

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**Competing interests:** None declared.

**Contributors:** R. Gold, F. Al Zoubi, D. Garvin, D. Schramm and A. Seely designed the study. J. Brillinger and C. Kreviazuk acquired the data, which P. Fallavollita and P. Beaulé analyzed. R. Gold, F. Al Zoubi and D. Garvin wrote the manuscript, which J. Brillinger, C. Kreviazuk, D. Schramm, P. Fallavollita, A. Seely and P. Beaulé critically revised. All authors gave final approval of the article to be published.

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