Utilizing Previous Patient Opioid Experiences for Pain Plan Implementation: Role of Opioid Use Categorization on Inpatient and Outpatient Opioid Use, Length of Stay, Pain Scores, and Clinic Resource Utilization following Elective Spine Surgery
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INTRODUCTION:
A Pain Plan was implemented for all patients undergoing elective spine surgery at our institution. The Pain Plan is formulated collaboratively between the patient and the surgeon in clinic. The Pain Plan consists of intraoperative, postoperative, and planned discharge medications to address pain, and is referenced across all phases of care.

- Category 1 – No previous opioid experience
- Category 2 – Previous opioid experience with acceptable pain control and no side effects
- Category 3 – Previous opioid experience with unacceptable pain control and/or side effects
- Category 4 – Opioid use leading up to surgery

Category 3 and 4 patients generally require more time and effort in building the Pain Plan, as it is anticipated that postoperative pain management could be more difficult in these patients because of their previous unfavorable experiences with opioids or variable tolerances due to consistent preoperative opioid use.

The purpose of this study is to compare the different Pain Plan categories to determine if categorization is predictive of opioid use, hospital length of stay (LOS), patient-reported pain scores, and clinic resource utilization related to pain management.

METHODS:
This is a retrospective cohort study comparing the 4 different Pain Plan categories in patients undergoing elective spine surgery over a 1-year period (n = 313). Demographic data collected includes patient age, gender, BMI, ASA class, smoking history, alcohol or drug abuse history, insurance status, and anxiety or depression diagnosis. Surgical invasiveness indices (SII) were calculated for each surgery using a previously published and validated method. Inpatient opioid use and outpatient opioid prescriptions for 90 days postoperatively were tabulated and converted to morphine milliequivalents (MME) using the Center for Disease Control guidelines.

Primary outcome variables were inpatient opioid use, outpatient opioid prescription quantities, hospital length of stay (LOS), patient-reported pain scores, number of clinic communication encounters related to pain management, and communication encounter complexity.

Demographics and SII were compared between the 4 categories via ANOVA, Mann-Whitney U, or Chi-square tests to assess for underlying group differences. Age, surgeon, and SII were significantly different between groups and included as covariates. ANOVA models with covariates were fit to test for differences between groups. For LOS and both inpatient and outpatient opioid use, a log-transformation was used to ensure model assumptions were met. For number of encounters, a Poisson regression fit was used. Post-hoc two-way comparisons with Holm adjustment were examined for those outcomes with a significant ANOVA p-value.

RESULTS:
A regression model was used to control for patient age, surgeon, and SII covariates. There was no statistically significant difference in LOS among groups (Table 1). Inpatient opioid use and outpatient opioid prescription quantities were greatest in category 4, followed by categories 2, 3, and 1, respectively. Statistically significant differences were found for inpatient opioid use and outpatient opioid prescription quantities among groups. Category 4 patients had more than double the prescription quantities than the next highest category. Patient-reported pain scores showed statistically significant differences; as with inpatient and outpatient opioid quantities, the highest pain scores were seen in category 4 patients, followed by categories 2, 3, and 1, respectively. The number of clinic communication encounters was statistically significant for category 1 vs. 4 only. There were no statistically significant effects in any group on the number of steps required to complete a pain-related clinic communication encounter.

DISCUSSION AND CONCLUSION:
The Pain Plan was implemented to collaboratively address pain management with patients. This approach sets expectations and empowers the patient to be involved in the pain management aspect of their care. Patients were categorized based on previous opioid experience, and we expected that category 3 and 4 patients would require greater opioid quantities, report higher pain scores, and require more outpatient clinic resources than category 1 and 2 patients. This was consistent with our results for category 4 patients, but not for category 3 patients, who ended up using fewer opioids and had lower pain scores than category 2 patients. Category 3 and 4 patients required substantially more effort to build the Pain Plan, and we feel this extra effort is responsible for category 3 patients showing characteristics similar to category 1 and 2 patients. In addition, despite category 4 patients requiring more inpatient opioids and reporting
greater pain scores, there was no difference in the length of stay, which we feel is also attributable to the Pain Plan setting expectations for their hospitalization. In summary, Pain Plan implementation, particularly the use of categories when developing the plan, was shown to be a useful tool for postoperative pain management at our institution.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Category 1 n=87</th>
<th>Category 2 n=126</th>
<th>Category 3 n=48</th>
<th>Category 4 n=52</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOS - hours</td>
<td>8.6 (6.3 - 10.5)</td>
<td>29.8 (7.6 - 33.3)</td>
<td>30.5 (20.8 - 34.8)</td>
<td>30.1 (8.8 - 31.6)</td>
<td>0.262</td>
</tr>
<tr>
<td>Total opioids Inpatient - MME</td>
<td>7.5 (0.0 - 21.4)</td>
<td>20.0 (7.5 - 56.0)</td>
<td>15.5 (4.0 - 48.0)</td>
<td>35.0 (13.2 - 92.2)</td>
<td>&lt; 0.001&lt;sup&gt;CEF&lt;/sup&gt;</td>
</tr>
<tr>
<td>Total opioids Outpatient - MME</td>
<td>147.5 (100 - 300)</td>
<td>240.0 (150 - 600)</td>
<td>217.5 (150 - 320)</td>
<td>630.0 (257 - 1630)</td>
<td>&lt; 0.001&lt;sup&gt;CEF&lt;/sup&gt;</td>
</tr>
<tr>
<td>Pain score - 1-10</td>
<td>3.2 (1.9)</td>
<td>4.0 (1.9)</td>
<td>3.9 (2.0)</td>
<td>4.9 (2.1)</td>
<td>&lt; 0.001&lt;sup&gt;CEF&lt;/sup&gt;</td>
</tr>
<tr>
<td>Communication Encounters</td>
<td>1.0 (0.0 - 2.6)</td>
<td>1.0 (0.0 - 1.2)</td>
<td>0.0 (0.0 - 1.2)</td>
<td>1.0 (0.0 - 3.0)</td>
<td>0.006&lt;sup&gt;A&lt;/sup&gt;</td>
</tr>
<tr>
<td>Average Steps per Encounter</td>
<td>2.9 (1.3)</td>
<td>2.7 (1.3)</td>
<td>2.6 (0.9)</td>
<td>3.1 (1.2)</td>
<td>0.40</td>
</tr>
</tbody>
</table>

The following superscripts indicate significant Holm adjusted two way comparisons:

- A = 1 vs 2, B = 1 vs 3, C = 1 vs 4, D = 2 vs 3, E = 2 vs 4, F = 3 vs 4

Results reported as mean (standard deviation) or median (interquartile range)