Quality Improvement Project: Pain Assessment and Management in the Cardiovascular Intensive Care Unit

Ben Carmichael

Oregon Health & Science University, School of Nursing

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Dr. Robin Miller

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Pain is a universal experience that is subjective and unique. The International Association for the Study of Pain (2020) defines pain as "An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage." Data shows that 30-40% of hospitalized patients experience uncontrolled pain (Beck et al., 2019; Craig et al., 2015; Institute of Medicine (IOM), 2011). In the intensive care unit (ICU), 50-70% of patients experience moderate to severe pain (Devlin et al., 2018; Tarigopula et al., 2014). In addition, patients within the cardiovascular intensive care unit (CVICU) are estimated to have less pain control at rest and during care, with medical patients experiencing as much pain as post-surgical patients (Devlin et al., 2018).

Improving pain management is shown to improve patient outcomes and satisfaction. Pain management is associated with patient length of stay (LOS), time receiving mechanical ventilation, morbidity, and mortality (Damico et al., 2020; Georgiou et al., 2015; Ovsiowitz, 2021; Wiatrowski et al., 2016). A study completed by Olsen et al. (2016) involving patients 18 years old and greater in a medical intensive care unit (ICU), a surgical ICU, and a postanesthesia care unit showed that when pain management strategies were implemented, LOS decreased by 0.2 to 5.2 days and mechanical ventilation time decreased by 21 to 70 hours. Decreasing LOS and ventilator time decreases hospital costs and patient complications (Deffland et al., 2020). Given this data, it can be posited that improving pain management within the CVICU could improve LOS, mechanical ventilation time, patient experience, morbidity, and mortality.

Available Knowledge

The IOM identified nursing as having the essential responsibility of pain management by providing prompt and safe interventions to relieve pain and performing effective assessments (Institute of Medicine, 2011, pp. 202-203). Performing accurate pain assessments, reassessments, interventions to reduce pain, and documentation of these steps is a crucial part of providing adequate pain management and providing sufficient information for providers to create and update the plan of care for pain management (Hamdan et al., 2021; Kerbage et al., 2021; Vilīte et al., 2019; Zuazua-Rico et al., 2020).

Current requirements and guidelines for pain assessment require standardized assessment tools specific to patient age, ability to understand, setting, and condition (The Joint Commission, 2017). A full pain assessment is performed on admission, with a focused pain assessment done every four hours or less as needed, with reassessment performed 30 minutes to one hour after an intervention. While the requirement for a focused pain assessment is every four hours, the current recommendation for best practice from the Society for Critical Care Medicine is every two to three hours in the ICU setting (Devlin et al., 2018; Nordness et al., 2021).

Each assessment, reassessment, and intervention must be documented in the patient's electronic health record (EHR). The Numeric Pain Rating Scale (NPRS) and the Critical Care Pain Observation Tool (CPOT) are validated pain assessment tools widely used in the US (Czarnecki, 2018; Devlin et al., 2018). The NPRS is used for patients who can communicate the severity of their pain based on a numeric scale. The RN uses the CPOT to estimate a patient's pain who cannot communicate the severity of the pain they are experiencing. The NPRS and CPOT were the primary tools used for pain assessment and documentation where this Quality Improvement (QI) project took place. See Appendix A for an overview of the NPRS and CPOT assessments.

Research has demonstrated gaps in RN pain documentation practice compared to hospital requirements. Documentation gaps typically include inconsistent practices among staff, missed documentation, and utilization of inappropriate assessment tools (Cline, 2016; Hamdan et al., 2021; Ma et al., 2021; Pun et al., 2019; Zuazua-Rico et al., 2020). The most significant factor shown to improve documentation gaps is nurse education on pain assessment, documentation, and management (Devlin et al., 2018; Devonshire & Nicholas, 2018; Georgiou et al., 2015; Hamdan et al., 2021; Institute of Medicine, 2011; Kerbage et al., 2021; Lin et al., 2021; Olsen et al., 2016; Olsen et al., 2020; Vilīte et al., 2019; Wiatrowski et al., 2016; Zuazua-Rico et al., 2020).

Rationale

The CVICU in which this QI project took place had no quality improvement process or model for improving pain management, assessment, documentation practices, or education for staff. A policy was in place for pain assessment tools to be used in the adult population and included the use of the NPRS, CPOT, and the Pain Assessment in Adult Dementia Scale (PAINAD) for adult patients. The interval for pain management stated, "intervals appropriate for the intervention and patient's condition." However, assessment criteria for ICU-level patients require documentation every four hours. Considering this, the Six Sigma model was chosen for this QI project. The Six Sigma model focuses on process improvement by identifying problems and defects through process measure data analysis using the DMAIC steps: 1) Define, 2) Measure, 3) Analyze, 4) Improve, and 5) Control Cycles (Jenab et al., 2018). It has been successful in quality management by using a methodological approach that analyzes data to find areas of improvement (Hernández-Lara et al., 2021; Niñerola et al., 2020).

This QI project focused on completing the first three steps within the Six Sigma model. The first step identified the lack of tracking, measuring, or improvement plan for pain management and documentation practices within the CVICU. Step two, Measure, identified data points for documentation analysis. The third step, Analyze, utilized the specified data points to identify current documentation, assessment, and management trends. The fourth step, Improve, identified that providing education on pain assessment and documentation was the most significant way to improve documentation, assessment and management practices.

Specific Aims

This project aimed to provide a retrospective chart review (RCR) of RN documentation of pain assessments for adult patients aged 19 and older with a heart failure diagnosis who did not receive a surgical intervention requiring general anesthesia within the CVICU. Analysis of documentation was used to create staff education to align documentation to current requirements, increasing documentation practices, with a long-term goal of improving patient pain management and aligning practice to policy, and providing current best practice recommendations.

Methods

Context

This project occurred in the CVICU, located in a metropolitan academic teaching hospital. The hospital is a quaternary care center with 576 licensed beds, including 151 pediatric beds. The CVICU is a 26-bed unit that provides ICU-level care, including advanced mechanical ventilation, mechanical circulatory support, veno-arterial extracorporeal membrane oxygenation, and renal replacement therapy. The patient population served in the CVICU includes the management of acute and chronic cardiovascular conditions. Conditions include but are not

limited to cardiothoracic surgery, congenital heart disease, aortic conditions, valvular disease, heart failure, ischemic heart disease, arrhythmias, electrophysiology, heart transplant, and cardiovascular surgery and procedures.

Intervention

The planned intervention was to identify trends in pain documentation and then provide targeted education to address the identified trends.

Patient Population

Patient data was collected on patients in the CVICU and excluded patients from other units. The inclusion of patient data required an age of 19 years or greater and a diagnosis of heart failure (See appendix B for ICD-10 codes used). Patients that had a surgical intervention that required general anesthesia were excluded. Patients undergoing procedures such as intubation, line and tube insertion or removal, or percutaneous interventions were included.

Data Collection

Data was collected from a six-month period from January 2022 to June 2022. Data collection occurred in November 2022 and was de-identified but included such descriptors as age, sex, and diagnoses. Documentation collected included pain assessment scores, patient pain goal, and assessment tool used. The name of the nurse performing documentation was excluded. Each patient meeting the inclusion criteria was associated with the pain assessment documentation.

- Inclusion Criteria: age ≥ 19, heart failure diagnosis, admission in CVICU
- Exclusion criteria: age ≤ 18, no heart failure diagnosis, no CVICU admission, surgery requiring general anesthesia during hospital stay

Data Analysis

A retrospective analysis was performed on the collected data. The analysis provided baseline information on the documentation practices of RNs within the CVICU for the specified patient population. Data analysis was performed from November 2022 until February 2023.

Built-in reporting software from the EHR was utilized to find patient encounters with a diagnosis of heart failure who were 19 years and older. This report was housed in the EHR reporting system. Each record was assessed for exclusion and inclusion criteria. Each encounter was entered using the patient categorical variables of age, sex, and LOS.

Each encounter was reviewed for completion of the initial pain assessment and patient pain goal, then indexed as yes or no, providing completion percentage. All documented pain scores were manually entered into Excel by patient encounter and differentiated by NPRS or CPOT. This provided a total of 1,376 pain assessments that was used as discrete variables for trend identification. Pain scores were coded by severity rating of mild, moderate, and severe as defined by the NPRS and CPOT assessment tools (See Appendix A).

Trend Identification

Three main data points were analyzed: initial pain assessment, focused pain assessment, and pain severity. Completion of the initial pain assessment was deemed complete if a pain goal was documented and if the pain assessment included items one-six of the NRPS assessment (see Appendix A). Focused pain assessment was coded complete if a pain score was documented. Each documented assessment was assessed for another documented assessment occurring at two- and four-hour intervals +/- 30 minutes of the previously documented score. Each incidence where no documented pain score occurred within the two-and four-hour time frame was indexed as a missing assessment providing the percentage of missed documentation. Pain severity coding was used to provide markers for the incidence of pain severity and episodes of unrelieved pain.

Frequency for the focused pain assessment was assessed at four and two-hour intervals with a 30-minute documentation window from the previous documented pain assessment or standard assessment times of 0800, 1000, 1200, 1400, 1600, 1800, 2000, 2200, 0000, 0200, 0400, and 0600. The 30-minute window to either side of the expected time was chosen as legal requirements allow for this time variance. The two-hour interval was chosen based on current recommendations for a two-three hour assessment time frame within the ICU. Four-hour assessment interval was chosen based on minimum assessment documentation requirements for an ICU. Documentation of pain assessments that did not include approved pain assessment tools, multiple tools used at once, or referenced "pain goal achieved" without a documented pain goal was coded as an assessment error. Assessment frequency was coded as complete if a pain score was documented, including instances that were coded as assessment errors.

Uncontrolled pain was indexed as an occurrence when two consecutive pain score ranges of moderate or severe was documented when the severity did not decrease, stayed the same, or increased. If three consecutive pain score severity ranges met these criteria, it was indexed as two occurrences, four consecutive severity ranges was indexed as three occurrences, and so forth.

Creation of Education

Education was created for the nursing staff of the CVICU. The education provided was based on the data analysis. Education was then given on current requirements for both hospital policy and regulatory requirements. This included assessment tools approved for use in the CVICU based on current policy. Instruction for the use of the NRPS, CPOT, and PAINAD included how to score, how to document the score, and when each tool was appropriate to use. Further education was provided for assessing and documenting patient pain goals, interventions

performed, response to interventions, and follow-up questions to pain (Provoking/reliving, quality, region and radiation, severity, and time). The creation of education occurred from February to March 2023.

Education Administration

Administration of the nurse education will be done through the Compass online education training and tracking software used at the location of this project. Education was done voluntarily with a goal of 50% of staff RNs completing the education. Education for the staff will occur in May 2023.

Quantitative Analysis

The data obtained from the hospital EHR system provided discrete quantitative information. The EHR reporting system was used to create a report for CVICU encounters. This provided 2,237 patient encounters. Of the 2,237 encounters, 321 were identified as potential encounters. This was narrowed to 20 patient encounters that met inclusion and exclusion criteria (See Appendix C).

Pain assessment data provided 711 NPRS assessments and 665 CPOT assessments. From there, the scores for each graph was broken down by severity range of mild, moderate, and severe (See Appendix A for NPRS and CPOT severity scoring). This allowed the combination of the NPRS and CPOT scores to provide data on the reporting and documentation of pain severity within the patient population.

Results

Of the 20 patient encounters included in the analysis, one male and one female patient had two admissions within the time frame. The mean age of the patient population was 64.9

(range of 21 to 95), and 40% were female. The length of stay (LOS) mean was 7.45 days (range of one to 35 days).

The admission assessment completion rate for the 20 encounters was 0%, with the pain goal documented within 24 hours of admission or transfer to the CVICU being 26% (5 patient encounters). Of the n=1376 documented assessments, 153 had an error, accounting for an 11% error rate in pain assessment documentation. Using the four-hour assessment time frame, two of the 20 encounters had a documented pain score every four hours, giving a 90% incomplete rate when held to that standard. This gave a count of 101 missed assessments for the four-hour standard. The two-hour assessment recommendation had no records with complete documentation of a pain score for that time frame, giving a 100% incompletion rate. Using the two-hour assessment time frame, 449 assessments would have been missed. See Appendix D for a breakdown of pain assessment scores for the NRPS and CPOT.

Of the documented assessments with a pain score, 75% of the scores were 0, 10% were mild, 12% moderate, and 3% severe. The severity of the NPRS and CPOT scores was counted and graphed separately and combined (See Appendix E for details). Of the 20 encounters, nine meet the criteria for having uncontrolled pain. In total, there were 77 incidents among the nine patients of uncontrolled pain in the moderate and severe categories (see Appendix F for details).

Summary

Analysis showed an error rate of 11% in documented pain assessments with nonapproved pain scale tools, conflicting use of multiple pain tools used in the same documentation or using "pain goal achieved" when no pain goal was documented. The rate and areas where errors were made provided a base for RN education, showing a potential benefit for continued education on performing and documenting pain assessments within the CVICU. Initial data analysis was to

assess each pain assessment for completion based on requirements for the NPRS (See appendix A) and the available documentation fields within the EHR.

Assessment time frames of four hours had a similar finding of error rate, showing a completion rate of 90%. The two occurrences in which the four-hour documentation of a pain score happened both had a LOS of one day. A total of 101 pain scores were missed within the four-hour required assessment documentation. Five instances occurred with no pain assessment documentation during a 12-hour shift between 0700-1900 or 1900-0700. Decreasing the assessment time frame to the two-hour recommendation level showed a completion rate of 0% for the 20 patient encounters, gave an incomplete documentation occurrence rate of 25% (449 missed assessments). See Appendix G for missed assessment data. Analysis of these patterns showed that a longer LOS increased missed assessment prevalence for the minimum four-hour assessment requirement and the two-hour (see Appendix H).

Uncontrolled pain occurrence happened for 11 of the 20 patient encounters. A total of 77 occurrences of uncontrolled pain was found, showing a 55% occurrence of at least one episode of uncontrolled pain in this patient population (See Appendix F). Analysis of these data points did not show a significant correlation to LOS or the assessment tool used.

Limitations

This project was limited by missing documentation and the limits of the EHR chart review system. Due to the complexity of the data needed to perform the RCR, data was collected manually. The EHR system required documentation of pain assessments to be documented in the medication administration record (MAR) when pain medication was given and for reassessment after medication administration. Any pain assessment done by an RN when medication was given and the required one-hour reassessment after pain medication was given was not accounted

for in this analysis. This would potentially affect missed documentation occurrence rates when documentation was performed in the MAR. Missing documentation limited analysis of interventions, escalation of interventions, and attempts to manage pain.

Conclusions

Research has demonstrated gaps in RN documentation practices, inappropriate assessment tool use, and missed documentation compared to requirements and best practices. The findings of this QI project showed that gaps existed in the data analyzed. Gaps identified were: missed assessments, errors in charting, unapproved assessment tool use, and absence of follow-up questions and intervention documentation. Best practice recommendations for staff education as an effective way to address gaps in documentation was incorporated into the creation of education for staff where this QI project took place.

Future Considerations

Aligning with current research and best practice recommendations, this project recommends consideration for the continuation of pain management quality improvement. In providing baseline data and education, further data analysis is recommended to assess any changes in the documentation and reporting of pain for the patient population on the CVICU. An ongoing QI project for pain assessment and management is a recommendation of current literature. This QI project also recommends continued data analysis and education to address a variety of potential areas that affect pain management and documentation.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board (IRB), where this project took place. Patient data was de-identified, with privacy ensured throughout the use of this project in accordance with hospital policy and guidelines.

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Appendix A

Numeric Pain Scale

(NPRS) of 0-10. With 0 being no pain and 10 being the "worst possible pain". 0-3 is considered as mild pain, 4-6 is considered as moderate pain, 7-9 is considered as severe pain, and 10 is the most severe pain imaginable (Longo & Schub, 2022).

Pain Assessment

Initial full pain assessment

1. Pain Type: Chronic, Acute, Idiopathic, Cancer, Neuropathic, Psychogenic
2. Assess the patient's response to previous pharmacologic interventions, especially his or her ability to function.
3. Determine the patient's previous responses to analgesics.
4. Assess for signs and symptoms of pain
5. Perform NPRS
6. Follow up with the questions; "What makes your pain better or worse?", "What does your pain feel like? (Sharp, dull, throbbing, etc.)", "Where is your pain and does it radiate?", and "What is the timing of your pain? (intermittent, continuous, with activity, etc.)"

Focused pain assessment

1. Perform NPRS
2. Document interventions performed

Reassessment

1. Perform NPRS
2. Compare to pre-intervention NPRS and evaluate the effectiveness of intervention
3. Consider different intervention options or notify the provider if ineffective

(Elsevier, 2019)

Critical Care Pain Observation Tool

The CPOT is used in place of the NPRS when patients cannot communicate and provide a number or understand the NPRS scale. A score of 0 is no pain, 1-2 is mild pain, 3-5 is moderate, and 6-8 is severe.

Indicator	Score	Operational Definition
Facial Expressions	Relaxed, neutral 0	No muscle tension observed
	Tense 1	Presence of frowning, brow lowering, orbit tightening, and levator contraction or any other change (e.g., opening eyes or tearing during nociceptive procedures)
	Grimacing 2	All previous facial movements plus eyelid tightly closed (the patient may present with mouth open or biting the endotracheal tube)
Body Movements	Absence of movements or normal position 0	Does not move at all (doesn't necessarily mean absence of pain) or normal position (movements not aimed toward the pain site or not made for the purpose of protection)
	Protection 1	Slow, cautious movements, touching or rubbing the pain site, seeking attention through movements
	Restlessness 2	Pulling tube, attempting to sit up, moving limbs/thrashing, not following commands, striking at staff, trying to climb out of bed
Compliance with the ventilator (intubated patients)	Tolerating ventilator or movement 0	Alarms not activated, easy ventilation
	Coughing but tolerating 1	Coughing, alarms may be activated but stop spontaneously
	Fighting ventilator 2	Asynchrony: blocking ventilation, alarms frequently activated
Or		
Vocalization (extubated patients)	Talking in normal tone or no sound 0	Talking in normal tone or no sound
	Sighing, moaning 1	Sighing, moaning
	Crying out, sobbing 2	Crying out, sobbing
Muscle tension: Evaluation by passive flexion and extension of upper limbs when patient is at rest or evaluation when patient is being turned	Relaxed 0	No resistance to passive movements
	Tense, rigid 1	Resistance to passive movements
	Very tense or rigid 2	Strong resistance to passive movements, incapacity to complete them
Total	/8	

(Ovsiowitz, 2021)

Appendix B

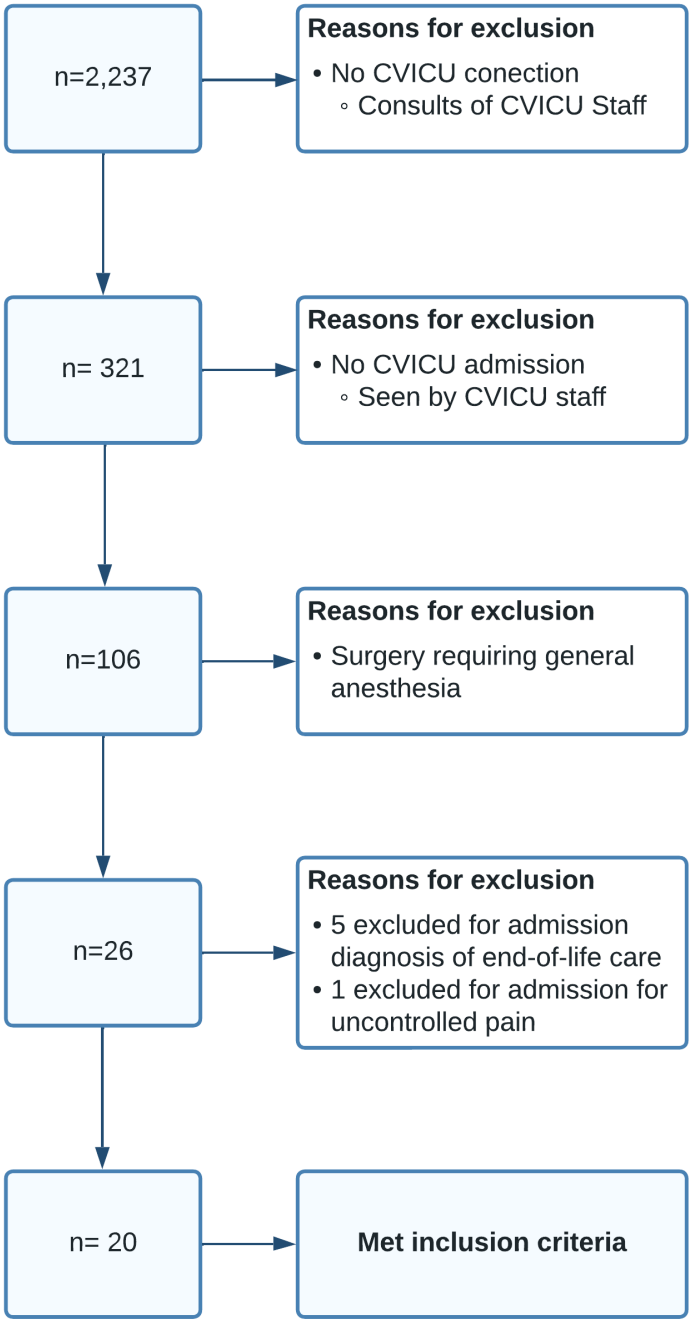
ICD-10 Heart Failure Codes

- I50 Heart failure
  - I50.1 Left ventricular failure, unspecified
- I50.2 Systolic (congestive) heart failure [HFrEF]
  - I50.20 Unspecified systolic (congestive) heart failure
  - I50.21 Acute systolic (congestive) heart failure
  - I50.22 Chronic systolic (congestive) heart failure
  - I50.23 Acute on chronic systolic (congestive) heart failure
- I50.3 Diastolic (congestive) heart failure [HFpEF]
  - I50.30 Unspecified diastolic (congestive) heart failure
  - I50.31 Acute diastolic (congestive) heart failure
  - I50.32 Chronic diastolic (congestive) heart failure
  - I50.33 Acute on chronic diastolic (congestive) heart failure
- I50.4 Combined systolic (congestive) and diastolic (congestive) heart failure
  - I50.40 Unspecified combined systolic (congestive) and diastolic (congestive) heart failure
  - I50.41 Acute combined systolic (congestive) and diastolic (congestive) heart failure
  - I50.42 Chronic combined systolic (congestive) and diastolic (congestive) heart failure
  - I50.43 Acute on chronic combined systolic (congestive) and diastolic (congestive) heart failure
- I50.8 Other heart failure

    - I50.81 Right heart failure
        - I50.810 …… unspecified
        - I50.811 Acute right heart failure
        - I50.812 Chronic right heart failure
        - I50.813 Acute on chronic right heart failure
        - I50.814 …… due to left heart failure
    - I50.82 Biventricular heart failure
    - I50.83 High output heart failure
    - I50.84 End stage heart failure
    - I50.89 Other heart failure
- I50.9 Heart failure, unspecified

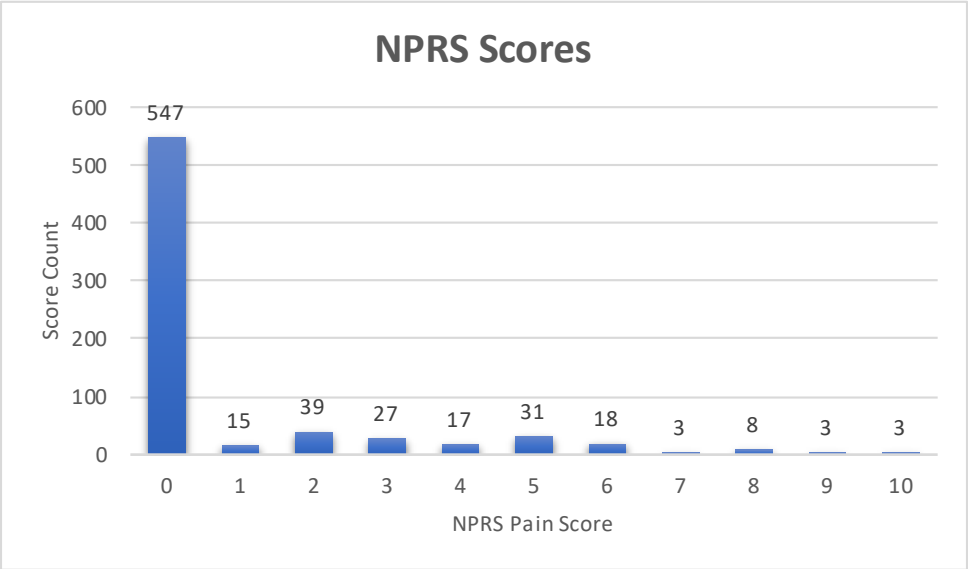
Appendix C

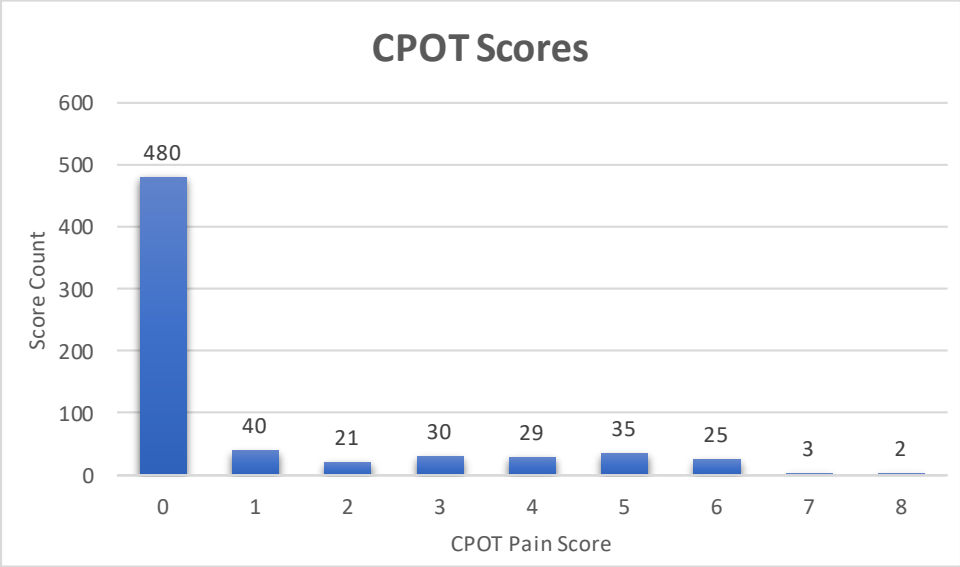
Population Encounter Analysis



Appendix D

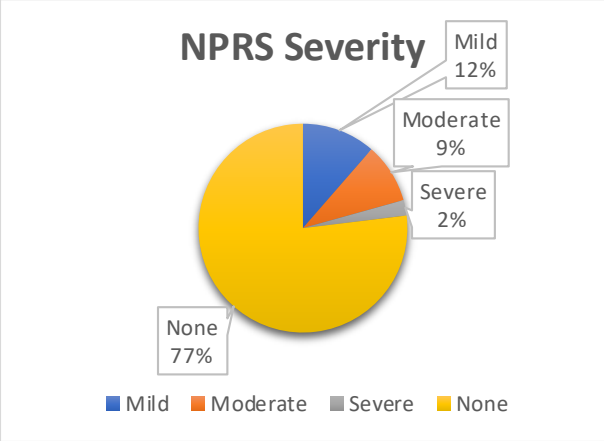
Pain Scores

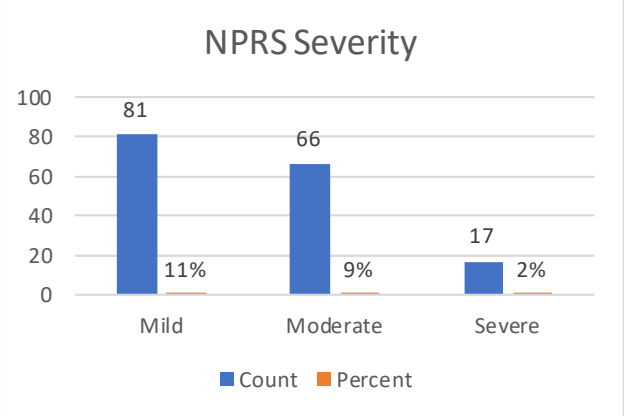


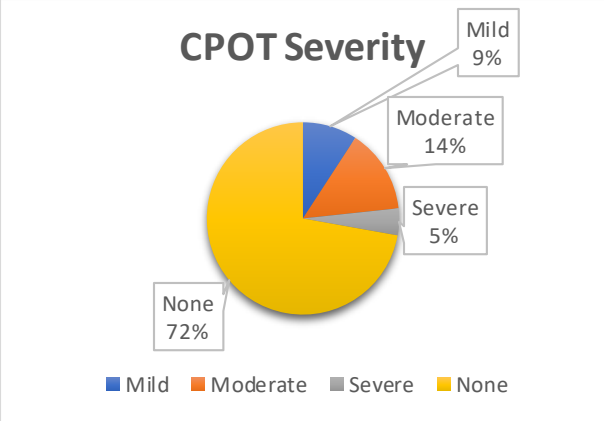


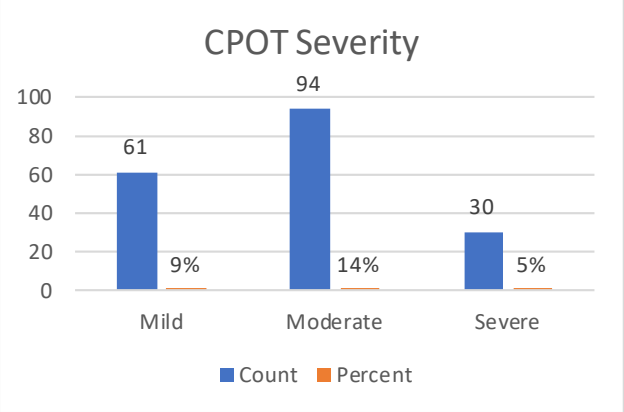
Appendix E

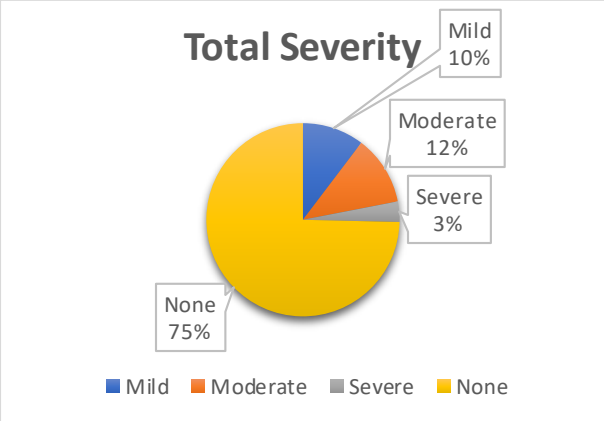
Severity of Pain

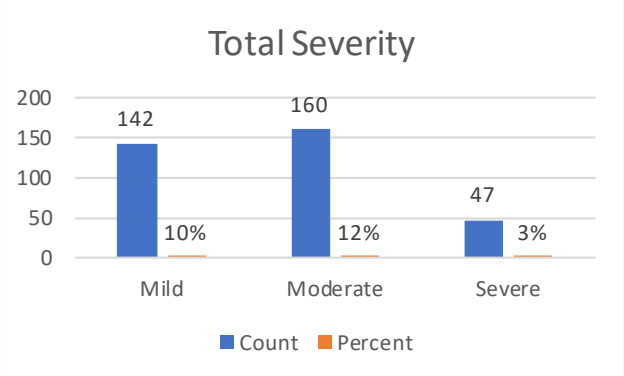






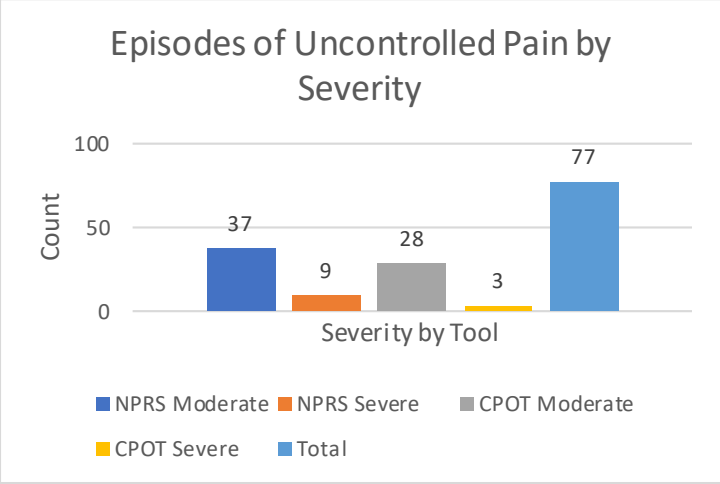


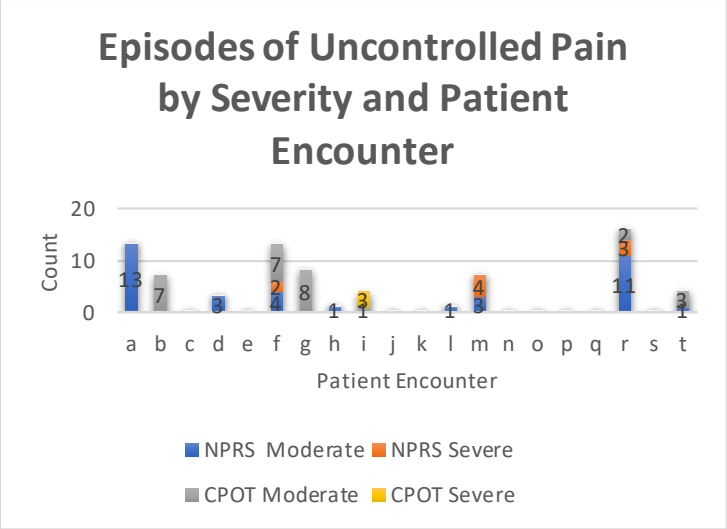


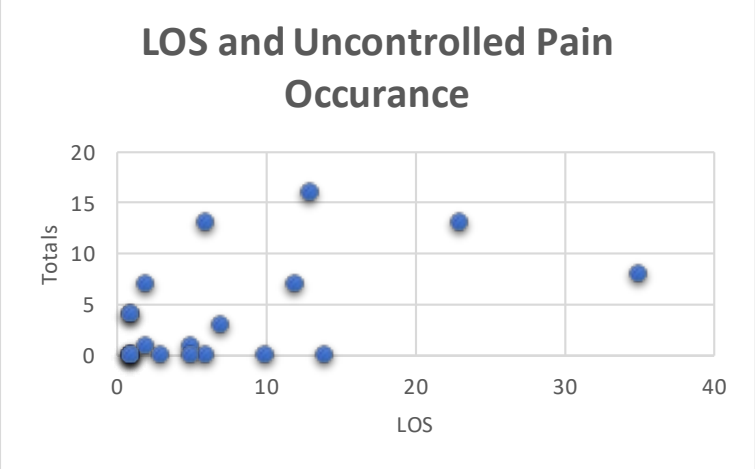


Appendix F

Uncontrolled Pain



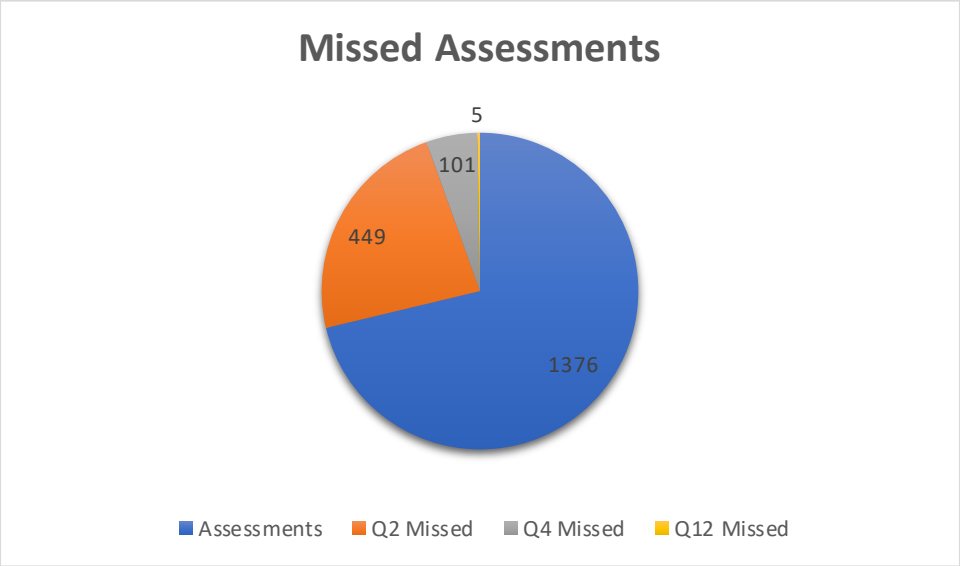




Appendix G

Missed Assessments

Assessment	Count	Percent
Assessments	1376	
Q2 Missed	449	24.6%
Q4 Missed	101	6.8%
Q12 Missed	5	0.4%



Appendix H

LOS Correlation of Error and Missed Assessment