IMPLEMENTATION OF NITROUS OXIDE SEDATION IN THE PEDIATRIC EMERGENCY DEPARTMENT

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PROBLEMS STATEMENT

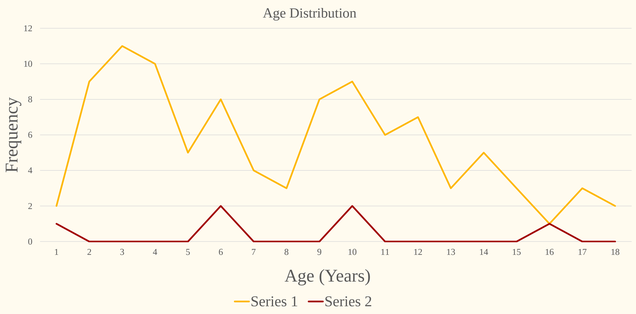
The purpose of this quality improvement project was to measure LOS and frequency of adverse reactions in a PED for those children undergoing procedural sedation.

PICO QUESTION

In PED patients who require procedural sedation, how does the use of NO compared to the use of ketamine, affect the type of procedure, number of adverse events, recovery times and overall LOS?

LITERATURE REVIEW

- Ketamine
  - a dissociative anesthetic medication that provides sedation and analgesia and is infused either intravenously or intramuscular. IV or IM access causes increased pain and suffering for the child (Kuensting et al., 2009; Luhmann et al., 2006).
  - Last approximately 11 minutes when used alone but can have a recovery period of up to two hours when combined with midazolam (Luhmann et al., 2012)
  - Has minimal respiratory and cardiovascular effect (Lee et al., 2012)
  - Adverse events include nausea, vomiting, hypersalivation, and/or an emergence phenomenon (Mace et al., 2008)
- NO is favorable for PED procedures requiring minimal or moderate sedation as it does not require IV access.
  - NO is an odorless gas, producing dissociative or euphoric state relieving anxiety and decreasing pain in distressed children (Luhmann et al., 2006)
  - Has minimal adverse effects, rapid onset and offset making it a popular choice for PEDs (Lee et al., 2012; Babl et al., 2008; Seith, Theophilos, & Babl, 2012).
  - NO could decrease LOS and impact on staffing due to the reduced risk of adverse events, rapid onset and offset (German et al., 2011)



Frequency of Age in Years by Sedation Type

MATERIALS AND METHODS

Design

- Cohort design using a retrospective medical record review of children undergoing procedural sedation in the pediatric emergency department

Setting

- 13 bed PED in a moderately sized, Midwestern urban women's and children's hospital
- Inclusion Criteria:
  - All genders, races, and ethnicities were included
  - Ages 1 year to 18 years
- Exclusion Criteria:
  - Any child with a pre-existing conditions rendering them not suitable for PED sedation
  - Under one year of age or greater than 18 years

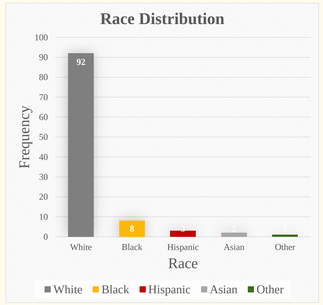
Interventions

- Staff education provided on two separate occasions on NO equipment, use of NO, sedation protocols, proper sedation technique, and data collection
- NO made available for use on November 1, 2016
- Follow up education and monitoring throughout implementation period
- Medical Record review of all patients requiring sedation during this period to collect demographic information, LOS, sedation type, and adverse events.

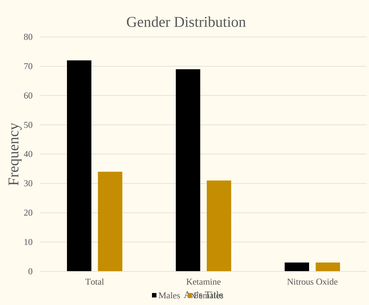
Tools/Measures

- A minimum of 84 medical records reviewed would provide a confidence interval of 95%. This quality improvement study reviewed 106 medical records

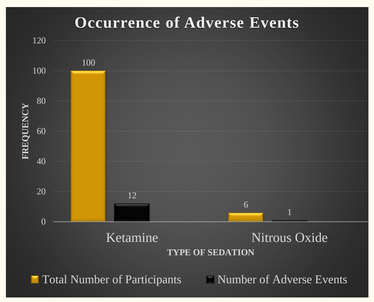
RESULTS



Race distribution frequency histogram



Gender distribution frequency histogram



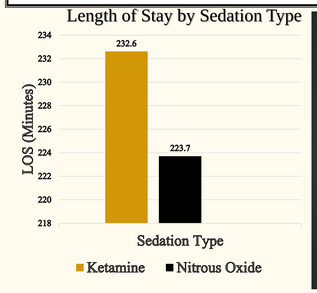
Adverse reactions by sedation histogram

Results

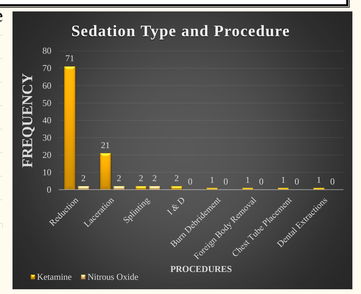
- Age
  - Ketamine μ = 8.17 years (SD = 5.08), NO μ = 7.91 years (SD = 4.57)
  - No statistical significance, t(104) = 0.13, p = 0.9
- Gender
  - Male (n = 72, 67.9%)
    - Ketamine (n = 69, 65.1%), NO (n = 3, 2.8%)
  - Female (n = 34, 32.1%)
    - Ketamine (n = 31, 29.2%), NO (n = 3, 2.8%)
  - No statistical difference in gender between ketamine and NO, χ^2 (1) = 0.938, p = 0.33
- Race
  - No statistical difference found in race between the two groups, χ^2 (4) = 1.07, p = 0.9.

RESULTS

- **Adverse Events (Emesis)**
  - No statistical or clinical significance between ketamine and NO (χ^2 (1) = 0.12, *p* = 0.735, *phi* (Φ) of 0.03)
- **Gender and Adverse Event.**
  - No statistical difference
    - Males (Ketamine n = 9, 12.5%; NO n = 0) $\chi^2(1) = 0.45$, *p* = 0.5
    - Females (Ketamine n =3, 8.8%; NO n = 1, 2.9%) $\chi^2(1) = 1.48$, *p* = 0.23.
- **Race and Adverse Event.**
  - No statistical or clinical significance χ^2 (1) = 0.115, *p* = 0.74, Φ = 0.03.
- **Length of Stay (LOS).**
  - No statistical or clinical significance, t(104) = 0.32, *p* = 0.9, cohen's d = 0.06
  - Statistical and low clinical significance between procedure type and LOS was found , *t*(92) = 1.31, *p* = 0.004 , cohen's *d* = 0.27



Length of stay distribution by sedation histogram



Type of Sedation by Procedure histogram

CONCLUSIONS

- **Conclusions**
  - No statistical or clinical significance found with LOS and adverse events between NO and Ketamine sedation or the type of procedure performed.
- **Recommendations**
  - Continuing to encourage use of NO when appropriate to determine true impact of NO as use was low during this study period
- **Limitations**
  - Low usage of NO
  - Inability to determine recovery times on sedation documentation
  - Implementation in a single PED
  - Education on documentation was not completed by all staff
  - This data is not generalizable.

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REFERENCES

Available upon request

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