Sleep Disordered Breathing: Screening and Implications in Pediatric Patients

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Abstract

Children with diagnosed and undiagnosed sleep disordered breathing (SDB) may require incidental surgery under general anesthesia. Despite recommendations, only 37% of all children undergoing surgical procedures under general anesthesia are screened for SDB. The only tool specifically developed for, and repeatedly used in the pediatric population is the Sleeping, Trouble Breathing, Unrefreshed (STBUR) questionnaire. The aims of this scholarly project were to perform a needs assessment, evaluate the patients at the office of Pediatric Surgery P.A., and make evidence-based recommendations appropriate for those findings. The design was a prospective, quantitative needs assessment. The scholarly project methods included the implementation of the STBUR questionnaire to assess children presenting for surgery to Pediatric Surgery P.A., and a retrospective chart review for responses from primary caregivers regarding postoperative maladaptive behavior (POMB) in children that were screened for SDB. Sequential convenience sampling was used for subject recruitment. Descriptive and Inferential statistics were used to analyze the data at the end of the six-month time frame. None of the 83 participants screened positive for SDB or POMB; however, the minimum recommended sample size for statistical significance was not met and may be an implicating factor in the results of this project.

Keywords: Sleep disordered breathing, screening, STBUR, postoperative complication, postoperative maladaptive behavior & incidence.

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Sleep Disordered Breathing: Screening & Implications in Pediatric Patients

Sleep disordered breathing (SDB)—a term for sleep-related disorders involving the airway—is understudied and underreported in children (Holmes et al., 2017; Raman et al., 2019; Tait, Voepel-Lewis, & O'Brien, 2014). Of concern are adverse respiratory implications of SDB in the perioperative period, as well as possible implications between SDB and post-operative maladaptive behavior. These outcomes may be prevented or mitigated through screening that is not presently used (Bauer, Lee, & Campbell, 2016; Ishman et al., 2015).

Significance & Background of Clinical Problem

Varying classifications of sleep-related disorders have been identified; however, few studies of quality have been conducted to examine key issues related to SDB in the pediatric population. Present verified health risks of undiagnosed and untreated SDB in the pediatric population include metabolic derangements, reduced cognitive function, behavioral issues, and developmental retardation (American Academy of Pediatrics [AAP], 2002; Bauer et al., 2016; Holmes et al., 2017; Tait et al., 2014). Long-standing undiagnosed SDB may cause chronic health debilitations including but not limited to ventricular failure, hypertension, and stroke, resulting in decreased quality of life and possibly premature death (AAP 2002; Holmes et al., 2017).

Clinically, children with undiagnosed SDB may require incidental surgery or procedures unrelated to SDB under general anesthesia. According to the Centers for Disease Control (CDC) most recent National Health Statistics Report, 3,266,000 of 53,329,000 surgeries completed in ambulatory surgical centers (ASCs) were performed on children less than 15 years of age (Cullen, Hall, & Golosinskiy, 2009). SDB is not routinely screened for by anesthesia providers in

ASCs, and research shows children with diagnosed SDB have more perioperative complications per child than their non-SDB counterparts (Ishman et al., 2015; Sanders et al., 2006). This is of importance to anesthesia providers because lack of screening, or improper screening of children with undiagnosed SDB, may result in unexpected morbidities and mortality during the perioperative period, requiring the escalation of care (Galvez et al., 2019; Raman et al., 2019; Sanders, King, Mitchell, & Kelly, 2006; Tait et al., 2014; Tait et al., 2016; Whippey et al., 2016).

Most ASCs are stand-alone sites. Given that research has shown children with SDB require intensive monitoring, increased vigilance, have higher rates of complications, and may require escalation of care, including but not limited to overnight hospitalization, it is prudent to evaluate every child for SDB undergoing surgery in ASCs to determine the risk for complications (Galvez et al., 2019; Raman et al., 2019; Ishman et al., 2015; Sanders et al., 2006). Therefore, the importance of screening for SDB is of significance in ASCs to improve patient outcomes and decrease unexpected morbidities and mortality in pediatric patients during the perioperative period.

Currently, the prevalence of diagnosed SDB globally remains questionable and ranges anywhere from 1% to 12% based on several factors including the specific terminology and tools used (AAP, 2002; Holmes et al., 2017; Sanders et al., 2006; Tait et al., 2014; Tait et al., 2016). The reported prevalence ranges do not consider undiagnosed SDB and may be much higher (Ishman et al., 2015, Holmes et al., 2017). To date, no studies have looked at the prevalence of undiagnosed SDB in children (Holmes et al., 2017; Ishman et al., 2015; Raman et al., 2019). Due to the gap in the literature, as well as the gap in practice, it is difficult to truly declare the extent of SDB within the pediatric population in the United States. Because of the lack of screening in the office of Pediatric Surgery P.A. and Downtown Surgery Center (DSC), it is challenging to

address the topic of maladaptive behaviors before a thorough investigation of the prevalence of SDB. Therefore, the purpose of this project is to conduct a needs assessment to determine the prevalence of SDB, as well as determine if there exists a need for permanent implementation of a preoperative screening tool.

PICOT Evidence Review Questions

Two questions, posed in PICOT format, were used to conduct a systematic review of literature. The first addresses the clinical problem: In pediatric patients with Sleep Disordered Breathing (P), does administration of general anesthesia (I) have an impact on post-operative maladaptive behavior (O)? The second question addresses the clinical innovation: In a six-month period (T), do pediatric patients presenting for surgery to the office of Pediatric Surgery P.A. in Orlando, Florida (P) screen positive for Sleep Disordered Breathing, and does there exist a need (I) for the permanent implementation of a preoperative screening tool (O)?

Search Strategy and Results

The search strategy for relevant evidence included websites, databases, government agencies, and reference lists: Google, PubMed, Google Scholar, Cochrane Review, CDC, United States Department of Education. A total of 2686 articles were initially retrieved. Thirty-four articles met inclusion criteria of SDB, OSA in children, and needs assessment. Abstracts, purpose statements, and results were reviewed to determine the relevance of findings to SDB. Exclusion criteria were: narrow in focus, not systematic reviews, or not research-based. Framework exclusion criterion was: not applicable to healthcare. Fourteen research articles, two framework articles, two practice guidelines, and one governmental survey report were retained

for this review. Key search terms included: *Pediatric* AND *sleep disordered breathing* AND *general anesthesia* AND *emergence delirium* AND *needs assessment* AND *STBUR*. MESH terms included: *pediatrics, general anesthesia, etiology, sleep apnea syndromes, needs assessment,* and *standards.* Search limits were: clinical trial, English, and human subjects.

GRADE Evidence

GRADE criteria were used in rating the joint body of evidence. The initial rating of evidence was low with a preliminary GRADE score of 2, as most studies were observational case-control or cohort style; however, due to imprecision and methodological flaws in a limited number of lower quality studies, the evidence was rated down -1, bringing the GRADE level to very low (GRADE score=1). Problems associated with imprecision included small sample sizes and statistical omissions. Methodological flaws included convenience sampling and recruitment bias (see Appendix A). Due to the high magnitude of effect of most observational studies, the total body of evidence was then rated up +1, resulting in an overall GRADE level of low with a final GRADE score of 2. The themes with the largest magnitude included utilizing tools to detect SDB, utilizing STBUR in the detection of postoperative respiratory events, and an overwhelming consensus regarding the lack of screening and its implications. Implementing standardized preoperative screening of all children, regardless of age or operatory setting, is likely to result in early detection of sleep-related breathing disorders with no known undesirable outcomes leading to a strong practice recommendation (AAP, 2002; American Society of Anesthesiologists [ASA] Task Force on Perioperative Management of Patients with Obstructive Sleep Apnea, 2014; Holmes et al., 2017; Raman et al., 2019). In summary, the overall quality of evidence is low, but clinical practice recommendation is high.

Literature Review and Synthesis of Evidence

A comprehensive discussion of all concerns related to SDB exceeds the scope of this review. Therefore, a selection of three recurring themes were chosen to narrow the focus to issues inherent to SDB within the pediatric population: screening and recognition of SDB; validated tools to assist in screening for SDB; and implications of diagnosed and undiagnosed SDB in the perioperative period. For this review, variables are defined as follows: SDB is used as an "umbrella" term to encompass a variety of sleep-related disorders including OSA, obstructive sleep apnea syndrome (OSAS), and primary snoring; postoperative respiratory adverse events (PRAEs) are defined as any respiratory event requiring intervention by a medical professional including, but not limited to, desaturation (<91%), airway obstruction, laryngospasm, and reintubation; postoperative maladaptive behaviors (POMBs) are defined as any change from baseline behavior as reported by the caregiver more than 48 hours after anesthesia and may include things such as irritability, change in sleep schedule, and change in eating habits.

Screening and Recognition of SDB

In 2002, the AAP issued a clinical practice guideline recommending the screening of all children for snoring as part of routine healthcare maintenance (AAP, 2002). In 2014, the ASA published a revised practice guideline for the perioperative management of patients with OSA, reinforcing the guideline published by the AAP (ASA Task Force on Perioperative Management of Patients with Obstructive Sleep Apnea, 2014). Despite the information provided by the guidelines and the strong practice recommendations, recent studies suggest the lack of screening to be a widespread issue among anesthesia providers (Bauer et al., 2016; Ishman et al., 2015). It

is estimated that only 37% of children are screened for SDB—part of the problem may stem from the lack of consensus among organizations such as the American Association of Nurse Anesthetists (AANA), the ASA, and the Society of Pediatric Anesthesia (SPA) (Bauer et al., 2016; Ishman et al., 2015). Each organization has a published guideline regarding perioperative management of SDB; however, neither the ASA nor the AANA has adopted pediatric-specific guidelines recommended by the AAP and the SPA (Bauer et al., 2016). Additionally, in up to 25% of children presenting for surgery and anesthesia, symptoms of SDB were missed entirely; when screening did occur, snoring was identified as the most common symptom (Ishman et al., 2015; Tait et al., 2013). Lack of agreement on an organizational level in addition to a poor understanding of SDB by the professional completing the evaluation may be facets, which when compounded, deter the provider from screening altogether.

Validated Tools to Assist in Screening for SDB

Adding to the inconsistency is the lack of agreement on a defined tool used to identify SDB in children. The current gold standard for diagnosis is polysomnography (PSG); however, it is rarely utilized due to its cost, inconvenience, and time needed to complete the test (AAP, 2002; Bauer et al., 2016, Galvez et al., 2019; Raman et al., 2019; Sanders et al., 2006). In an attempt to close the gap on screening, multiple tools validated for use in adults have been used to conduct various studies in children including PSQ, CAS-15, and OSA-18; however, due to the lack of repetition and comparison studies, none of the aforementioned tools have been truly validated or deemed superior to one another or PSG within the pediatric population (Bauer et al., 2016; Holmes et al., 2017; Ishman et al., 2015; Tait et al., 2013)

The STBUR was purposely developed for the screening of pediatric patients. Despite lacking validation as a diagnostic tool for SDB, STBUR has shown excellent specificity within the pediatric population in multiple studies (Galvez et al., 2019; Tait et al., 2013; Tait et al., 2014; Tait et al., 2016). Unlike other tools mentioned, STBUR is promising. It is simple, cost-effective, time effective, and appears to have great sensitivity within the pediatric population (Bauer et al., 2016; Tait et al., 2013; Tait et al., 2014; Tait et al., 2016; Terry, Disabato & Krajicek, 2015). Further testing in larger pediatric samples is warranted, however, to verify its validity and examine its usefulness as a preoperative risk stratification tool (Galvez et al., 2019).

Implications of Diagnosed and Undiagnosed SDB in the Perioperative Period

Of multiple perioperative events identified by researchers, two implications were chosen for discussion due to significance: post-operative respiratory adverse events (PRAEs) and post-operative maladaptive behaviors (POMBs). Evidence sufficiently points to an increased number of PRAEs experienced in children with diagnosed and undiagnosed, but probable SDB (Galvez et al., 2019; Raman et al., 2019; Tait et al., 2013; Tait et al., 2016). Children with suspected and diagnosed SDB were 2 to 10 times more likely to experience a PRAE when all five markers of the STBUR questionnaire were present (Tait et al., 2013; Tait et al., 2016). Across all studies and surgeries, the most experienced PRAE was oxygen desaturation to <91% (Galvez et al., 2019; Raman et al., 2019; Tait, et al., 2013; Tait et al., 2016). Additionally, children with diagnosed SDB were more likely to encounter more serious PRAEs and require escalation of care (Galvez et al., 2019; Tait et al., 2013; Tait et al., 2016).

Several studies identify a plausible relation between SDB and POMB. Children with diagnosed SDB are more likely to experience baseline behavior issues (AAP, 2002; Bauer et al.,

2016; Tait et al., 2014). These issues may be intensified by anesthesia and may materialize as postoperative agitation, also described as emergence delirium (ED) (Kain et al., 2004; Tait et al., 2014; Tait et al., 2016). The odds of a child developing POMB are increased significantly when that child experiences ED (Kain et al., 2004). Symptoms of ED include thrashing, restlessness, inconsolability, and non-purposeful movement (Kain et al., 2004; Voepel-Lewis, Malviya, & Tait, 2003). Factors that increase the risk of ED include the type of anesthetic used (inhalational>intravenous), young age (2-6 years old), and preoperative anxiety (Kain et al., 2004; Voepel-Lewis, Malviya, & Tait, 2003). This may impact the child as well as the caregiver and create unnecessary distress within the family unit, negatively affecting patient and parental satisfaction with both the provider and the facility.

While information is abundant regarding ED, there is a gap in the literature regarding POMB in children with diagnosed and suspected SDB. Although age is an implicating factor for ED, age may not be the only implicating factor for POMB; therefore, due to the magnitude of the effects of POMB, the relationship between ED and long-term POMB, as well as the aforementioned gap discussing SDB and POMB, further investigation is warranted in children to determine if SDB plays a role in developing POMB.

Conceptual Framework

The ability of both surgeons and anesthesia providers to understand and expect potential perioperative complications for children with suspected SDB is crucial to the safety and well-being of the pediatric patient undergoing surgery. Although STBUR is still relatively new to the field of pediatric screening, it has shown great specificity and has the potential to not only diagnose SDB with relative ease, but also shows promise as a risk stratification tool to help aid

providers in making critical decisions such as potentially canceling or delaying a case, or choosing a different setting aside from an ASC (Galvez et al., 2019; Raman et al., 2019; Tait, et al., 2013; Tait et al., 2016; Whippey et al., 2016).

Because of the significant airway and morbidity implications of undiagnosed SDB, varying reports of prevalence, as well as a lack of data and screening in Pediatric Surgery P.A., a needs assessment project is warranted. The purpose of this needs assessment project will be to determine the prevalence of SDB within the chosen population and region and investigate if there exists a need for the permanent implementation of a preoperative screening tool.

Several models of needs assessment exist; however, most are not easily applied to the field of healthcare which is why Witkin's Three Phases of Needs Assessment— Pre-assessment, Assessment, and Post-assessment—was chosen for this project (Altschuld, 2004; Leigh, Watkins, Platt, & Kaufman, 2000). In phase I, the pre-assessment period, areas of major need are identified, and necessary data and outcomes are determined (Altschuld, 2004; Leigh et al., 2000). In phase II, the assessment period, data is gathered, analyzed, and synthesized (Altschuld, 2004; Leigh et al., 2000). In phase III, the post-assessment period, an action plan is developed, and outcomes are communicated with all involved parties (Altschuld, 2004; Leigh et al., 2000).

Aims & Objectives

The primary aims of this scholarly project were to perform a needs assessment, evaluate the patients at the office of Pediatric Surgery P.A., and make evidence-based recommendations appropriate for those findings. The objectives for this scholarly project were delineated as follows:

1. Determine the prevalence of SDB in children presenting for surgery to the office of Pediatric Surgery, P.A. in Orlando Florida over a six-month period.
2. Determine the incidence of POMB in children screened positive for SDB over a six-month period.
3. Determine if a relationship exists between SDB and POMB in children receiving inhalational general anesthetics over a six-month period.
4. Determine if there is a difference between the average age of children screening positive for both SDB and POMB and children screening positive for SDB and negative for POMB over a six-month period.
5. Make evidence-based recommendations regarding screening of children for SDB based on the findings of this scholarly project after the six-month period.

Methods

The design of this needs assessment project was quantitative and prospective. The control variable was general anesthesia with inhalational agent used during the maintenance phase for surgery. The independent variable was the STBUR screening questionnaire. The dependent variables were the prevalence of SDB among patients presenting to Pediatric Surgery P.A. and the incidence of POMB in children screened for SDB.

Setting

Two sites were selected for this project: Pediatric Surgery, P.A., and Downtown Surgery Center (DSC). The primary location for all screening and follow-up questions as well as subject recruitment was the Office of Pediatric Surgery P.A. in Orlando FL. Since surgery was

completed at Downtown Surgery Center (DSC) and not in the office, DSC was recruited to ensure that screening documents travel with the patient to the surgery center, and to ultimately obtain the type of anesthetic performed. The closure of the project was communicated via email sent to the President of Pediatric Surgery P.A. and the Director of DSC after the specified time frame.

Sample

For this project, a pediatric patient was defined as a child greater than 60 weeks post-conceptual age and less than or equal to 18 years of age. Inclusion criteria were children of both sexes ages > 60 weeks post-conceptual age to 18 years of age presenting to the office of Pediatric Surgery P.A. for surgery under general anesthesia. Exclusion criteria were the use of any anesthetic other than inhalational anesthetic for the maintenance phase of anesthesia, age older than 18 years or younger than 60 weeks post-conceptual age, and parent/caregiver spoken language other than English due to lack of STBUR tool validation in languages other than English.

Access and Recruitment

The sample was obtained through sequential convenience sampling based on the number of surgeries scheduled by Pediatric Surgery P.A. at DSC over a period of six months. Ms. Lindsey Roberts—office coordinator at Pediatric Surgery P.A. and Downtown Surgery Center liaison—presented all eligible participants or their guardians with the letter of invitation (see Appendix B) at the start of their initial appointment with Pediatric Surgery P.A.

Ethical Considerations

All participants were allowed to read and review the letter of invitation as well as ask any questions before agreeing or refusing to participate. All participants were also provided with an email address to contact the co-primary investigator on the letter of invitation for any future questions that may arise. An hour-long introduction to the project and orientation to the recruitment process was completed with Ms. Lindsey Roberts to ensure adequate depth and breadth of understanding. No compensation was offered to participants. Ms. Roberts was provided with a written protocol (see Appendix C) as well as the inclusion and exclusion criteria for project implementation.

Instruments

An intake form was constructed containing the five STBUR questions (see Appendix D). Results from the 2003 "National Assessment of Adult Literacy" indicated only 12% of the nation's adults had proficient health literacy (Kutner, Greenberg, Jin & Paulsen, 2006). Thus, a Flesch-Kincaid readability test was attained using word readability statistics resulting in a 1.6 Flesch-Kincaid Grade reading level for the aforementioned screening questions.

The STBUR has shown excellent reliability and specificity in multiple studies within the pediatric population and is partially validated for the detection but not diagnosis of SDB (Bauer et al., 2016; Tait et al., 2013; Tait et al., 2014; Tait et al., 2016; Terry, Disabato & Krajicek, 2015). Permission to use the tool was obtained via email from the original author, Dr. Alan Tait, in September 2020.

Data Collection & Analysis

Completed paper questionnaires were scanned into each participant's respective electronic file by Ms. Lindsey Roberts. Participants were numbered serially starting at "one" based on their scheduled surgery date and time. After the six-month time frame, a retrospective chart review was completed by the co-primary investigator. The co-primary investigator was granted temporary access to the office's electronic medical records as well as paper charts at DSC to allow for data collection. Access to the aforementioned records was terminated at the end of data collection.

De-identified data of all participants were entered into an Excel spreadsheet into the University's Microsoft Teams account. Microsoft Teams is HIPAA compliant (*Compliance framework for industry standards and regulations for office 365 and related Microsoft services*, 2019). This data will be autodeleted by the AdventHealth University IT department in seven years. Electronic charts were reviewed in numerical order to ensure the single-entry of all data without duplication. Non-participants were not assigned a number and were skipped during data entry but were accounted for at the end of the data collection period to allow for accurate incidence and prevalence calculations. Paper charts from DSC were matched to electronic charts at Pediatric Surgery P.A. to ensure the single entry of all data without duplication. At no time did the co-primary investigator remove any type of identifiers from the office of Pediatric Surgery P.A. or DSC.

Descriptive statistics were completed with the guidance of a statistician, Dr. Hongyuan Cao, and were used to determine the prevalence of SDB and the incidence of POMB within the sample. An excel spreadsheet containing the de-identified data was transmitted via email to Dr. Hongyuan Cao.

A power analysis completed by Dr. Roy Lukman utilizing XLSTAT2020 revealed the required minimum sample size for conventional values of power at .90, alpha at .05. and effect size at .5 was 85 per group. With an added 20% sample loss per group, the minimum sample size per group increased to 102 for a total minimum sample size of 204 participants. Data collection ended at the six-month period, regardless of statistical significance and sample size. Due to the lack of power, a decision was made to forgo all planned inferential analyses due to the high potential for statistically skewed results. Evidence-based recommendations were made after statistical analyses were complete.

Planning and Procedures: Phase I (Pre-Assessment)

Planning

In September of 2019, a problem was identified, PICOT questions were developed, and a proposal for a topic was submitted to AdventHealth University faculty in the Department of Nurse Anesthesia. Databases, websites, and reference lists were reviewed in October of 2019 to identify relevant literature. The topic received preliminary approval from faculty in December of 2019. In July of 2020, interviews were conducted with key players and a proposed methods PowerPoint was submitted to faculty for review and approval. Constructive feedback was received on the proposed methods PowerPoint in July of 2020 and appropriate changes were made.

Key players were identified and selected based on their roles within Pediatric Surgery P.A. The following individuals were identified as critical to ensure the success of this project: Dr. Mark Chaet, President, medical director, and sole pediatric surgeon for Pediatric Surgery P.A.; Ms. Lindsey Roberts, office administrator, scheduler, and mediator between Pediatric

Surgery P.A. and DSC; Dr. Harsh Wilkhu, anesthesiologist and board member at DSC; and Mr. Matthew Solis, director at DSC. To facilitate buy-in, a thorough evidence-based explanation of the problem, STBUR questionnaire, and the potential benefits to both the practice and the surgery center was completed with each key player. There was a consensus among the interviewed key players that this is not a resource-heavy project.

Implementation & Timeline

In the Fall of 2020, a proposal was submitted to the AdventHealth Institutional Review Board (IRB), and in the Spring of 2021, this project received the designation of "Not Research". Implementation began in the Summer of 2021 and included the use of the intake form (see Appendix D) in the office of Pediatric Surgery P.A. The form was completed by eligible participants who met inclusion criteria, or their guardians, as part of the standard office paperwork. All participants/guardians were also asked a single question by Dr. Chaet at their two-week post-operative visit (see Appendix D). Data were collected monthly starting in August of 2021 using retrospective chart reviews at both Pediatric Surgery P.A. and DSC. Implementation was completed in December of 2021 and final data collection was completed in January 2022. Data analysis was completed using descriptive statistics with the assistance of a statistician, Dr. Hongyuan Cao. Results were disseminated at AdventHealth University and summaries were sent via email to the office of Pediatric Surgery P.A. and DSC with evidence-based recommendations.

Barriers & Facilitators

Potential barriers identified during key player interviews revolved around current world events—namely novel Coronavirus (COVID-19). Nearly every key player implicated COVID-19 as a potential barrier that may limit the number of patients and thereby potentially impact statistical significance. A thorough discussion of the proposed project methods was essential to the understanding of, and assent to, data collection from both the office and the surgery center. However, despite the discussion of the proposed methods, none of the key players or the investigators could predict or affect the track of the global pandemic. Thus, the number of participants was affected as expected due to the decline in surgical procedures that resulted because of patient fear for the pandemic and its repercussions.

An unanticipated barrier that arose during the implementation phase was the misunderstanding of the original project protocol, resulting in a timeline delay and a second attempt at implementation. This barrier was remedied by halting the initial implementation, revising the original project proposal to include detailed steps, re-educating staff, and finally re-implementing the project with a complete disregard for previously collected data.

The single most important facilitator to this project was Dr. Mark Chaet. His agreement to work on this project was the provoking factor that initiated the cascade of events that followed, including facilitating the “onboarding” of the surgery center to allow the data to be collected at the end of the project timeframe. The remaining key players were essential for the implementation portion of this project to ensure as close to 100% compliance as possible.

Procedures to Sustain

Weekly phone calls were completed with Ms. Lindsey Roberts to determine the efficacy of implementation, answer any questions, ensure adherence to project protocol, and encourage sustainability. Monthly communications via email/phone were completed with the remaining key players and committee members to maintain relations and answer any questions. Phone calls were used to troubleshoot any potential issues and ensure the scholarly project remained on target as scheduled. Site visits were conducted at a minimum monthly and occasionally, as needed, as determined by weekly phone calls with Ms. Lindsey Roberts.

Budget/Grant

There was a consensus among interviewed key players that this was not a resource-heavy project; therefore, due to this being a needs assessment, we did not incur any costs.

Results/ Findings: Phase II (Assessment)

The final sample consisted of a total of 86 participants of whom two were excluded due to age, and one was excluded due to surgery cancellation, bringing the total sample size down to 83 participants. There were a total of 115 patients scheduled for surgery at DSC during the six-month period. The overall participation rate was 74.78%. The mean age of all participants was 7.6 years old, and the most common ages of all participants were between 6 and 12 years old. A summary of the ages of all participants can be seen in Appendix F, Figure 1.

All participants received inhalational anesthesia for the maintenance phase of their anesthetic during surgery. Of the 83 participants, a total of 8 (9.64%) participants answered “Yes” to one or two of the five STBUR questions. None of the participants answered “Yes” to

three or more of the five STBUR questions; therefore, none of the participants screened positive on the STBUR tool, resulting in a 0% prevalence of SDB in the selected population. A summary of all responses to the STBUR tool can be seen in Appendix F, Figure 2.

Of the 83 participants, none answered “Yes” to the post-operative question; therefore, none of the participants screened positive for POMB, resulting in a 0% incidence of POMB in the selected population. Sixty-four participants (77.12%) answered “No” to the postoperative question and nineteen (22.89%) were missing data due to the participant not coming in for their two-week post-operative visit. The resulting sample loss to follow-up was 22.89%. A relationship between POMB and SDB could not be established with the said results. A summary of both pre- and post-operative screening results can be seen in Appendix F, Figure 3.

Inferential Statistics

Due to the lack of sample power, a decision was made to forgo all originally planned inferential statistics because of the high probability of statistically skewed results, and poor generalizability to the desired population.

Discussion & Implications

Children with diagnosed and undiagnosed SDB have more perioperative complications per child than their non-SDB counterparts (Ishman et al., 2015; Sanders et al., 2006). These complications may be mitigated or prevented with screening that is not presently used (Bauer, Lee, & Campbell, 2016; Ishman et al., 2015). The purpose of this project was to conduct a needs assessment to determine the prevalence of SDB, as well as determine if there exists a need for permanent implementation of a preoperative screening tool.

Sample & Results

Although the implementation of the desired innovation was successful, there was a lack of statistical significance, as well as a lack of positive screens for both SDB and POMB; therefore, we were unable to achieve objectives three and four as planned. However, there may be several implications for the lack of statistical significance, lack of a positive screen on the STBUR, and a lack of a positive screen for POMB.

First, the brief collection time frame, combined with a global pandemic resulting in the decline of outpatient surgeries, may have contributed to a significant reduction in sample size. Moreover, the setting that this project was established in may have played a key role in the lack of any positive screens and thus statistical significance. DSC, much like other ASCs, only admits children who are healthy, without any unstable medical conditions, including but not limited to abnormal psychological behavior, compromised airway, or bleeding disorders, presenting for routine, non-emergent surgery. Additionally, children are screened at Pediatric Surgery P.A. to determine the appropriateness of both the child's medical condition and surgery, before scheduling at DSC. Children are not scheduled for surgery at DSC by the office if they are less than six months of age, require an overnight stay post-procedure, have a BMI >42, or require specific equipment not available at DSC. These factors when combined, result in a generally healthy patient population undergoing surgery at DSC.

Finally, misunderstanding of the original project protocol by staff may have played a small, albeit noteworthy, role in the lack of significance. The need to reimplement this project and forgo all previously collected data may have resulted in a loss of valuable information which may have been the difference between a lack of statistical power and achieving the suggested minimum sample size.

Implications for Practice and Research

Current practice recommendations include the screening of all children during the preoperative period for SDB (AAP, 2002; ASA Task Force on Perioperative Management of Patients with Obstructive Sleep Apnea, 2014; Holmes et al., 2017; Raman et al., 2019). Although the overall participation rate for this project was high, the sample size was not large enough to assume a normal distribution or to achieve statistical power, and thus may not be an accurate representation of the local population. Consequently, though the current results suggest that there does not exist a need for the implementation of a permanent preoperative screening tool within the outpatient surgical center setting, the small sample size makes it difficult to conclude a generalization to the selected population and make evidence-based recommendations. Therefore, the author would like to recommend the reimplementation of this project in a larger, hospital-based setting over a prolonged period, to truly determine if there exists a need for the implementation of a permanent preoperative screening tool.

The implementation of this type of project in a community setting, although not impossible, may be a sustainability issue if certain needs are not addressed during future implementation attempts. The understanding of simple medical terminology and basic familiarity with Quality assessment and Quality Improvement is vital to the establishment of a solid foundation for this type of project. As such, the author would like to recommend the use of a written protocol for community personnel to follow along as well as frequent monitoring and check-ins by the project investigators during future implementation attempts.

Limitations

Several limitations were identified for this type of project. The time restraint for data collection as well as the use of convenience sampling and lack of randomization were confounding variables that could have skewed results due to the lack of long-term data gathering; therefore, the current sample may contain a certain degree of bias. Statistically insignificant or small sample size was a limitation due to declining outpatient surgery procedures because of COVID-19; thus, generalizability to the desired population is limited. Reliance on parental response may have limited valuable data and may be a factor when discussing reliability due to the potential for subjective reporting error. The questions on this tool require a parent/caregiver to have more than a basic familiarity with their child's sleeping patterns and habits, and it is difficult to measure or gauge the degree of accuracy of the information, especially if the child is older, and the child and parent/caregiver do not share a bed or a room. Finally, the use of a semi-validated tool may be of significance for future replications of this type of scholarly project. The STBUR is validated for the detection but not diagnosis of SDB (Bauer et al., 2016; Tait et al., 2013; Tait et al., 2014; Tait et al., 2016; Terry, Disabato & Krajicek, 2015).

Conclusion

Issues surrounding the airway and associated disease processes, such as SDB will remain a relevant perioperative anesthesia factor in the safe planning and caring for children undergoing surgery. Though the findings of this project do not suggest a relationship between SDB and POMB or a need for the permanent implementation of a preoperative screening tool, ultimately, both originally asked PICOT questions remain to be answered. This project's data support the existing knowledge gap and literature gap, thereby validating the need for a replication of this

study with a larger sample size that meets the recommended statistical power before the findings of this project could be deemed accurate and generalizable to the desired population.

Dissemination Plan: Phase III (Post-Assessment)

The project results were disseminated in Spring of 2022 locally, at AdventHealth University as part of the requirement for successful completion of the Doctor of Nurse Anesthesia Program. Summaries of the results were sent via email to the office of Pediatric Surgery P.A. and DSC with evidence-based recommendations. The dissemination date was scheduled with consideration given to faculty and key player schedules. Information was shared with a presentation summarized in a PowerPoint format.

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Appendix A: Article Matrix Tables

<table>
<tr><th colspan="6">References</th></tr>
<tr><td colspan="6">Sanders, J. C., King, M. A., Mitchell, R. B., & Kelly, J. P. (2006). Perioperative complications of adenotonsillectomy in children with obstructive sleep apnea syndrome. Anesthesia and Analgesia, 103(5), 1115-1121. doi:10.1213/01.ane.0000244318.77377.67
Whippey, A., Kostandoff, G., Ma, H. K., Cheng, J., Thabane, L., Paul, J., & Lerman, J. (2016). Predictors of unanticipated admission following ambulatory surgery in the pediatric population: A retrospective case–control study. Pediatric Anesthesia, 26(8), 831-837. doi:10.1111/pan.12937</td></tr>
<tr><th>Purpose</th><th>Variables</th><th>Setting/Subjects</th><th>Measurement and Instruments</th><th>Results</th><th>Evidence Quality</th></tr>
<tr><td>Study One: Rate and type of perioperative complication in children w/ OSAS vs. children w/ recurrent tonsillitis undergoing adenotonsillectomy

Study Two: determinants of unexpected admission post pediatric ambulatory surgery</td><td rowspan="2">Study One:
Primary variable: determine risk factors for perioperative complications for children w/ OSAS

Secondary variable: determine safety standard of standard anesthesia protocol in children w/ OSAS

Study Two:
Primary variable: unanticipated admission after ambulatory surgery up to 24 hours post-operatively

Secondary variable: Reason for readmission: surgical anesthetic, medical, social/administrative causes.</td><td rowspan="2">Study One:
Settings: unspecified pediatric otolaryngology clinic and University of New Mexico sleep study laboratory.
Subjects: 82 children—61 w/ diagnosis of OSAS and 21 w/ recurrent tonsillitis between 2 and 16 years of age; ASA/PS <3; no additional surgical procedures, w/ no prior hx. of craniofacial abnormalities, down syndrome, or contraindications to general anesthesia.
Study Two:
Setting: unspecified single center pediatric Canadian tertiary hospital from 4/2005-10/2012
Subjects: 21,957 children <18 years but > 60 weeks post conceptional age who underwent ambulatory surgery at the center</td><td rowspan="2">Study One: six identified scales (tools) and four set definitions (measurements) for outcomes measured were used and preset by this study.

Study Two: modified post anesthesia discharge scoring system; electronic medical registry: Sovera 9.0 HIM for preoperative data recording; secure online database: RedCap, software version 5.12.1 used to extract preoperative variables; surgical procedures classified using ICD10 codes.</td><td>Study One: OSAS children had more complications per patient than non-OSAS children (5.7 vs. 2.9, P<0.0001)
Study Two: There were 213 unanticipated admissions (0.97%, 95% CI: 0.84-1.1%); Anesthesia related causes accounted for 100 patients (47% of unanticipated admissions; 95% CI: 40.3%-53.7%) Surgical 71 patients (33%, 95% CI: 26.7-39.3%). Unanticipated admission rate in children w/ diagnosed OSA 89% (P <0.01)</td><td rowspan="2">Study One:
Methodological flaws: only observers blinded to the outcomes of polysomnography and child’s diagnosis. States some data lost to follow-up but doesn’t define data lost.
Inconsistency: none
Indirectness: none
Imprecision: small sample size; author states possibility of lack of generalizability due to population sampled.
Publication bias: lack of conflict-of-interest disclosure.
Study Two:
Methodological flaws: reason for admission was determined by reviewers (3 total)—subject to interpretation and bias; risk for bias low due to methods used to reduce bias.
Inconsistency: none
Indirectness: none
Imprecision: none
Publication bias: none</td></tr>
<tr><td>Design</td><td>Implications</td></tr>
<tr><td>Study one: mentioned prospective in nature but actual design not found; appears to be an observational study

Study Two: Retrospective Case control study</td><td>Study One: standard anesthetic plans may be used in children w/ OSAS.
Study Two: incidence of unexpected admission is low but significant; OSA is a predictive factor in peds</td></tr>
</table>

<table>
<tr><td colspan="6">References
Kain, Z. N., Caldwell-Andrews, A. A., Maranets, I., McClain, B., Gaal, D., Mayes, L. C., . . . Zhang, H. (2004). Preoperative anxiety and emergence delirium and postoperative maladaptive behaviors. Anesthesia and Analgesia, 99(6), 1648-1654. doi:10.1213/01.ANE.0000136471.36680.97
Tait, A. R., Voepel-Lewis, T., & O'Brien, L. M. (2014). Postsurgical behaviors in children with and without symptoms of sleep-disordered breathing. Perioperative Medicine (London, England), 3(1), 8. doi:10.1186/2047-0525-3-8</td></tr>
<tr><td>Purpose</td><td>Variables</td><td>Setting/Subjects</td><td>Measurement and Instruments</td><td>Results</td><td>Evidence Quality</td></tr>
<tr><td>Study One: Examine the relationship between preoperative anxiety, emergence delirium, and postoperative maladaptive behaviors
Study Two: compare post-operative behaviors between children with and without symptoms of SDB.</td><td rowspan="2">Study One:
Primary variable: Preoperative anxiety and emergence delirium

Secondary variable: Absence or presence of maladaptive behaviors on post-operative day 1,2,3,7 &14 based on Post Hospitalization Behavior Questionnaire (PHBQ) score

Study Two:
Primary variable: Postoperative behavior using the PHBQ scale

Secondary variable: SDB identification by Sleep-Related Breathing Disorder (SRBD) subscale of Pediatric Sleep Questionnaire (PSQ)</td><td rowspan="2">Study One:
Setting: Unspecified database of studies conducted in an unspecified laboratory over the past 6 years.
Subjects: 791 children w/ PS/ASA I-II, having outpatient surgery under general anesthesia w/o hx. of chronic illness, prematurity, developmental delay, or psychiatric illness. No administration of midazolam in pre-op and a N2O/ O2/ Sevoflurane anesthetic induction.
Study Two:
Setting: Not described.
Subjects: 337 children aged 2 to 14 years presenting for an outpatient elective surgical procedure requiring general anesthesia; ASA I-II, w/o cognitive impairment or hx of cardiovascular disease.</td><td rowspan="2">Study One:
Instruments: State-Trait Anxiety Inventory (STAI); Emotional, Activity, Sociability, and Impulsivity (EASI) Scale of child temperament; Modified Yale Preoperative Anxiety Scale (mYPAS); PHBQ.

Measurements: Emergence status was measured using observer measure yielding a score of 1, 2, or 3: 1= no emergence delirium, 2= mild symptoms, 3= marked symptoms.

Study Two: 16-item SRBD subscale to measure SDB; PHBQ to measure changes in postoperative behaviors on post-operative days 7-10.</td><td>Study One: Children w/ more intense pre-op anxiety were more likely to show signs of emergence delirium [F(4, 1572)= 10.75, P= 0.000]. Children w/ intense pre-op anxiety showed increased maladaptive behavior changes after surgery [F(4, 91)= 7.21, P= 0.0001)
Study Two: 26% (N=90) of children w/o previous diagnosis of SDB screened positive for SDB. Children w/ SDB were more prone to exhibit anxiety, apathy, aggression and eating disturbances</td><td rowspan="2">Study one:
Methodological flaws: exclusion of pain as a variable due to high correlation between pain and emergence delirium; cannot rule out “dose dependent” results.
Inconsistency: none
Indirectness: none
Imprecision: no effort made to rule out pain as a plausible factor for emergence delirium.
Publication bias: lack of conflict-of-interest disclosure.
Study two:
Methodological flaws: no randomization, convenience sampling
Inconsistency: statistics inconsistently performed
Indirectness: none
Imprecision: reported % of children screening positive for SDB using SRBD but did not run statistics on it.
Publication bias: none</td></tr>
<tr><td>Design
Study one: Design not stated, but appears to be a retrospective database review of previous studies over 6 years

Study Two: Secondary analysis of data from a primary study</td><td>Implications
Study One: emergence delirium increases risk of behavior changes
Study Two: SDB symptoms often go unrecognized; SDB may predict rate of postoperative maladaptive behaviors</td></tr>
</table>

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<tr><td colspan="6">Holmes, E. M., Singh, H. H. K., Kirk, V. G., Brindle, M., Luntley, J., Weber, B. A., & Yunker, W. K. (2017). Incidence of children at risk for obstructive sleep apnea undergoing common day surgery procedures. Journal of Pediatric Surgery, 52(11), 1791-1794. doi:10.1016/j.jpedsurg.2017.05.020
Raman, V. T., Geyer, E., Miller, R., Tumin, D., Splaingard, M., Jatana, K. R., & Tobias, J. D. (2019). Pediatric obstructive sleep apnea screening questionnaire and post-operative outcomes: A prospective observational study. International Journal of Pediatric Otorhinolaryngology, 127, 109661. doi:10.1016/j.ijporl.2019.109661</td></tr>
<tr><th>Purpose</th><th>Variables</th><th>Setting/Subjects</th><th>Measurement and Instruments</th><th>Results</th><th>Evidence Quality</th></tr>
<tr><td>Study One: Evaluate the prevalence of sleep-related breathing disorders (SRBD) in children undergoing elective day surgery

Study Two: Evaluate the effectiveness of a six-question survey in predicting post-operative respiratory events</td><td>Study One:
Primary variable: Prevalence of SRBD in patients awaiting common day surgery as compared to published prevalence figures.

Secondary variable: type of surgery as a possible determinant for SRBD

Study Two:
Primary variable: post-operative outcomes—specifically supplemental oxygen requirement in PACU

Secondary variable: Validity of Questionnaire</td><td>Study One:
Setting: Alberta Children’s Hospital (ACH) in Canada between 9/2012 and 11/2013
Subjects: All children < 18 years having a day surgical procedure done by a general surgeon, urologist, or otolaryngologist. No prior polysomnography or hx. Of OSA recorded in medical record; No prior respiratory comorbidities. 288 surveys were completed
Study Two:
Setting: Nationwide Children’s Hospital
Subjects: 707 children from 3 to 18 years presenting for scheduled surgery to the main operating room between 11/2016 and 7/2018; ASA I, II, III</td><td>Study One: PSQ

Study Two: Unvalidated Six-question survey used by the same author on a previous study</td><td>Study One: Otolaryngology patients have increased risk for OSA compared to general surgery patients (51.9% P<0.0001 vs. 11.1% P<0.0001) or urology (9.1% P<0.001). Prevalence higher than published. Study Two: Children w/ predicted OSA were more likely than children w/o OSA to require O2 in PACU (24% vs. 17%; 95% CI 0.3%-13% P=0.049); median survey score was 1 and 26% had a score of 2 or more of 6.</td><td rowspan="2">Study One:
Methodological flaws: no blinding; but states results of PSQ were not made available to surgeons and anesthesiologists.
Inconsistency: none
Indirectness: none
Imprecision: small sample size, however it was a pilot study; recruitment of children for otolaryngology day surgery may be cause for bias; cannot rule out “dose dependent” result
Publication bias: lack of conflict-of-interest disclosure.
Study Two:
Methodological flaws: Limited sample to ASA I-III after data collection.
Inconsistency: none
Indirectness: none
Imprecision: use of unvalidated tool
Publication bias: none</td></tr>
<tr><td>Design</td><td colspan="3"></td><td>Implications</td></tr>
<tr><td>Study one: Mentions prognosis study but actual design not stated; appears to be longitudinal.
Study Two: Pilot Prospective observational study</td><td colspan="3"></td><td>Study One: Prevalence of undiagnosed OSA in common day surgery higher than reported.
Study Two: Incidence of OSA underestimated in children presenting for non-otolaryngology surgical procedures</td></tr>
</table>

<table>
<tr><td colspan="6">References
Bauer, E. E., Lee, R., & Campbell, Y. N. (2016). Preoperative screening for sleep-disordered breathing in children: A systematic literature review. AORN Journal, 104(6), 541-553. doi:10.1016/j.aorn.2016.10.003
Ishman, S. L., Tawfik, K. O., Smith, D. F., Cheung, K., Pringle, L. M., Stephen, M. J., . . . Stierer, T. L. (2015). Screening for pediatric obstructive sleep apnea before ambulatory surgery. Journal of Clinical Sleep Medicine : JCSM : Official Publication of the American Academy of Sleep Medicine, 11(7), 751-755. doi:10.5664/jcsm.4852</td></tr>
<tr><td>Purpose</td><td>Variables</td><td>Setting/Subjects</td><td>Measurement and Instruments</td><td>Results</td><td>Evidence Quality</td></tr>
<tr><td>Study One:
- To discuss pediatric SDB
-To explain why SDB is important in the ambulatory setting
-To discuss the value in using a SDB questionnaire

Study Two: Assess the frequency of screening by anesthesia providers for the signs and symptoms of OSA in children undergoing ambulatory surgery

Design
Study one: Systematic Literature Review
Study Two: Prospective single-blinded observational study</td><td>Study One:
Databases: PubMed, MEDLINE, Cumulative Index to Nursing and Allied Health Literature, Ovid
Search Terms: pediatric, sleep disordered breathing, obstructive sleep apnea, anesthetic management, screening, and practice guidelines.
Limits: published from 2009-2015
Reviewers: single author reviewer
Study Two:
Primary variable: frequency of screening for OSA by anesthesia providers in an ambulatory surgery setting
Secondary variable:
-type of surgery
-most identified OSA screening term used by providers</td><td>Study One: This review included 12 studies with 6,799 participants

Study Two:
Setting: Johns Hopkins Hospital Outpatient Center
Subjects: Consecutive patients younger than 18 years coming in for ambulatory surgery from 7/2009- 10/2009 with English-speaking/hearing caregivers. Children of caregivers w/ language impairments were excluded. N= 101.</td><td>Study One: Tools evaluated included CAS-15, SRBD questionnaire, STBUR; there were many different variables discussed and looked at; this precluded statistical analysis.

Study Two: OSA-18: validated disease specific quality of life questionnaire; 12 terms were defined related to the signs and symptoms of OSA.</td><td>Study One: No statistical analysis; isolates STBUR as valid tool; defines PRAEs as major preventable outcome.
Study Two: 37% of pts were screened for OSA; patients undergoing otolaryngology procedures were more likely to be screened than any other surgery (49% vs. 29% P= 0.0619); “Snoring” was the most common OSA-related term used for screening (61%) across all surgeries.

Implications
Study One: STBUR is a reliable tool for predicting PRAEs
Study Two: Anesthesia providers do not regularly screen for OSA in pediatric patients undergoing ambulatory surgery</td><td>Study One:
Methodological flaws: Possible article selection bias-single author reviewer
Inconsistency: wide variation of questions addressed
Indirectness: no exact recommendation made by authors based on systematic review
Imprecision: single author reviewed the literature
Publication bias: none
Study Two:
Methodological flaws: convenience sampling; single blind.
Inconsistency: none
Indirectness: none
Imprecision: small sample size; selection of non-medical observers to determine types of screening terms used-risk for error.
Publication bias: none</td></tr>
</table>

<table>
<tr><th colspan="6">References</th></tr>
<tr><td colspan="6">Tait, A. R., Bickham, R., O'Brien, L. M., Quinlan, M., Voepel-Lewis, T., & Veyckemans, F. (2016). The STBUR questionnaire for identifying children at risk for sleep-disordered breathing and postoperative opioid-related adverse events. Pediatric Anesthesia, 26(7), 759-766. doi:10.1111/pan.12934
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<tr><th>Purpose</th><th>Variables</th><th>Setting/Subjects</th><th>Measurement and Instruments</th><th>Results</th><th>Evidence Quality</th></tr>
<tr><td>Study One: To confirm that otherwise healthy children with symptoms of SDB are at greater risk for PRAEs

Study Two: To develop a simple tool to identify children w/ symptoms of SDB who may be at risk for PRAEs</td><td rowspan="2">Study One:
Primary variable: Sensitivity of STBUR questionnaire in identifying children at risk for SDB

Secondary variable: Postoperative respiratory and opioid related events

Study Two:
Primary variable: factors of SRBD most predictive of PRAEs and development of simple tool to screen for SDB in children based on those factors

Secondary variable: sensitivity of STBUR as compared to SRBD in detecting SDB and PRAEs</td><td rowspan="2">Study One:
Setting: setting not mentioned
Subjects: 678 parents of children scheduled for surgery completed STBUR; children aged 2-17 scheduled for surgery requiring general anesthesia and perioperative pain management from 6/2014- 4/2015; ASA I-II; no presence of a trach; no surgery for CHD, CF, and w/o moderate/ severe cognitive impairment.
Study Two:
Setting: Setting not mentioned
Subjects: 337 parents of children scheduled for surgery completed SRBD survey; children aged 2-14; ASA I-II; presenting for elective surgery requiring GA; no hx of CV disease, no emergency surgery and no TIVA.</td><td rowspan="2">Study One: STBUR questionnaire; PRAEs defined as one or more major event (cont. cough >4x; desat. <91%, breath holding >30s, obstruction requiring jaw thrust or OPA; bronchospasm; laryngospasm) during peri-op. period. 4-point scale used to measure emergence agitation; ORAEs defined as any of these events: desat. <91%; over-sedation; use of naloxone; supplemental O2 use or need for escalation of care occurring 24 hours from discharge from PACU; SPSS software used for statistical analysis.
Study Two: SRBD subscale of PSQ; PRAEs defined same as above. PASW software used for statistical analysis.</td><td>Study One: STBUR identified 85 (17.7%) pts w/ masked SDB signs; incidence of PRAEs in children w/ ≥3 STBUR signs was greater than children w/ <3 signs (52.8% vs. 27.9%; 95% CI= 1.60-2.49 P<0.001) and similar to that of pts. w/ confirmed PSG (52.5%)
Study Two: <u>S</u>noring, <u>t</u>rouble <u>b</u>reathing and <u>un</u><u>r</u>efreshed were all significant factors; STBUR was 3x more sensitive at detecting PRAEs when ≥3 symptoms were present and 10x more sensitive when all 5 were present.</td><td rowspan="2">Study One:
Methodological flaws: no blinding; no control of anesthetic method; unknown sampling approach
Inconsistency: none
Indirectness: none
Imprecision: no control of anesthetic method
Publication bias: none

Study Two:
Methodological flaws: missing PRAEs for 35 surveys-no mention of how that was dealt w/; unknown sampling approach
Inconsistency: none
Indirectness: none
Imprecision: possible result bias d/t missing information-not addressed. Result may be over or underestimated
Publication bias: none</td></tr>
<tr><td>Design
Study one: Prospective observational study.
Study Two: Design not mentioned but appears to be prospective observational study.</td><td>Implications
Study One: Children= high risk for PRAEs & ORAEs; screening for SBD recommended
Study Two: STBUR showed good sensitivity</td></tr>
</table>

References

Altschuld, J. W. (2004). Emerging dimensions of needs assessment. Performance Improvement, 43(1), 10-15. doi:10.1002/pfi.4140430104

Leigh, D., Watkins, R., Platt, W. A., & Kaufman, R. (2000). Alternate models of needs assessment: Selecting the right one for your organization. Human Resource Development Quarterly, 11(1), 87. doi:10.1002/1532-1096(200021)11:1<87::AID-HRDQ7>3.3.CO;2-1

Purpose	**Definitions of key terms**	**Levels of need**	**Models for NA**	**Implications**	**Issues/Bias**
Article One: explore and define need as well as various levels of need. Explore dimensions of needs assessment (NA) **Article Two:** define NA & explore purposes of NA through various models	**Article One:** Need: noun; measured discrepancy/gap between 2 conditions: "what should be" & "what is" NA: process of identifying needs, prioritizing them, using information obtained to make need-based decisions, allocating resources, & implementing actions to resolve problems. **Article Two:** Need: problem/ opportunities NA: the formal process of identifying needs as gaps between current & desired results, placing those needs in priority based on the cost to meet each need versus the cost for ignoring it, and selecting the most important needs for reduction/ elimination.	**Article One:** Kaufman's Organizational Elements Model (OEM): 3 basic levels of need—mega, macro, micro Cohen: procedures for mobilizing support & procedures for resource allocation Witkin: 3 levels of need Level 1: direct recipient of services, level 2: service providers, level 3: what is required by the system that supports service providers and service recipients; level 1 needs come first; levels 2&3 exist to serve level 1. **Article Two:** Mega (society); Macro (organization); Micro (individual/ small group)	**Article One:** Kaufman's OEM—3 basic levels of need: mega (society& larger environment), macro (institutions & organizations), micro (individual performers & teams) Witkin—3 phases of NA; Phase 1: pre-assessment, Phase 2: NA, Phase 3: post-assessment **Article Two:** Alternative/ training-based models: Purpose Based Assessment (1987), Systems Approach Model (1988), Educational System Planning (1972) More inclusive models: Four Phase NA (1991), Front-End Analysis Model Of NA (1994), Content Levels Framework (1995), Witkin's 3-Phase Model Of NA (1995), Kaufman OEM (1992)	**Article One:** how statements are scaled on a NA survey can lead to varying views of need; concept of discrepancy is key to the discussion of needs and NA; NA effort must be focused, purpose must be clear, & rational for process unambiguous. **Article Two:** needs are "gaps in results" not deficiencies in processes/ resources **Recommendations** **Article One:** NAs should first look at needs, not solutions; concurrent w/ NA, should look at the organization's commitment & willingness to change. **Article Two:** consider strengths & weaknesses of various models for NA; suggest the use of Kaufman's OEM; model should be malleable.	**Article one:** few considerations for various NA models **Article Two:** narrow perspective of levels of need and definition of need; writer bias; Recommends the use of Kaufman's OEM model—Kaufman is one of the contributing authors.

Appendix B: Recruitment Materials

Dear Parent/Participant:

I am Marina Aronova, a student in the Department of Nurse Anesthesia at AdventHealth University. I am working with Dr. Sarah Snell faculty member and Assistant Professor at AdventHealth University on a scholarly project. This project will be examining Sleep Disordered Breathing (SDB) and the rate of post-operative maladaptive behavior (POMB) in children presenting for surgery to this office.

Before you decide whether to answer questions about yourself/your child as part of this project, however, it's important for you to understand why we're doing it and what's involved. Children who are suspected or confirmed to have SDB are 2 to 10 times more likely to have difficulty or problems related to breathing after surgery. They may also exhibit changes in their behavior after surgery such as irritability, change in sleep schedule, and change in eating habits. We hope that the results of this project will help Pediatric Surgery PA. leadership to better understand the scope of the SDB and POMB problem as well as help providers to take steps to lessen or prevent adverse events in children who screen positive.

We want you to know that your participation will be entirely voluntary, and that you can stop at any time without consequences. You/your child will receive the same quality of care regardless of whether or not you decide to participate.
If you decide to participate, you will be asked to answer 5 questions at your preoperative visit and one question at your postoperative visit. The total time required will be approximately 10 minutes.

Please carefully review the questions listed below and if you decide you do not wish to participate please notify Dr. Chaet during your initial office visit.
Your/your child's information in this scholarly project will be treated confidentially and all information will be kept secure. No personal identifying information will be collected for this project. If we publish or present results of this project we will only present information in summary form and not include any personal identifying information .

If you have any comments or questions about this scholarly project please contact the investigators at marina.aronova@my.ahu.edu

Preoperative Visit Questions
While sleeping, does your child ….
1. …snore more than half the time?
2. …snore loudly?
3. …have trouble breathing, or struggle to breathe?
4. Have you ever seen your child stop breathing during the night?
5. Does your child wake up feeling unrefreshed in the morning?

Postoperative Visit Question
Did you notice any change in your child's eating, sleeping, or behavior patterns? Y/N

Appendix C: Ethical Considerations

Project Protocol

Visit One

1. Ms. Lindsey Roberts will greet the parent/caregiver of the patient during their first office visit

Responsible person: Lindsey Roberts

2. If the parent/caregiver is unable to communicate in English, they will be excluded from this scholarly project.

Responsible person: Lindsey Roberts

3. Ms. Lindsey Roberts will also question and document the age of the child prior to informing their caregiver of the scholarly project.

Responsible person: Lindsey Roberts

4. The patient will be evaluated by Dr. Chaet and a determination of the need for a surgical procedure made

5. Each participant will then be given a letter of invitation describing the scholarly project and asking for their voluntary participation.

Responsible person: Lindsey Roberts

a. If they DO NOT wish to participate, they must notify Ms. Roberts that they do not wish to answer the STBUR questions.
b. If they AGREE, the parent/caregiver will be asked the 5 STBUR questions by Ms. Lindsey Roberts during their initial preoperative visit.

Visit Two

1. After having surgery, the patient and parent/caregiver will return to the office of Pediatric Surgery P.A. for their two-week post-operative visit. During this visit, the parent/caregiver will be asked the single follow-up question: “Did you notice any changes in your child’s eating, sleeping or behavior patterns?” (Y/N).

Responsible person: Dr. Chaet

Appendix D: Questionnaires

STBUR Questionnaire: Snoring, Trouble Breathing, Unrefreshed

STBUR Questionnaire:

1. When sleeping does your child snore more than half the time?
   Y / N

2. Does your child snore loudly?
   Y / N

3. When sleeping does your child have difficulty breathing?
   Y / N

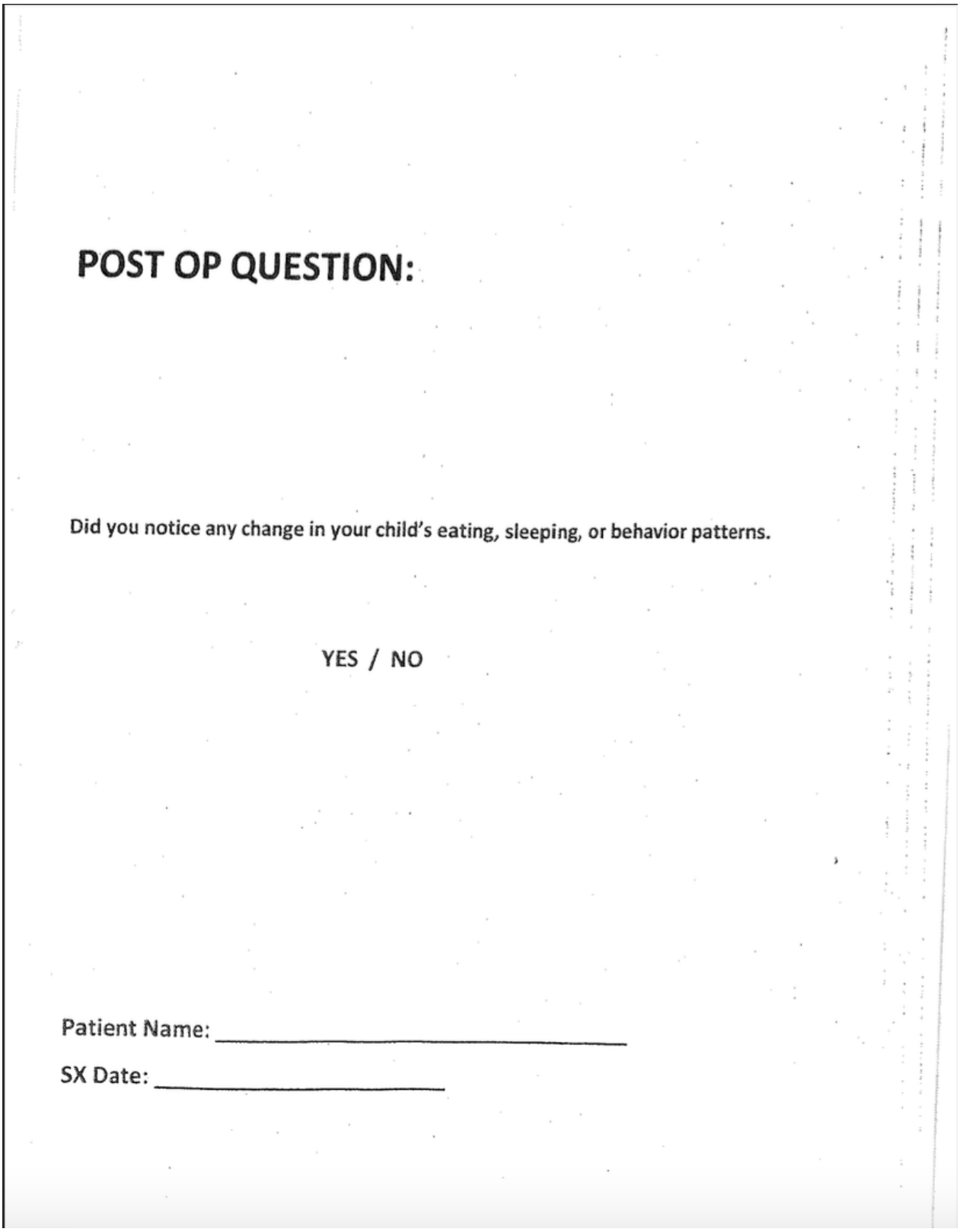
4. Has your child ever stop breathing during the night?
   Y / N

5. Does your child wake up feeling un-refreshed?
   Y / N

PATIENT NAME: _____

APPT. DATE: _____

Two-week follow-up question:



POST OP QUESTION:

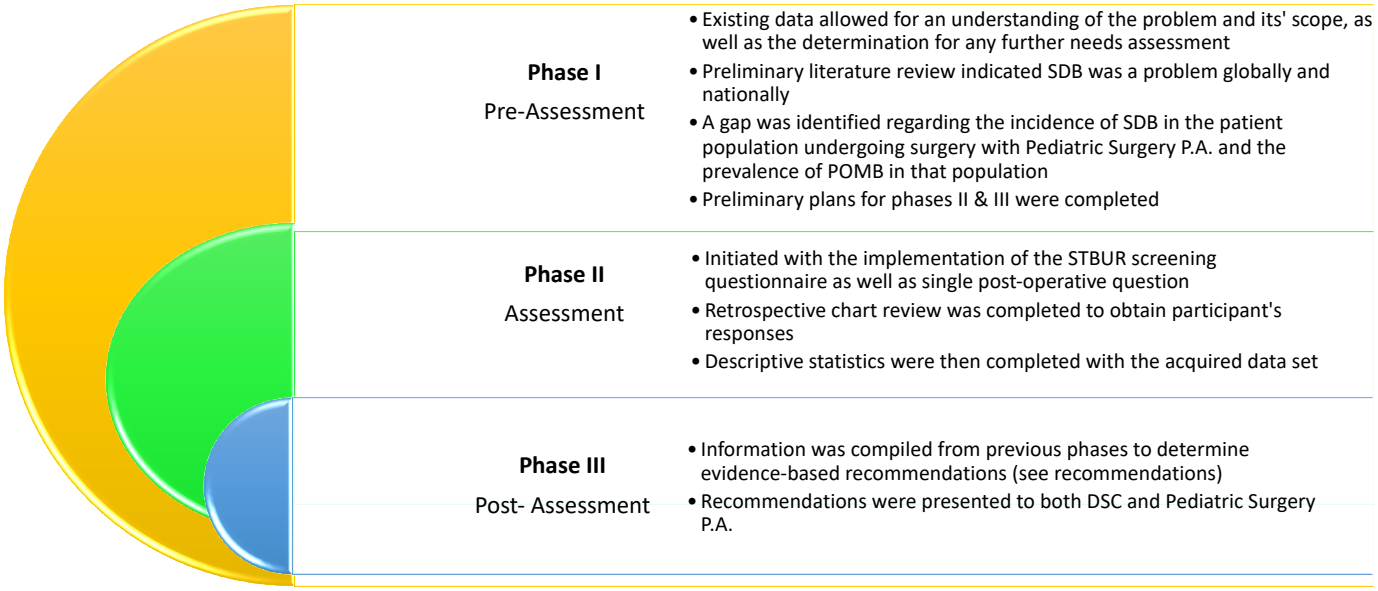
Did you notice any change in your child's eating, sleeping, or behavior patterns.

YES / NO

Patient Name: _____

SX Date: _____

Appendix E: Timeline



Appendix F: Figures

Figure 1

Distribution of Age Groups

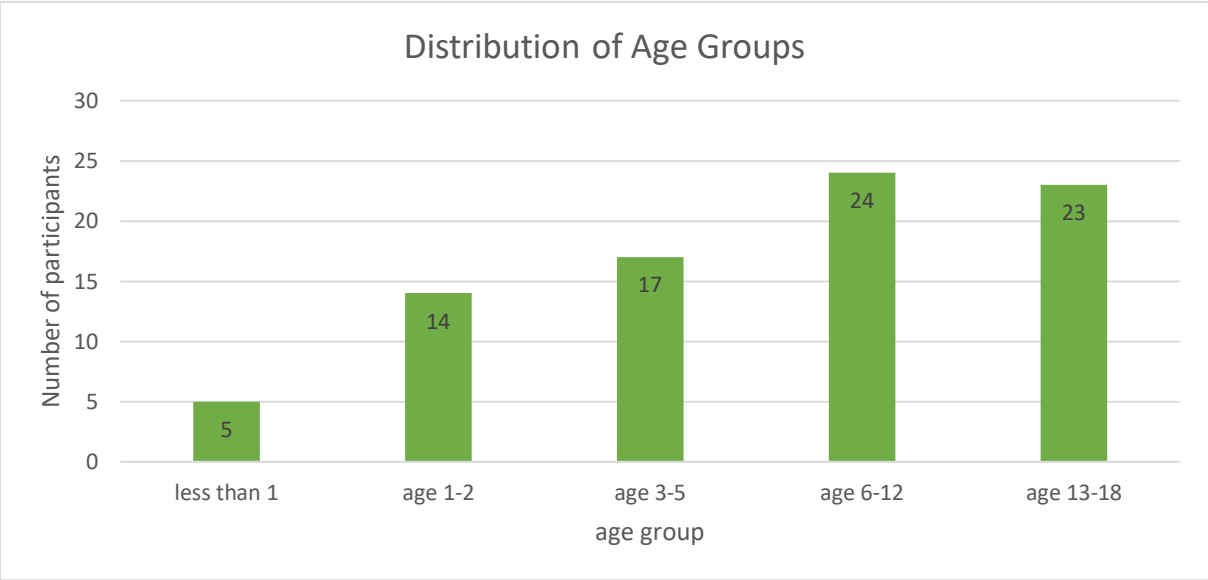


Figure 2

STBUR Questionnaire Responses

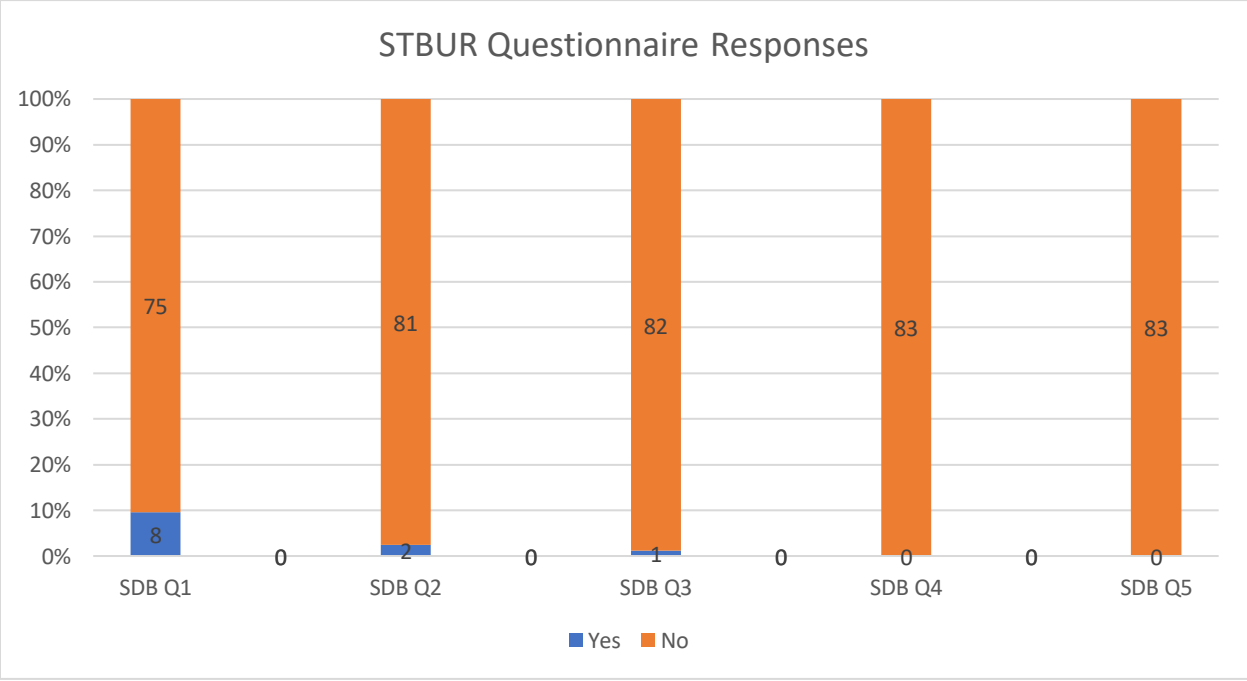


Figure 3

Screening Results Summary