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## Optimizing NPO Times in Infant Outpatient Surgical Patients

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## **Optimizing NPO Times in Infant Outpatient Surgical Patients**

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A DNP project submitted in partial fulfillment of the requirements for the degree of Doctor of  
Nursing Practice

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March 5, 2023

This is to certify that the DNP Project Final Report by

Julie Colangelo Ward

has been approved by the DNP Project Team on

March 5, 2023

for the Doctor of Nursing Practice degree

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## **Abstract**

### **Background**

All patients are standardly kept NPO prior to surgery to minimize aspiration risks. Increased NPO times for infants has been found to lead to patient distress, hemodynamic instability, ketoacidosis and acid-base imbalances. Optimizing NPO times for young pediatric patients helps to decrease fasting times, which minimizes the safety concerns listed above.

### **Objectives**

The objective of this project was to implement specific education instructions to parents of infants during the pre-operative phone calls and confirm their understanding of this education through the teach-back method.

### **Methods**

The intervention for this project added educational instructions with a teach-back question into the verbal portion of “The Standing Orders with Authentication for Pediatric Patients Receiving Anesthesia and/or Sedation” in the pediatric operating room at a large academic hospital located in Connecticut. This addition directed the Pre-Anesthesia Visit (PAV) RNs to educate parents of infants < 1 year of age undergoing outpatient surgery about the importance of encouraging clear fluids up until 1 hour before arrival (2 hours before surgery).

### **Results**

The data collected showed that the average NPO time for the group prior to the intervention was 5.75 hours and the average NPO time for the post-intervention group was 3.88 hours.

### **Conclusion**

The data demonstrates that the intervention group displayed a decreased average NPO time by almost two hours. This suggests that implementing parental education on the importance of clear fluid intake in the preoperative phone calls helped to decrease NPO times.

## **Optimizing NPO Times in Infant Outpatient Surgical Patients**

### **Phase 1: Problem Identification & Evidence Review**

#### **Background and Significance of Problem**

All patients are standardly kept NPO prior to surgery to minimize aspiration risks. This includes pediatric patients, many of which do not receive IVs until already asleep. A literature review demonstrated that increased NPO times for infants leads to patient distress, hemodynamic instability, ketoacidosis and acid-base imbalances (Dennhardt et. al, 2015; Dennhardt et. al, 2016; Rosen et. al, 2019; Schmidt et. al, 2018). Optimizing NPO times for young pediatric patients leads to decreased fasting times, which minimizes the safety concerns listed above (Dennhardt et. al, 2015; Dennhardt et. al, 2016; Rosen et. al, 2019; Schmidt et. al, 2018). It has been demonstrated that optimizing NPO times for infants does not lead to aspiration nor does it affect the gastric pH or residual gastric volume (Beach et. al, 2016; Rosen et. al, 2019; Schmidt et. al, 2018; Thomas et. al, 2018).

Parents have communicated concerns about their infants being NPO for extended periods of time to the surgical staff in the pediatric operating room of a large academic hospital in Connecticut. This has been reflected in Press Ganey/Patient satisfaction surveys. The pediatric anesthesia staff has echoed these concerns about extended NPO times for infants. In Fall of 2019, there was a serious safety event due to severe dehydration in an 8-day old baby which led to an extended hospital stay. There is a constant effort to move outpatient infant cases earlier in the day to avoid extended NPO times, however due to various constraints this is not always feasible. For cases that cannot be moved up, staff attempts to contact families on the morning of surgery and provide specific updated guidelines, so infants do not become dehydrated. However,

there was no formal process in place for communicating specific NPO guidelines for infants undergoing outpatient surgery.

### **Description of Organizational Priority**

This project was conducted in a large academic hospital in the Northeast of the United States. The pediatric operating room at this institution services 20-45 patients per day for a variety of surgical and sedation-requiring procedures. These patients range in age from birth to 18 years of age, with exceptions being made for some patients until 22 years of age. This unit is operational Monday through Friday from 7am-7pm for scheduled and add-on cases, with one nursing team on call for emergencies on nights and weekends.

The mission and vision statements of this institution are philosophical ideas that are expected to drive the practice of every department in the healthcare system. These statements discuss providing patient-centered care and focus on a commitment to excellence and research. The problem of infants having lengthy NPO times needed to change and reflect best practices. This institution prioritizes innovation and provides patients with the most advanced care by using the most current evidence.

### **Focused Search Question**

In outpatient surgical patients who are less than one year of age, how does providing parental education on the importance of clear fluid intake until 2 hours prior affect NPO times and the overall safety conditions for these patients?

### **Evidence Search**



The CINAHL and Medline databases were searched. The keywords/phrases used were npo, “nothing by mouth”, fasting, “nil by mouth”, pediatric, surgery, operation, “surgical procedure” and “presurgical fasting”. The search was done for articles in the past 10 years. CINAHL headings and Medline MeSh terms helped to refine these searches also. The CINAHL headings used were “preprocedural fasting” and “pediatric surgery.” The MeSH terms used were “preoperative period” and “pediatric surgery”. Inclusion criteria was articles investigating NPO guidelines/instructions specifically for young pediatric patients (36 months and younger). Duplicate articles and articles not in English were discarded.

### **Evidence Appraisal, Summary, and Recommendations**

Johns Hopkins Nursing EBP Research Evidence Appraisal Tool was used to assess and evaluate the articles found for relevance to the clinical question and strength of evidence, and six studies were chosen. These studies were a mix of Levels I, III and V of evidence. This evidence review demonstrated that increased NPO times for infants leads to patient distress, hemodynamic instability, ketoacidosis and acid-base imbalances (Dennhardt et. al, 2015; Dennhardt et. al, 2016; Rosen et. al, 2019; Schmidt et. al, 2018). Optimizing NPO times for young pediatric patients leads to decreased fasting times, which minimizes the safety concerns listed above (Dennhardt et. al, 2015; Dennhardt et. al, 2016; Rosen et. al, 2019; Schmidt et. al, 2018). In addition, optimizing NPO times for infants does not lead to aspiration nor does it affect the gastric pH or residual gastric volume (Beach et. al, 2016; Rosen et. al, 2019; Schmidt et. al, 2018; Thomas et. al, 2018). This evidence is further described and organized in the evidence summary table in Appendix B and the outcome synthesis table in Appendix C.

Overall, these findings demonstrate that it is safe to hydrate infants closer to surgery time and that a careful balance between the risks of dehydration and aspiration is needed. The

evidence demonstrates that optimizing NPO times for young children through parental education leads to decreased fasting times, safer conditions and does not increase the risk of aspiration nor affect the gastric pH or residual gastric volume (Beach et. al, 2016; Rosen et. al, 2019; Schmidt et. al, 2018; Thomas et. al, 2018). The evidence shows that the optimal time for infants to be NPO is 2 hours prior to surgery, with a 2 to 4-hour pre-surgical window being an acceptable and safe goal (Dennhardt et. al, 2015; Dennhardt et. al, 2016; Rosen et. al, 2019; Schmidt et. al, 2018).

## **Phase 2: Project Planning**

### **Project Goals**

The ultimate goal of this project was to develop and implement educational instructions to parents of infants under one year of age undergoing outpatient surgery in order to optimize NPO times in these young patients. Other project goals were to include these instructions into the pre-operative phone calls, educate the nurses conducting the phone calls about this new process, track and average the NPO time for this population post intervention and compare to pre intervention data and track how often this new process is used on eligible patients.

### **Framework**

This evidence-based project was developed using the Iowa Model of EBP. Cullen et. al (2018) have identified four phases of the Iowa Model that lead to a successful implementation plan of an evidence-based project. These include Create Awareness and Interest, Build Knowledge and Commitment, Promote Action and Adoption, and Pursue Integration and Sustained Use (Cullen et al, 2018). Awareness and interest have already been created through conversations with the nursing staff and the anesthesia staff. This QI project was discussed with

nursing and anesthesia leadership. There was a high level of interest and many of the clinical leaders were aware of the problem and need for a solution. The plan also incorporated leadership at multiple levels throughout this entire process. Guerrero et. al (2020) support this theory of including multiple levels of leadership in evidence-based projects and found that it achieves higher success rates. The chief pediatric anesthesiologist is responsible for the NPO order set mentioned earlier, “The Standing Orders with Authentication for Pediatric Patients receiving Anesthesia and/or Sedation”, and he agreed to incorporate this new addition of specific education with a teach-back question to parents of this target infant surgical population.

The second phase of “Building Knowledge and Commitment,” consisted of providing one-on-one educational in-services to the three Pre-anesthesia Visit (PAV) nurses conducting these pre-operative phone calls. The educational in-service was conducted by the student project lead and used an instructional template that was given to each PAV nurse to use during the implementation. The phase of “Promoting Action and Adoption” pertained to the project implementation. To ensure success, the final phase of “Pursuing Integration and Sustained Use” required project monitoring for progress, feedback and making revisions via PDSA cycles as needed. This included auditing the charts and meeting with the PAV nurses frequently to ensure that this intervention was being implemented and to incorporate feedback.

### **Key Stakeholders**

The key stakeholders in this project are the nursing and anesthesia staff members of this large academic hospital. Of note this includes a member of the anesthesia staff who served as the project practice mentor, the Chief Pediatric Anesthesiologist, Children’s Operating Room Manager, Children’s Operating Room Assistant Manager and the three PAV nurses. Parents of these patients are also key stakeholders.

## **Barriers**

A barrier to implementation that worried the student project leader before implementation was concern from surgical staff about delays in the surgical schedule due to patients hydrating so close to surgery. However, the chief pediatric surgeon was supportive of this project and was helpful in overcoming this barrier. Another concern was communicating this information properly to ESL families, but this was overcome by using a translation service during the pre-operative phone calls.

## **Timeline**

- June 2022: SHU IRB
- August 2022: Incorporated specific instructions (interventions) into the standing orders in EPIC by the chief pediatric anesthesiologist, who is responsible for this order set.
- September 2022: Held one-on-one training meetings with the PAV nurses who conduct the pre-operative phone calls.
- September 2022: Implemented the intervention and all pre-operative phone calls were expected to include the new education set.
- December 2022: Data Collection
- January 2023: Results Analysis
- March 2023: Final Presentation

## **Resources**

The project did not require any budget. The student project lead spent time educating the PAV nurses on the new process and collecting data from EPIC patient charts. The estimated time

to do this was 30 hours of work time. This 30 hours x \$45 hourly rate = \$1350. No additional resources are needed.

### Review for Ethical Considerations

- Quality Improvement project- IRB exempt per Yale New Haven Hospital Nursing Research Committee
- Approval granted from Nursing Scientific Review Committee through formal application that included Letter of Intent with endorsement letters from the DNP project mentor, project practice mentor and director of the hospital department, initial approval meeting with the committee, and completed application and a final approval meeting with the committee.
- SHU IRB exemption form was completed and submitted for approval
- Table 1 indicates if the Quality Improvement Project criteria has been met.
  - An answer of yes to all the items in I-10 and no to all the items in 11-I4 indicate quality improvement.
  - Project does not qualify as human subjects' research.

Table 1.

#### Differentiating Quality Improvement and Research Activities Tool

Question	Yes	No
1. Is the project designed to bring about immediate improvement in patient care?	X	
2. Is the purpose of the project to bring new knowledge to daily practice?	X	
3. Is the project designed to sustain the improvement?	X	
4. Is the purpose to measure the effect of a process change on delivery of care?	X	
5. Are findings specific to this hospital?	X	

---

6. Are all patients who participate in the project expected to benefit?	X
7. Is the intervention at least as safe as routine care?	X
8. Will all participants receive at least usual care?	X
9. Do you intend to gather just enough data to learn and complete the cycle?	X
10. Do you intend to limit the time for data collection in order to accelerate the rate of improvement?	X
11. Is the project intended to test a novel hypothesis or replicate one?	X
12. Does the project involve withholding any usual care?	X
13. Does the project involve testing interventions/practices that are not usual or standard of care?	X
14. Will any of the 18 identifiers according to the HIPAA Privacy Rule be included?	X

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Adapted from Foster, J. (2013). Differentiating quality improvement and research activities. *Clinical Nurse Specialist*, 27(1), 10–3. <https://doi.org/10.1097/NUR.0b013e3182776db5>

### **Phase 3: Implementation**

#### **Intervention/Practice Change**

The project intervention added specific NPO educational instructions and a teach-back question within “The Standing Orders with Authentication for Pediatric Patients Receiving Anesthesia and/or Sedation” in the pediatric operating room at a large academic hospital located in Connecticut. This order-set is entered into EPIC for each pediatric patient who came to the hospital for a procedure requiring anesthesia. The order-set includes written orders, written instructions for the parents of these patients that are accessible via “MyChart”. It also includes verbal instructions for the PAV nurses to include in their pre-operative phone calls. The intervention for this project added educational instructions with a teach-back question into the verbal portion of the order-set that directed the PAV nurses to educate parents of infants < 1 year of age undergoing outpatient surgery about the importance of encouraging clear fluids up until 1

hour before arrival (2 hours before surgery). Bodenheimer (2018) demonstrated that using the teach-back method enhances patient understanding and allows the healthcare professional to assess this understanding. This educational instruction and teach-back question can be found in bold in Appendix A.

After one week of the implementation, the notes of the PAV nurses were audited and the student project lead met with the nurses. It was identified that not all patients who were eligible were receiving this new education. The intervention was reinforced with the PAV nurses to ensure the successful implementation. After this initial PDSA cycle, the pre-operative notes were audited and NPO data was collected weekly. Another PDSA cycle was completed at the end of the first month, as all eligible patients were still not receiving the new education. One-on-one meetings with the PAV nurses were held to discuss the percentage of patients who were receiving the intervention, discuss challenges and brainstorm ways to make this process more efficient and increase adherence. A tool that was used to remedy some of the challenges was starring the eligible patients on the patient lists at the beginning of every shift so that the PAV nurses would be reminded to implement the intervention. One-on-one meetings with the PAV nurses were held at the end of the second and third months to again discuss the percentage of patients who were receiving the intervention. It was discussed that the new tool had helped to improve compliance and would continue to be used. The intervention ran for 12 weeks (September 2022- November 2022).

#### **Phase 4: Evaluation**

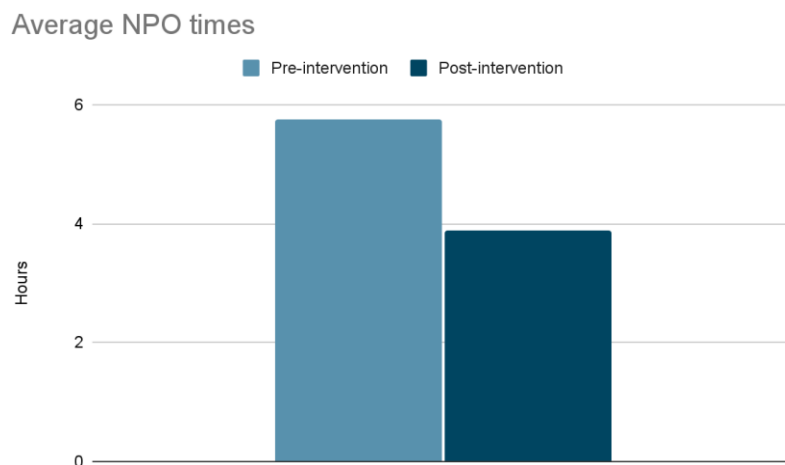
##### **Measures and Analysis**

All data was collected and entered in an excel spreadsheet. Each patient who met the criteria once the intervention had been implemented was labeled as Post1, Post2, Post3, etc. (NO

IDENTIFIERS). Y or N was recorded indicating if the new protocol was followed based on reading the PAV nurses' notes. NPO times were calculated and recorded along with the last item each patient consumed. The retrospective data collection occurred in a similar fashion for the three months prior to the implementation of the intervention. These patients were listed as Pre1, Pre2, Pre3, etc. NPO times and last item consumed were also recorded. There was no need to record if the protocol was followed because this was all pre-intervention data.

Fifty patients who had received the intervention were identified and the NPO times were averaged. Fifty patients from this same target population, who had surgeries before the project implementation and did not receive the intervention, were identified and those NPO times were also averaged. The data collected showed that the average NPO time for the group prior to the intervention was 5.75 hours and the average NPO time for the group that received the intervention was 3.88 hours. This information is also displayed in Chart 1. The data demonstrates that the intervention group displayed a decreased average NPO time of almost two hours. This suggests that the intervention was successful and implementing parental education on the importance of clear fluid intake in the preoperative phone calls leads to decreased NPO times.

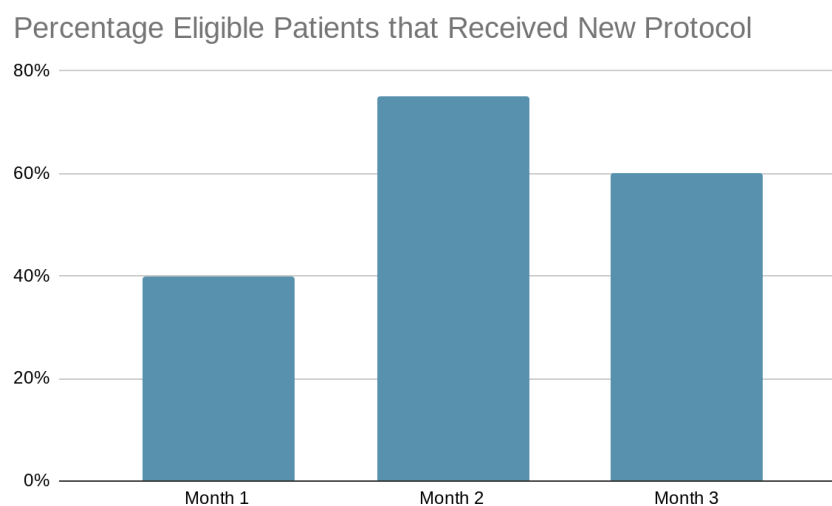
Chart 1.





Another important piece of data collected was the percentage of eligible patients who received the intervention once the project began. Only the patients who had documentation of the intervention were included in the NPO time post- intervention data described in Chart 1. The first month of the project, 40% of eligible patients received the intervention per the PAV nurse's notes. Discussions with the PAV nurses revealed that they were still getting used to the process and while they found it reasonable and manageable, it would take time to adapt. After several discussions, 75% of eligible patients received the intervention per the PAV nurse's note in the second month of the project. In month three, 60% of eligible patients received the intervention per the PAV nurse's note. This information is visually depicted in Chart 2.

Chart 2.



### **Return on Investment**

While there was not any funding used for this project, there was a large investment of time from those involved. This time and effort will eventually lead to a monetary return. The goal of this project was to create safer conditions for the pediatric surgical patients. This

intervention was shown to optimize NPO times and decrease these times for pediatric patients. Optimizing NPO times has been proven to lead to safer conditions and outcomes in several studies (Dennhardt et. al, 2015; Dennhardt et. al, 2016; Rosen et. al, 2019; Schmidt et. al, 2018). Safer conditions and reduced adverse events, such as the one that helped give rise to this project, leads to decreased hospital costs (Brilli et. al, 2013).

### **Key Lessons Learned**

The main lesson learned is that NPO guidelines should reflect best practices and contribute to safer patient conditions. The intention of keeping patients NPO before surgery as a safety measure led to concerns for unsafe conditions, especially in pediatric patients. By using best evidence-based practices and developing more tailored NPO guidelines instructions for parents, we were able to reflect best practices. Another lesson learned was that buy-in and staff involvement were essential for making this project a success. This project could not have even gotten off the ground without buy-in. Staff involvement was needed to implement the practice change. A final lesson was that more education and daily reminders continue to be necessary if this intervention is to be permanently adapted by the department. There was an initial increase of the eligible patients that received the intervention with each PDSA cycle and conversation with the PAV nurses. However, this percentage was not able to be sustained at the level at which it would be desired.

### **Sustainability**

The project largely went as planned with no major changes. As suspected, conversations with the PAV nurses occurred often in the first month to determine the reason for not providing the intervention to some of the eligible patients. The main reason given was forgetting the

intervention, as it was new to their routine and flow. One PAV nurse also commented that if she was doing a lot of phone calls throughout her shift, and only a few of the patients were eligible to receive the intervention, she would forget to implement the educational intervention for these patients. A tool that was used to remedy this was starring the eligible patients on the patient lists at the beginning of every shift so that the nurses would be reminded to implement the intervention. It was positive to see that the percentage of eligible patients receiving the intervention improved greatly from month one to month two. It was not as positive to see that it decreased slightly from month two to month three. Discussions with the PAV nurses at the end of the project revealed that without frequent meetings with the DNP project leader, they were not as likely to implement the intervention. Clearly more education and daily reminders need to be incorporated for this intervention to be permanently adapted by the department.

### **Phase 5: Dissemination**

This project has shown that parental education on the importance of clear fluid intake in the preoperative phone calls leads to decreased NPO times. The anesthesia department has expressed interest in adapting this protocol permanently as it reflects best practice. The project executive summary, which can be found in Appendix D, will be printed and displayed on the unit. The data from this project will be used in a PowerPoint presentation scheduled for March 2023 and a poster presentation for Sacred Heart University in April 2023. The poster for this presentation can be found in Appendix E. The YNHHS Nursing Scientific Review Committee has also requested that this project be part of the annual research poster presentation on April 13, 2023. There is no plan at this time for this data to be used for journal publication.

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## Appendix A

### *Procedure Section from Standing Orders with Authentication for Pediatric Patients receiving Anesthesia and/or Sedation”*

Procedure: Patients and/or their medical records are assessed and identified by the PAV nurse for one of the above upcoming encounters. Based on the criteria listed above and below, nurses will enter and send for co-signature the following orders during the pre-call telephone encounter.

- NPO order according to ASA Fasting Guidelines (Epic Order #Diet 40, NUR1271 Pre-Call Protocol including NPO order and/or IP Order Panel: Diet NPO-Sedation/ Anesthesia Pediatric Only) for all pre-anesthesia and sedation pediatric patients.
- Female patients aged 10 years and older undergoing sedation/anesthesia; enter (Epic Order #POC 7 Urine Pregnancy).
- Pediatric patient with diagnosis of Diabetes 1 or Diabetes 2 undergoing sedation/anesthesia, enter (Epic Order #POC POCT Glucose).
- Verbal Instructions utilizing an approved standing order set in Epic (pre-selected order set) to patient/guardian include: Continuation of any regular medications with sips of water the morning of the sedation/anesthesia, if the patient has taken them regularly in the last 6 weeks. If the medication cannot be taken with sips of water, hold medication the morning of sedation/anesthesia. Consult your provider if the patient is taking any medication that can thin blood including but not limited to aspirin, heparin, warfarin (Coumadin) and enoxaparin (Lovenox). **For patients less than one year old, clear fluids (water or Pedialyte) need to be given up until 1 hour before arrival to the hospital. This is essential for the**

**child's safety. To ensure that this information has been properly communicated, please have parent repeat back when clear fluids should be given up until and why.**

## Appendix B

**Search Question in PICO format:** In outpatient surgical patients who are less than one year of age, how does providing parental education on the importance of clear fluid intake until 2 hours prior affect NPO times and the overall safety conditions for these patients?

Article number	First author year	Purpose	Evidence type, level of evidence	Sample, setting	Major Variables Study and their Definitions	How major variables were measured	Findings that help answer question	Worth to practice/project, quality of evidence
1	Schmidt (2018)	To determine if giving clear fluids up until premedication in healthy children undergoing general anesthesia for elective surgery significantly reduces actual fasting time, as well as the gastric pH and residual gastric volume compared to the two hour clear fluid fasting guidelines.	RCT Level II	162 children ASA I or II with similar characteristics between control and intervention groups  Hospital setting	Traditional preoperative fasting- Clear fluid fasting until 2 hours before the procedure  Liberal fluid fasting-giving clear fluid up until premedication	-Fasting Time: actual times recorded  -Gastric pH and Residual gastric volume: both measured after tracheal intubation via OG tube	The liberal fasting group had shorter fasting times (48 vs. 234 min) so this intervention does affect fasting times.  Overall gastric pH and residual gastric volume were not significantly different between the two groups. The difference was only significant if the patient fasting time was less than 30 min. This indicated clear fluid up until 30 min prior to surgery is	High strength



							safe in regards to gastric pH and residual gastric volume.  Authors do note that specific volume amounts would need to be dictated if clear liquids were given past 1 hour.	
2	Beach (2016)	To determine the occurrence of aspiration or pulmonary complications during sedation/general anesthesia	Retrospective study  Level III	42 institutions with elective procedures involving children  Information gathered was representative of 142 procedures between Sept 2, 2007- Nov 9, 2011	- Compliance with NPO guidelines (No solid food for 8 hr, non clear fluids for 6 hr and clear fluids for 2 hr) -Patient physical status based on ASA guidelines -Patient age -Propofol Use -Procedure type -Urgency of procedure  All of the above variables were analyzed with regards to the following outcomes	Deaths  Aspirations (Defined as event where emesis was noted or food material was found in the oral/pharyngeal cavity associated with any of the following- new cough, wheeze, increase in respiratory effort, positive chest x-ray, few need for oxygen)  Major complication (cardiac arrest or	While a factor, NPO status is not an independent predictor of aspiration or major complications These events are rare and more frequently occur in emergent procedures.  The age, Physical status and specific procedures are more correlated with occurrence of aspiration and	High Strength

					( death, aspiration event and major complications ) alone and in combination with one another.	unplanned admission to the hospital)	complications None of the cases looked at here resulted in patient death.	
3	Thomas (2018)	To update the pediatric fasting guidelines to reflect the most current literature.	Literature Review Level VI	Literature search done via PubMed, Medline and Embase	Traditional NPO fasting: clear fluids until 2 hr before procedure  Altered NPO fasting: clear fluids up until 1 hr before procedure	-Aspiration -Gastric volume -Gastric pH	After 1 hour, gastric volume is significantly decreased with no reported increased risk of aspiration.  Any fluid given closer than 1 hour prior to the procedure can increase the aspiration risk.  3 mL/kg clear fluid is the recommended volume.	Medium Strength
4	Rosen (2019)	To make a statement on clear fluid fasting for pediatric patients undergoing elective procedures under general anesthesia	Expert Opinion: Level VII	Canadian Pediatric Anesthesia Society (CPAS) reviewed the literature- details of review not discussed, but references were provided	Current guidelines: clear fluids 2 hours before elective procedures  Altered guidelines: clear fluids 1 hour before elective procedures	Aspiration events Patient distress Hemodynamic instability Ketoacidosis	Based upon the evidence, CPAS believes that pediatric patients should be encouraged and allowed to ingest clear fluids up until one	Low/ Medium Strength

							hour before elective anesthesia procedures.	
5	Dennhardt (2015)	To investigate the relationship of preoperative fasting with blood glucose concentration-s, ketone bodies and acid-base balances in children less than 36 months.	Prospective non-interventional observational study Level II	100 children age 0-36 months scheduled for elective pediatric surgery  Hospital setting	Fasting Times: Actual fasting time and how far this time deviated from recommended 2 hour clear fasting guidelines	-Glucose concentration -Ketone bodies -Acid-base balance	Prolonged fasting can lead to ketoacidosis and low blood glucose in patients less than 36 months. Children less than one year experienced an average of 6 hours fasting ( 4 hours more than recommended) and displayed higher acid base imbalances and ketone bodies.	High Strength
6	Dennhardt (2016)	To evaluate the effect of an optimized preoperative fasting management on glucose concentration, ketone bodies, acid base balance and change in mean arterial blood pressure during induction of anesthesia in children 36	Prospective observational study Level II	150 children age 0-36 months scheduled for elective pediatric surgery  Hospital setting	Optimized preoperative fasting time: Instructions given to encourage fluids up until the latest possible time according to written guidelines (2 hr prior to surgery), children not scheduled for first time slot allowed to drink clear	-Glucose concentration, -Ketone bodies -Acid base balance - Change in mean arterial blood pressure	Optimized fasting times improved the metabolic and hemodynamic conditions during the induction of anesthesia in children 36 months and younger leading to safer	High strength

		months and younger.			fluids until morning with additional instructions  Non-optimized preoperative fasting time-standard guidelines given before this intervention		conditions. The average fasting time was significantly decreased and the led to lower ketone body concentrations, and higher MAPs	
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#### References (In numerical order)

1. Schmidt, A. R., Buehler, K. P., Both, C., Wiener, R., Klaghofer, R., Hersberger, M., Weiss, M., & Schmitz, A. (2018). Liberal fluid fasting: impact on gastric pH and residual volume in healthy children undergoing general anaesthesia for elective surgery. *BJA: The British Journal of Anaesthesia*, *121*(3), 647–655.
2. Beach, M. L., Cohen, D. M., Gallagher, S. M., & Cravero, J. P. (2016). Major adverse events and relationship to nil per os status in pediatric sedation/anesthesia outside the operating room: A report of the pediatric sedation research consortium. *Anesthesiology*, *124*(1), 80–88.
3. Thomas, M., Morrison, C., Newton, R., & Schindler, E. (2018). Consensus statement on clear fluids fasting for elective pediatric general anesthesia. *Paediatric Anaesthesia*, *28*(5), 411–414.
4. Rosen, D., Gamble, J., & Matava, C. (2019). Canadian Pediatric Anesthesia Society statement on clear fluid fasting for elective pediatric anesthesia. *Canadian Journal of Anaesthesia*, *66*(8), 991–992.

5. Dennhardt, N., Beck, C., Huber, D., Nickel, K., Sander, B., Witt, L.-H., Boethig, D., & Sümpelmann, R. (2015). Impact of preoperative fasting times on blood glucose concentration, ketone bodies and acid-base balance in children younger than 36 months: A prospective observational study. *European Journal of Anaesthesiology (Cambridge University Press)*, 32(12), 857–861.
6. Dennhardt, N., Beck, C., Huber, D., Sander, B., Boehne, M., Boethig, D., Leffler, A., & Sümpelmann, R. (2016). Optimized preoperative fasting times decrease ketone body concentration and stabilize mean arterial blood pressure during induction of anesthesia in children younger than 36 months: A prospective observational cohort study. *Paediatric Anaesthesia*, 26(8), 838–843.

## Appendix C

This table represents the outcomes found when NPO Guidelines were decreased/optimized for pediatric patients.

Outcomes Synthesis Table

Article Number	1	2	3	4	5	6
Aspiration	NE	ND	ND	ND	NE	NE
Ketoacidosis/ Ketone bodies	NE	NE	NE	Decreased	Decreased	Decreased
Fasting Time	Decreased (234 min to 48 min)	NE	NE	NE	Decreased	Decreased (8.5 to 6 hours)
Gastric pH	ND	NE	ND	NE	NE	NE
Residual gastric volume	ND	NE	ND	NE	NE	NE
Patient Distress	NE	NE	NE	Decreased	NE	NE
Glucose concentration	NE	NE	NE	NE	Decreased	Decreased
Acid-base balance	NE	NE	NE	NE	Improved	Improved
Change in mean arterial blood pressure	NE	NE	NE	Increased	NE	Increased

NE, not evaluated; ND, no statistically significant difference

References (In numerical order)

- Schmidt, A. R., Buehler, K. P., Both, C., Wiener, R., Klaghofer, R., Hersberger, M., Weiss, M., & Schmitz, A. (2018). Liberal fluid fasting: impact on gastric pH and residual volume in healthy children undergoing general anaesthesia for elective surgery. *BJA: The British Journal of Anaesthesia*, *121*(3), 647–655.
- Beach, M. L., Cohen, D. M., Gallagher, S. M., & Cravero, J. P. (2016). Major adverse events and relationship to nil per os status in pediatric sedation/anesthesia outside the operating room: A report of the pediatric sedation research consortium. *Anesthesiology*, *124*(1), 80–88.
- Thomas, M., Morrison, C., Newton, R., & Schindler, E. (2018). Consensus statement on clear fluids fasting for elective pediatric general anesthesia. *Paediatric Anaesthesia*, *28*(5), 411–414.

4. Rosen, D., Gamble, J., & Matava, C. (2019). Canadian Pediatric Anesthesia Society statement on clear fluid fasting for elective pediatric anesthesia. *Canadian Journal of Anaesthesia*, 66(8), 991–992.
5. Dennhardt, N., Beck, C., Huber, D., Nickel, K., Sander, B., Witt, L.-H., Boethig, D., & Sümpelmann, R. (2015). Impact of preoperative fasting times on blood glucose concentration, ketone bodies and acid-base balance in children younger than 36 months: A prospective observational study. *European Journal of Anaesthesiology (Cambridge University Press)*, 32(12), 857–861.
6. Dennhardt, N., Beck, C., Huber, D., Sander, B., Boehne, M., Boethig, D., Leffler, A., & Sümpelmann, R. (2016). Optimized preoperative fasting times decrease ketone body concentration and stabilize mean arterial blood pressure during induction of anesthesia in children younger than 36 months: A prospective observational cohort study. *Paediatric Anaesthesia*, 26(8), 838–843.

## Appendix D

### *Executive Summary*

All patients are standardly kept NPO prior to surgery to minimize aspiration risks. This includes pediatric patients, who often do not get IVs placed until they are asleep. Parents have communicated concerns about their infants being NPO for extended periods of time to the surgical staff in the pediatric operating room of a large academic hospital in Connecticut. The pediatric anesthesia staff has echoed these concerns about extended NPO times for infants. In Fall of 2019, there was a serious safety event due to severe dehydration in an 8-day old baby which led to an extended hospital stay. There was no formal process in place for communicating specific NPO guidelines for infants undergoing outpatient surgery.

A literature review demonstrated that increased NPO times for infants leads to patient distress, hemodynamic instability, ketoacidosis and acid-base imbalances (Dennhardt et. al, 2015; Dennhardt et. al, 2016; Rosen et. al, 2019; Schmidt et. al, 2018). Optimizing NPO times for young pediatric patients leads to decreased fasting times, which minimizes the safety concerns listed above (Dennhardt et. al, 2015; Dennhardt et. al, 2016; Rosen et. al, 2019; Schmidt et. al, 2018). It has been demonstrated that optimizing NPO times for infants does not lead to aspiration nor does it affect the gastric pH or residual gastric volume (Beach et. al, 2016; Rosen et. al, 2019; Schmidt et. al, 2018; Thomas et. al, 2018). This project was conducted in a large academic hospital in the Northeast of the United States. This institution prioritizes innovation and provides patients with the most advanced care by using the most current evidence. Optimizing NPO times in infants would lead to higher quality care and safer conditions as demonstrated by the literature.



The intervention for this project added educational instructions with a teach-back question into the preoperative phone calls to the parents of infants < 1 year of age undergoing outpatient surgery. The nurses conducting these phone calls were asked to tell parents that clear fluids (water or Pedialyte) need to be given up until 1 hour before arrival to the hospital and that this is essential for the child's safety. To ensure that this information has been properly communicated, the nurses were then asked to have parents repeat back when clear fluids should be given up until and why. The intervention ran for three months with two PDSA cycles

Fifty patients who had received the intervention were identified and the NPO times were averaged. Fifty patients from this same target population, who had surgeries before the project implementation and did not receive the intervention, were identified and those NPO times were also averaged. The data collected showed that the average NPO time for the group prior to the intervention was 5.75 hours and the average NPO time for the group that received the intervention was 3.88 hours. The data demonstrates that the intervention group displayed a decreased average NPO time by almost two hours. This suggests that the intervention was successful and implementing parental education on the importance of clear fluid intake in the preoperative phone calls leads to decreased NPO times.

The goal of this project was to create safer conditions for the pediatric surgical patients. This intervention was shown to optimize NPO times and decrease these times for pediatric patients. Optimizing NPO times has been proven to lead to safer conditions and outcomes in several studies (Dennhardt et. al, 2015; Dennhardt et. al, 2016; Rosen et. al, 2019; Schmidt et. al, 2018). Safer conditions and reduced adverse events, such as the one that helped give rise to this project, leads to decreased hospital costs (Brilli et. al, 2013).

# Appendix E



## An Evidence Based Project : Optimizing NPO Times in Infant Outpatient Surgical Patients

Julie Colangelo Ward, RN, BSN, CNOR, DNP student; Sylvie Rosenblom, DNP, APRN, FNP-BC, CDCEs, CME, DNP Project advisor; Cheryl Gooden, MD, FAAP, DNP Project practice mentor

### Rationale

All patients are standardly kept NPO prior to surgery to minimize aspiration risks. This includes pediatric patients, many of which do not receive IVs until already asleep. Increased NPO times for infants has been found to lead to patient distress, hemodynamic instability, ketoacidosis and acid-base imbalances. Optimizing NPO times for young pediatric patients through additional parental education helps to decrease fasting times, which minimizes the safety concerns listed above.

### Evidence Synthesis

Topic	1	2	3	4	5
Dehydration	NE	ND	ND	NE	NE
Respiratory distress	NE	NE	NE	Decreased	Decreased
Distress	NE	NE	NE	Decreased	Decreased
Feeding time	Decreased	NE	NE	NE	Decreased
Time to eat	Decreased	NE	NE	NE	Decreased
Time to sleep	NE	NE	NE	NE	NE
Respiratory rate	ND	NE	NE	NE	NE
SpO2	NE	NE	NE	NE	NE
Heart rate	NE	NE	NE	NE	NE
Diastolic blood pressure	NE	NE	NE	NE	NE
Systolic blood pressure	NE	NE	NE	NE	NE
Temperature	NE	NE	NE	NE	NE
Weight	NE	NE	NE	NE	NE
Length	NE	NE	NE	NE	NE
Change in weight	NE	NE	NE	NE	NE
Change in length	NE	NE	NE	NE	NE

NE, not evaluated; ND, no statistically significant difference

### Intervention

**Added Educational Instruction**

"For patients less than one year old, clear fluids (water or Pedialyte) need to be given up until 1 hour before arrival to the hospital. This is essential for the child's safety. To ensure that this information has been properly communicated, please have parent repeat back when clear fluids should be given up until and why."

**PDSA Cycle 1**

- Occurred after first week of intervention
- Notes were audited and it was identified that not all eligible patient were receiving intervention
- Student project lead met with PAV nurses and intervention was reinforced

**PDSA Cycle 2**

- Occurred one month into intervention. All eligible patients still not receiving intervention
- Had several discussion with PAV nurses to discuss barriers
- Implemented tool to star eligible patients at the beginning of every shift as a reminder

### Background

Parents have communicated concerns about their infants being NPO for extended periods of time to the surgical staff in a large academic hospital in Connecticut. The pediatric anesthesia staff has echoed these concerns about extended NPO times for infants. In the Fall of 2019, there was a serious safety event due to severe dehydration in an 8-day old baby leading to an extended hospital stay.

There is a constant effort to move outpatient infant cases earlier in the day to avoid long NPO times, however due to various constraints this is not always possible. For the cases that cannot be moved up, staff attempts to contact families on the morning of surgery and provide specific updated guidelines so infants do not become dehydrated.

However, there was no formal process in place for communicating specific NPO guidelines, education or instructions for infants undergoing outpatient surgery.

### PICO Question

In outpatient surgical patients who are less than one year of age, how does providing parental education on the importance of clear fluid intake until 2 hours prior affect NPO times and the overall safety conditions for these patients?

### EVIDENCE SEARCH

**Information Sources**  
The CINAHL and Medline databases were searched

**Key Words/Phrases**  
npo, "nothing by mouth", fasting, "nil by mouth", pediatric, surgery, operation, "surgical procedure" and "presurgical fasting".  
The CINAHL headings used were "preprocedural fasting" and "pediatric surgery." The MeSH terms used were "preoperative period" and "pediatric surgery."

The search was done for articles in the past 10 years. Inclusion criteria was articles investigating NPO guidelines/instructions specifically for young pediatric patients (36 months and younger)

**Article/Study Evaluation**  
Johns Hopkins Nursing EBP Research Evidence Appraisal Tool used and 6 keeper studies identified

### Evidence-Based Recommendation

**Summary of Evidence**  
The literature review demonstrated that increased NPO times for infants leads to patient distress, hemodynamic instability, ketoacidosis and acid-base imbalances (Denhardt et al, 2015; Denhardt et al, 2016; Rosen et al, 2019; Schmidt et al, 2018). Optimizing NPO times for young pediatric patients leads to decreased fasting times, which minimizes the safety concerns listed above (Denhardt et al, 2015; Denhardt et al, 2016; Rosen et al, 2019; Schmidt et al, 2018). In addition, optimizing NPO times for infants does not lead to aspiration nor does it affect the gastric pH or residual gastric volume (Beach et al, 2016; Rosen et al, 2019; Schmidt et al, 2018; Thomas et al, 2018).

**Recommendation**  
These findings demonstrate that it is safe to hydrate infants closer to surgery time and that a careful balance between the risks of dehydration and aspiration is needed.

### Project Goals

- Develop and implement educational instruction to parents of infants under one year of age undergoing outpatient surgery in order to optimize NPO times in these young patients.
- Incorporate these instructions into the pre-operative phone calls.
- Educate the nurses conducting the phone calls about this new process.
- Track and average the NPO time for this population post intervention and compare to pre intervention data
- Track how often this new process is used on eligible patients.

### Implementation Plan

The intervention for this project added educational instruction with a teach-back question into the verbal portion of the order set that directed the Pre-Anesthesia Visit (PAV) nurses to educate parents of infants < 1 year of age undergoing outpatient surgery about the importance of encouraging clear fluids up until 1 hour before arrival (2 hours before surgery).

### Outcomes

**Average NPO Times**

**Percentage Eligible Patients that Received New Protocol**

Fifty patients who had received the intervention were identified and the NPO times were averaged. Fifty patients from this same target population, who had surgeries before the project implementation and did not receive the intervention, were identified and their NPO times were also averaged. The average NPO time for the group prior to the intervention was **3.75 hours** and the average NPO time for the group that received the intervention was **2.88 hours**.

Another important piece of data collected was the percentage of eligible patients that received the intervention once the project began. In the first month of the project, 40% of eligible patients received the intervention. 70% of eligible patients received the intervention in the second month of the project and 60% of eligible patients received the intervention in the third month per PAV nurse documentation.

### Sustainability Plan



The anesthesia department has expressed interest in adapting this protocol permanently due to the results. It would be essential to continue to re-educating staff until intervention becomes part of normal flow and routine. A tool that can be used would be to star/mark the eligible patients on the patients lists at the beginning of every shift so that the nurses would be reminded to implement the intervention.

### Lessons Learned

- NPO guidelines should reflect best practices.
- Buy-in and staff involvement was essential for making this project a success.
- More education and daily reminders needs to be incorporated if this intervention is to be permanently adapted by the department.

**Contact:** Julie Colangelo Ward, RN BSN CNOR, DNP student, colangeloj@msd.sacredheart.edu

## Appendix F

  Completion Date 09-May-2022  
Expiration Date 08-May-2025  
Record ID 48563884


This is to certify that:

**Julie Colangelo**

Has completed the following CITI Program course:



**Social & Behavioral Research - Basic/Refresher**  
(Curriculum Group)  
**Social & Behavioral Research - Basic/Refresher**  
(Course Learner Group)  
**1 - Basic Course**  
(Stage)

Under requirements set by:  
**Sacred Heart University, Inc.**

  
Collaborative Institutional Training Initiative  
101 NE 3rd Avenue, Suite 320  
Fort Lauderdale, FL 33301 US  
www.citiprogram.org

Not valid for renewal of certification through CME.

Verify at [www.citiprogram.org/verify/?w0aab752c-0563-4ca3-979d-541ac9f39e35-48563884](http://www.citiprogram.org/verify/?w0aab752c-0563-4ca3-979d-541ac9f39e35-48563884)

  Completion Date 25-Apr-2022  
Expiration Date 24-Apr-2025  
Record ID 48563886


This is to certify that:

**Julie Colangelo**

Has completed the following CITI Program course:

**Responsible Conduct of Research (RCR)**  
(Curriculum Group)  
**Responsible Conduct of Research (RCR)**  
(Course Learner Group)  
**1 - RCR**  
(Stage)

Under requirements set by:  
**Sacred Heart University, Inc.**

  
Collaborative Institutional Training Initiative  
101 NE 3rd Avenue, Suite 320  
Fort Lauderdale, FL 33301 US  
www.citiprogram.org

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  Completion Date 20-Apr-2022  
Expiration Date 19-Apr-2026  
Record ID 48563887

This is to certify that:

**Julie Colangelo**

Has completed the following CITI Program course:

**Conflict of Interest mini-course**  
(Curriculum Group)  
**Conflict of Interest**  
(Course Learner Group)  
**1 - Stage 1**  
(Stage)

Under requirements set by:  
**Sacred Heart University, Inc.**

  
Collaborative Institutional Training Initiative  
101 NE 3rd Avenue, Suite 320  
Fort Lauderdale, FL 33301 US  
www.citiprogram.org

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Verify at [www.citiprogram.org/verify/?we941a1a3-e511-45a1-8d74-f7064a632d37-48563887](http://www.citiprogram.org/verify/?we941a1a3-e511-45a1-8d74-f7064a632d37-48563887)

## Appendix G

4/9/23, 8:59 PM

Mail - Ward, Julie C. - Outlook

### IRB#220613A - Exempt Status Request

Taber, Prof. Christopher B. <taberc@sacredheart.edu>

Tue 6/14/2022 9:37 AM

To: Ward, Julie C. <colangeloj6@mail.sacredheart.edu>

Cc: Alp, Feride F. 'Funda' <alpf1@sacredheart.edu>;Londo, Madeline C. <londom@mail.sacredheart.edu>

Dear Applicant,

Thank you for your submission to the IRB requesting exempt review. Based on the application submitted, the IRB is pleased to approve your submission and we wish you great success in your research.

Sincerely,  
Christopher Taber  
Chair, IRB

Christopher B. Taber, PhD, CSCS, USAW2, EP-C, PES  
Director, Exercise and Sport Science M.S. Program  
Associate Professor  
College of Health Professions  
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(203) 396-6342



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