

Pediatric Perioperative Pathways

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- American Society of Anesthesiologists

- Society for Pediatric Anesthesia

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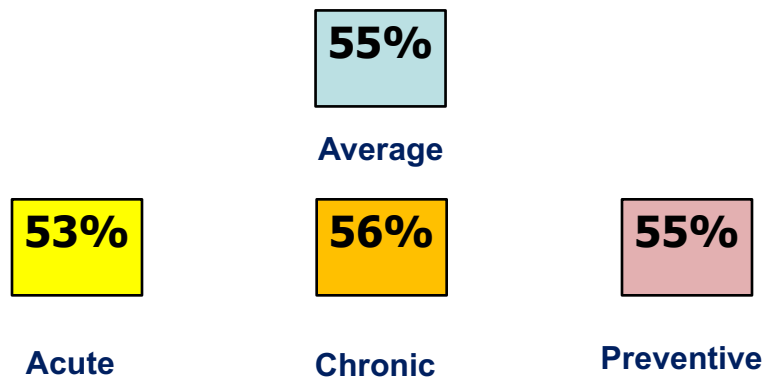
Learning Objectives

- Quality of care
- Pathways – Need and Examples
- Example of NPO pathway
- Example of tonsillectomy pathway

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Quality of Care in U.S. Adults

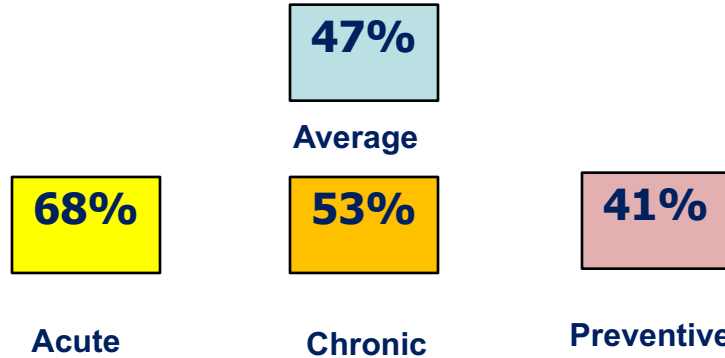


McGlynn EA, Asch AM, Adams J, Keeseey J, Hicks J, DeCristofaro A, Kerr EA. The quality of health care delivered to adults in the United States. *N Engl J Med* 2003;348:2635-45

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Quality of Care in U.S. Children



Mangione-Smith R, DeCristofaro AH, Setodji CM, Keesey J, Klein DJ, Adams JL, Schuster MA, McGlynn EA. The quality of ambulatory care delivered to children in the United States. *N Engl J Med.* 2007 Oct 11;357(15):1515-23.

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Start of Pathways

- Healthcare system pressures
- Tightly constrained resources
- Global Economic Crisis 2007-2008
- Great Recession 2008-2012
- Improvement in clinical quality
- Good value
 - Cost effective
 - Clinical effective



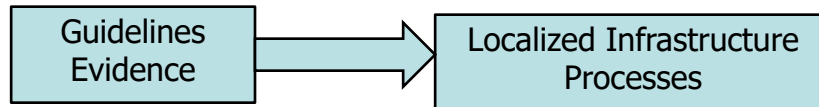
Grocott et al. 2015
Grocott et al. *Perioperative Medicine.* 2017

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What is a Pathway?

- **Structured plans of care**
- **Each pathway details care in a protocol, algorithm, or other inventory of actions**

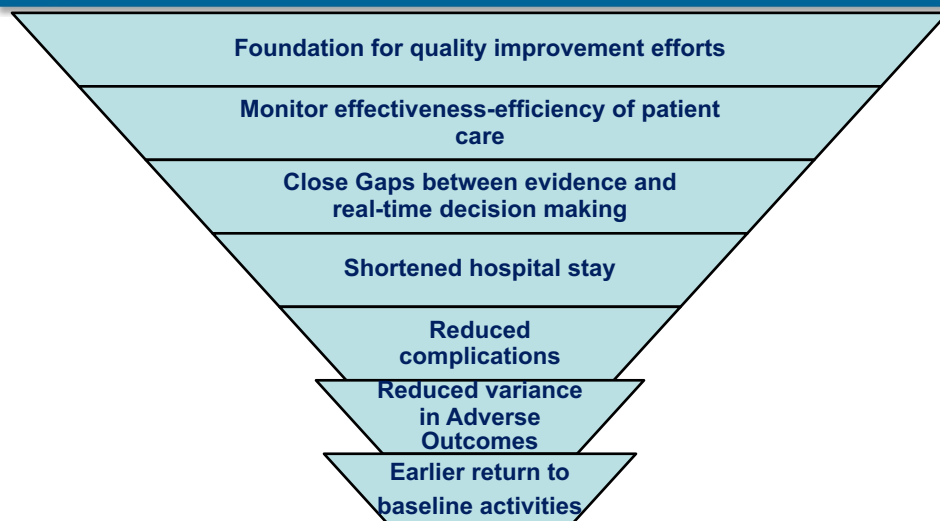


- **Multidisciplinary clinical care teams**
- **Covers 80% of the intended population**
 - Limits practice variation
 - Does NOT affect patient related variation

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Benefits of Having A Pathway

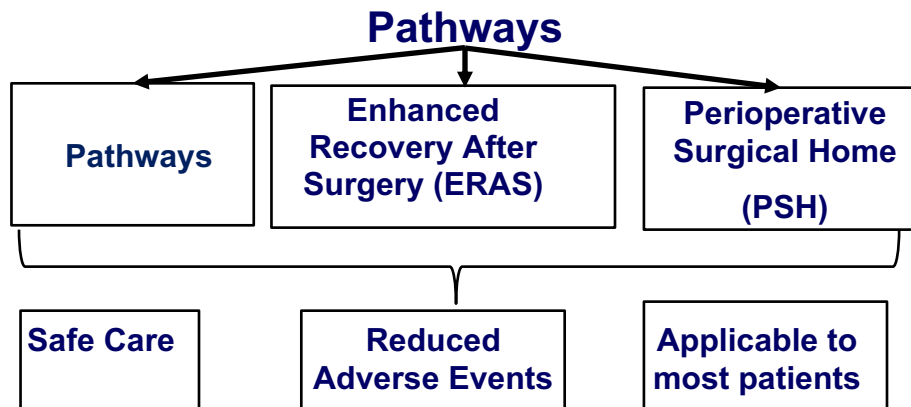


Gan et al. Anesthesia & Analgesia 2018;126:1870-1873

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Examples of Pathways



Bagnall et al. A systematic review of enhanced recovery care after colorectal surgery in elderly patients. *Colorectal Dis* 2014;16:947e56.

Braga et al. Enhanced recovery program in high-risk patients undergoing colorectal surgery. Results from the Perioperative Italian Society registry. *World J Surg* 2017;41:860e7.

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Pathways in Children (vs. Adults)

- Underdeveloped
- Challenges (compared to adults)
- Heterogeneity in the age and development
- Burden of morbidity
- Adverse Events
- Interpretation of Surgical Outcomes - Variable

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Pediatric Pathways (vs. Adults)

- Approximately 24 interventions in adults
- Mean number of interventions in pediatrics – 5.6
- Thromboembolism prophylaxis – less important
- Exciting and uncharted research territory
- Pathways mostly on abdominal surgeries
- *Patient specific sleep apnea pathway is limited*

Gustafsson et al. World J Surg 2013;37:259.
Mortensen et al. Br J Surg 2014;101:1209.
Cerantola et al. Clin Nutr 2013;32:879.
Lassen et al. World J Surg 2013;37:240.
Nygren et al. World J Surg 2013;37:285.

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Research Challenges



**“it takes 17 years, on average,
...for 14 % of research
...to translate into practice”**

Balas EA. Pediatr Ann. 1998; 27:581–4.
Slide Courtesy: Dr. E. Alessandrini MD, Cincinnati Children's Hospital Medical Center, Ohio

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Interventions for children with OSA

Preoperative

- Education
- **Avoidance of prolonged fasting**
- **Carbohydrate Loading**
- Antibiotics
- **Pain Adjuncts**

Intraoperative

- **Multimodal Pain Rx**
- **Fluids**
- **Antiemetics**
- Temperature

Postoperative

- **Multimodal Pain Rx**
- Avoidance of Foley
- Avoid NG catheters
- **Nutrition**
- Early mobilization

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Pathway to reduce prolonged fasting – Quality Improvement Project at Children's Hospital of Philadelphia

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ASA Clear Fluid NPO Guidelines

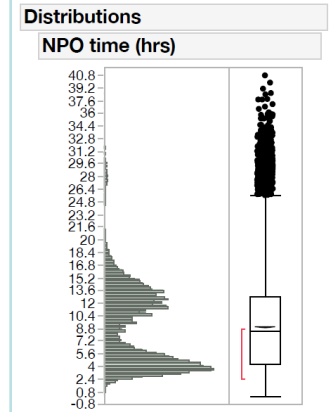
Why Fast?

- **Current American Society of Anesthesiologists (ASA) Guidelines:**

- NPO Clears 2 hours prior to induction of Anesthesia

- Prevent pulmonary aspiration of gastric contents

- **New data shows safety of shorter clear fluid fasting times**



Mean: ~ 9 hours
N: 37,081 patients

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Preoperative fasting and OSA

- Dehydration
- Increased difficulty in IV placement
- Hypotension
- Increased postoperative dehydration risk
- Increased PONV risk
- Increased readmissions?



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Key Drivers for NPO times

OR delays	<ul style="list-style-type: none">• Knowing about delays• Deciding if appropriate for patient to drink in pre-op
Preop Instructions	<ul style="list-style-type: none">• No active language or wording to encourage drink• Format – many disparate locations for preop instructions
Family/Parent Themes	<ul style="list-style-type: none">• Kid Factors – Won't drink• Parent Factors – feel 'longer is better'
Clinician Themes	<ul style="list-style-type: none">• Unwilling to offer clears (case might move)• GA Policy for clears was 2 hours prior to induction
System Issues/Patient Flow	<ul style="list-style-type: none">• First cases – longer NPO times due to early morning arrival• Board runner (not in-charge anesthesiologist) often called to request clears• OR unaware of NPO time - too late to offer drink

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Project SMART Aim

To decrease clear liquid NPO time prior to induction of anesthesia to ≤ 4 hours for 60% of day procedure patients by July 2018.

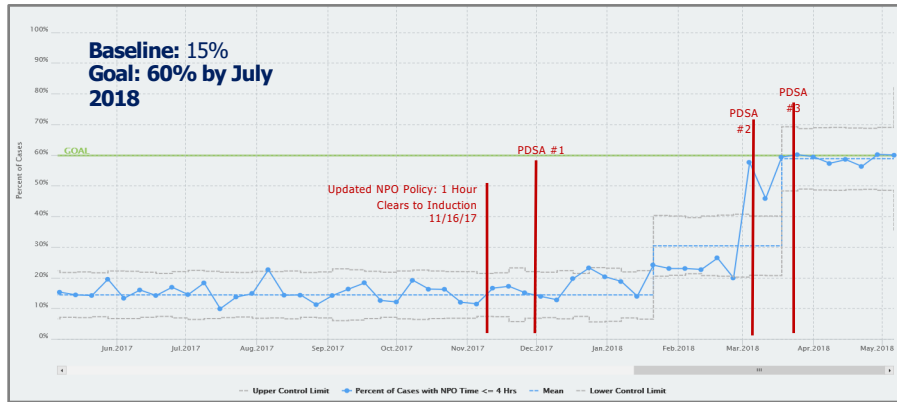
S = Specific	– Children having anesthesia
M = Measurable	– 60% of day procedures
A = Attainable	– ≤ 4 hours
R = Relevant	– Preliminary data and published literature
T = Time-Bound	– by July 2018

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Main Hospital OR – Control Chart

% Patients with NPO Time ≤ 4 Hours



25% of children received a drink after reaching the hospital

Elliott ME, Isserman R, Stricker P, Kraus B, Madu C, Obermeier L, Subramanyam R. A4115 ASA 2018

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How do we know we are not making things worse?

Balancing Measures

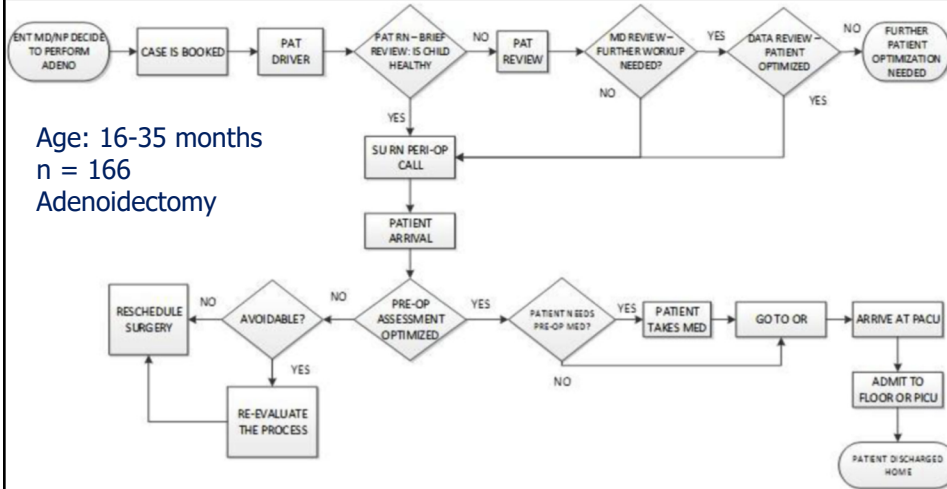
Goal: see no increase in these measures from baseline

	Case Cancellations for NPO Violations	Case Delays for NPO Violations	Emesis Events
Baseline	Main: 0.21% ASCs: 0.31%	Main: 0.37% ASCs: 0.15%	Any Anesthetic event: < 0.08%
Current State	Main: 0.24% ASCs: 0.19%	Main: 0.29% ASCs: 0.16%	All cases are being reviewed monthly. No increase in events post-changes

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Perioperative Surgical Home



Age: 16-35 months
n = 166
Adenoidectomy

Raman et al. Implementation of perioperative surgical home protocol for pediatric patients presenting for adenoidectomy. *Int J Ped Otorhinolaryngol* 2017;101:215-222.

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Pathway Creation for Tonsillectomy for OSA at CHOP



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Tonsillectomy Malpractice Claims

Pediatric Anesthesia

Pediatric Anesthesia ISSN 1155-5645

ORIGINAL ARTICLE

Anesthesia- and opioids-related malpractice claims following tonsillectomy in USA: LexisNexis claims database 1984-2012

- **Opioid related claims**

- 16% of death claims
- 4% injury claims
- Highest monetary awards

- **Monetary awards**

- Death claims \$1,625,892
- Injury claims \$3,484,278

Fatal Injuries = 98
Non fatal Injuries = 144

- OSA was the most common comorbidity

- 17.4% of fatal claims
- 10.4% of nonfatal claims

Subramanyam et al. Paediatr Anaesth. 2014 Apr;24(4):412-20.

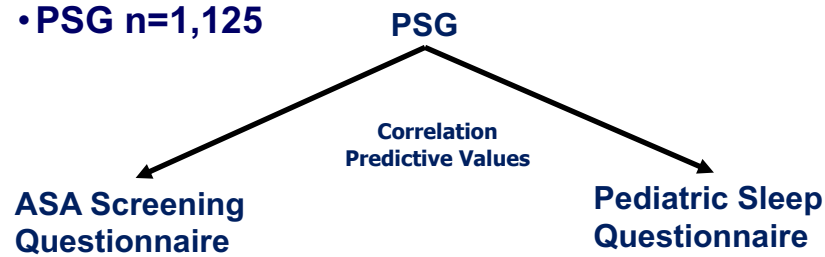
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Challenges of pediatric preoperative screening

- N = 37,325

- PSG n=1,125



Practice guidelines for the perioperative management of patients with obstructive sleep apnea. Anesthesiology Feb 2014

Chervin RD, Weatherly RA, Garetz SL, Ruzicka DL, Giordani BJ, Hodges EK, Dillon JE, Guire KE. Pediatric sleep questionnaire: prediction of sleep apnea and outcomes. Arch Otolaryngol Head Neck Surg. 2007 Mar;133(3):216-22.

McClung H, Jablonka D, Subramanyam R. Screening for Pediatric Obstructive Sleep Apnea. SASM Newsletter

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Challenges of pediatric preoperative screening

Mean Age 8.5 years; BMI 22 kg/m²; AHI 7.7

	No OSA	Mild OSA	Moderate	Severe	Total	p-value
OSA on ASA Screening Questionnaire Yes/No	65/111	207/247	87/88	102/96	461/542	0.026
OSA on Pediatric Sleep Questionnaire Yes/No	96/1	284/15	105/3	103/5	588/24	0.33
AHI continuous vs. ASA Guidelines						0.0059
AHI continuous vs. PSQ						0.567

(Unpublished Data from Cincinnati Children's Hospital, Ohio)

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ASA screening questionnaire vs. PSG

Questionnaires on ASA Guidelines	p-value (AHI categorical)	p-value (AHI continuous)
1. PREDISPOSING PHYSICAL CHARACTERISTICS	ONE OR MORE	
Adolescent BMI	0.0687	0.02
95 th percentile for age and sex	0.0008	<0.0001
Craniofacial abnormalities affecting the airway	<0.0001	<0.0001
Anatomical nasal obstruction	0.0032	0.0003
Tonsils nearly touching or touching in the midline	<0.0001	<0.0001
2. HISTORY OF APPARENT OBSTRUCTION DURING SLEEP	TWO OR MORE	
Loud snoring	<0.0001	<0.0001
Frequent snoring	0.0002	<0.0001
Observed pauses in breathing during sleep	<0.001	<0.0001
Awakens from sleep with choking sensation	<0.001	<0.0001
Frequent arousals from sleep	0.1168	0.0068
Intermittent vocalization during sleep	0.0667	0.0107
Parental report of restless sleep, difficulty breathing	<0.0001	0.0001
Child with night terrors	0.1009	0.2009
Child sleeps in unusual position	0.002	0.0001
New onset enuresis	0.0038	0.0098
3. SOMNOLENCE	ONE OR MORE	
Frequent daytime somnolence	0.2178	0.2713
Falls asleep easily in a non-stimulating environment	0.5414	0.1355
Parents/teacher - child appears sleepy during the day	0.0918	0.0383
Child often difficult to arouse	0.2166	0.0024
OSA PRESENT IF = 1+2, 1+3, 2+3 OR 1+2+3		



T & A Pathway Creation at CHOP

- **Marked variation for children who undergo adenotonsillectomy (T & A)**
 - Location - Ambulatory care center (ASC) vs. hospital
 - Hospital discharge criteria:
 - ~To home
 - ~Hospital ward
 - ~Pediatric intensive care unit (PICU)
- **Discrepancy exists in published guidelines:**
 - American Academy of Otolaryngology - Head and Neck Surgery (AAO-HNS)
 - American Academy of Pediatrics (AAP)

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American Academy of Otolaryngology-Head and Neck Surgery

- **Clinical practice guidelines in 2011 (2-18 years)**
- **Post-operative admission**
 - Children < 3 years of age
 - Any age with severe OSAS
 - ~AHI > 10 apnea or hypopnea events/hour
 - ~SpO₂ nadir < 80% on preoperative PSG
- **Comorbid conditions (mentioned in fine print)**

Roland PS. Otolaryngol Head Neck Surg. 2011;145:S1-15.

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American Academy of Pediatrics

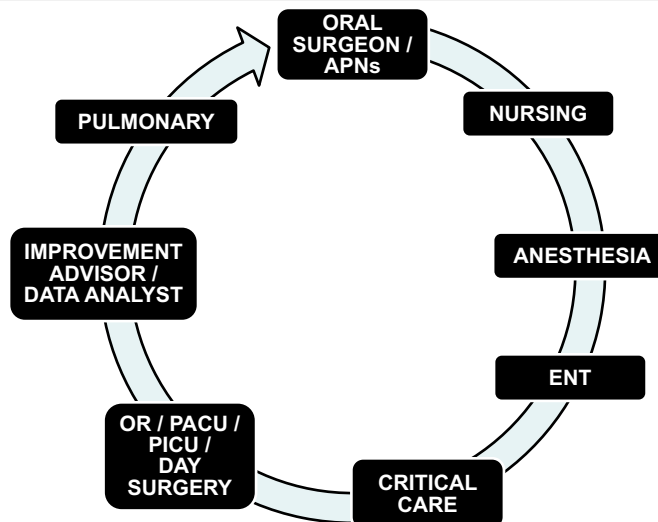
- **Published similar clinical practice guidelines in 2012**
- **Hospital admission for high-risk children**
 - Age < 3 years
 - Obese or had serious comorbidities
 - Severe OSAS
 - ~ $AHI \geq 24/\text{hour}$
 - ~ $\text{Peak } PCO_2 \geq 60 \text{ mmHg}$
 - ~ $\text{SpO}_2 \text{ nadir} < 80\%$

Marcus CL. *Pediatrics*. 2012;130:576-584.

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Multidisciplinary Team at CHOP



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T&A at CHOP – Surgery Location

	Ambulatory Surgery Center (ASC)	Day Surgery	Inpatient
Age	>= 3.5 years	> 3 years	< 3 years
Comorbid conditions	No comorbid conditions	No comorbid conditions	Any age with comorbid condition
Weight	BMI < 99% BMI 10-34	BMI > 99% and approved by physicians	BMI > 99% BMI < 10 and > 35
PSG	AHI 0-23 Peak CO2 <=/=55 O2 nadir >= 90	AHI 0-23 Peak CO2 <=/=60 O2 nadir >= 85	AHI 0-23 Peak CO2 >=/=60 O2 nadir <=/= 85
Bed Request	None	None	PICU or inpatient unit

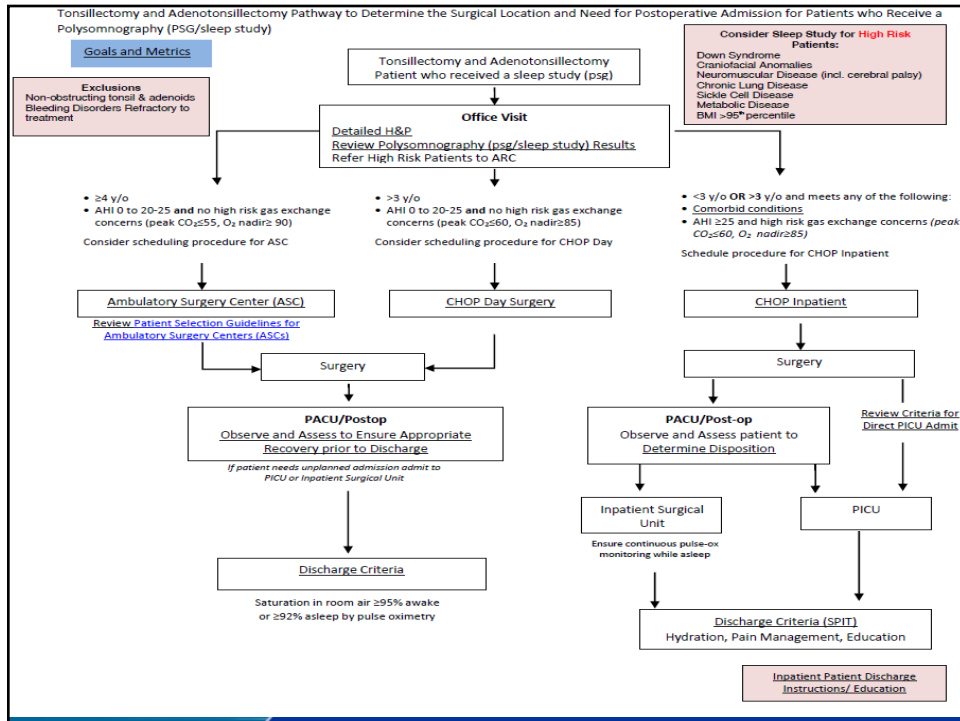
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T&A at CHOP – Post Op Disposition

	Ambulatory Surgery Center (ASC)
Admit to Inpatient Surgical Unit	<ul style="list-style-type: none"> • FiO₂ < 40% by mask • Length of time to get to Phase II Recovery
Direct Admit to PICU	<ul style="list-style-type: none"> • Age: < 1 y/o or < 2 y/o and history of < 36 weeks premature • Severe obesity (BMI > 99 percentile) • Comorbid conditions: <ul style="list-style-type: none"> ○ Cardiac – pulmonary hypertension or requires cardiac anesthesia ○ Respiratory – post-operative intubation, or acute mechanical ventilation via trach, baseline home ventilator, BiPAP/CPAP dependence or oxygen requirement, difficult/critical airway, active wheezing

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ICU Admissions with the Pathway?

- **PICU admissions decreased by 40% in 3 years**
 -255 to 154
- **PICU admissions**
 - Scheduled patients decreased from 181 to 99
 - Unscheduled patients decreased from 74 to 55



Barriers to Pathway Compliance

- **Lack of education**
 - Patients
 - Family members
 - Medical staff
- **Lack of available resources**
 - Nurses
 - Financial support
- **Inadequate buy-in & Resistance to change**
 - Rigid guidelines not evidence based
 - Poor communication
 - Lack of collaboration between team members.

Pearsall EA et al. A Qualitative Study to Understand the Barriers and Enablers in implementing an ERAS program. Ann Surg, 2015; 261: 91-96

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Future Areas for Pathway Development

- **Complete pathway for OSA patient presenting for various operating room and NORA procedures**
- **Account for absence of pre-procedure polysomnography (majority of patients)**
- **Monitor pathway compliance over time**
- **Assess for potential gains**
 - Reduced cost
 - Reduced length of stay
 - Reduced readmissions
 - Improved resource utilization
 - Improved patient outcomes and family satisfaction



“Between the health care that we have and health care that we could have lies not just a gap, but a chasm.”

Institute of Medicine, Crossing the Quality Chasm, 2001