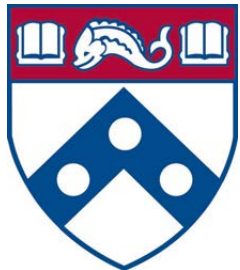


# Enhanced Recovery After NeuroSurgery: Opioid Management in Spinal Surgery

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Michigan Spine Surgery Improvement Collaborative

August 2, 2019



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Department of Neurosurgery

◆ **No relevant disclosures**

Revised: April 20, 2018



# Prescribing Guidelines for Pennsylvania

A grayscale photograph of a person's back and shoulder, with a red glow highlighting the lower back area to indicate pain. The person's hand is resting on their lower back.

## TREATING CHRONIC NON-CANCER PAIN

# Incidence of and Risk Factors for Chronic Opioid Use Among Opioid-Naive Patients in the Postoperative Period

Eric C. Sun, MD, PhD; Beth D. Darnall, PhD; Laurence C. Baker, PhD; Sean Mackey, MD, PhD

**IMPORTANCE** Chronic opioid use imposes a substantial burden in terms of morbidity and economic costs. Whether opioid-naive patients undergoing surgery are at increased risk for chronic opioid use is unknown, as are the potential risk factors for chronic opioid use following surgery.

**OBJECTIVE** To characterize the risk of chronic opioid use among opioid-naive patients following 1 of 11 surgical procedures compared with nonsurgical patients.

**DESIGN, SETTING, AND PARTICIPANTS** Retrospective analysis of administrative health claims to determine the association between chronic opioid use and surgery among privately insured patients between January 1, 2001, and December 31, 2013. The data included 11 surgical procedures (total knee arthroplasty [TKA], total hip arthroplasty, laparoscopic cholecystectomy, open cholecystectomy, laparoscopic appendectomy, open appendectomy, cesarean delivery, functional endoscopic sinus surgery [FESS], cataract surgery, transurethral prostate resection [TURP], and simple mastectomy). Multivariable logistic regression analysis was performed to control for possible confounders, including sex, age, preoperative history of depression, psychosis, drug or alcohol abuse, and preoperative use of benzodiazepines, antipsychotics, and antidepressants.

**EXPOSURES** One of the 11 study surgical procedures.

**MAIN OUTCOMES AND MEASURES** Chronic opioid use, defined as having filled 10 or more prescriptions or more than 120 days' supply of an opioid in the first year after surgery, excluding the first 90 postoperative days. For nonsurgical patients, chronic opioid use was defined as having filled 10 or more prescriptions or more than 120 days' supply following a randomly assigned "surgery date."

**RESULTS** The study included 641 941 opioid-naive surgical patients (169 666 men; mean [SD] age, 44.0 [12.8] years), and 18 011 137 opioid-naive nonsurgical patients (8 849 107 men; mean [SD] age, 42.4 [12.6] years). Among the surgical patients, the incidence of chronic opioid in the first preoperative year ranged from 0.119% for Cesarean delivery (95% CI, 0.104%-0.134%) to 1.41% for TKA (95% CI, 1.29%-1.53%). The baseline incidence of chronic opioid use among the nonsurgical patients was 0.136% (95% CI, 0.134%-0.137%). Except for cataract surgery, laparoscopic appendectomy, FESS, and TURP, all of the surgical procedures were associated with an increased risk of chronic opioid use, with odds ratios ranging from 1.28 (95% CI, 1.12-1.46) for cesarean delivery to 5.10 (95% CI, 4.67-5.58) for TKA. Male sex, age older than 50 years, and preoperative history of drug abuse, alcohol abuse, depression, benzodiazepine use, or antidepressant use were associated with chronic opioid use among surgical patients.

**CONCLUSIONS AND RELEVANCE** In opioid-naive patients, many surgical procedures are associated with an increased risk of chronic opioid use in the postoperative period. A certain subset of patients (eg, men, elderly patients) may be particularly vulnerable.

JAMA Intern Med. 2016;176(9):1286-1293. doi:10.1001/jamainternmed.2016.3298  
Published online July 11, 2016. Corrected on August 8, 2016.

# Penn Neurosurgery ERAS Protocol

## Pre-op

Surgical Education & Expectation Management

Surgical Site Education

Nutrition Optimization

Diabetes Management

Smoking Cessation

Narcotic/Alcohol Use

Obstructive Sleep Apnea

Discharge Planning

## Peri-op

Metabolism Management

Multimodal Analgesia

Surgery Checklist

Early Mobilization

Wound Care Management

## Post-op

Clinical Team Communication

Wound Care Management

Post Acute Care Resource Utilization



# Penn Neurosurgery ERAS – Peri-op

## Peri-op

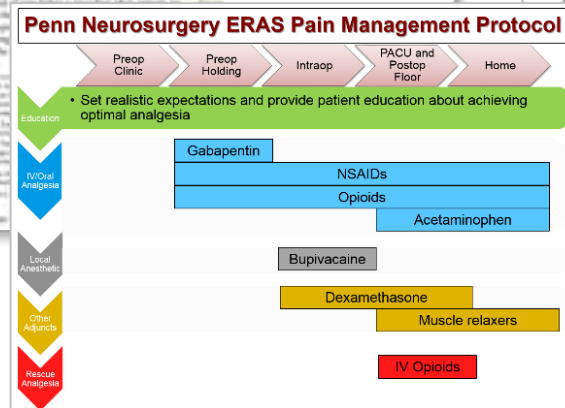
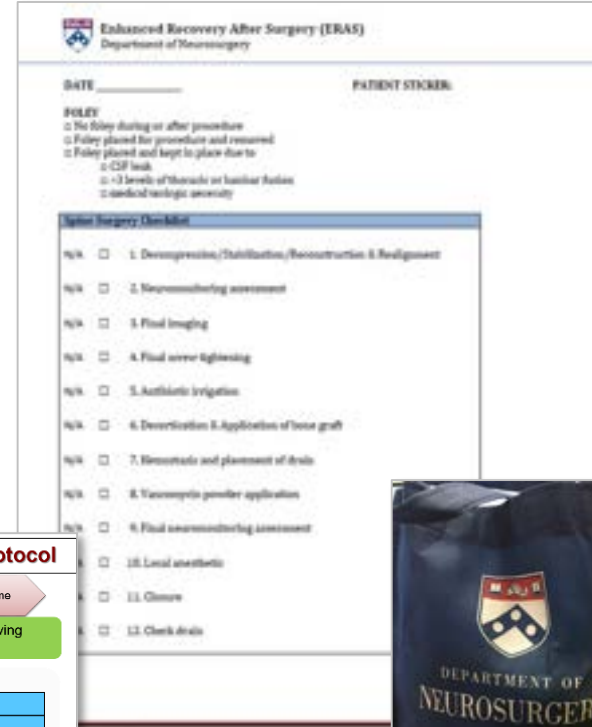
Metabolism Management

Multimodal Analgesia

Surgery Checklist

Early Mobilization

Wound Care Management



# Penn Neurosurgery ERAS – Post-op

## Post-op

Clinical Team  
Communication

Wound Care Management

Post Acute Care  
Resource Utilization




**PAH Postop Spine Triage Protocol**  
Department of Neurosurgery  
335 S. 34<sup>th</sup> Street Entrance on Level 2  
Philadelphia, PA 19106  
Phone: 215-829-6700 Fax: 215-829-6667

Routine Care	Routine Contact
<ul style="list-style-type: none"> <li>Medication management or refill</li> <li>Physical or Occupational Therapy Orders</li> <li>Schedule Routine Post-Op Visits</li> <li>Requesting Office Notes or Discharge Summaries to be fixed</li> <li>Non-urgent patient-related questions</li> </ul>	<p>Neurosurgery Main Number: <b>215-829-6700</b></p>
Urgent Care	Urgent Care Contact
<p>Patients showing worsening symptoms related to:</p> <ul style="list-style-type: none"> <li>Wound drainage or dehiscence</li> <li>Warm, Red, Swollen site</li> <li>Fever (<math>\geq 101.5</math>)</li> <li>Uncontrollable pain</li> </ul>	<ul style="list-style-type: none"> <li>Call <b>215-829-6700</b> to speak to a nurse right away to address serious patient concerns related to surgery</li> <li>Hours: 24/7</li> <li>You may be asked to send the patient to the Emergency Room for evaluation.</li> </ul> <p style="text-align: center;">*Use for clinical staff only</p>
Emergency Care	Emergency: Call 911
<ul style="list-style-type: none"> <li>Abnormal / difficulty breathing</li> <li>Confusion</li> <li>Unrelieved chest pain</li> <li>Loss of consciousness</li> </ul>	<p style="text-align: center;"><b>Call 911 right away</b></p>


Penn Medicine
ERAP Home   Colorectal Surgery   Gynecologic Surgery   Neurosurgery

## Neurosurgery


In an effort to provide the best care before, during, and after spine surgery, the Department of Neurosurgery has introduced an evidence-based approach to delivering spine care, called Enhanced Recovery After Surgery (ERAS). Through our protocol and Engaged Recovery at Penn (ERAP), we will address your pain, nutrition, movement, surgical site care and educational needs. Our goal is to deliver the highest quality of care across all phases of your surgical journey.



**Reducing Pneumonia Risk: Breathing and Oral Care**



**Staying Active After Surgery**



**Strengthening Exercises**

### Checklists & Instructions

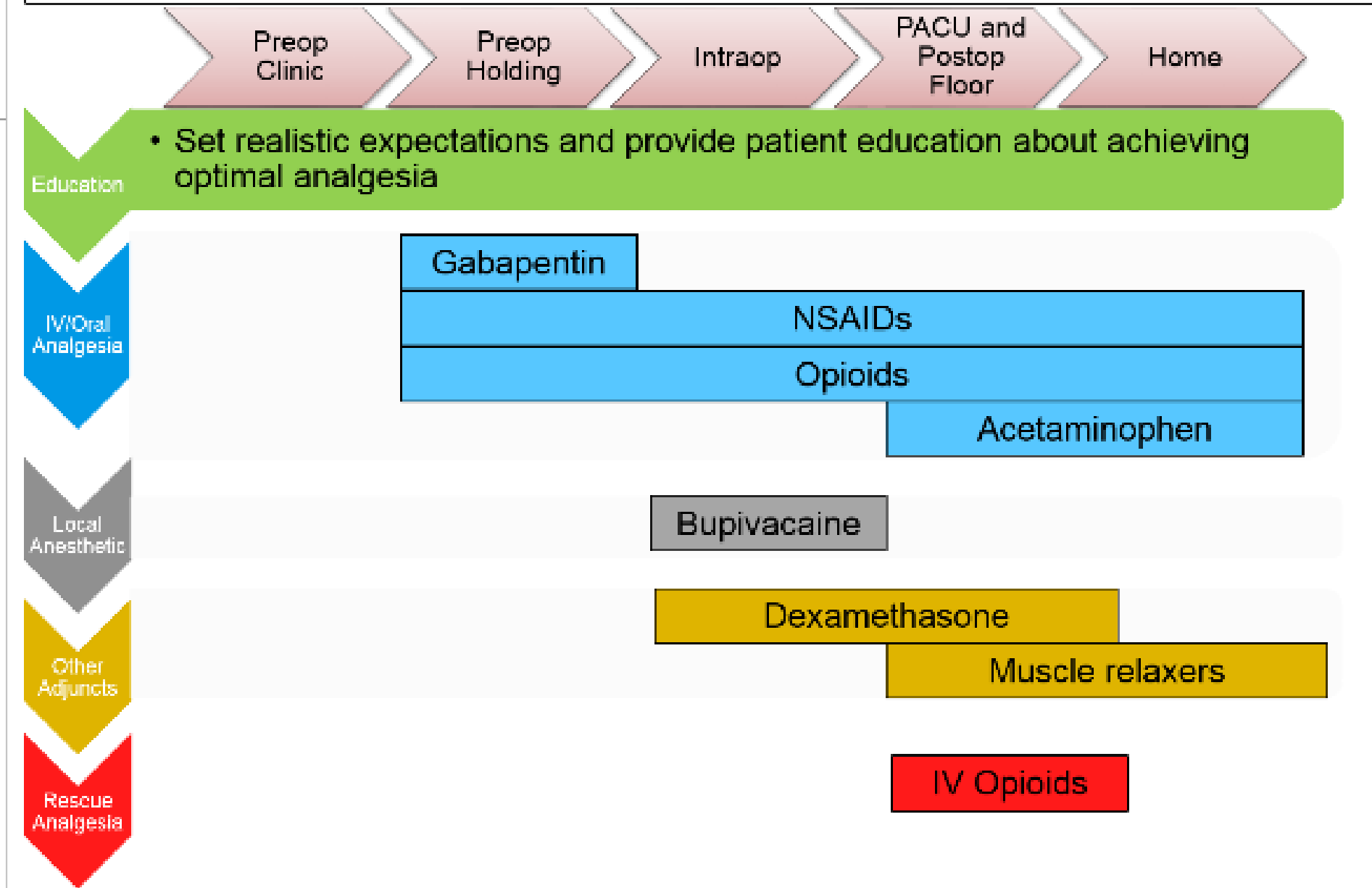
- Preoperative Skin Wash Instructions (PDF)
- Quit Smoking Before Your Operation (FCP)
- Protein Intake Pre/Post Spinal Surgery (PDF)
- ERAS Patient Checklist (PDF)
- Video on Surgical Site Care
- Eating and Drinking Before Surgery (PDF)
- Opioid Fact Sheet (PDF)
- Safe Pain Management (PDF)
- Home Safety Tips (PDF)
- Preventing Blood Clots (PDF)

### Other Resources

- Free mindfulness meditation app to reduce stress



# Penn Neurosurgery ERAS Pain Management Protocol



# Penn Neurosurgery ERAS Study: Patient Inclusion and Exclusion Criteria/Outcomes

## Inclusion Criteria:

- ◆ Have a clinical history and diagnostic imaging supporting the need for elective spine or peripheral nerve surgery
- ◆ Be over 18 years of age
- ◆ Ability to understand and actively participate in the program as deemed by the attending neurosurgeon

## Exclusion Criteria:

- ◆ Contraindications to elective spine or peripheral nerve surgery
- ◆ Diagnosis of liver disease
- ◆ Pregnancy

## Primary Outcomes:

- ◆ Opioid and non-opioid consumption on POD 1
- ◆ Need for opioid use at one month post-operatively
- ◆ Patient-reported pain scores

## Secondary Outcomes:

- ◆ Length of stay (days)
- ◆ Need for ICU admission
- ◆ Discharge status
- ◆ Re-admission within 30 days
- ◆ Re-admission within 90 days

## Statistics:

- ◆ Independent two-sample t-tests for continuous variables and Fisher's exact test for categorical variables
- ◆ All data for the study were collected and analyzed by independent observers in collaboration with a biostatistician

# Penn Neurosurgery ERAS Study: One Year Data

- ◆ **Prospective enrollment of 805 ERAS patients (April 2017 – June 2018)**
- ◆ **PAH Historical Control n=149 (September – December 2016)**
  - Traditional surgical care at the discretion of the attending neurosurgeon in a non-standardized fashion, including routine post-operative pain management with patient-controlled analgesia (PCA) from POD 0-1

# Baseline Demographics

## PAH Controls vs. PAH ERAS

Preoperative Characteristics	PAH Controls (n=149)	PAH ERAS (n=805)	p-value
Age (years)	61.9	61.7	0.86
BMI	30.3	29.9	0.53
Males	51.70%	53.90%	0.66
History of Spinal/Peripheral Nerve Surgery	47.00%	37.50%	<b>0.035</b>
History of Sleep Apnea	18.80%	16.90%	0.56
CPAP Use	10.70%	9.70%	0.66
Smoking Status			0.16
Current	17.40%	12.20%	
Former	38.90%	37.90%	
Never	43.60%	49.90%	
Diabetes	18.80%	17.30%	0.64
Hypertension	61.70%	57.30%	0.32
COPD	2.00%	3.90%	0.34
Mental Health Disorder	26.20%	23.00%	0.40
Substance Abuse Disorder	6.00%	3.10%	0.09
Glucose (mg/dL)	102.8	106.3	0.11
HbA1c (mg/dL)	9.0	7.1	0.64
Albumin (mg/dL)	4.4	4.4	0.71
Lag Time (days)	44.6	42.8	0.70
Preoperative Working Status			0.17
Yes	43.40%	49.70%	
No	56.60%	50.30%	
Disabled	27.20%	20.30%	0.17
Retired	60.50%	70.90%	
Due to reason other than the condition being treated	11.10%	6.40%	
No reason given	1.20%	2.30%	

# Procedures

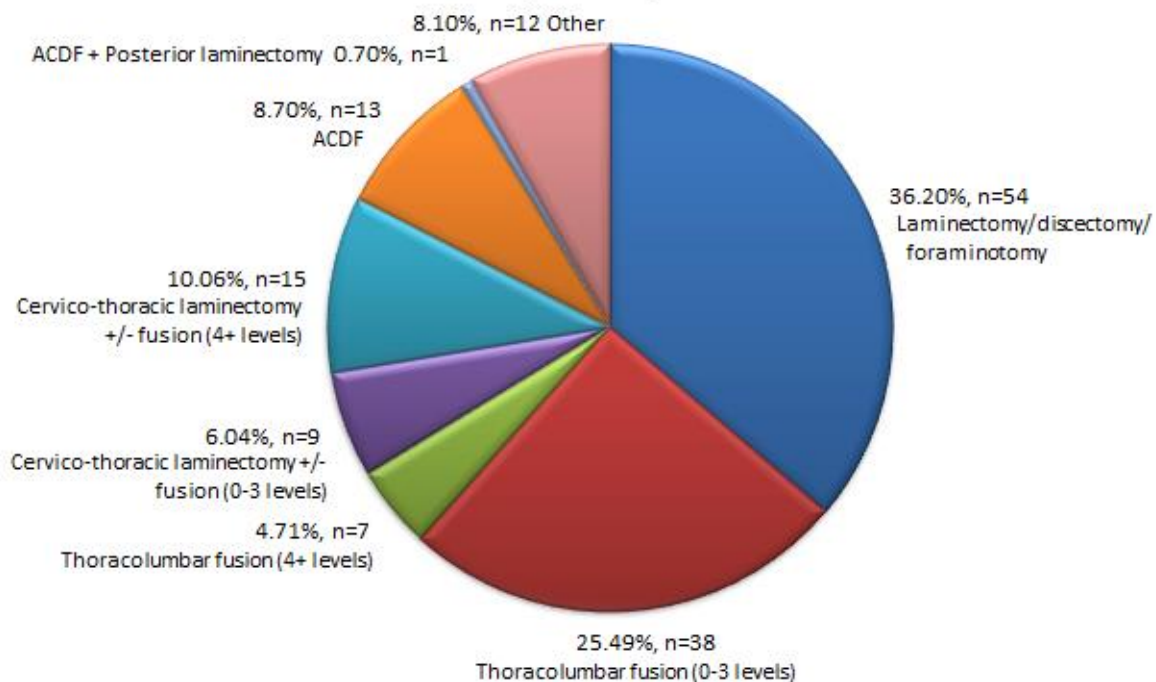
## PAH Controls vs. PAH ERAS

Procedures	PAH Controls (n=149)	PAH ERAS (n=805)	p-value
Laminectomy/discectomy/foraminotomy	36.20%	39.10%	0.56
Thoracolumbosacral fusion (0-3 levels)	25.49%	21.21%	
Thoracolumbosacral fusion (4+ levels)	4.71%	4.59%	
Cervico-thoracic laminectomy +/- fusion (0-3 levels)	6.04%	12.15%	
Cervico-thoracic laminectomy +/- fusion (4+ levels)	10.06%	5.95%	
ACDF	8.70%	6.00%	
ACDF + Posterior Laminectomy	0.70%	0.60%	
Other	8.10%	10.30%	

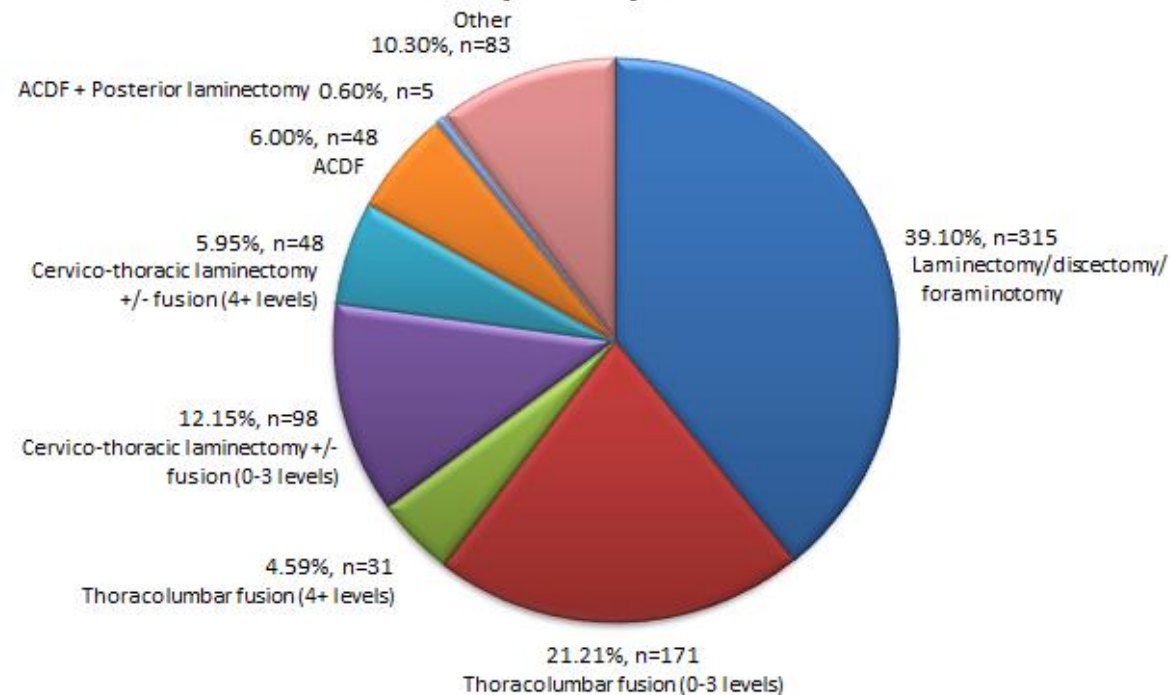
# Procedures

## PAH Controls vs. PAH ERAS

**PAH Controls (n=149): Procedures**



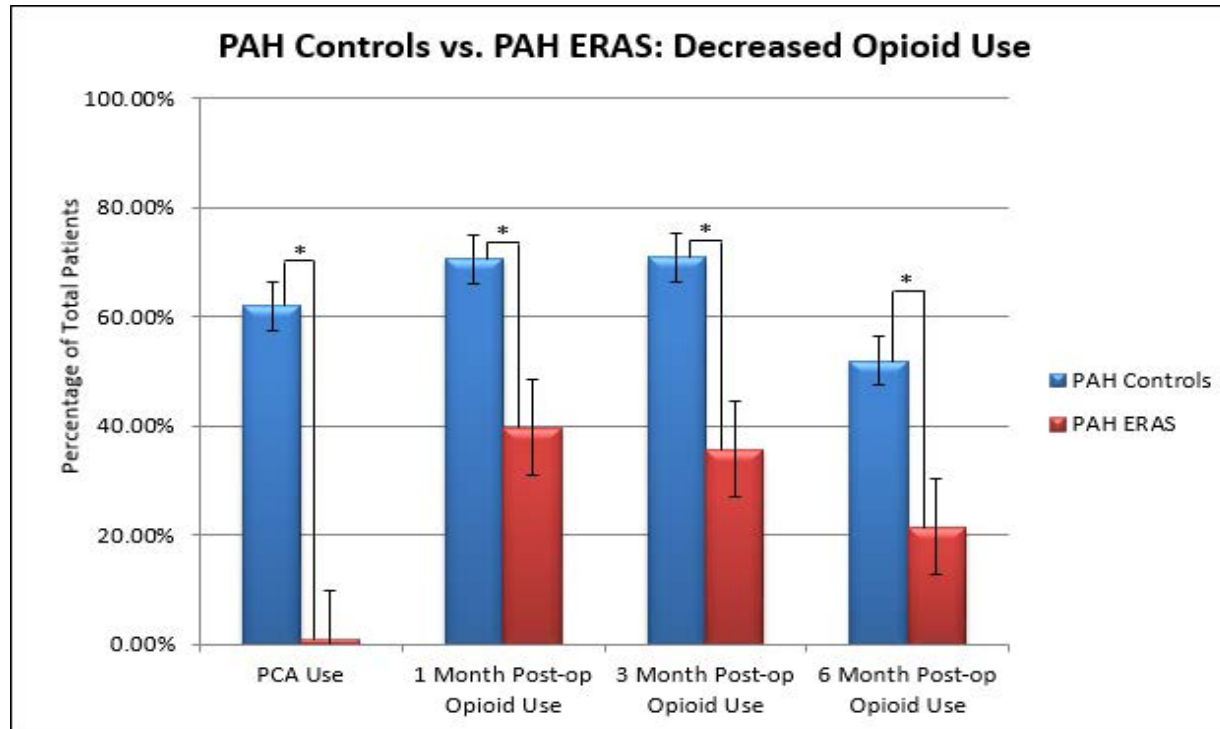
**PAH ERAS (n=805): Procedures**



$p=0.56$

# Decreased Opioid Use PAH Controls vs. PAH ERAS

	PAH Controls	PAH ERAS	p-value
PCA Use (n=149/805)	62.00%	1.00%	<0.001
1 Month Post-op Opioid Use (n=139/772)	70.50%	39.60%	<0.001
3 Month Post-op Opioid Use (n=55/168)	70.90%	35.70%	<0.001
6 Month Post-op Opioid Use (n=27/103)	51.90%	21.40%	0.003



# Pain Scores

## PAH Controls vs. PAH ERAS

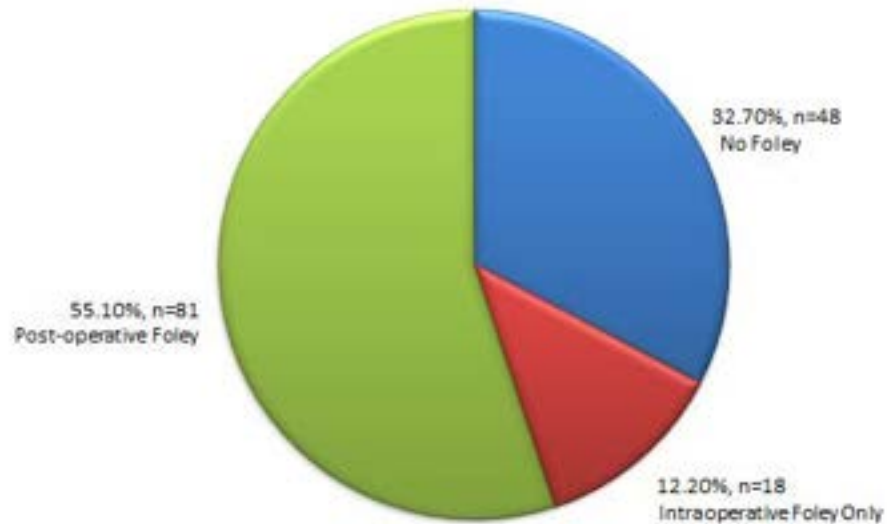
Post-op Day	PAH Controls	PAH ERAS	p-value
POD0 (n=141/793)	4.4	4.1	0.20
POD1 (n=106/686)	5.6	5.6	0.87
POD2 (n=87/505)	5.6	5.6	0.99
POD3 (n=56/309)	5.4	5.3	0.57



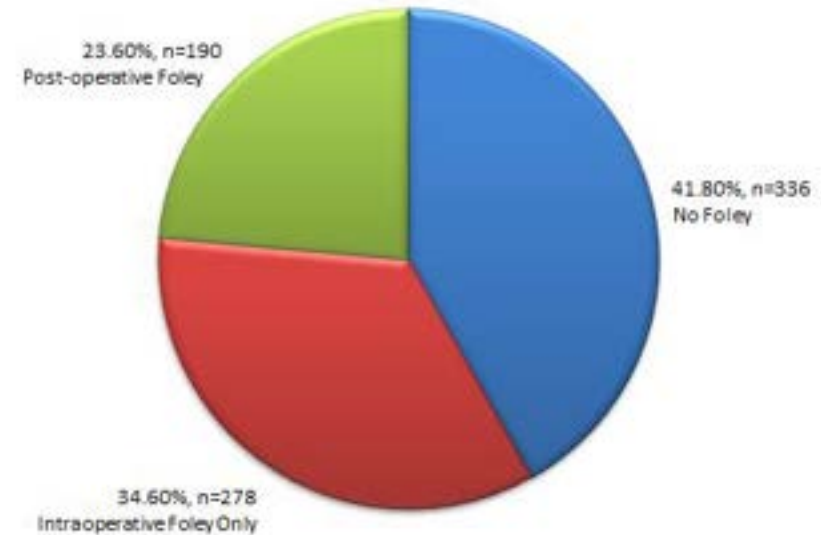
# Decreased Foley Use PAH Controls vs. PAH ERAS

Use of Foley/Straight Catheter	PAH Controls (n=149)	PAH ERAS (n=805)	p-value
No Foley	32.70%	41.80%	<b>&lt;0.001</b>
Intra-operative Foley Only	12.20%	34.60%	
Post-operative Foley	55.10%	23.60%	
Straight catheterization	9.40%	10.30%	0.88

PAH Controls (n=149): Foley Use

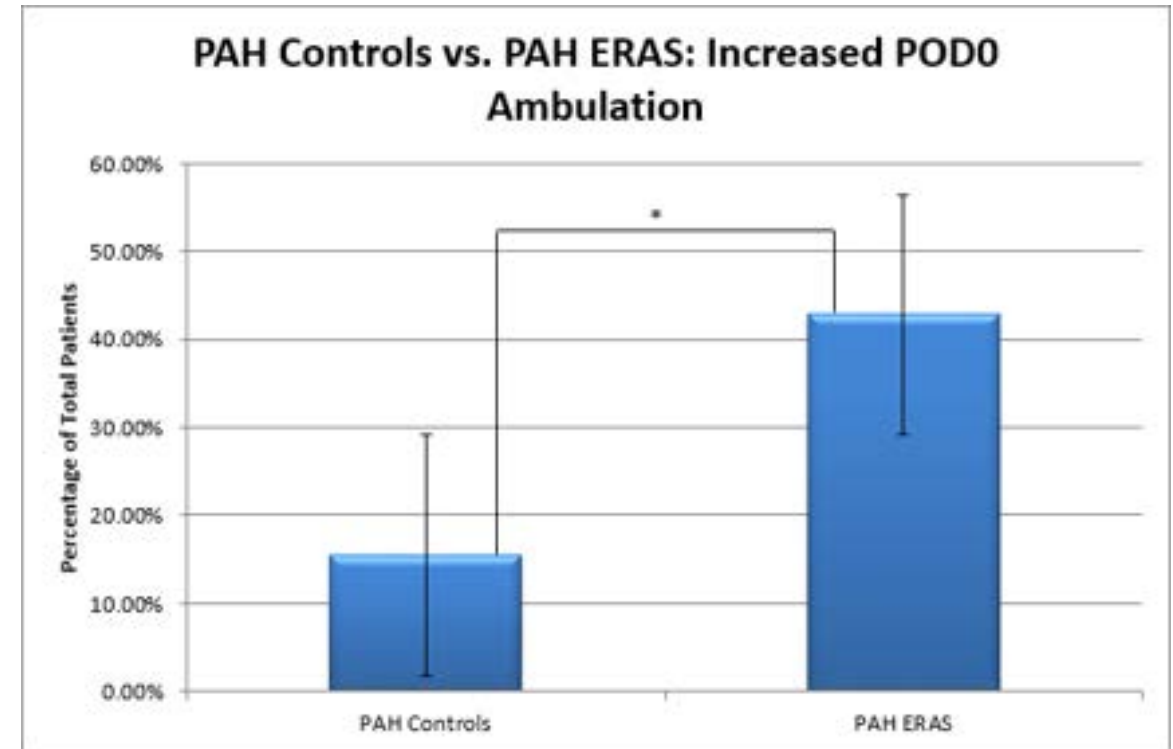
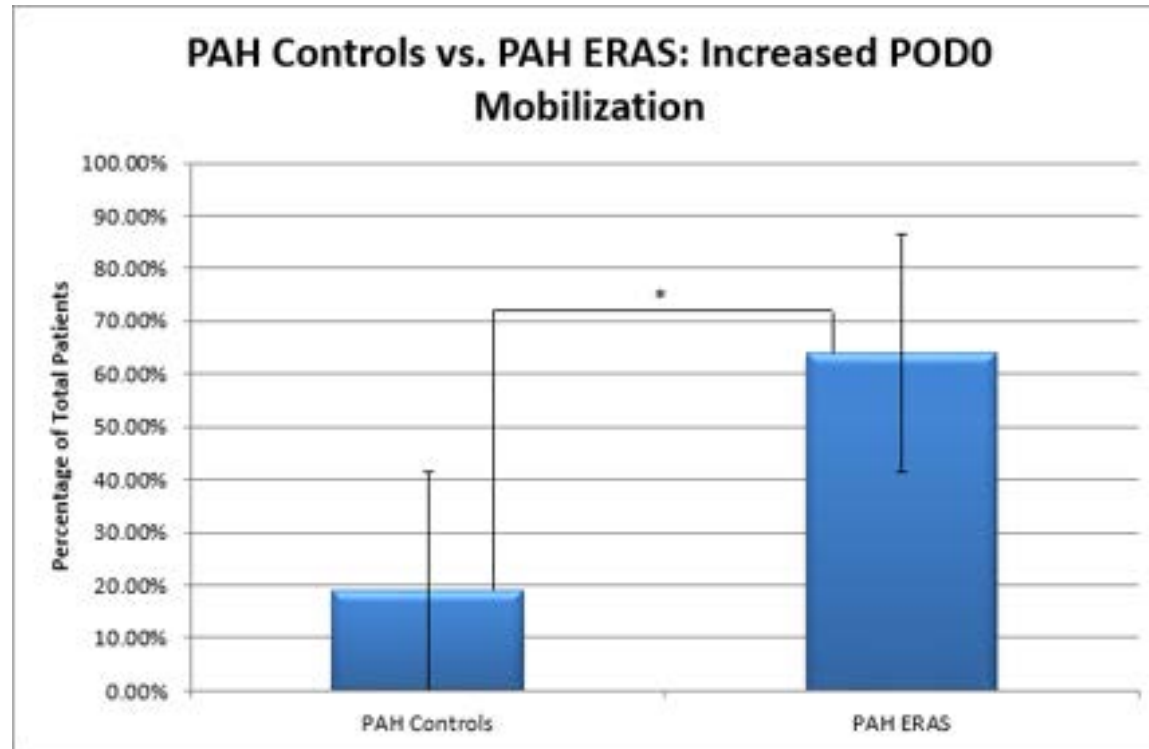


PAH ERAS (n=805): Foley Use



# Increased POD0 Mobilization/Ambulation PAH Controls vs. PAH ERAS

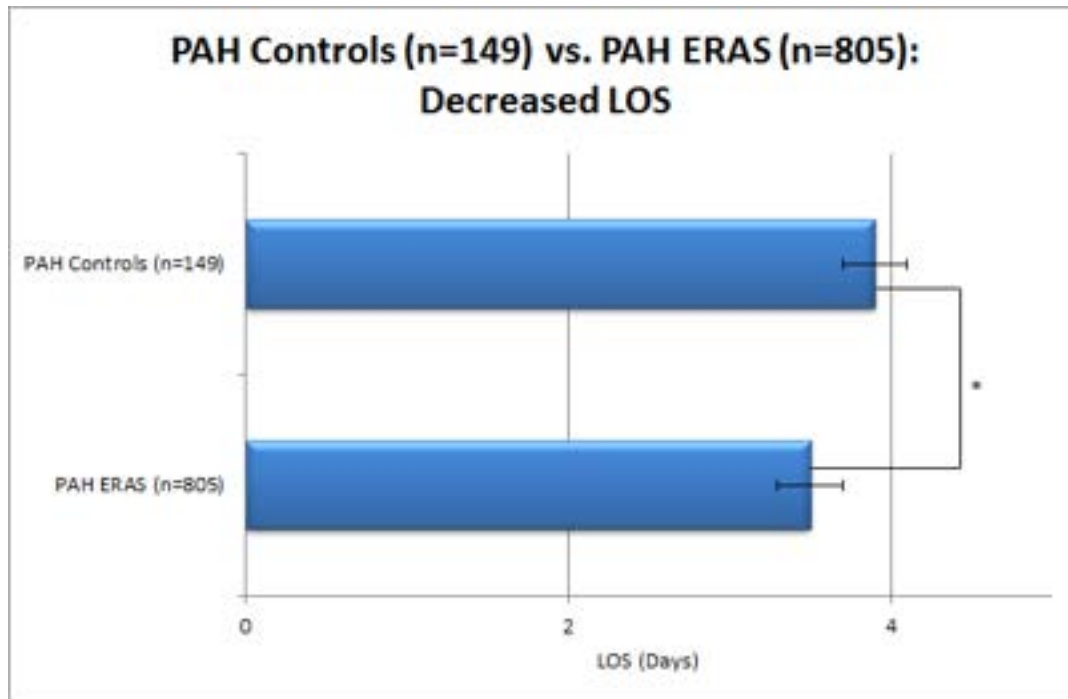
	PAH Controls	PAH ERAS	p-value
POD0 Mobilization (n=116/783)	19.00%	63.90%	<0.001
POD0 Ambulation (n=116/782)	15.50%	42.80%	<0.001



# Resource Allocation

## PAH Controls vs. PAH ERAS

	PAH ERAS (n=805)	PAH Controls (n=149)	p-value
Total LOS (days)	3.5	3.9	<b>0.043</b>



# Conclusions

- ◆ ERAS engages each aspect of the patient's surgical journey in order to improve outcomes in a multi-disciplinary, multi-modal approach.
- ◆ In the elective spinal and peripheral nerve surgical patient, ERAS is feasible and necessary.
- ◆ The present study has shown that our ERAS protocol, and, in particular, our ERAS pain management protocol has the potential to safely reduce opioid use both in the peri-operative period as well as at one, three, and six months after surgery.
- ◆ ERAS patients demonstrated reduced hospital length of stay.
- ◆ Re-admission rates at 30 and 90 days were not found to be significantly different.

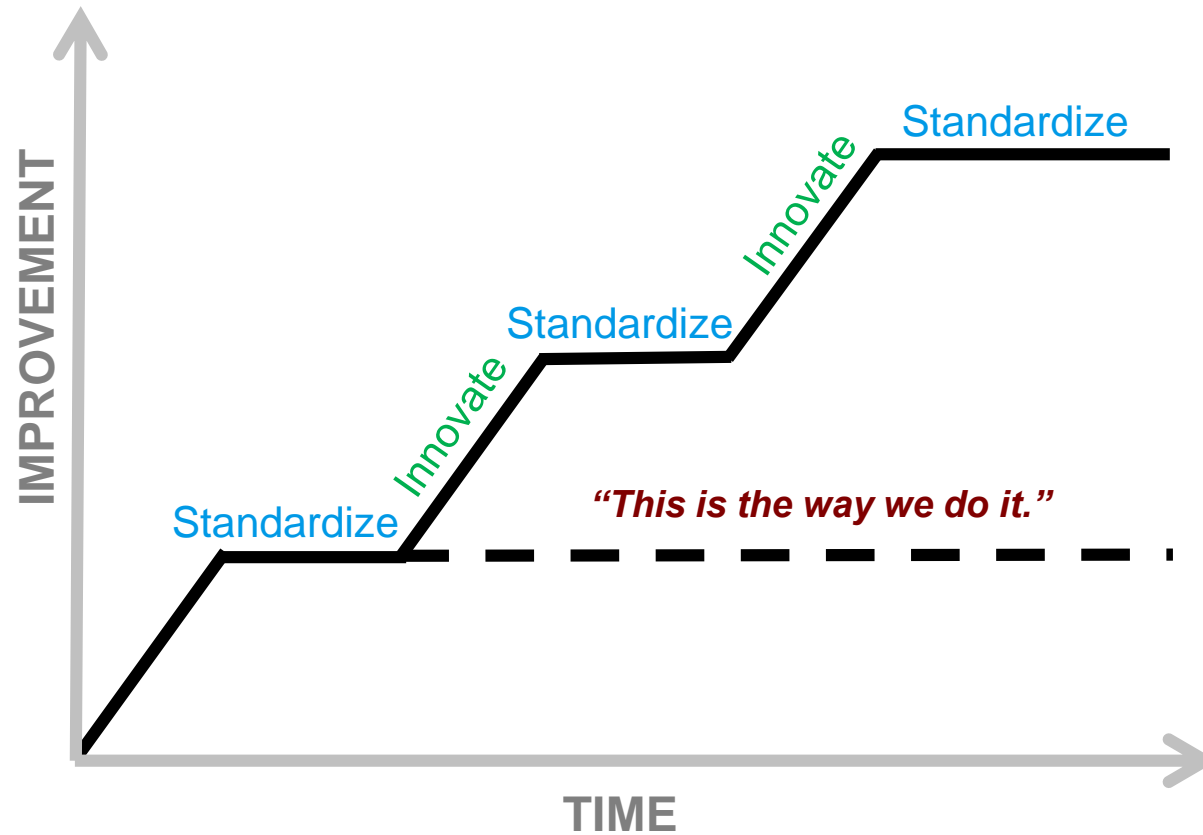
# Limitations

- ◆ Opioid data monitoring
- ◆ Retrospective data analysis, randomization and blinding not performed

.....Penn Neurosurgery ERAS Randomized Clinical Trial

# ERAS:

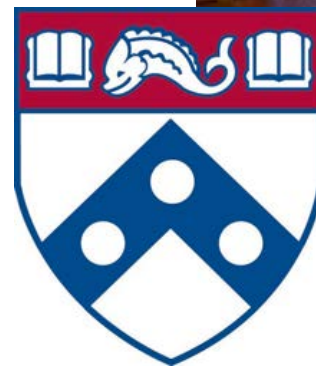
## An Iterative Process of Quality Improvement, From Bench to Bedside and BEYOND



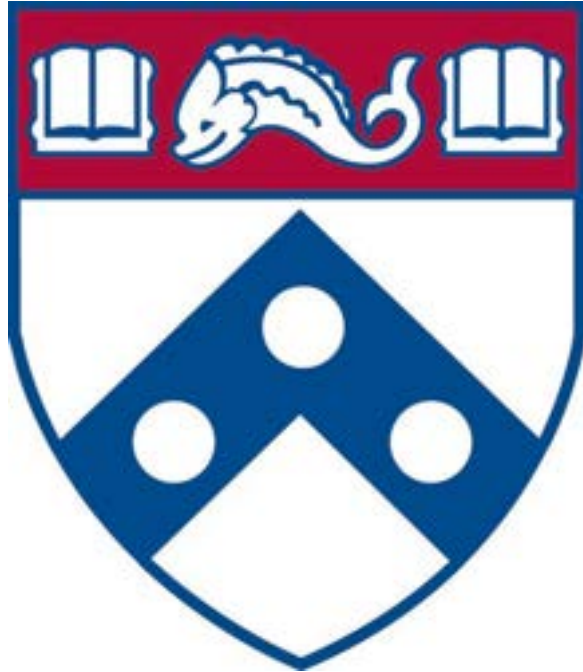
Clifford Ko, MD; ACS Director of NSIQP

# Acknowledgements

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- ◆ Practice Providers
- ◆ Neurosurgery Clinical Research Division
- ◆ Neurosurgery Residents
- ◆ Neurosurgery Clinical and Operating Room Staff
- ◆ Neurosciences Service Line
- ◆ Penn Innovation Center
- ◆ Penn Leonard Davis Institute of Health Economics
- ◆ Center for Clinical Epidemiology and Biostatistics
  - Michael Kallan, MS



# Thank you



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