

# Research & Quality

## A Marriage Made in Heaven

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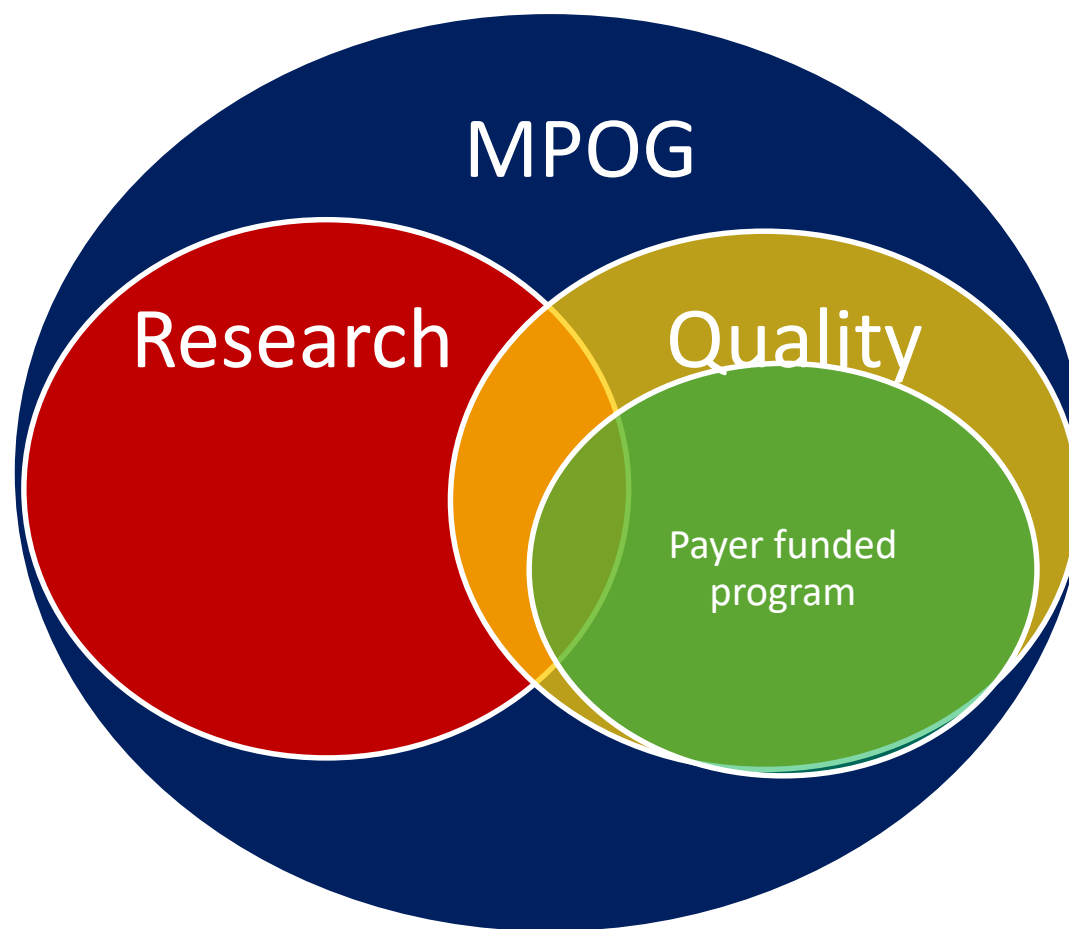
*University of Michigan Medical School*

*Co-Director, Precision Health @ University of Michigan*

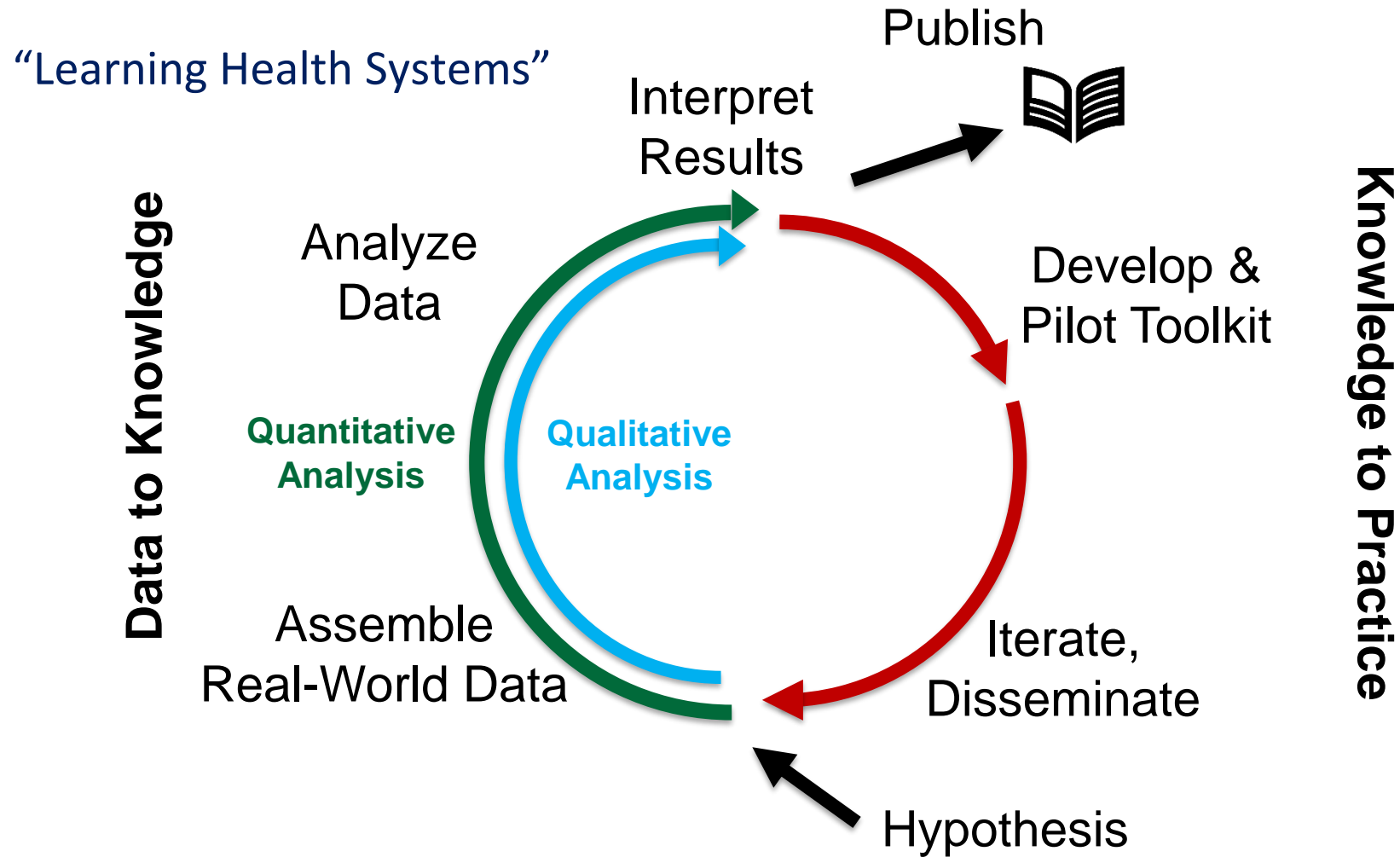


# Lesson #1

The marriage of research and quality improvement is essential



# How do we improve care?



# How do they compare?

## Research

- Data submitted q3-6 months
- PI cleans the data
- Peer review = a few advanced reviewers
- Novelty is encouraged
- Collaboration across disciplines & centers
- Seeks clinical impact
- Must evolve rapidly
- Needs high quality, reusable data elements

## Quality Improvement

- Data submitted q1 month
- Each center submits good data
- Peer review = every clinician
- Conservative consensus building
- Collaboration across disciplines & centers
- Seeks scientific foundation
- Must evolve rapidly
- Needs high quality, reusable data elements

# Developing a Research Study

- Examples of Research Studies Leveraging MPOG:

- Descriptive Studies
- Operational Analyses
- Outcomes Studies
  - MPOG Data
  - MPOG + Surgical Registry



The Society  
of Thoracic  
Surgeons



ACS  
NSQIP®

MSQC  
Michigan Surgical Quality  
Collaborative

- Enhanced Observational Studies (EOS)
- Clinical Trials Network

[Anesthesiology](#), 2016 Nov;125(5):904-913.

## Reference Values for Noninvasive Blood Pressure in Children during Anesthesia: A Multicentered Retrospective Observational Cohort Study.

[de Graaff JC<sup>1</sup>](#), [Pasma W](#), [van Buuren S](#), [Duijghuisen JJ](#), [Nafiu OO](#), [Kheterpal S](#), [van Klei WA](#).

[Anesth Analg](#), 2017 Oct;125(4):1203-1211. doi: 10.1213/ANE.0000000000002305.

## Alarm Limits for Intraoperative Drug Infusions: A Report From the Multicenter Perioperative Outcomes Group.

[Berman MF<sup>1</sup>](#), [Iyer N](#), [Freudzon L](#), [Wang S](#), [Freundlich RE](#), [Housey M](#), [Kheterpal S](#); [Multicenter Perioperative Outcomes Group \(MPOG\) Perioperative Clinical Research Committee](#).

JAMA | **Original Investigation**

## Association of Overlapping Surgery With Perioperative Outcomes

[Eric Sun](#), MD, PhD; [Michelle M. Mello](#), JD, PhD; [Chris A. Rishel](#), MD, PhD; [Michelle T. Vaughn](#), MPH; [Sachin Kheterpal](#), MD, MBA; [Leif Saager](#), Dr Med, MMM; [Lee A. Fleisher](#), MD; [Edward J. Damrose](#), MD; [Bassam Kadry](#), MD; [Anupam B. Jena](#), MD, PhD; for the Multicenter Perioperative Outcomes Group (MPOG)

## Management of 1-Lung Ventilation—Variation and Trends in Clinical Practice: A Report From the Multicenter Perioperative Outcomes Group

[Colquhoun](#), Douglas, A., MB ChB, MSc, MPH<sup>1</sup>; [Naik](#), Bhiken, I., MBBCh<sup>1</sup>; [Durieux](#), Marcel, E., MD, PhD<sup>2</sup>; [Shanks](#), Amy, M., PhD<sup>3</sup>; [Kheterpal](#), Sachin, MD, MBA<sup>4</sup>; [Bender](#), S., Patrick, MD, MPH<sup>5</sup>; [Blank](#), Randal, S., MD, PhD<sup>2</sup> on behalf of the MPOG Investigators

## Lesson #2

Pick the right questions

# How we pick a research topic

- What are you interested in?
- What topic would you LOVE to spend days reading?
- What bad outcomes have you seen?
- What matters to patients and clinicians?

You will hate the manuscript by the time it is published . . .





# The current literature

- You have to know the existing literature better than the experts
  - Does a knowledge gap currently exist?
  - Can the proposed project close that gap?
- Current literature
  - Patient sample size
  - Generalizability
  - Data elements collected
- PubMed search galore...
  - Get help..Medical library has lots to offer
  - Find the references in recent review article and scour it

Contemporary

Quality of study

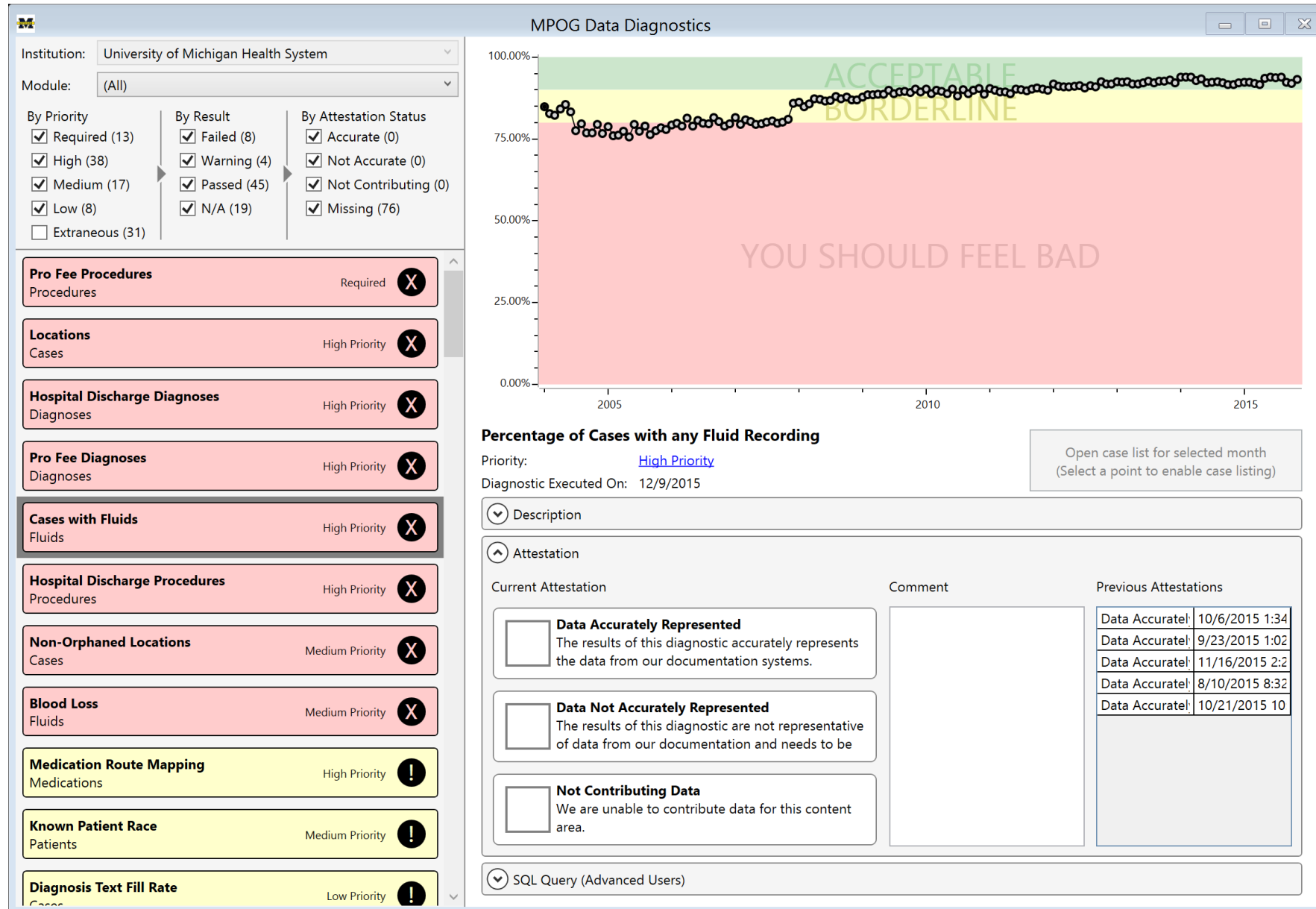
# The three E's of evidence

- Efficacy
  - Can it work?
  - Prospective controlled trials with very specific protocols
- Effectiveness
  - Does it work?
  - Multicenter observational databases
- Efficiency
  - Is it worth it?
  - Longitudinal database incorporating clinical, cost, and quality of life data


## Lesson #3

Research without rigorous data validation,  
curation, & self-serve data access is wasted effort

# Data quality obsession




# “Nitty gritty” details

 MPOG Case Validation Utility


**Case Lookup Information**  
Patient MRN:  
Date of Operation: 12/02/2014 - 07:54  
MPOG Case ID: 5BC68F24-D57A-E411-BA4E-00215A9B0A8C

Open Case in  
MPOG Case Viewer


**Questions for Validation** Enter Comments Below Here

 **Notes**

Did this patient receive a general anesthetic?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Was anesthesia start at 'Dec 2 2014 7:54AM'?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Was surgical incision at 'Dec 2 2014 10:59AM'?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Was anesthesia end at 'Dec 2 2014 10:37PM'?	<input type="checkbox"/> Yes <input type="checkbox"/> No	

 **Physiologic**


Did the patient have an invasive arterial line in place?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Was the highest value for a non-invasive blood pressure (systolic) 130?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Was the lowest value for a non-invasive blood pressure (systolic) 72?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Did the patient receive all of following volatile gases: Isoflurane Sevoflurane	<input type="checkbox"/> Yes <input type="checkbox"/> No	

 **Preop**

Was the patient's preoperative weight 12 kg (rounded to the nearest kg)?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Was the patient's preoperative height NOT FOUND cm (rounded to the nearest cm)?	<input type="checkbox"/> Yes <input type="checkbox"/> No	


Save Answers

Cancel




# Data curation

- For example, how do you define diabetes?
  - By ICD9/10, anesthesia H&P, medication, or lab value?
  - Does every project need to re-invent the wheel?
- Build reusable “phenotypes” for various analyses
  - Patient / case characteristics
    - Race, ASA status, comorbidities
    - Emergency, weekend, or cardiac case
  - Exposure variables
    - # of min of hypotension, crystalloid equivalents, PRBC
  - Outcomes
    - Acute kidney injury, 30 day mortality, pulmonary event
- Legos, not sculptures
- Making “technics” not “duplos”
- Go to: <https://Phenotypes.mpog.org>



AnesthesiaLeftBound			
AnesthesiaRightBound			
AnesthesiaSta	ComplicationCardiacAdministrative		
AnesthesiaTec	ComplicationMyocardialInfarctionAdministrative		
AnesthesiaTec	CryoprecipitateMLDerived		
AnesthesiaTec	CryoprecipitateMLRaw		
AnesthesiaTec	CryoprecipitateUnitsRaw		
AnesthesiaTec	Crystalloids		
AnesthesiaTec	DataCaptureEnd		
AntiemeticsGi	DataCaptureStart		
ArrivedIntubat	EBL		
ArrivedIntubat	EmergencyStatus		
ArterialLinePla	EmergencyStatus_YesNo		
Asa5or6	EndotrachealTube		
AsaClass_Clea	ExtubationTimes		
BaselineBlood	FFPMLDerived		
Beard_Cleaned	FFPMLRaw		
BlockNotes	FFPUnitsRaw		
BMI	Fluid01		
Cardiac	GeneralAnesthesiaNotesPresent		
CaseDuration	GlucoseObservationsDuringAnesthesia		
CaseEnd	Height		
CaseStart	HematocritObservationsDuringAnesthesia		
CasesWithCor	HemoglobinObservationsDuringAnesthesia		
	Holiday		
	HospitalDischargeCodeCount		
	IdealBodyWeight		
	InductionDuration		
	InductionEnd		
	InductionStart		

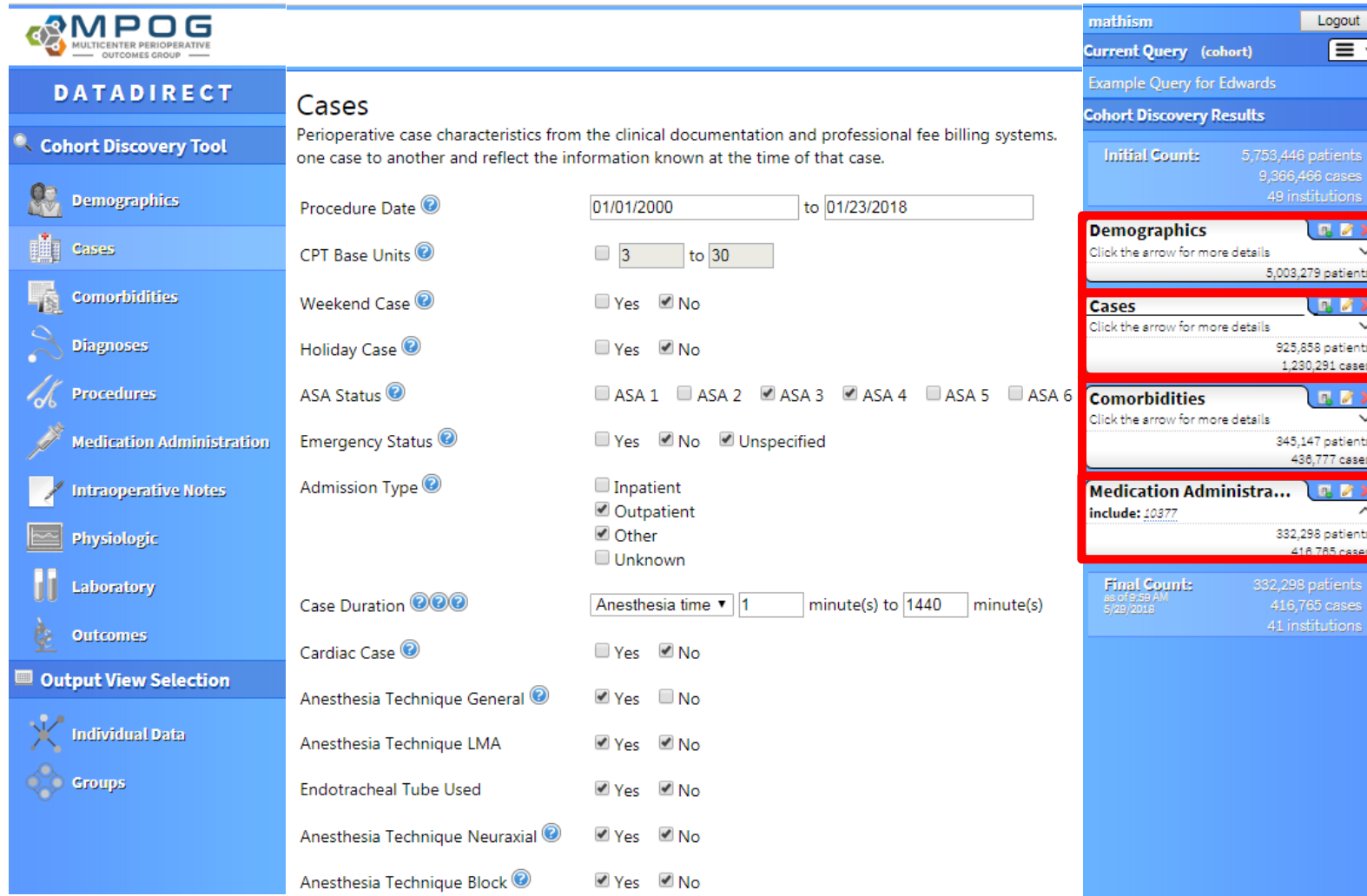


## Lesson #4

Tools make research & QI easier

# Developing a Research Study

- Cohort Discovery – DataDirect



**MPOG**  
MULTICENTER PERIOPERATIVE  
OUTCOMES GROUP

**DATADIRECT**

**Cohort Discovery Tool**

**Demographics**

**Cases**

**Comorbidities**

**Diagnoses**

**Procedures**

**Medication Administration**

**Intraoperative Notes**

**Physiologic**

**Laboratory**

**Outcomes**

**Output View Selection**

**Individual Data**

**Groups**

**Cases**

Perioperative case characteristics from the clinical documentation and professional fee billing systems, one case to another and reflect the information known at the time of that case.

Procedure Date 01/01/2000 to 01/23/2018

CPT Base Units 3 to 30

Weekend Case Yes No

Holiday Case Yes No

ASA Status ASA 1 ASA 2 ASA 3 ASA 4 ASA 5 ASA 6

Emergency Status Yes No Unspecified

Admission Type Inpatient Outpatient Other Unknown

Case Duration Anesthesia time 1 minute(s) to 1440 minute(s)

Cardiac Case Yes No

Anesthesia Technique General Yes No

Anesthesia Technique LMA Yes No

Endotracheal Tube Used Yes No

Anesthesia Technique Neuraxial Yes No

Anesthesia Technique Block Yes No

**mathism** Logout

**Current Query (cohort)**

Example Query for Edwards

**Cohort Discovery Results**

**Initial Count:** 5,753,446 patients  
9,366,466 cases  
49 institutions

**Demographics**  
Click the arrow for more details  
5,003,279 patients

**Cases**  
Click the arrow for more details  
925,858 patients  
1,230,291 cases

**Comorbidities**  
Click the arrow for more details  
345,147 patients  
436,777 cases

**Medication Administra...**  
Click the arrow for more details  
include: 10377  
332,298 patients  
416,765 cases  
41 institutions

**Final Count:** 332,298 patients  
416,765 cases  
41 institutions  
as of 9:59 AM  
5/29/2018

*How many...*

*...adult females...*

*...undergoing elective non-cardiac surgery with general anesthesia...*

*...with hypertension, diabetes, or renal insufficiency...*

*...received heparin during the surgery?*



# Developing a Research Study

- Peer Review & Study Registration

- Single Center: ACRC
- Multicenter: PCRC



About Join Research Quality Apps Downloads

## PCRC Review

When a proposal is submitted online to the PCRC, it will be reviewed within 60 days. The PCRC meets on the first Monday of each month, from 10:00am – 12:00pm Eastern Time Zone. Proposals must be received two weeks prior to a meeting and will be considered for review. Proposals may be approved as is. If so, access will be provided to those data fields from the PCRC database. Otherwise, the PCRC will make recommendations for changes so that a future submission will be more likely to be approved.

Members of the PCRC will evaluate proposals based on the following questions:

1. Is the study as presented in the Introduction complete and comprehensive?
2. Is the specific study question concisely presented?
3. Are the data (data fields) requested specifically delineated?
4. Will the data requested answer the question being asked?
5. Is the proposed statistical technique appropriate?
6. Is the literature review complete and comprehensive?

Submit research proposals as email enclosures to [mpog-research@med.umich.edu](mailto:mpog-research@med.umich.edu).



This site maintains a list of current research projects, along with their respective meeting notes and recordings below, to ensure productive collaboration in research areas. If you are interested in submitting a research project, first review this list to prevent duplication or competition. If you have a similar research area feel free to contact those involved in the project to determine if collaboration with that project is possible, or a closely related project may be appropriate.

Click on a project title to view a copy of the proposal.

Show 10 entries Search:

Project #	Date Presented	Institution	First Author	Proposal and Supporting Documents	Status
PCRC-0056	03/12/2018	Weill Cornell	<a href="#">White</a>	<a href="#">The Association of Race with Utilization</a>	Accepted
PCRC-0054	01/08/2018	Virginia	<a href="#">Blank</a>	<a href="#">Management of ventilation for</a>	Accepted
PCRC-0052	01/26/2018	Michigan	<a href="#">Shanks</a>	<a href="#">Automated Identification and Validation of Detecting Physiologically</a>	Accepted

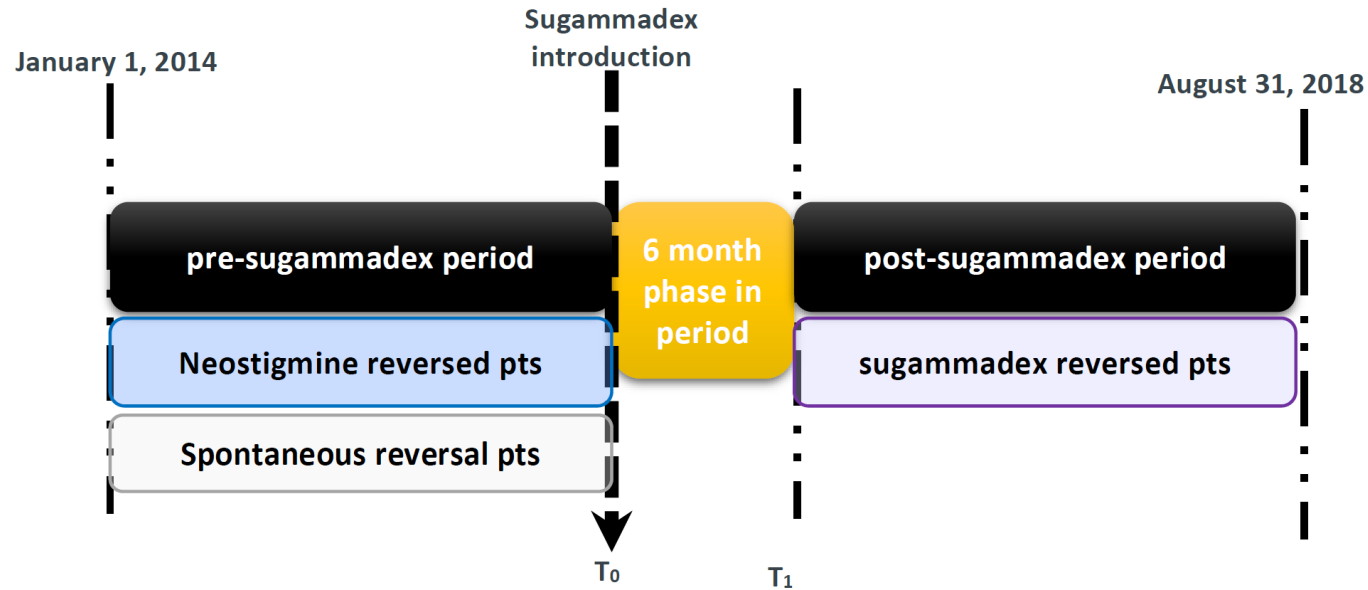


# Where has research helped the quality mission of MPOG?

- Lung Protective Ventilation
- Acute Kidney Injury
- CPT prediction
- Patient linking
- Pulmonary complications

# MPOG analysis of sugammadex

- 13 MPOG centers, 2014-2018



N= 122,025 cases eligible for matching  
N= 23,899 sugammadex cases  
N= 77,549 neostigmine cases  
N= 20,577 spontaneous reversal cases

# Compare apples to apples

- “exact” matched on age, procedure, ASA status, obesity, cardiac disease, pulmonary disease, CHF, liver disease
- Adjust for last TOF before extubation, fluid balance, opioids, time from NMB to extubation, NMB to reversal

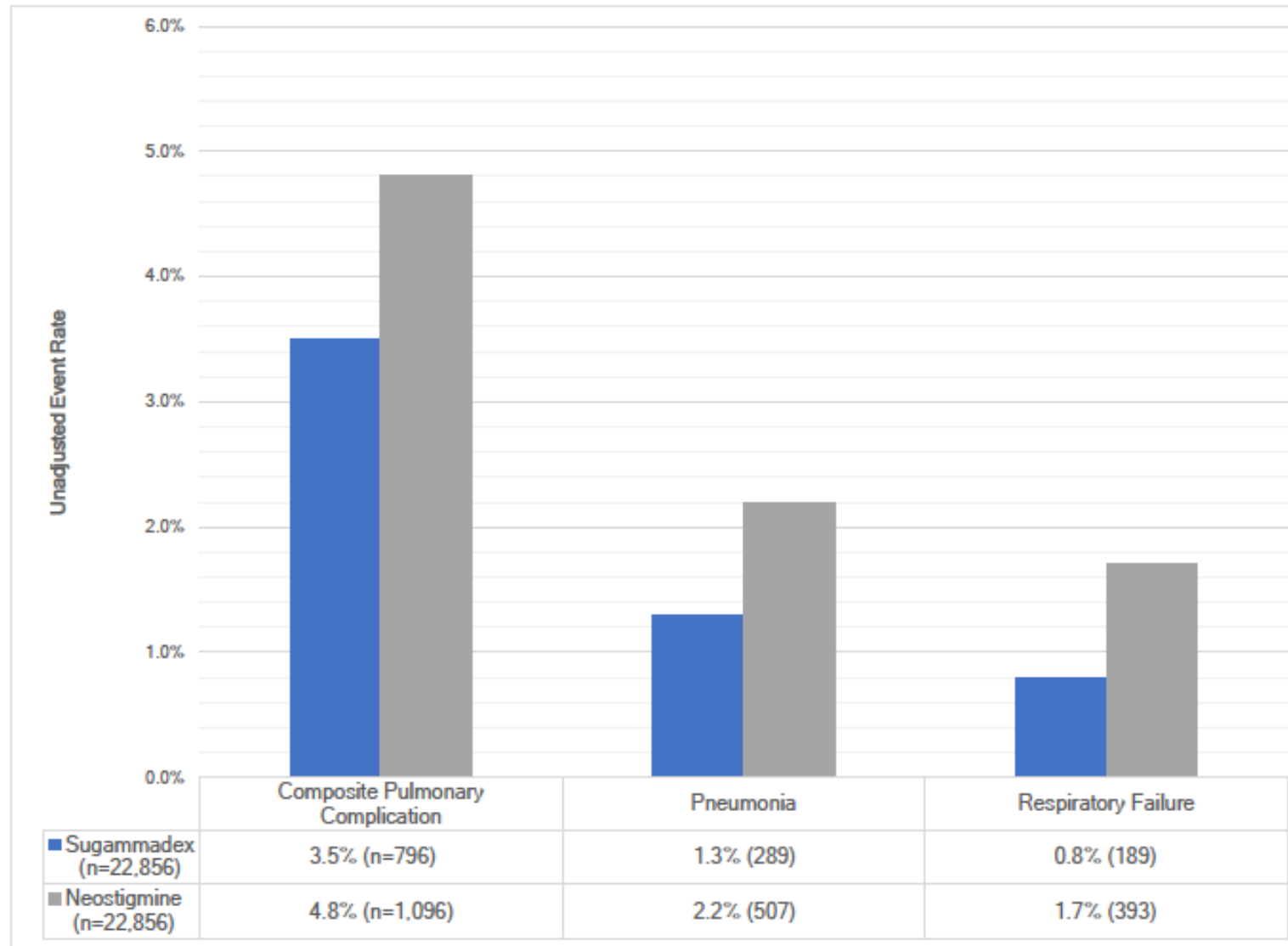


Figure 1: Major pulmonary complication event rates (unadjusted) in matched cohort of patients undergoing noncardiac inpatient surgery

## How much does it matter?

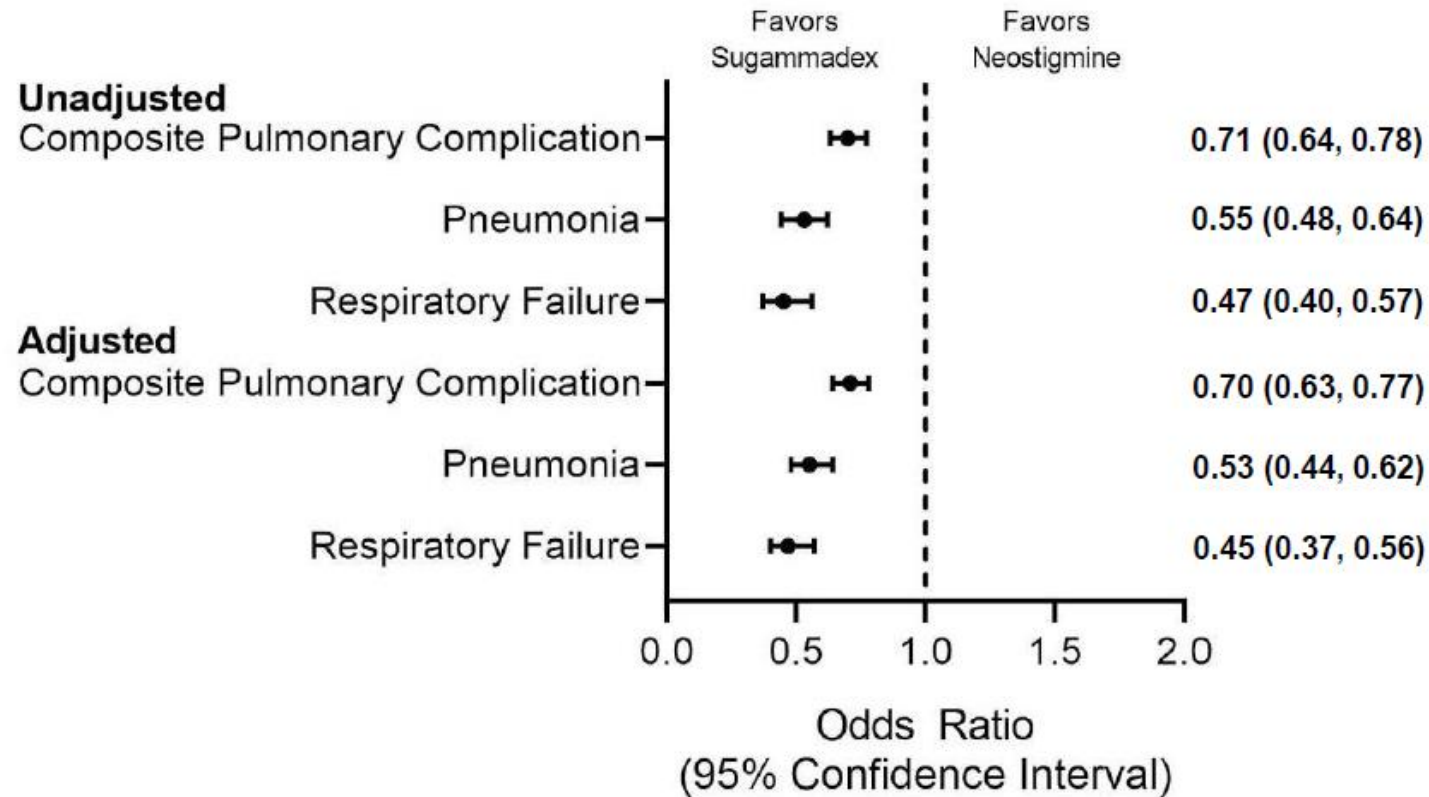


Figure 2: Unadjusted and adjusted association of sugammadex versus neostigmine administration with major pulmonary complications after inpatient noncardiac surgery

# Want to learn more about research process?

- <https://medicine.umich.edu/dept/anesthesiology/research/outcomes-research>