



Using Data to Improve Care In The NORA Setting



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Disclosures

No financial relationships with the manufacturers of health care products.

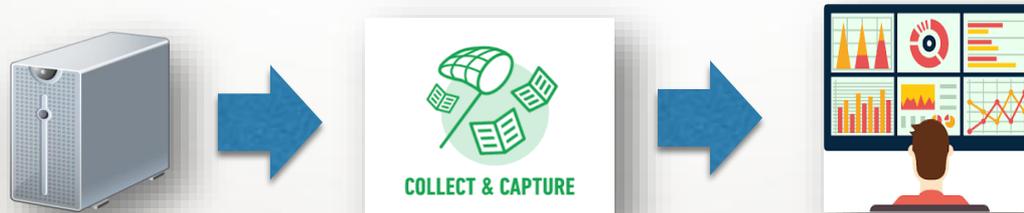
- Currently serving on
 - AQI Data Definitions Committee
 - AQI Data Use Committee
 - AQI Registry Operations Committee

- Prior support from
 - Support from NIH R01 EB020666-01A1 (Identification, Extraction and Display of Clinical Data Patterns with Application to Anesthesia Workflows)
 - Support from NSF 1526014 (Analysis and Tools for Auditing)
 - Funding from IBM as part of the
CMS Artificial Intelligence Health Outcomes Challenge



Learning Objectives

- Describe how data can be extracted from the electronic health care record
- Understand the role of 3rd party systems in generating data for quality
- Review results from analyses of large NORA data sets



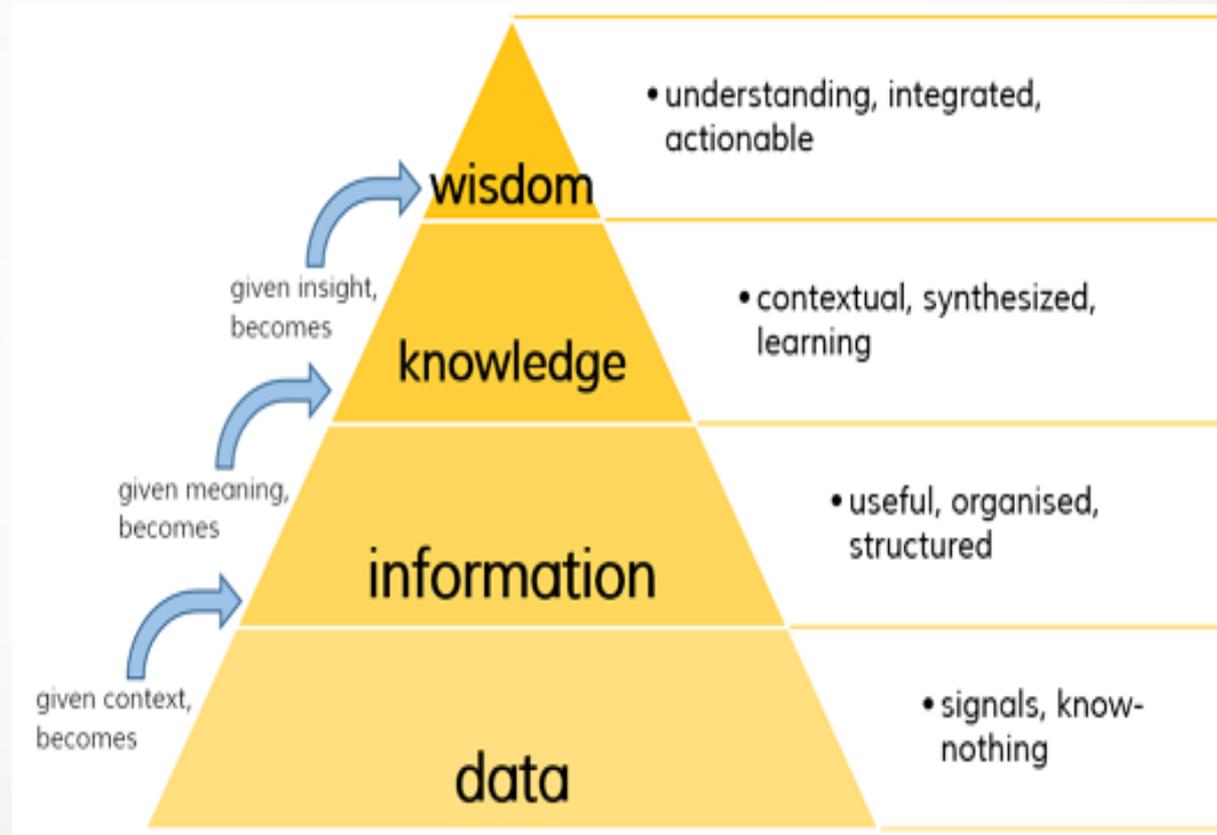


Our Data Conundrum





Our Data Conundrum



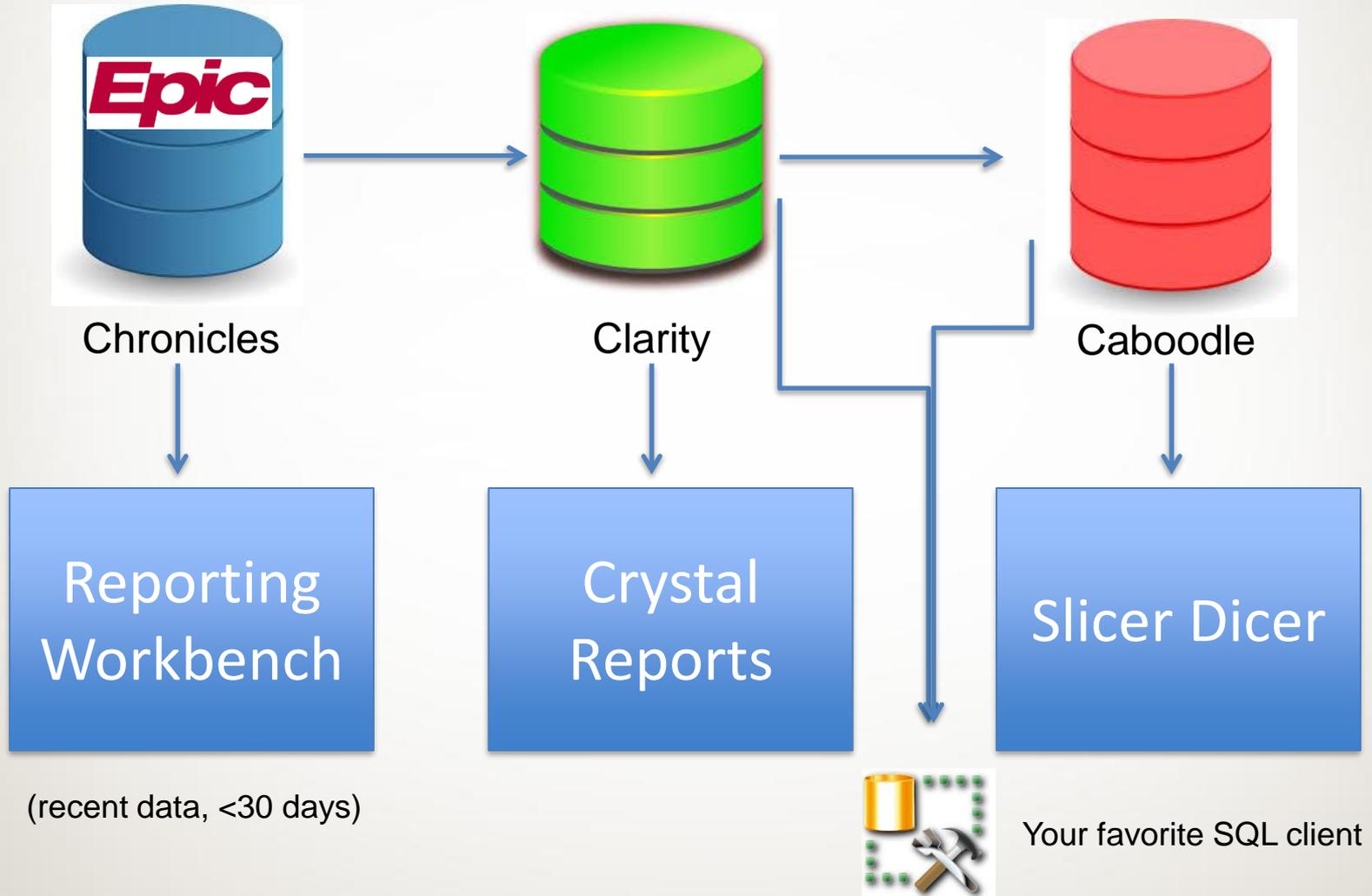
...how can we make our data more useful?

Build a Data Model

- VUMC Perioperative Data Warehouse Model
 - VPIMS + Clarity + Caboodle
 - Singular representation of cases from 2000 – today
 - Patient: Demographics, comorbidities
 - Case: Times, meds, fluids, staff, etc
 - Outcomes: PONV, AKI, etc
 - Admission: Length of stay, mortality
 - Requires a lot of mapping and validation
- Other models: MPOG, NACOR, Caboodle



Reporting Platforms





An Example

- How many times did we lose an airway in GI the past 30 days?
 - Defined as any SpO2 < 50%



Chronicles



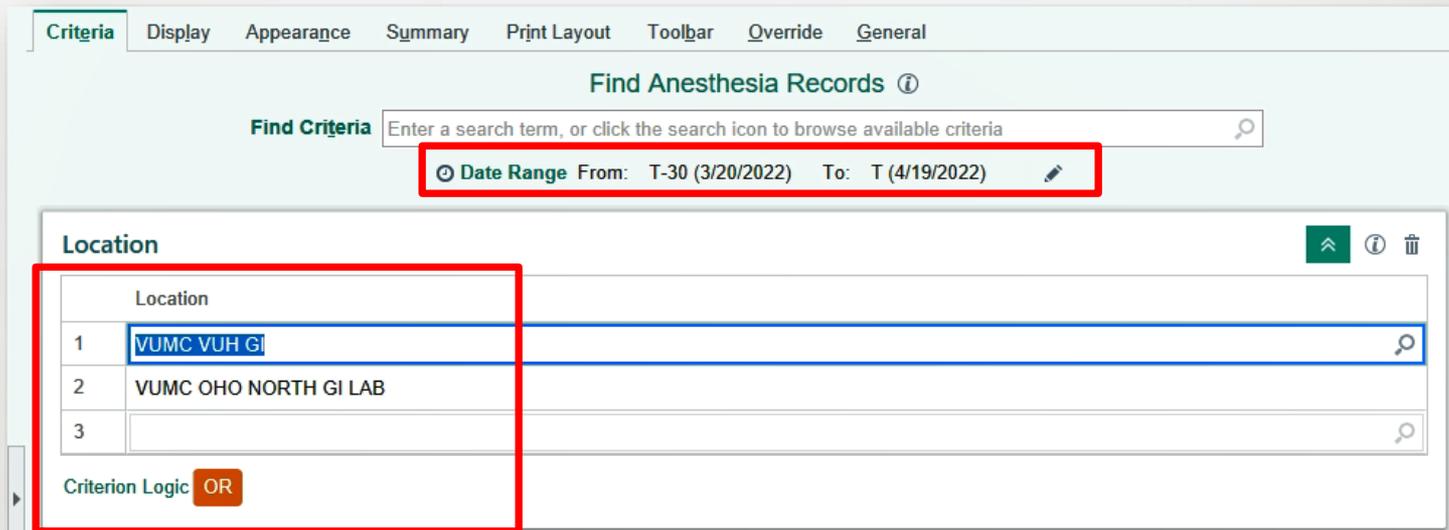
Reporting
Workbench



Create a New Report



Add location and dates



The screenshot shows the 'Find Anesthesia Records' interface. At the top, there are tabs for 'Criteria', 'Display', 'Appearance', 'Summary', 'Print Layout', 'Toolbar', 'Override', and 'General'. Below the tabs is a search bar with the text 'Find Criteria' and a placeholder 'Enter a search term, or click the search icon to browse available criteria'. A red box highlights the 'Date Range' section, which shows 'From: T-30 (3/20/2022)' and 'To: T (4/19/2022)'. Below this is a 'Location' section with a table of three rows. The first row is highlighted with a blue border and contains 'VUMC VUH G'. The second row contains 'VUMC OHO NORTH GI LAB'. The third row is empty. A red box highlights the first two rows of the table. At the bottom of the location section, there is a 'Criterion Logic' section with a radio button set to 'OR'.

Criteria | Display | Appearance | Summary | Print Layout | Toolbar | Override | General

Find Anesthesia Records ⓘ

Find Criteria Enter a search term, or click the search icon to browse available criteria

🕒 Date Range From: T-30 (3/20/2022) To: T (4/19/2022) ✎

Location

	Location	
1	VUMC VUH G	🔍
2	VUMC OHO NORTH GI LAB	
3		🔍

Criterion Logic OR

Add SpO2 < 50%

Report Settings - Anesthesia Records In GI With SpO2 <= 50% (Last 30 Days) [6204045]

Criteria Display Appearance Summary Print Layout Toolbar Override General

Find Anesthesia Records ⓘ

Find Criteria

Date Range From: T-30 (3/20/2022) To: T (4/19/2022)

Location

Location
1 VUMC VUH GI
2 VUMC OHO NORTH GI LAB
3 <input type="text"/>

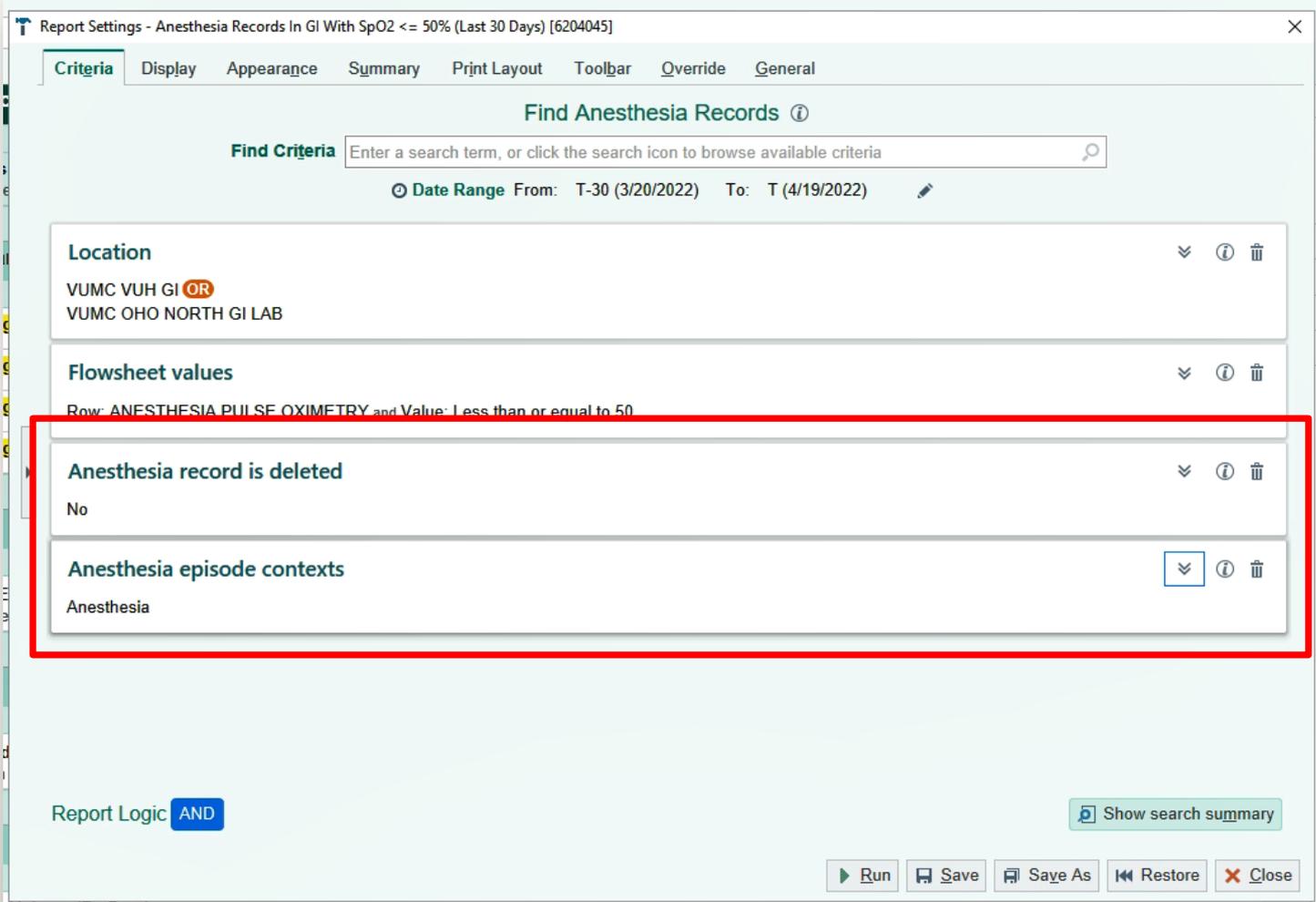
Criterion Logic **OR**

Flowsheet values

Row	Relationship	Value
1 <input type="text" value="ANESTHESIA PULSE OXIMETRY"/>	Less than or equal to	50
2 <input type="text"/>	<input type="text"/>	<input type="text"/>

Criterion Logic **OR**

Completed Report



The screenshot shows a web-based reporting tool interface. At the top, the window title is "Report Settings - Anesthesia Records In GI With SpO2 <= 50% (Last 30 Days) [6204045]". Below the title bar are tabs for "Criteria", "Display", "Appearance", "Summary", "Print Layout", "Toolbar", "Override", and "General". The "Criteria" tab is active, showing a search bar with the text "Find Anesthesia Records" and a search icon. Below the search bar is a "Find Criteria" section with a text input field containing "Enter a search term, or click the search icon to browse available criteria" and a search icon. Below the input field is a "Date Range" section with "From: T-30 (3/20/2022)" and "To: T (4/19/2022)". Below the date range are four expandable criteria sections, each with a dropdown arrow, an information icon, and a trash icon. The first section is "Location" with the text "VUMC VUH GI OR" and "VUMC OHO NORTH GI LAB". The second section is "Flowsheet values" with the text "Row: ANESTHESIA PULSE OXIMETRY and Value: Less than or equal to 50". The third section is "Anesthesia record is deleted" with the text "No". The fourth section is "Anesthesia episode contexts" with the text "Anesthesia". A red rectangular box highlights the "Anesthesia record is deleted" and "Anesthesia episode contexts" sections. At the bottom left, there is a "Report Logic" section with a blue button labeled "AND". At the bottom right, there is a "Show search summary" button. At the very bottom, there is a row of buttons: "Run", "Save", "Save As", "Restore", and "Close".

Anesthesia Records In GI With SpO2 <= 50% (Last 30 Days) [18567321] as of Tue 4/19/2022 10:40 AM

My Reports
Library
Anesthesia R...

Preprocedure Intraoperative Postprocedure Follow-up Orders Procedures

Detail List - Original

Detail List

Explore

Filter

Re-run Report

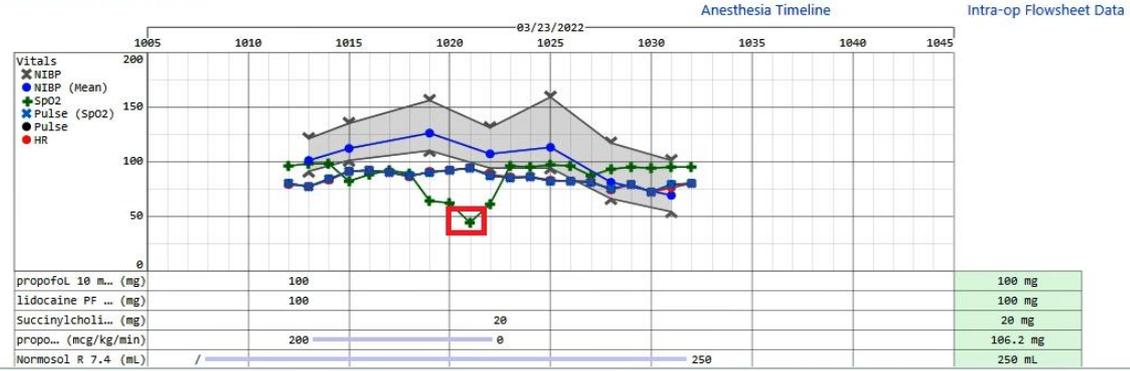
Select All

Date	Patient Name	Diagnosis	Procedure	Anesthesiologist	Pre Note	Post Note
03/23/22		Chronic pancreatitis, unspecified pancreatitis type (CMS/HCC)	ESOPHAGOGASTRODUODENOSCOPY WITH ENDOSCOPIC ULTRASOUND (N/A)			
04/07/22		1 Odynophagia	EGD (N/A Esophagus)			
04/18/22		Encounter for screening colonoscopy	COLONOSCOPY (N/A)			

Anesthesia Report

88.5 kg (195 lb) Weight 34.6 BMI 3 ASA Status

Intraoperative Grid/Graph



propofol 10 mg/mL	100 mg
propofol Infusion	106.2 mg
mcg/kg/min	
lidocaine PF 20 mg/mL (2 %)	100 mg
Succinylcholine 20 mg/mL 5 mL syringe	20 mg
PARALYZING AGENT	
Normoso1 R 7.4	250 mL

Blood Products
None

Intraoperative I/O Totals
None

Responsible Staff
03/23/22
Name Role Begin End

3 results

Modify

An Example

- What's the NORA acuity like over the past 6 months, aside from GI?
 - Defined as
 - Interventional radiology
 - Fluoroscopy
 - MRI
 - CT (ED, main hospital)



Caboodle





Hyperspace - VUH ANESTHESIA - eStar Production

145 : Open Anesthesia Records

Jonathan W.

Cogito SlicerDicer

Number of Anesthesia Records

Last 6 months

Department	Number of Anesthesia Records
MRI VUH 1, FLUOROSCO...	601

601

MRI VUH 1, FLUOROSCO...

Population

Base: All Anesthesia Records

Any of:

- Any of Department: MRI VUH 1, FLUOROSCOPY VUH 1, CT VUH ED, CT VUH 1, INTERVENTIONAL RADIOLOGY CT VUH 1
- Location: VUMC VUH IR

Slices

No Slices

Measures

Number of Anesthesia Records

Dates

Start Date: Feb 11, 2022

End Date: Aug 10, 2022

Slice By: None

Based On: Anesthesia Date

Visual Options

Bar Color: By Measure

Y-Axis Range: Automatic

MRI VUH 1, FLUOROSCOPY VUH 1, C...

Base: All Anesthesia Records

Search for criteria + Browse

Department

FDS B9006

- MRI VUH 1
- FLUOROSCOPY VUH 1
- CT VUH ED
- CT VUH 1
- INTERVENTIONAL RADIOLOGY CT VUH 1

FDS 28006

Location

VUMC VUH IR

Advanced Logic



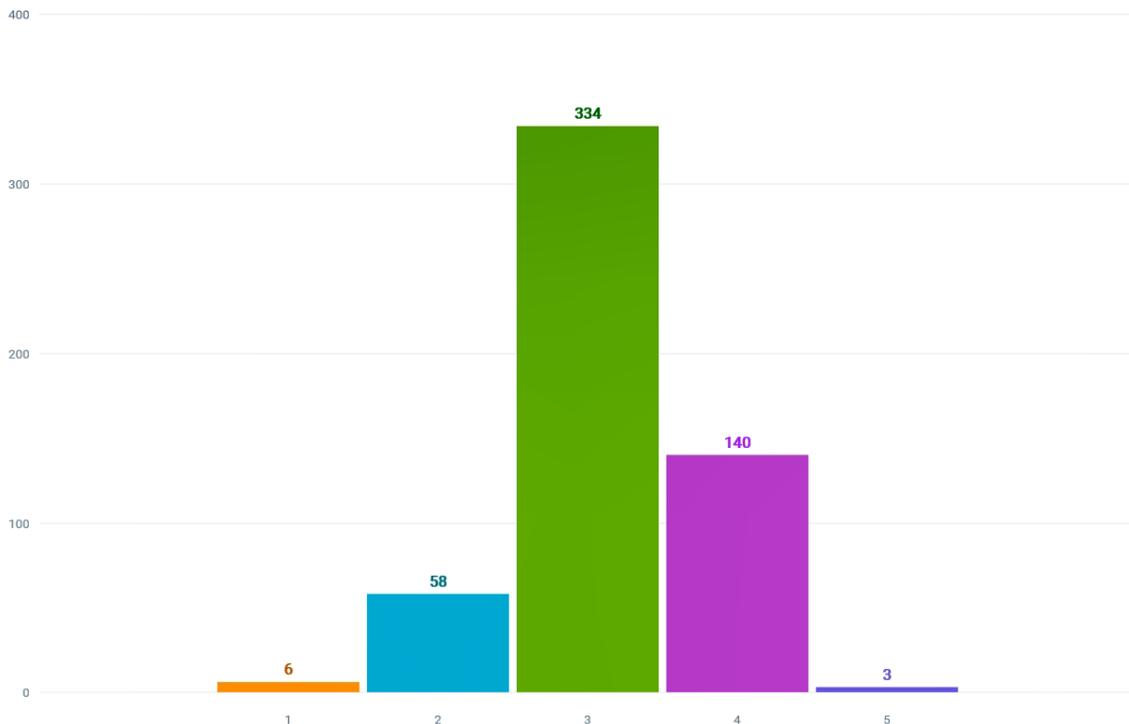
The screenshot displays the Cogito SlicerDicer software interface. The main window features a chart titled "Number of Anesthesia Records" for the "Last 6 months". The chart shows a single data point for "MRI VUH 1, FLUOROSCO..." with a value of approximately 700. A red box highlights the "Add Slice" dialog box, which is open over the chart. The dialog box has a search bar containing "ASA ph" and a list of search results. The first result is "ASA Score" (FDS 89083), which is highlighted. Other results include "Billed ASA Score" (FDS 89055), "Preprocedure ASA Status" (FDS 89123), "Billed Procedure ASA Code" (FDS 89057), "Intraprocedure Morphine Equivalence" (FDS 89122), "Number of Prophylactic Antiemetics Administered" (FDS 89090), "PACU Morphine Equivalence" (FDS 89157), and "Peripheral Nerve Block Given?" (FDS 89053). Below the list, there are 10 results and a note "more matches exist". At the bottom of the dialog, there are several category tiles: "Patient Class", "Support", "Department", "Durations", "Efficiency", "In Registry?" (FDS 89138), and "Medical History". The background interface includes a "Population" panel on the right with search criteria for "MRI VUH 1, FLUOROSCOPY VUH 1, CT VUH ED, CT VUH 1, INTERVENTIONAL RADIOLOGY CT VUH 1" and "Location: VUMC VUH IR". A "Department" filter is also visible, showing "MRI VUH 1", "FLUOROSCOPY VUH 1", "CT VUH ED", "CT VUH 1", and "INTERVENTIONAL RADIOLOGY CT VUH 1". A "Location" filter shows "VUMC VUH IR". The bottom right corner of the interface displays "Advanced Logic".



Cogito SlicerDicer

Number of Anesthesia Records by Billed ASA Score

Last 6 months



- About
- Undo
- Redo
- Start Over
- Load
- Save As
- Share
- Troubleshoot
- Settings
- Tutorials

Population

Base: All Anesthesia Records
Any of:
Any of Department: MRI VUH 1, FLUOROSCOPY VUH 1, CT VUH ED, CT VUH 1, INTERVENTIONAL RADIOLOGY CT VUH 1
Location: VUMC VUH IR

Slices

5 Slices by Billed ASA Score

Measures

Number of Anesthesia Records

Dates

Start Date: Feb 11, 2022
End Date: Aug 10, 2022
Slice By: None
Based On: Anesthesia Date

Visual Options

Bar Color: 5 Slices by Billed ASA...
Y-Axis Range: Automatic

Slice by Billed ASA Score

FDS 89055

- Grab Top 10
- 1
 - 2
 - 3
 - 4
 - 5

+ Compare to rest of population



Roadmap

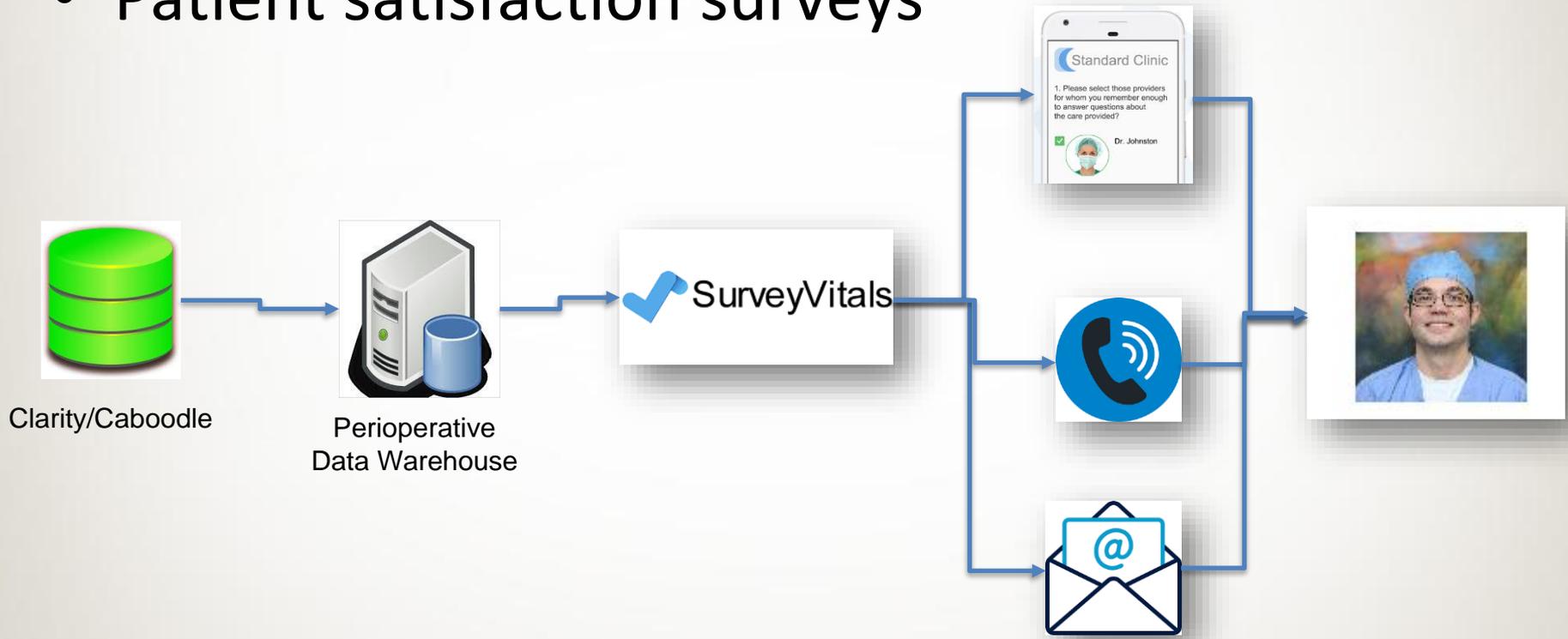
- How to get quality data out of your EHR
- Systems for quality data capture
- Review of NORA “big data” analyses





Data from Patients

- Patient satisfaction surveys



Data from Patients

Your Bi-Weekly APSQ2 Positive Patient Satisfaction Results

SurveyVitals <reports@surveyvitals.com>
To Wanderer, Jonathan Porter
7/19/2022

 **SurveyV**

 **Kudos**
APSQ2 status

Composite Mean
★★★★★ 5

5 Star Ratings AKA Passionate
Promoters
14

Top Ranked Areas As compared to your peers
- Ensure Comfort



APSQ2 Experience Details 

76 % Composite Rank (30 days)

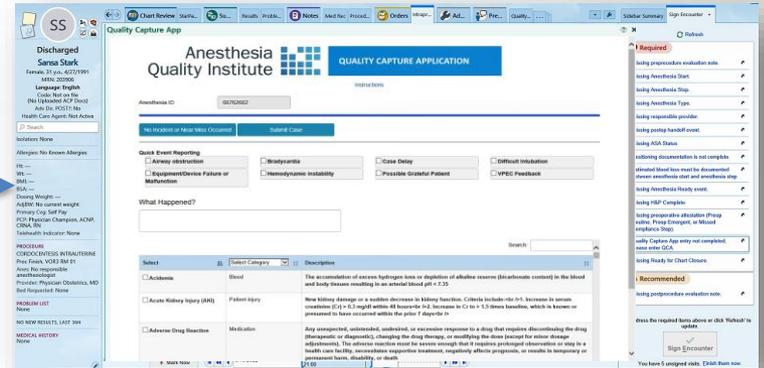
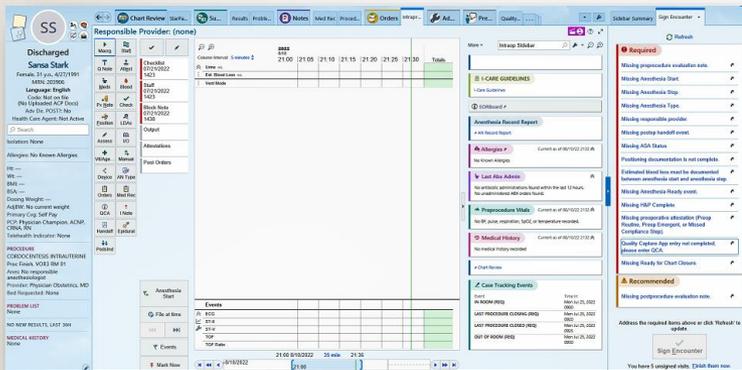
88 %
56 %

Feb Mar Apr May Jun Jul

Metric	Value	Change
Composite Mean	★★★★★ 4.78/5	- 0.00
Surveys	2,636	
Response*	51.1%	
Alerts	64	
Low Score	64	
Contact Requests	12	
Best	Overall	
Worst	Communication	
Improved	Decision Prep	
Top & Bottom Divisions		
99% Rads		
41% VWCH		
Data Sources		
Upload Quality	90.70%	↓ 0.96%
Successfully Processed	6,156	↑ 1,219

Non-EHR Data from Providers

- Quality Capture Application



Quality Capture App entry not completed, please enter QCA.

Requirement completed?

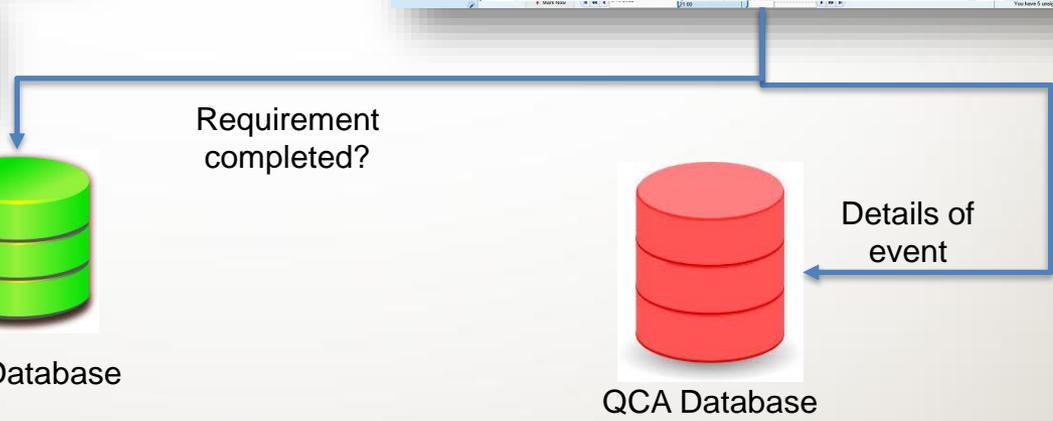


Epic Database



QCA Database

Details of event



Non-EHR Data from Providers

- QCA Dashboard, NORA Filtered



Quality Capture App

Service Date	Medical Record Number	Primary Surgeon	OR Site	Primary Anes Attending	Patient Sex	Patient Age	combined Outcome Name	Rank	Outcome Category
7/25/2022				gi	Jonathan, Wanderer	Male	Possible aspiration as pt had new O2 requirement and pleuritic chest pain following uneventful procedure—see attending postop note for details ; Aspiration	1	Aspiration
				gi	Jonathan, Wanderer	Male	Called to room for LAC IV infiltration at time of induction and difficult IV access; I placed a R AC PIV under U/S; IV Infiltration	3	IV Infiltration
				gi	Jonathan, Wanderer	Male	Called to room to assist with airway rescue; per CRNA SpO2 was in 70s although not reading when I arrived. Able to mask ventilate with oral airway; SpO2 was in 80s when reading obtained and rose to 97% quickly. Continued with...	3	Airway obstruction
7/22/2022				gi	Female	47	Please disregard the QI report submitted for this patient and case. It was submitted in error - Lusine Danakian; Equipment/Device Failure or Malfunction	1	Equipment/Device Failure or Malfunction
							Pulse oximeter (module, not the cable or sensor) failed during this patient's procedure. We switched to a portable monitor after trouble-shooting the failure. There was no apparent harm done, however, this failure occurred in the ...	1	Equipment/Device Failure or Malfunction
							Pulse oximeter module failed during complex case with LVAD patient. With troubleshooting, we determined the module itself had failed, and not the cable or the probe. Once we determined the absence of pulse ox reading was ...	1	Equipment/Device Failure or Malfunction
7/18/2022			VUH IR SUITE		Female	74	Patient arrived from the floor with 3 PIVs. RUE was flushed by RN in GI prep and 5% albumin given via that IV. After completion of albumin, RUE was noted to be taught and swollen. MD examined IV under ultrasound and found to b...	3	IV Infiltration
							minor bruising at sight of eye tape, bilateral	5	not specified
							Airway obstruction	3	Airway obstruction

Surgery Date
8/3/2022 to 8/8/2022

OR Site
(Multiple values)

Event Severity
(All)

Outcome Name
(All)

Use a Data Model



Perioperative Data Warehouse

- Automated system that retrieves EHR data for postoperative outcomes, detecting
 - PONV
 - Reintubation
 - Care escalation
 - Positive troponin
 - Acute kidney injury
 - Rapid response calls
 - In-hospital mortality
- Feedback provided
 - Weekly summary email

Here are your patients' outcomes:

Surgery Date	Description	Length Of Stay	Patient Outcomes
11/15/16	64yo F with Gamboa	No d/c found	RIFLE Risk Within 07 Days
11/15/16	34yo F with Wiese	0.31	
11/15/16	31yo F with Bream	No d/c found	Repeat Anesthetic Within 7 Days; RIFLE Risk Within 07 Days
11/15/16	70yo F for THROMBOENDARTERECTOMY, W/PATCH GRAFT; CAROTID, VERTEBRAL, SUBCLAVIAN, BY NECK INCISION (35301)(35301) with Garrard	No d/c found	PACU PONV; PACU PONV Rx
11/15/16	70yo F for ABDOMINAL TUMOR EXCISION & DEBULKING (49205) (49205) with Idrees	No d/c found	
11/15/16	69yo F for EXPLORATORY LAPAROTOMY (49000)(49000) with Garrard	No d/c found	Death in Hospital; RIFLE Injury Within 07 Days; RIFLE Risk Within 07 Days
11/15/16	59yo M for LAPAROTOMY FOR OPEN ABD (49002)(49002) with Hopper	No d/c found	Repeat Anesthetic Within 7 Days
11/15/16	56yo M for EXPLORATORY LAPAROSCOPY (49320)(49320) with Idrees	0.33	Elevated PostOperative Troponin within 7 days

For detailed information on your cases' outcomes, please visit the [Patient Outcomes Dashboard](#)

This automated email was generated by Vanderbilt Anesthesiology and Perioperative Informatics Research. Contact [VAPIR Tech Support](#) for assistance.



Roadmap

- How to get quality data out of your EHR
- Systems for quality data capture
- Review of NORA “big data” analyses



NACOR

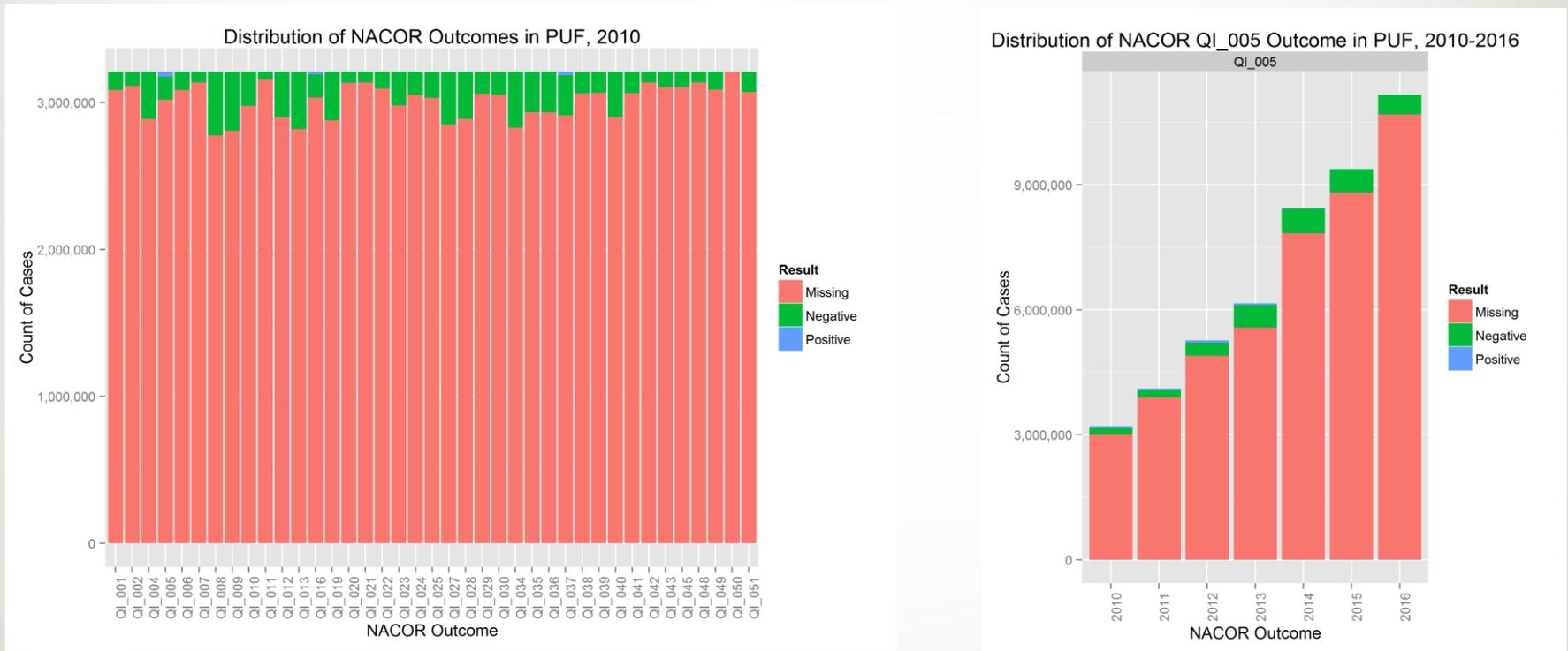
- AQI chartered in 2008 by ASA to develop the National Anesthesia Clinical Outcomes Registry
- Millions of cases from thousands of practices
 - **“Mile wide”**
- Minimal Data Elements
 - Staff information
 - Anesthesia dates/times
 - Patient characteristics
 - Procedure codes
 - Anesthesia type
 - Diagnosis codes
 - Payment type
 - **“Inch deep”**

NACOR Minimum Data Fields

Data Element	Location in XML Schema	NACOR (Declined QR or QCDR)	Qualified Registry	Qualified Clinical Data Registry
Unique Anesthesia Episode of Care ID	<AnesthesiaRecordID>	✓	✓	✓
Staff ID	<StaffID>	✓	✓	✓
Staff Role (MD, DO, CRNA, AA)	<StaffRole>	✓	✓	✓
Staff NPI Number	<NPI>	✓	✓	✓
Facility ID	<FacilityID>	✓	✓	✓
Date of Service	<AnesthesiaStartTime>	✓	✓	✓
Anesthesia Start Time	<AnesthesiaStartTime>	✓	✓	✓
Anesthesia End Time	<AnesthesiaEndTime>	✓	✓	✓
Patient Gender	<Gender>	✓	✓	✓
Patient age or Date of Birth	<DOB> or <Age>	✓	✓	✓
Anesthesia Type (General, MAC, etc.)	<AnesthesiaCategory>	✓	✓	✓
ASA Physical Status (E Designator when appropriate)	<ASAClass>	✓	✓	✓
Surgical CPT Code	<CPTValue>	✓	✓	✓
Payment Code (i.e., Medicare)	<PaymentCode>	✓	✓	✓
PQRS Measure Number *	<QCDRMeasure>		✓	✓
ASA Measure Number	<QCDRMeasure>		✓	✓
PQRS Measure Code* (i.e., 0581P)	<QCDRCodeValue>		✓	✓
ASA Measure Code (i.e., ASA10N)	<QCDRCodeValue>			✓
Modifier (1P or 8P, if applicable)*	<QCDRModifier>		✓	✓
Denominator Exclusion *	<QCDRDenomExclusion>		✓	✓
ASA CPT Code (If billing vendor does not collect Surgical CPT codes ok to send ASA CPT code)	<CPTAnesValue>	✓	✓	✓
ICD10 (Required if part of the denominator criteria for a measure)	<ICDValue>		✓	✓

*Note: Measures reported for Qualified Registry (QR) should use the XML QCDR Node Set

NACOR: The outcome part



Zapf M, Grant B, McEvoy M, Wanderer JP. International Anesthesia Research Society Annual Meeting. Chicago, Illinois. 2018 Apr; An Analysis of the Utilization of Anesthesia Quality Measures using the Anesthesia Quality Institute's National Anesthesia Clinical Outcomes Registry.



NACOR

Strengths

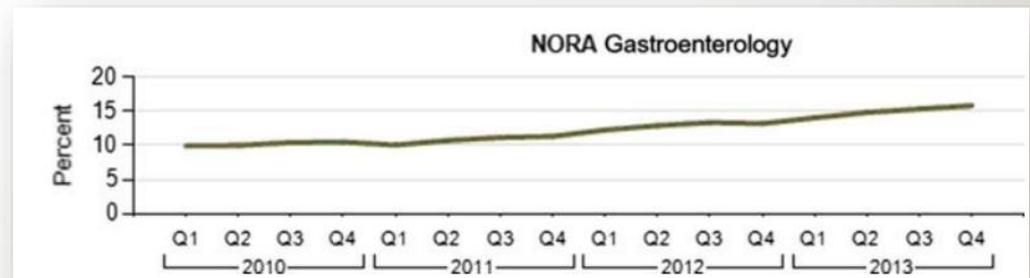
- Great capture of anesthetics across the US
- Longitudinal data
 - (10+ years)
- Represents different types of practices
- Supported by the ASA

Limitations

- Significant missingness for some data elements
- Not much granular data
- Data is variable by practice

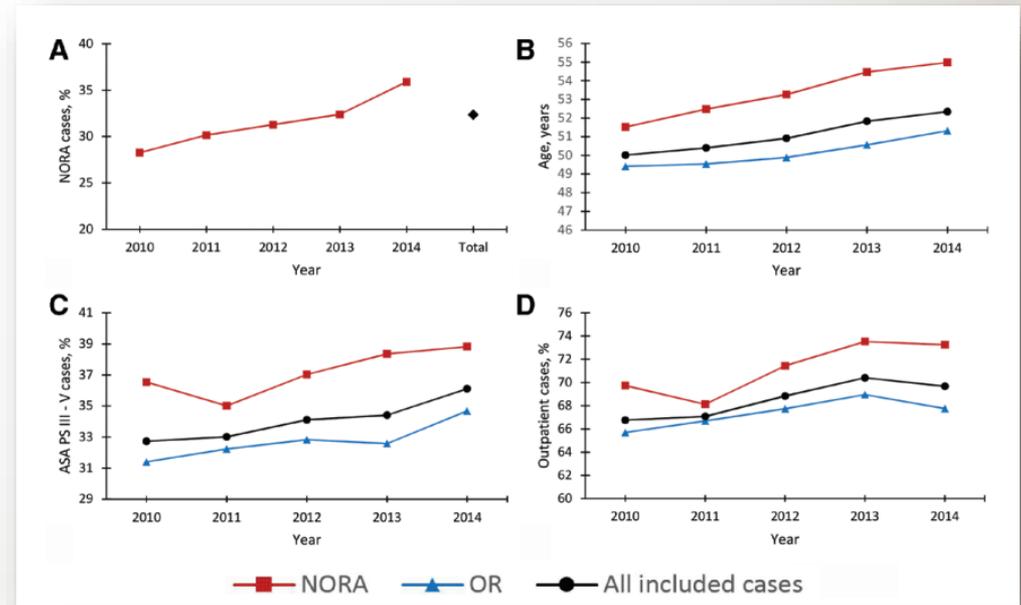
NORA Complications

- NACOR 2010-2013
 - 12,252,846 cases
 - Most common complication PONV (1.06%)
 - Lower overall mortality than OR locations (0.02% vs 0.04%, $P < 0.0001$)
 - Higher mortality in cardiology and radiology (0.05%)
 - Growth in GI cases



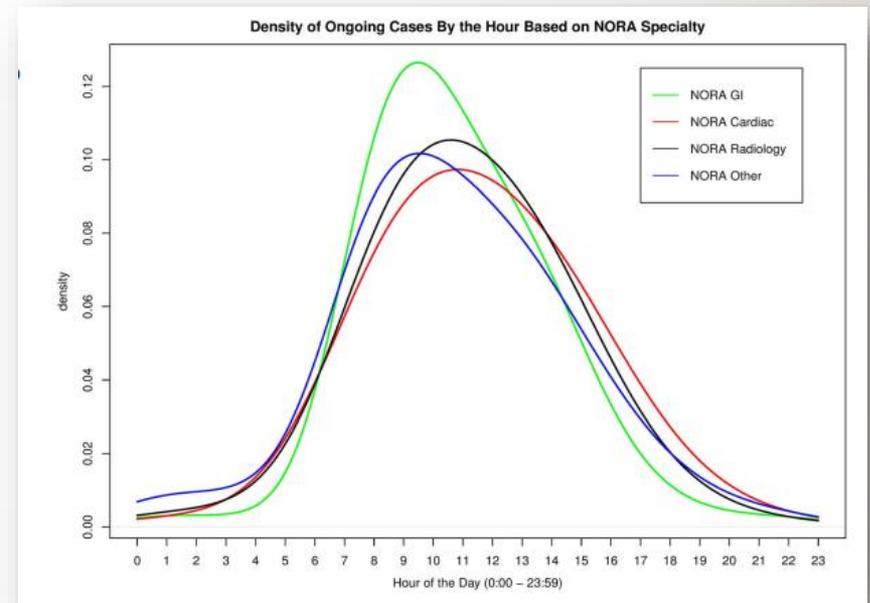
Growth of NORA

- NACOR 2010-2014
 - 5,929,953 NORA; 12,387,574 OR cases
 - Older patients
 - Sicker patients
 - More outpts
 - More NORA



NORA By Day and Night

- NACOR, 2010-2015
 - 4,948,634 cases
 - 4.3% during after hours
 - Higher ASA scores
 - Longer cases
 - GI cases least frequent





The Conclusion Slide

- You too can get useful data out of your EHR
- You can do much more with modeled data
- You can get useful data from systems interfaced with your EHR
- NACOR can tell us a bit about NORA



Thanks!

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