# MPOG Data Cleaning Tools

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# Outline

- Identify challenges associated with using 'big data'
- Describe tools to refine MPOG data
  - –QI
  - Research
- Examine the roles of stakeholders in data cleaning process
  - ACQRs
  - QI Champions
  - Researchers
  - MPOG Coordinating Center



### Data Use Challenges

- Data quality not a priority for busy clinicians <sup>1</sup>
- Data are non-standardized <sup>2</sup>
- Average anesthesia record has 2,000 physiologic observations from 40 parameters <sup>3,4</sup>
- Data can be "locked" in text <sup>5</sup>

- 1. Cook JA, Collins GS. The rise of big clinical databases. The British journal of surgery. 2015;102(2):e93-e101
- 2. Mandel JC, Kreda DA, Mandl KD, Kohane IS, Ramoni RB. SMART on FHIR: a standards-based, interoperable apps platform for electronic health records. *Journal of the American Medical Informatics Association : JAMIA*. 2016;23(5):899-908.
- 3. Kheterpal S, Shanks A, Tremper KK. Impact of a Novel Multiparameter Decision Support System on Intraoperative Processes of Care and Postoperative Outcomes. Anesthesiology. 2018;128(2):272-282.
- 4. The Multicenter Perioperative Outcomes Group. https://mpog.org. Accessed March 6 2018, 2018.
- 5. Hripcsak G, Albers DJ. Next-generation phenotyping of electronic health records. Journal of the American Medical Informatics Association : JAMIA. 2013;20(1):117-121.



### Specific Example: PONV 01

Risk Factor for PONV 01: History of PONV

- <u>Site A</u>
  - Maps "<u>History of PONV</u>" variable → MPOG concept <u>70338 General- PONV Risk Factors</u>
- <u>Site B</u>
  - Maps "<u>History of PONV</u>" variable → MPOG concept: <u>70080 General- Previous Anesthetic Problem</u>

If either concept shows up  $\rightarrow$  mark as 'Yes' for "<u>History of PONV</u>", right?



### Actual values associated with PONV concepts:

General - Previous Anesthetic Problem	Brother with nausea/vomiting associated with anesthesia
General - Previous Anesthetic Problem	mother- PONV, father-requires larger doses of anesthesia then normal
General - Previous Anesthetic Problem	Last GA: 7/10/15- IV induction, LMA 2.5- easy mask; Mother reports x1 incidence of PONV during 5 previous eye surgeries
General - Previous Anesthetic Problem	pt had PONV with hysterectomy, none since. Mother PONV and "multiple allergies"
General - Previous Anesthetic Problem	Last GA 2008, did well, no PONV. Mother with strong history of PONV
General - Previous Anesthetic Problem	PONV x1 with last tympanoplasty
General - Previous Anesthetic Problem	+ motion sickness and vomits in the car
General - Previous Anesthetic Problem	Pt has severe PONV except for last surgery

General - PONV Risk Factors	Yes, treated in PACU.			
General - PONV Risk Factors	Yes after receiving morphine			
General - PONV Risk Factors	last surgery had no PONV			
General - PONV Risk Factors	last time she had no problems			
General - PONV Risk Factors	Yes, unknown			
General - PONV Risk Factors	Yes Treated in PACU, has been admitted in the past for pain.nausea			
General - PONV Risk Factors	Yesrelated to pain meds			
General - PONV Risk Factors	required over night hospitalization			
General - PONV Risk Factors	Unable to determine.			

Further cleaning needed...mapping gets us close but not quite there yet.

### **MPOG Tools for Data Cleaning**

- 1. <u>Concept Browser</u>:
  - Map AIMS variables to standard MPOG concepts (Variable Mapping)
- 2. <u>Collation Mapping</u>:
  - Sort 'answers' mapped to specific concepts
- 3. <u>Phenotype Browser</u>:
  - Intelligent characterizations of data usable for QI/Research
  - Derived through synthesizing <u>multiple concepts</u> and using <u>deductive/inductive</u> reasoning



# **<u>Step 1</u>**: Mapping Variables to Standardized MPOG Concepts

03	Configurati	on Tool								×[	🧐 MPOG Co	oncept Lookup
Fi	le Edit										MPOG Conc	epts
M	apping Grou	Preop		•	Refresh Current	Save All					ponv	
Do	ouble-Click s	elected AIMS concepts to assign sel	ected MPOG	concept i	n other window	. (Hold CTRL if mutliple)					Use Defa	ult Filter
Ria	ght-Click to	copy textfield to concept window se	archbox.								Silter by I	MPOG Concept Type
	(Inmanned (	Concents Manned Concents									(All C	oncepts)
	onnapped (	concepts mapped concepts									Select ne	vt unmanned concent after assignment
	AIMS ID	AIMS Desc	Row Count	Form	Case Linked?	Preoperative Days Limit	Exclude From Extract?	MPOG ID	MPOG Desc			tematically saarch for next concent
	13254	Anes LOC PE	230100	160000	<b>V</b>	0		70318	Physical exam - Level of Consciou		Au	tomatically search for next concept
	12150	Anes Malignacy Metastasis	47461	160000	<b>&gt;</b>	0		70101	Misc - Solid Organ Malignancy N		Double-Click	to assign selected MPOG concept to selected AIN
	17024	Anes  Motion Sickness	1345204	160000	<b>×</b>	0		70102	Misc - Motion Sickness			
	17025	Anes  Nausea Car	1328250	160000	<b>v</b>	0		70103	Misc - Nausea Car		MPOG ID	MPOG Desc
	11089	ANES  Neck circumference (cm)	48584	160000	<b>&gt;</b>	0		70010	Airway - Neck circumference (cm		70338	General - PONV Risk Factors
	18650	ANES  Neck circumference inches	38885	160000	>	0		70011	Airway - Neck circumference (in)		70339	General - PONV Risk Total Score
	<u>3588</u> 3	Anes  Peds CP Spasticity	84741	160000	<ul> <li>Image: A state of the state of</li></ul>	0		70107	Pediatrics - CP Spasticity			
	17034	ANES PONV Risk Total Score	266472	160000	<ul> <li>Image: A set of the set of the</li></ul>	0		70339	General - PONV Risk Total Score			
	36329	Anes  Preop Evaluation Complete	1154592	160000	>	0		70310	Assessment and Plan - Evaluation			
	4303	Anesth Family Hx of Anesth Prok	7157111	160000	<	0		70050	General - Family History of Anest			



# **<u>Step 1</u>**: Mapping Variables to Standardized MPOG Concepts

#### • MPOG Concept Browser: Click here for demo

Concept	t type [All concept types]	Ţ	
Query st	tring ponv		
Institutio	ons 81 selected	*	
Count M	1ode Concept occurrences		
🕑 Hide i	inactive concepts		
Submi	it		
ID	Concept Name	Concept Type	# of Occurrence
50046	Medical Performance Exclusion- PONV	Intraoperative Events, Interventions, and Observations	(
50644 •	Misc - PONV prophylaxis administered	Intraoperative Events, Interventions, and Observations	29,821
70338 4	General - PONV Risk Factors	Preoperative Observations	1,192,781
B Be	eaumont Dearborn		36,277
B Be	eaumont Dearborn and Taylor		60,247
B Be	eaumont Farmington Hills		3,501
B Re	eaumont Grosse Pointe		3 755



ces

## **MPOG Concept Browser**





# **<u>Step 2</u>**: Sort data using Collation Mapping

PreopPON	IVHistoryNotes			Missing or Unknown				
Institution			) / 11,784	(Description not provided)				
Mapping Filter	History of PONV			Rows Remaining: 0 /	/ 787,865	Invalid Value		
Time Filter	All			<ul> <li>Percent Mapped:</li> </ul>	100.0 %	This note is irrelevant or incorrect		
Value Filter				(What's This?)		No History of PONV		
					_	(Description not provided)		
MPOG Concept		Source Value	Count	Mapped As				
General - PONV F	Risk Factors	Yes	201,513	History of PONV		History of PONV		
Assessment and F	Plan - Comments	Post-Op Nausea and Vomiting	65,494	History of PONV		(Description not provided)		
General - Past Me	edical History ICD-10 Code	PONV (postoperative nausea and vomiting)	102,121	History of PONV		(beschption not provided)		
Assessment and F	Plan - Special Anesthesia Technique	PONV RISK SCORE	35,553 History of PONV					
General - Previous Anesthetic Problem Postoperat		Postoperative Nausea and Vomiting	51,925 History of PONV			History of PONV - Relatives Only		
General - PONV Risk Factors PON		PONV Present	25,812 History of PONV			There is no history of PONV for the patient, but documention mentions PO		
General - Previous Anesthetic Problem Postoperative Nausea and Vomiting Treated in PACU		21,795	History of PONV					
General - Previou	General - Previous Anesthetic Problem PONV		34,537	34,537 History of PONV				
General - Past Me	General - Past Medical History ICD-10 Code Postoperative nausea and vomiting		30,871	30,871 History of PONV				
General - PONV F	neral - PONV Risk Factors Yes Treated in PACU		17,111 History of PONV					
General - Family I	History of Anesthetic Problems	Postoperative Nausea and Vomiting	15,935	History of PONV				
General - PONV F	Risk Factors	MEDIUM 3-5	14,991	History of PONV				
General - Family I	History of Anesthetic Problems	PONV	10,666	10,666 History of PONV				
General - Previous Anesthetic Problem Postoperative Nausea and/or Vomiting		8,716	History of PONV					
Assessment and Plan - Anesthetic Consideration Postoperative Nausea and Vomiting		Postoperative Nausea and Vomiting	7,926	History of PONV				
General - PONV Risk Factors History of PONV/Motion Sickness		6,417	History of PONV					
General - Previous Anesthetic Problem Postoperative Nausea and Vomiting		6,063	5,063 History of PONV					
General - Past Medical History ICD-9 Code PONV (postoperative nausea and vomiting)		20,857	20.857 History of PONV					
General - Past Medical History ICD-10 Code Post-operative nausea and vomiting		21,577	History of PONV					
Assessment and F	Plan - Anesthetic Consideration	Postoperative Nausea and Vomiting, Postoperative	2,552					



#### Some measures are not as 'easy' as PONV...

**TRAN 01**: *Exclude* transfusions between:

Cardiopulmonary bypass start and cardiopulmonary bypass end

#### What concepts should we use?

Assume we find 2 concepts that directly reflect bypass start and end times.

Do most sites who perform bypass have variables mapped to these two concepts?

Assume again that yes, majority of sites are using these concepts.

Do providers consistently use the variables that are mapped to these concepts?

No assumptions here 🙂



### What concepts to use / are sites mapping?

ID	Concept Name			Concept Type	# of Occurrences		
3001 •	Perfusion- Cardiopulmonary Flow	w (ml/min)		Physiologic Observations	1,356,183		
3002 •	Perfusion- Cardiopulmonary Line	e Pressure	(mmHg)	Physiologic Observations	1,610,004		
3003 •	Perfusion- Cardiopulmonary volu	ume (ml)		Physiologic Observations	354,523		
3036 🕨	Perfusion - Cardiopulmonary by	50406 •	Cardiopulmonary bypa	ass rewarm temperature - detail	Intrac	perative Events, ventions, and Observations	15,972
3037 •	Perfusion - Cardiopulmonary by	CO 407 -	Cardiopulmonanthum	acc a stamic cooling initiated	Intra	operative Events,	20.786
3038	Perfusion - Cardiopulmonary by	p 1	Cardiopulitionary bypa	ass systemic cooling initiated	Interv	ventions, and Observations	29,760
3039 🕨	Perfusion - Cardiopulmonary by	50408 •	Cardiopulmonary bypa	ass systemic cooling temperature -	detail Intra	operative Events,	16,381
3044	Perfusion - Cardiopulmonary by	p			Interv		
3049	Perfusion - Cardiopulmonary by	50409 •	Cardiopulmonary bypa	ass (full/partial/left-heart) terminate	ed Inter	ventions, and Observations	55,958
3067 •	Perfusion - Cardiopulmonary byp (mL/min/m2)	50410 •	Cardiopulmonary bypa	ass initiated (full/partial/left-heart)	Intrad	operative Events, ventions, and Observations	66,310
10604 •	CARDIOPULMONARY BYPASS CIF	₹ 50411 ►	Cardiopulmonary bypa	ass – ventilator turned off	Intrac	operative Events, ventions, and Observations	35,106
10677	Modifier - Monitored anesthesia	50412 •	Cardiopulmonary bypa	ass – perfusion start	Intrac	operative Events, ventions, and Observations	33,513
40003	history of severe cardiopulmona	r 50413 •	Cardiopulmonary bypa	ass – perfusion end	Intrac	operative Events, ventions, and Observations	41,693
50399 •	Cardiopulmonary bypass – aorti	c - 50415 ►	Cardiopulmonary bypa	ass – aortic crossclamp off	Intrac	operative Events, ventions, and Observations	73,789
50401 >	Cardiopulmonary bypass vent or	50416 •	Cardiopulmonary bypa time totals	ass – crossclamp and circulatory ar	rest Intrad	operative Events, ventions, and Observations	47,855
50402 >	Cardiopulmonary bypass vent of	<sup>1</sup> 50417 ▶	Cardiopulmonary bypa	ass – Access cannula removed note	Intrac	operative Events, ventions, and Observations	70,799
50403 >	Cardiopulmonary bypass vent or	50418	Cardiopulmonary bypa detail	ass – Access cannula removed loca	tion Intrac Interv	operative Events, ventions, and Observations	0
50404 •	Cardiopulmonary bypass vent of	50419 <b>•</b>	Cardiopulmonary bypa therapy	ass – Aortic crossclamp removal re	quiring Intrad Interv	operative Events, ventions, and Observations	4,546
50405 >	Cardiopulmonary bypass rewarn	r 50420 ▶	Cardiopulmonary bypa	ass – Isoflurane vaporizer turned o	n Intrac	operative Events, ventions, and Observations	18,369
		50421 •	Cardiopulmonary bypa	ass – Arterial cannula inserted note	Intrac	operative Events, ventions, and Observations	92,858
		50422 •	Cardiopulmonary bypa	ass – Arterial cannula insertion site	detail Intrac	operative Events, rentions, and Observations	7,472
		50423	Cardiopulmonary bypa	ass – Arterial cannula insertion flow	v detail Intrac	operative Events, ventions, and Observations	0
		50424 •	Cardiopulmonary bypa	ass – Blood pressure lowered note	Intra	operative Events,	6,546

These are approximately half of the cardiopulmonary bypass MPOG Concepts in use.

Several Concepts used to determine start and stop times.

But, this still only covers 90% of the "true" instances of cardiopulmonary bypass.

How do we get the other 10%?



### **Step 3**: Build Phenotypes

- MPOG Phenotype Browser
  - Multiple observations from multiple parameters:

Sta	ndard Conce	MPOG epts
Fluids	Labs	Vitals
Meds	Times	Diagnoses
Outputs	Events	Outcomes





#### **MPOG Phenotypes**

On Cardiopulmonary Bypass Patient under General Anesthesia Low tidal volume ventilation achieved Total opioid analgesia, morphine equivalents



Figure 1: Cellular phone activity detector.

## Phenotype Browser

• MPOG Phenotype Browser: <u>Click here for demo</u>



Phenotype List Admin Login

Section C	Cardiopulmonary Bypass Start					
Description						
Limitation	pescription					
Value Type m	nis group returns the first date/time and last date/time of cardiopulmonary bypass specific concepts for each case, along with the duration (max-min) returned in inutes.					
Return Columns Fin	rst looks for instances of notes mapped with the concepts below, and then for physiologic data that meets the following criteria:					
Granularity SE	SBP-DBP<20 (MPOG Concept: 3030)					
Logic	HR <=5 (MPOG Concept: 3005)					
Dependency	R<=2 (MPOG Concept: 3580)					
or Et	CO2<=5 (MPOG Concepts: 3235, 3236)					
Fc	or intraoperative notes, the following concepts are used:					
50	2418 Cardiopulmonary bypass Access cannula removed location detail					
50	1423 Cardiopulmonary bypass Arterial cannula insertion flow detail					
50	1647 Cardiopulmonary bypass - Aprotinin test dose performed					
50	1/66 Cardiopulmonary bypass Circulatory arrest start					
50	1/12 Cardiopulmonary bypass ice of friend					
50	Cardiopulmonary bypass Blood pressure lowered therapy detail					



## **MPOG Phenotype Browser**





### **Roles and Responsibilities**

- ACQRs map to the best MPOG concept available: this is most important!
- Quality Champions communicate to providers the importance of standardized documentation
  - Avoid free text when possible
  - Use the standard variables available in Epic/Cerner
- Coordinating Center performs collation mapping and creates phenotypes to enable measure build and research projects

