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QI: TEMP-03

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Disclosures

- None

Agenda

- Defining the metric
- Past and current performance
- Suggestions and solutions
- Questions

TEMP-03: Perioperative Hypothermia

- Description: percentage of patients requiring **general** or **neuraxial** anesthesia for whom a body temperature of ≥36 degrees Celsius was not recorded within **30 minutes before** or **15 minutes after** anesthesia end time
- Key points are
  - The type of anesthetic
  - The "window" of recording

Why Monitor Temperature During Anesthesia?

- General anesthesia impairs thermoregulation, widening the interthreshold range to 2–4°C.
  - –Refers to the narrow temperature band between the body's cold and warm response thresholds
- This makes patients poikilothermic: they can’t defend themselves against temperature shifts and become passive to thermal changes.

Adverse Outcomes of Perioperative Hypothermia

- ↑ Surgical site infections
- ↑ Blood loss & transfusions
- ↑ Cardiac events
- ↓ Drug metabolism
- ↑ Discomfort & shivering
- Delayed emergence & PACU stay

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Why 36°C is the Threshold

- Below 36°C = ↑ wound infections, bleeding, cardiac risk (Rauch et al., 2021)
- Sessler NEJM (1997): Keep temp >36°C unless hypothermia is intentional
- Reflects loss of thermoregulation (Torossian, 2008)
- Endorsed by national clinical guidelines (Torossian et al., 2015)

How Do We Measure Temperature?

- Core temperature
  - Tympanic membrane
  - Pulmonary artery
  - Distal esophagus
  - Nasopharynx
  - **Zero-flux monitor**

Zero-Heat-Flux Cutaneous Thermometer

- A technology developed in the early 1970's
- Consist of a thermal insulator adjacent to the skin, covered by an electric heater
- Can effectively measure temperature approximately 1-2 cm below skin surface

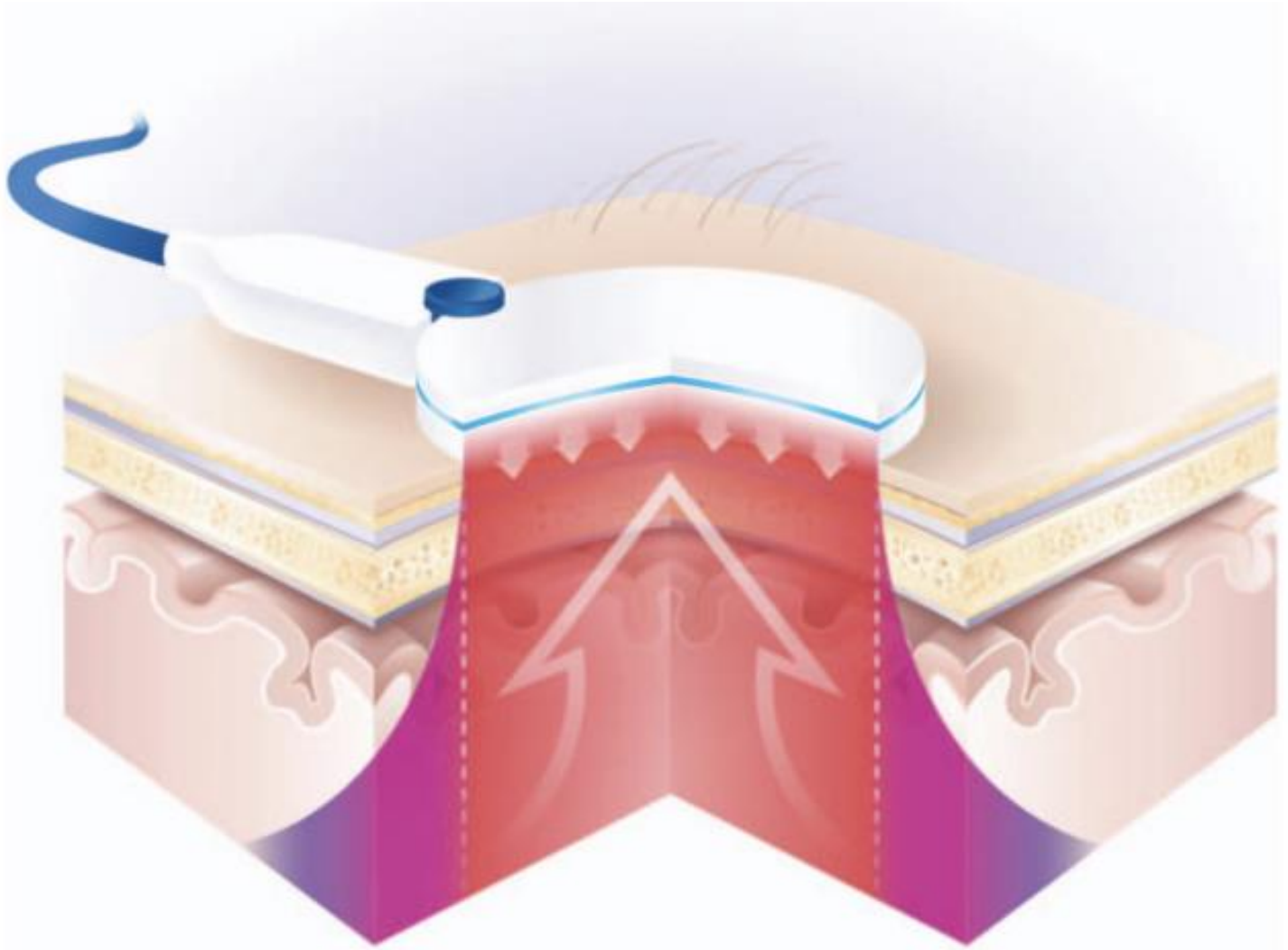

Figure 2. Cartoon of SpotOn Prototype™ zero-heat-flux cutaneous thermometer on a subject.The heater is servocontrolled to keep the 2 temperatures identical. At that point, an isothermal tunnel develops below the skin surface so that surface temperature is about the same as subcutaneous temperature.

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Core Temp Surrogate

Evidence:

- Liang et al. (2024): Excellent agreement with esophageal/tympanic temp

  https://link.springer.com/article/10.1007/s10877-023-01078-2

- Jack et al. (2019): Comparable to ingestible probes

  https://link.springer.com/article/10.1007/s10877-019-00252-9

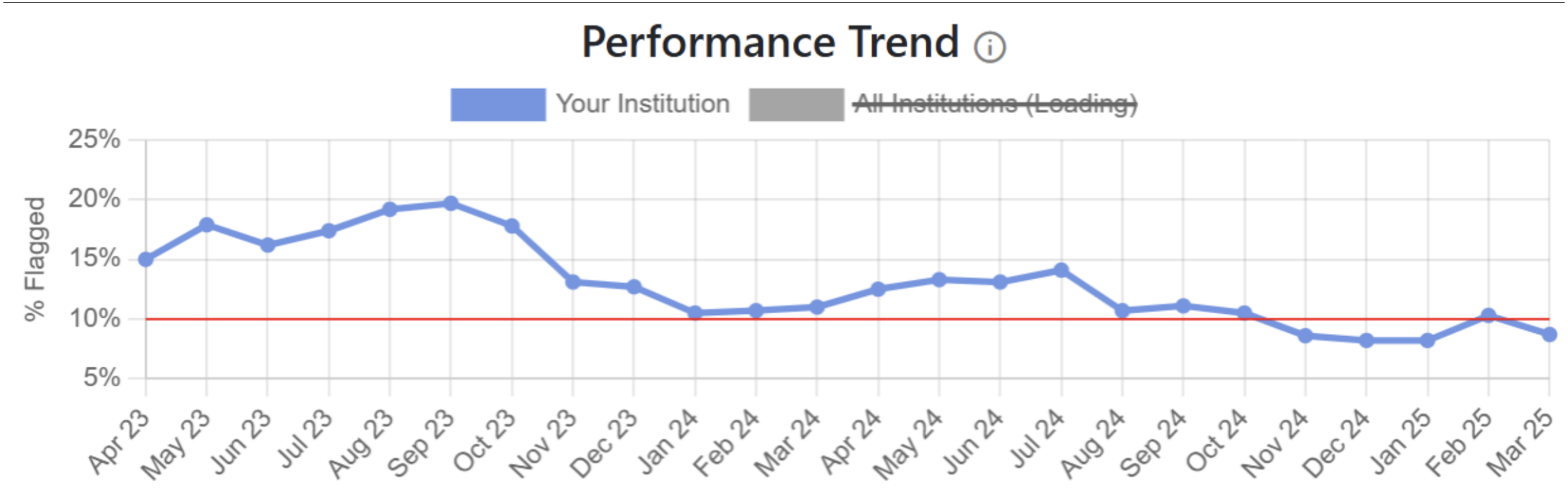
- Conway et al. (2021): Systematic review supports ZHF accuracy

  https://link.springer.com/article/10.1007/s10877-020-00543-6

Benefits of Zero-Flux

Clinical Benefits:

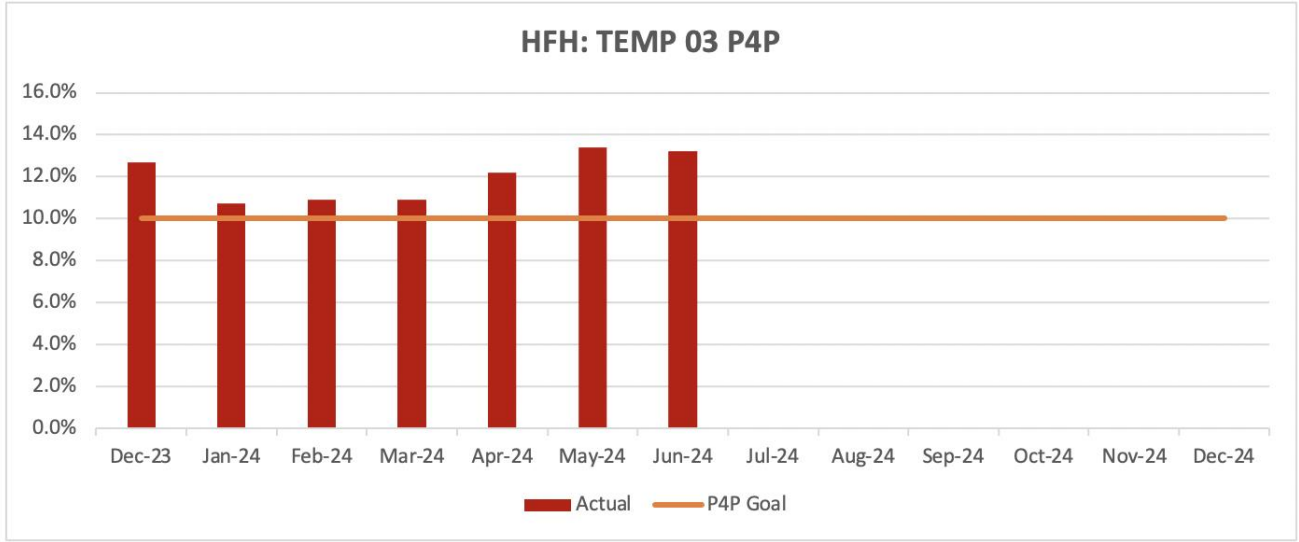
- Safe for awake or neuraxial patients
- Avoids complications of invasive probes
- Supports MPOG TEMP-03 compliance


Performance Trend
Your Institution
All Institutions (Loading)
% Flagged
25%
20%
15%
10%
5%
Apr 23
May 23
Jun 23
Jul 23
Aug 23
Sep 23
Oct 23
Nov 23
Dec 23
Jan 24
Feb 24
Mar 24
Apr 24
May 24
Jun 24
Jul 24
Aug 24
Sep 24
Oct 24
Nov 24
Dec 24
Jan 25
Feb 25
Mar 25

Root Cause Analysis

- Myself and my team looked into
  - Why are we missing?
    - No temp versus temp too low
  - Where are we missing?
  - How can I present this data in a way that makes sense to my department?

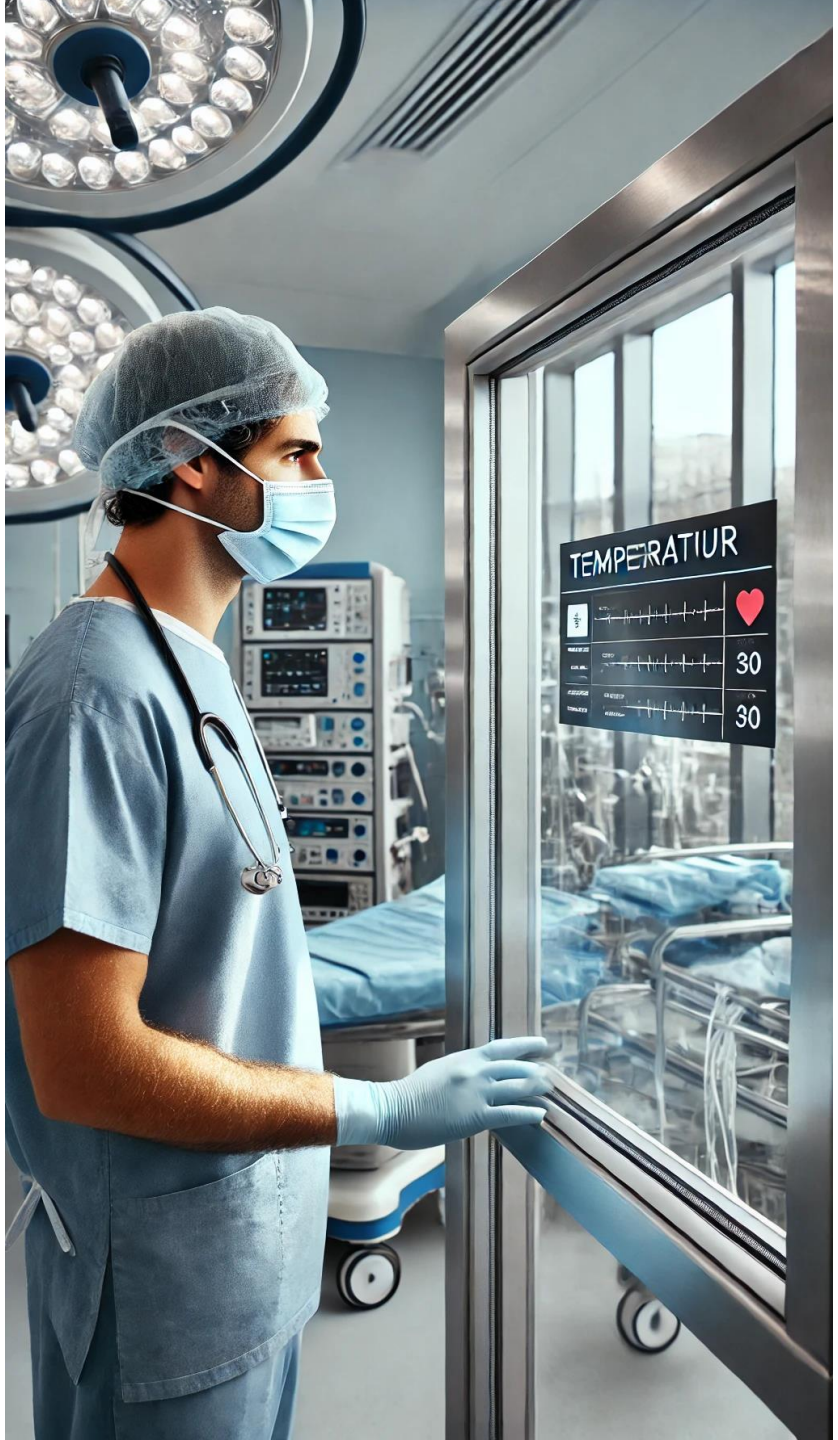
P4P	Henry Ford Hospital		
	Temp 03: Temp >36.0/96.8 documented within 30 mins before or 15 mins after anesthesia end time (all GA and neuraxial cases >60 mins		
	Month	Actual	P4P Goal
	Dec-23	**12.7%**	10.00%
	Jan-24	**10.7%**	10.00%
	Feb-24	**10.9%**	10.00%
	Mar-24	**10.9%**	10.00%
	Apr-24	**12.2%**	10.00%
	May-24	**13.4%**	10.00%
	Jun-24	**13.2%**	10.00%
	Jul-24		10.00%
	Aug-24		10.00%
	Sep-24		10.00%
	Oct-24		10.00%
	Nov-24		10.00%
	Dec-24		10.00%



No TEMP							
	Main	Cath	Endo	IR	L&D	Floor	Total
23-Nov	49	11	3	5	1	0	69
23-Dec	45	8	5	2	4	0	64
24-Jan	38	5	2	3	2	1	51
24-Feb	33	3	5	5	0	0	46
24-Mar	39	4	4	1	0	0	48
24-Apr	38	13	7	2	0	0	60
24-May							
24-Jun							
24-Jul							
24-Aug							
24-Sep							
24-Oct							
24-Nov							
24-Dec							
	242	44	26	18	7	1	337

“The Window”

- 30 minutes before anesthesia end time
- 15 minutes after anesthesia end time



Cases with no Temp Recorded

HFH MAIN OR	HFH OR 10	Plastics	Outpatient	wide local excision of squamous cell scalp; Excision Bone Mass
HFH MAIN OR	HFH OR 06	Otolaryngology	Inpatient	Right Glossectomy Partial (Right: Mouth); Right selective Neck Dissection (Right: Neck); Left radial forearm free flap (Left); Microvascular ana
HFH MAIN OR	HFH OR 16	General	Inpatient	Left Radical Mastectomy (Left: Breast); BREAST RECONSTRUCTION; WITH pedical tram from right abdomen (Left: Breast); Reconstruction Breas
HFH MAIN OR	HFH OR 03	Vascular	Inpatient	1. US-GUIDED R CFA ACCESS (22FR SHEATH MAX) - CLOSED WITH 2 PROGLIDES 2. DIAGNOSTIC AORTOGRAM 3. INTRAVASCULAR ULTRASOUND E
HFH MAIN OR	HFH OR 03	Vascular	Inpatient	Thoracic Endovascular Aorta Repair and septostomy
HFH MAIN OR	HFH OR 15	Neurosurgery	Outpatient	L1-L5 FUSION WITH 4 LEVEL TRANSFORAMINAL LUMBAR INTERBODY FUSION AND DECOMPRESSION (Spine Lumbar)
HFH MAIN OR	HFH OR 32	Neurosurgery	Inpatient	LEFT FRONTAL CRANIOTOMY FOR TUMOR RESECTION, IMRI (Left: Head)
HFH MAIN OR	HFH OR 19	Otolaryngology	Inpatient	Incision and Drainage hypopharyngeal Space (Mouth)
HFH MAIN OR	HFH OR 24	Urology	Inpatient	Cystoscopy with Retrograde Pyelography with Insertion of Ureteral Stent (Left)
HFH MAIN OR	HFH OR 20	General	Inpatient	Repair Recurrent Ventral Hernia with bilateral compartment seperation and wound VAC placement (Abdomen)
HFH MAIN OR	HFH OR 09	General	Inpatient	Diagnostic laparoscopy followed by Whipple pancreaticoduodenectomy Portal vein resection with reconstruction Retroperitoneal lymphade
HFH MAIN OR	HFH OR 32	Neurosurgery	Inpatient	LEFT FRONTAL AWAKE CRANIOTOMY WITH SPEECH AND MAPPING FOR TUMOR RESECTION , iMRI, GLEOLAN (Left: Head)
HFH MAIN OR	HFH OR 19	General	Inpatient	Re-exploration Laparotomy, repair of urinary bladder, application of topical hemostatic agents, delayed primary closure of abdominal wall (A
HFH MAIN OR	HFH OR 30	Vascular	Inpatient	Creation Bypass Graft left femoral artery to left posterior tibial artery with 6 mm ringed ePTFE graft, creation of miller vein cuff left posterior
HFH MAIN OR	HFH OR 32	Neurosurgery	Inpatient	Removal of sEEG leads (Right: Head)
HFH MAIN OR	HFH OR 06	Oral / Maxillofacial	Inpatient	Tracheostomy (Throat); Right Neck Dissection (Right: Neck); Wide local Excision of right mucosa SCCA (Right: Mouth); Direct Laryngoscopy (Th
HFH MAIN OR	HFH OR 10	General	Inpatient	Exploration Laparotomy, Ileoscectomy, placement of woven vicryl mesh in right gutter, staple of anastomosies (Abdomen); Debridement Abd
HFH MAIN OR	HFH OR 14	General	Inpatient	small bowel resection with ileostomy,lysis of adhesions,revision of ileal conduit (Abdomen); loop endoscopy of ileal conduit (Bladder)
HFH MAIN OR	HFH OR 09	Obstetrics / Gynecology	Outpatient	Exploration Laparoscopy, lysis of adhesions, drainage of ovarian cyst (Abdomen); Hysteroscopy with Dilation and Curettage of Uterus using Hy
HFH MAIN OR	HFH OR 03	Vascular	Inpatient	Endovascular abdominal aortic aneurysm repair

>50% had a temperature >36 throughout a majority of the case **but none recorded within "the window"**

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Location/Case Type

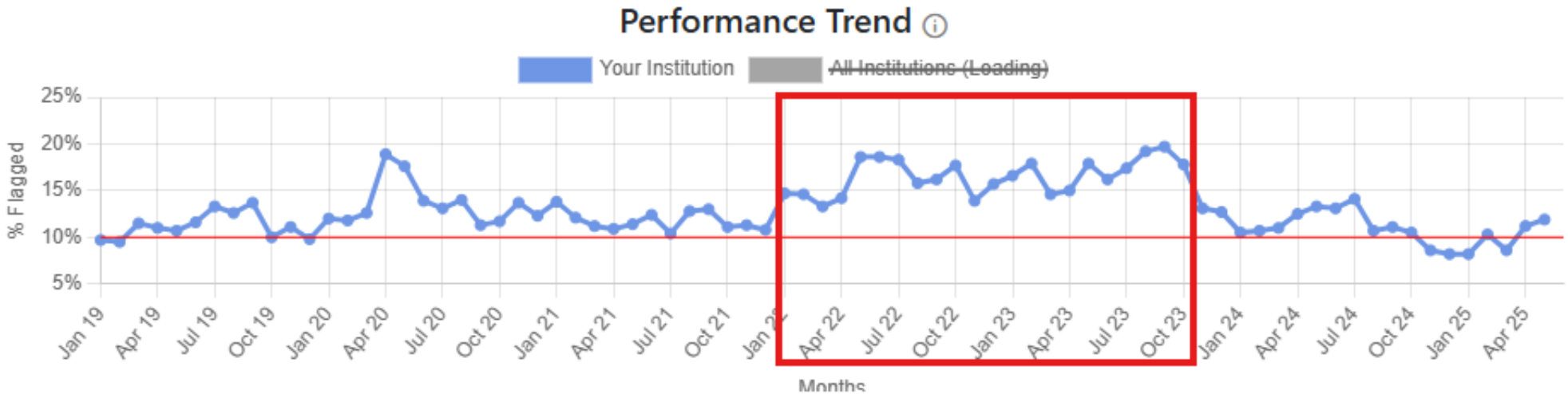
- We noticed longer cases and neuro/vascular had the highest incidence of either failed temp or no temp recorded
- Patients with ICU transfer also had a high incidence of no temperature recorded
  - –After the transfer and the provider comes back, they forget to document or the “window” has lapsed

Other Thoughts

- Naming metric champions
  - –Minimum 35 cases
  - –I name a CRNA, resident, and attending
- Transparency: We share all audits, results with everyone
- Multiple flyers/newsletters posted in physician/resident/CRNA lounge

Zero-Flux

- Zero-Flux: Inaccurate or super accurate?



- Variability amongst monitoring modalities

Thoughts

- What are we doing to ensure we have a reliable identification process for hypothermia?
- Are we actually identifying hypothermia?
- Is hypothermia just that much more common and are we at the forefront of identifying it with the Zero-Flux?

Thoughts for the Future

- Are we really looking at the right thing?
  - Is a temperature reading of 36 degrees C in the final 45 minutes of anesthesia time truly representative of an 8 hour case where the temperature was 36+ the entire time and only at the end was the bair hugger removed and the patient took 25 minutes to emerge?

End of the Day

- I encourage all staff before they leave the room to make sure a temperature is logged or manually entered
- If their temperature was compliant for the majority of the case and only dips at the very end, I do encourage them to manually enter an average of the reading during the case
- The spirit of this measure should be maintaining temperature throughout the maintenance phase, not just the very end