RESEARCH AND QI PERSPECTIVES ON SUSTAINABILITY

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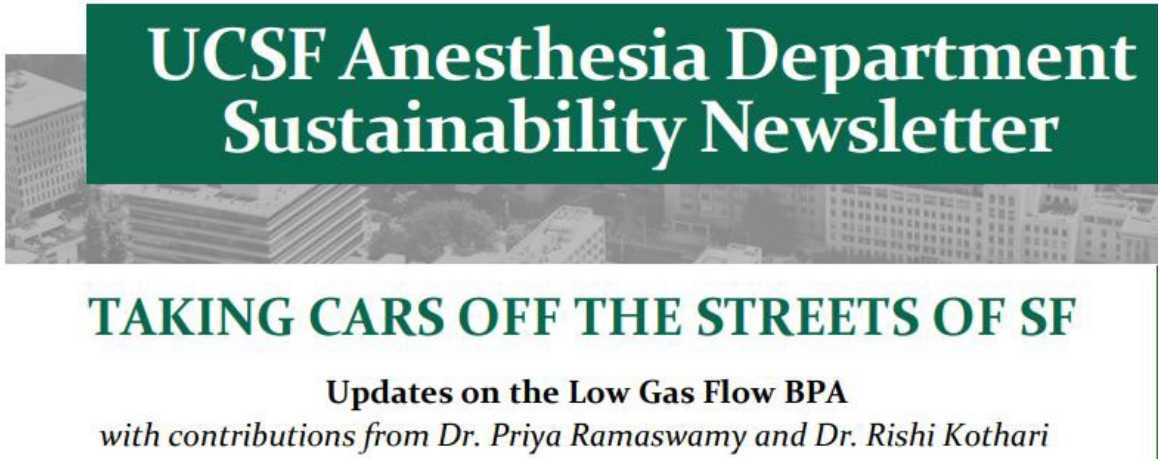
Background

- The harmful environmental impacts of volatile anesthetics are well documented.
- Strategies to minimize these impacts include:
  - Avoiding desflurane and nitrous oxide use
  - Reduction of fresh gas flow (FGF) rates
  - Total intravenous anesthesia (TIVA)
  - Regional anesthesia

Ryan, S. M., & Nielsen, C. J. (2010). Global warming potential of inhaled anesthetics: application to clinical use. Anesthesia & Analgesia, 111(1), 92-98.
Sherman, J., Le, C., Lamers, V., & Eckelman, M. (2012). Life cycle greenhouse gas emissions of anesthetic drugs. Anesthesia & Analgesia, 114(5), 1086-1090.

UCSF's Journey

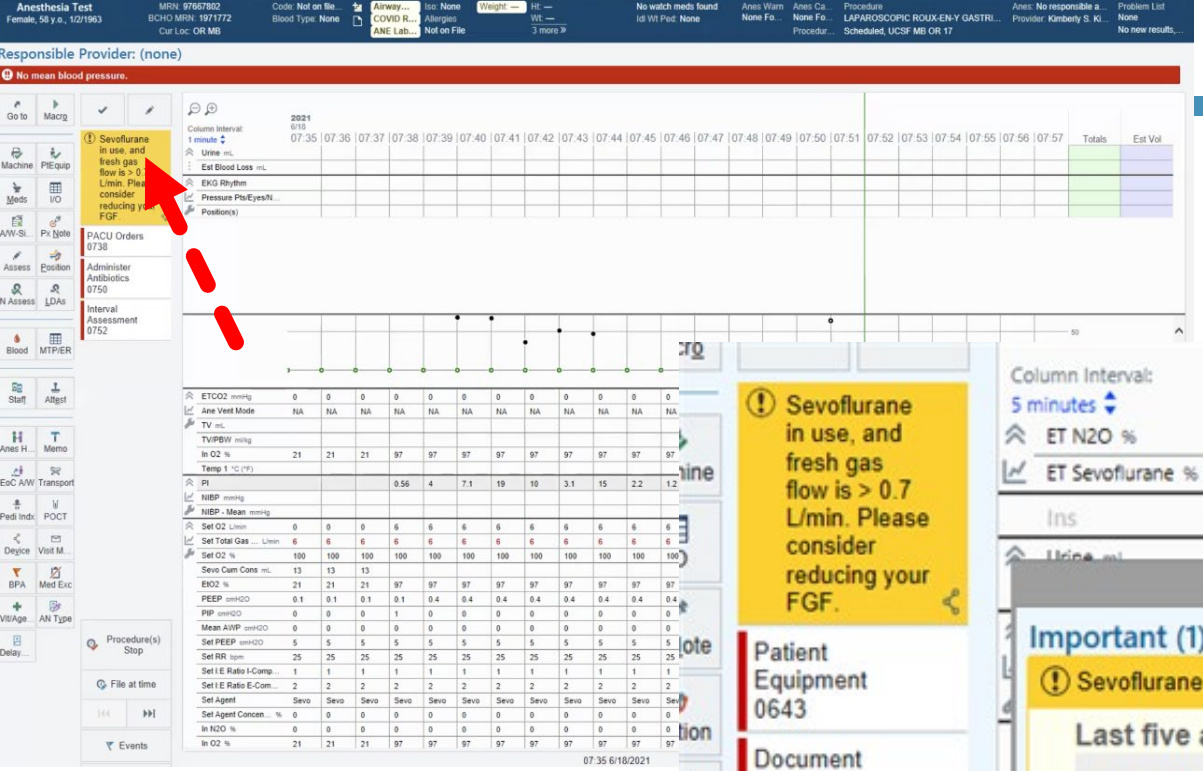
- Education
  - Grand rounds
  - Resident didactics
  - Sustainability newsletter
- Personalized feedback reports
- Desflurane vaporizer only available in the workroom
- Clinical Decision Support (CDS) tool

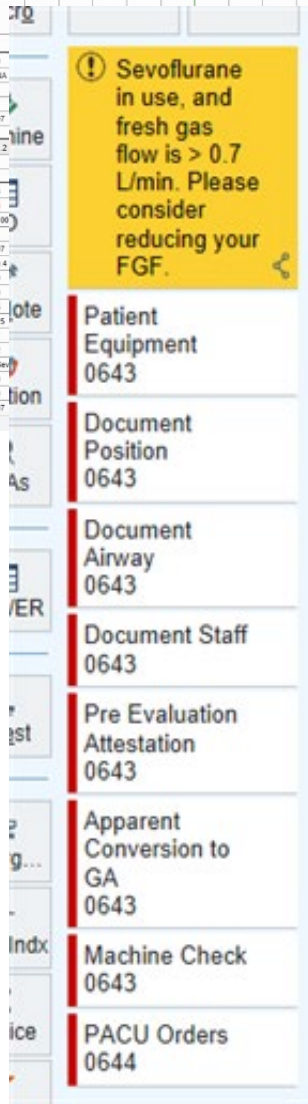


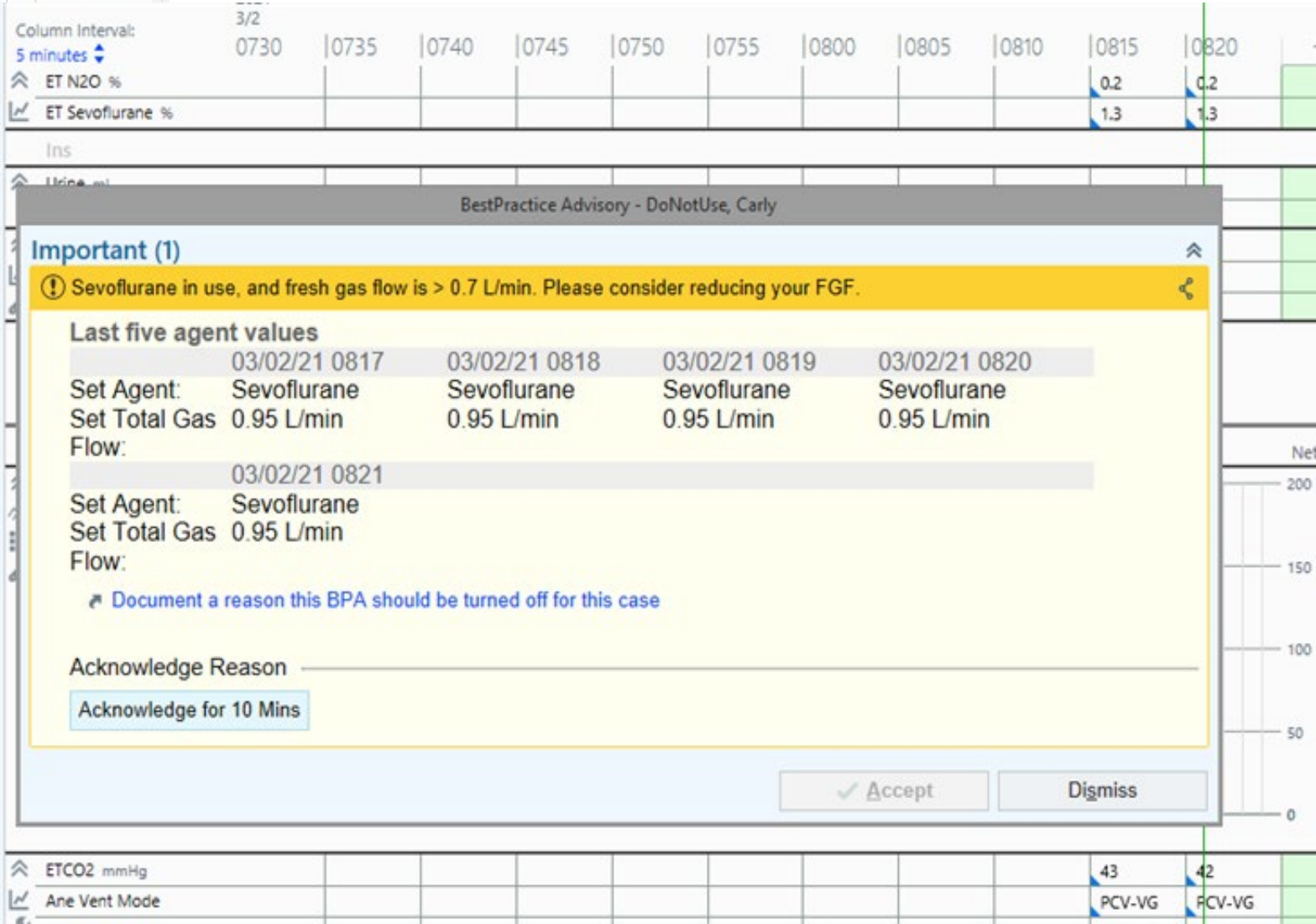
Personalized "Hall of Fame" Report

Name	Weight Average of Set Gas Flow During Mainenance					
	Desflurane	Sevoflurane	Isoflurane	n Des	n Sevo	n Iso
[redacted]	0.42	1.83		2140	491	
[redacted]	0.82	1.05		1471	1917	
[redacted]	0.87	2.27		520	2251	
[redacted]	0.88	1.71		937	260	
[redacted]	0.89	1.94		2017	1948	
[redacted]	0.90	2.00	0.70	163	3151	207
[redacted]	0.90	2.10		426	179	
[redacted]	0.92	1.95		2109	938	
[redacted]	0.93	2.04	2.14	586	1543	31
[redacted]	0.93	2.86	1.07	1419	2364	95
[redacted]	0.97	2.00		1044	1065	
[redacted]	0.99	1.76		141	316	
[redacted]	0.99	2.01	3.43	956	1146	36
[redacted]	1.00	1.66	1.10	470	576	148

Active Non-interruptive BPA for FGF







ANESTHESIA & ANALGESIA

ORIGINAL CLINICAL RESEARCH REPORT

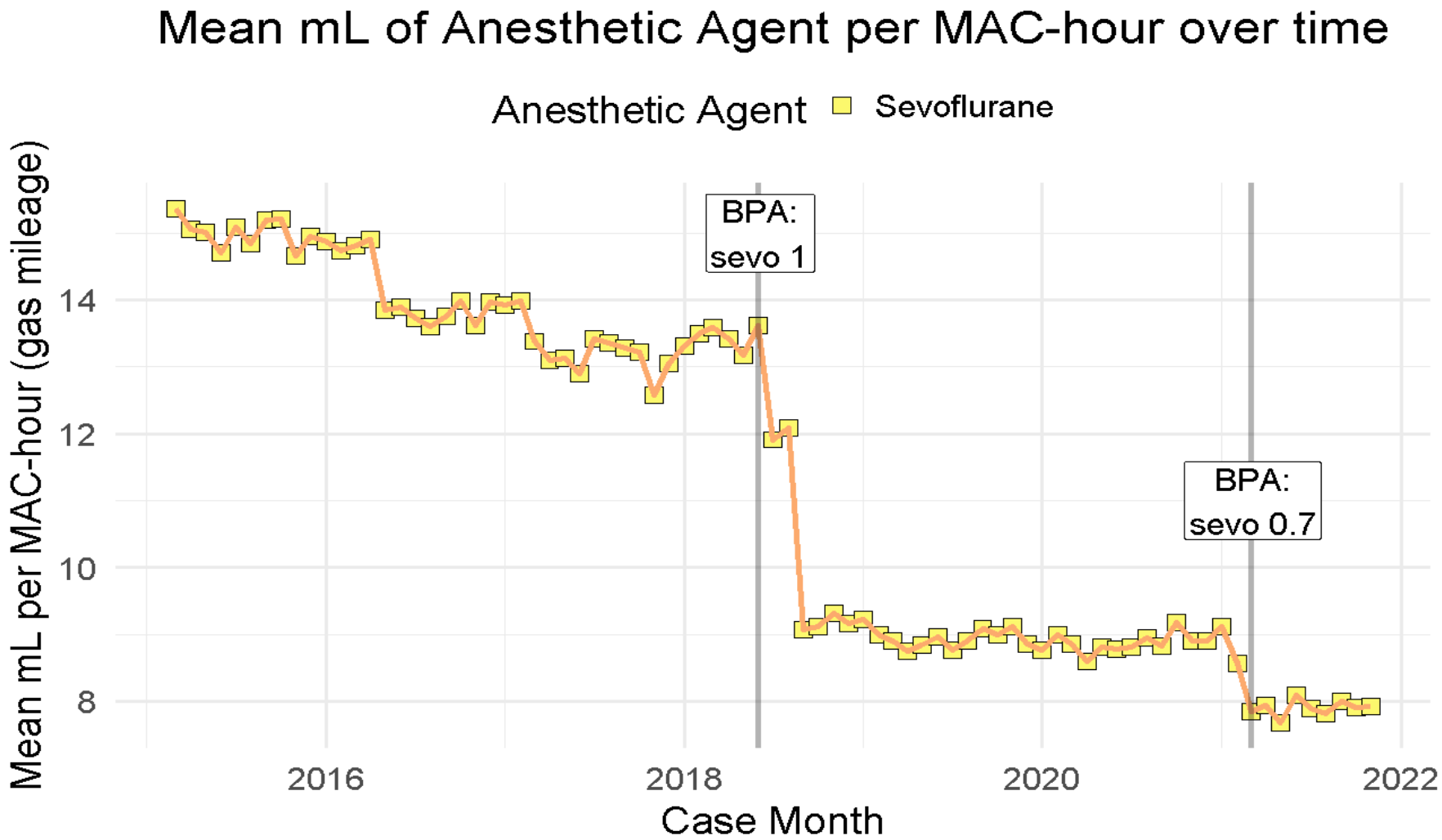
Reducing Volatile Anesthetic Waste Using a Commercial Electronic Health Record Clinical Decision Support Tool to Lower Fresh Gas Flows

Andrea V. Olmos, MD,* David Robinowitz, MD,† John R. Feiner, MD,‡ Catherine L. Chen, MD, MPH,‡§‖ and Seema Gandhi, MD‡

RESULTS: Segmented regression of the interrupted times series demonstrated a decrease in mean FGF by 0.6 L/min (95% CI, 0.6–0.6 L/min; $P < .0001$) for sevoflurane and 0.2 L/min (95% CI, 0.2–0.3 L/min; $P < .0001$) for desflurane immediately after implementation of the intervention. For sevoflurane, mL/MAC-h decreased by 3.8 mL/MAC-h (95% CI, 3.6–4.1 mL/MAC-h; $P < .0001$) after implementation of the intervention and decreased by 4.1 mL/MAC-h (95% CI, 2.6–5.6 mL/MAC-h; $P < .0001$) for desflurane. Slopes for both FGF and mL/MAC-h in the postintervention period were statistically less negative than the preintervention slopes ($P < .0001$ for sevoflurane and $P < .01$ for desflurane).

CONCLUSIONS: A commercial AIMS-based decision support tool can be adopted to change provider FGF management patterns and reduce volatile anesthetic consumption in a sustainable fashion. (Anesth Analg 2022;00:00–00)

Results


Mean mL of Anesthetic Agent per MAC-hour over time
Anesthetic Agent
Sevoflurane
Mean mL per MAC-hour (gas mileage)
14
12
10
8
BPA:
sevo 1
BPA:
sevo 0.7
2016
2018
2020
2022
Case Month

	Baseline	Intervention	Difference (95% CI)	P Value
Sevoflurane				
n cases	44,899 (62.5%)	26,911 (37.5%)		
Duration (hours)	2.0 ± 1.7	2.1 ± 1.8	0.1 (0.1 to 0.1)	< 0.0001
Fresh Gas Flow (L/minute)	2.0 ± 0.6	1.2 ± 0.5	-0.8 (-0.8, -0.8)	< 0.0001
Mean End-tidal Agent Concentration (volume %)	1.6 ± 0.6	1.5 ± 0.5	-0.1 (-0.1, -0.1)	< 0.0001
MAC	0.9 ± 0.3	0.9 ± 0.3	0.0 (-0.1, 0.0)	< 0.0001
Total mL/hour	13.8 ± 6.8	8.2 ± 4.8	-5.5 (-5.6, -5.4)	< 0.0001
mL/MAC-hour	14.5 ± 5.3	9.3 ± 6.9	-5.2 (-5.3, -5.1)	< 0.0001
$/MAC-hour	$5.82 ± $2.11	$3.72 ± $2.77	-$2.10 (-$2.13, -$2.06)	< 0.0001

"Maintenance" is defined as procedure start to procedure end.

CI, confidence interval; MAC, minimum alveolar concentration

Baseline period was from July 22, 2015 to July 10, 2018. Intervention was implemented on August 29, 2018. Data during the transition period (July 11, 2018 to August 28, 2018) were excluded.

The impact of surgery on global climate: a carbon footprinting study of operating theatres in three health systems

Andrea J MacNeill, Robert Lillywhite, Carl J Brown

Summary

Background Climate change is a major global public health priority. The delivery of health-care services generates considerable greenhouse gas emissions. Operating theatres are a resource-intensive subsector of health care, with high energy demands, consumable throughput, and waste volumes. The environmental impacts of these activities are generally accepted as necessary for the provision of quality care, but have not been examined in detail. In this study, we estimate the carbon footprint of operating theatres in hospitals in three health systems.

Lancet Planet Health 2017; 1: e381–88

See Comment page e357

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(A J MacNeill MD,

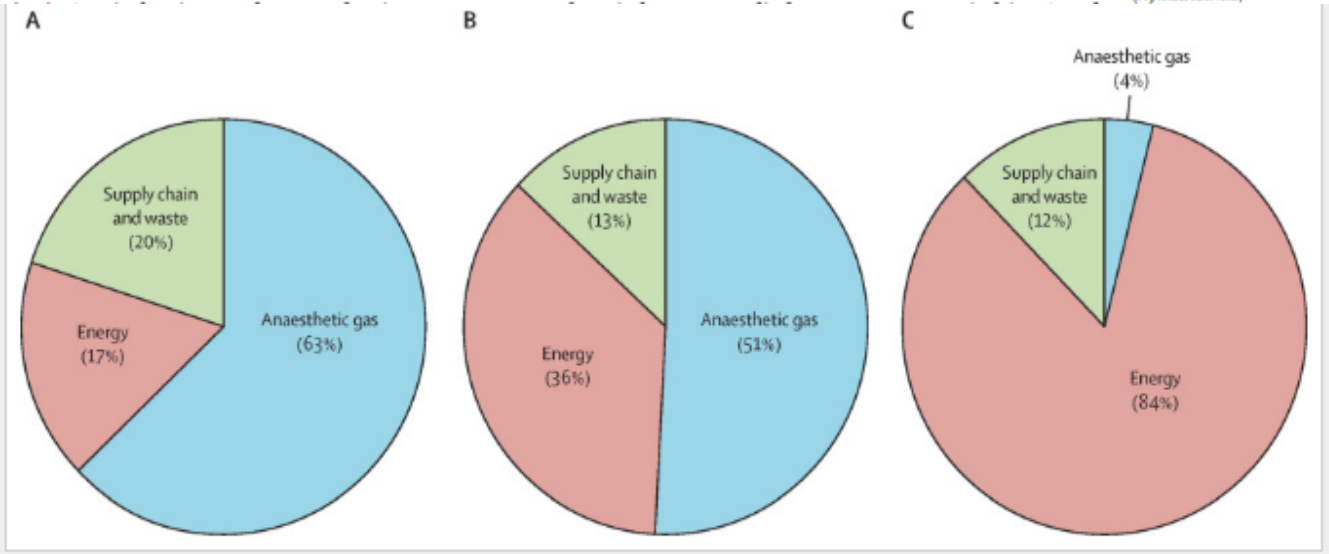


Figure 2

Relative contribution of scopes 1, 2, and 3 to the carbon footprint of operating theatres at (A) Vancouver General Hospital, (B) University of Minnesota Medical Center, and (C) John Radcliffe Hospital

MacNeill, A. J., Lillywhite, R., & Brown, C. J. (2017). The impact of surgery on global climate: a carbon footprinting study of operating theatres in three health systems. The Lancet Planetary Health, 1(9), e381-e388.

Study Aims

- Describe patterns of volatile agent and nitrous oxide use and trends over time
- Identify factors associated with agent consumption including patient characteristics, airway type and procedure
- Estimate variation in agent consumption at provider and institutional level that is not explained by patient level variables

MPOG Study Overview

Practice Patterns of Volatile Anesthetic Use During General Anesthesia

- Describe patterns of volatile agent and nitrous oxide use and trends over time
- Identify factors associated with agent consumption including patient characteristics, airway type and procedure
- Estimate variation in agent consumption at provider and institutional level that is not explained by patient level variables

Data Sources:

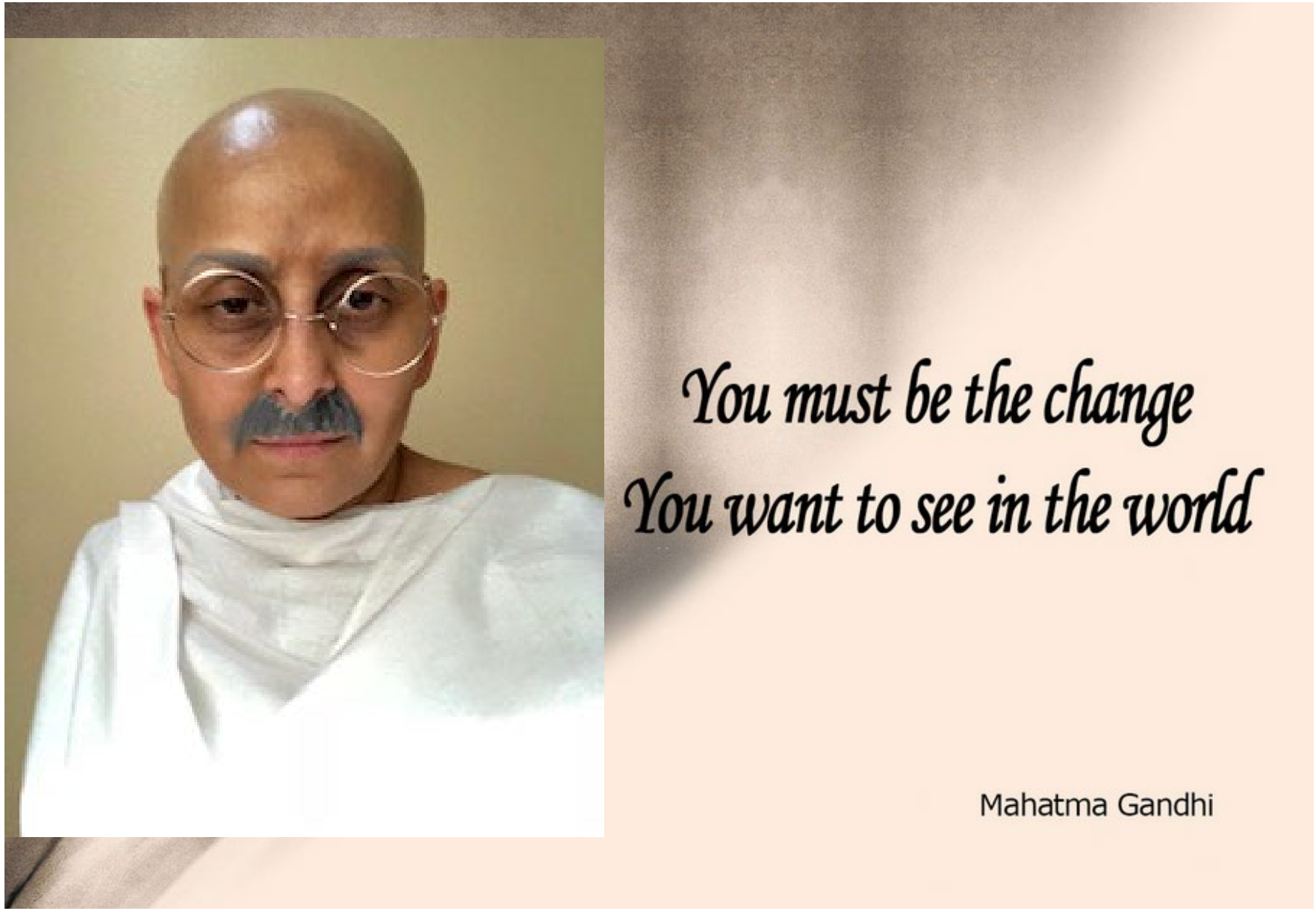
- MPOG database SUS 1 metrics)
  - > 5 million cases
  - Across 61 centers
  - SUS-O1 metrics
- Survey of MPOG institutions
  - To understand behavioral changes

Primary Outcomes:

- Estimated anesthetic agent consumption (mL/min) during general anesthesia
  - Reported by each agent
  - Convert to CO_2 equivalent based on LCA*

Study Significance

- Descriptive analysis of volatile anesthetic agent use across US
  - Variabilities by providers and institution
  - Presence or absence of nitrous oxide
- Quantify the excess carbon emissions from "wasteful" practice patterns
- Identify ongoing mitigation efforts by various institutions (via survey)
- Provide guidance for future SUS metrics


You must be the change
You want to see in the world
Mahatma Gandhi