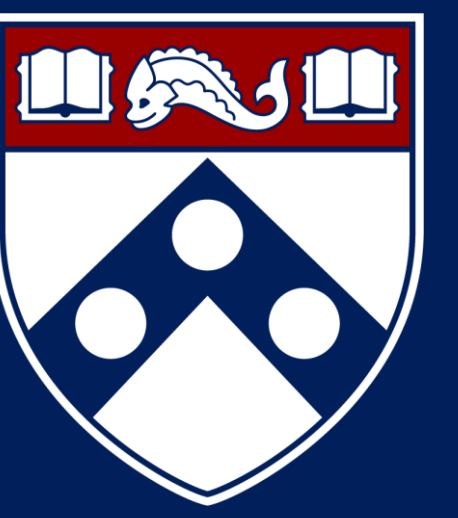


GREEN OR: Guiding Reductions in Excess and Expenses in the Neurosurgery Operating Room

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Introduction

- The world's fifth leading cause of climate change is the healthcare system. Hospitals throughout the country are positioned to consider more sustainable practices and improve efficiency of all hospital sectors.
- Operating rooms (OR) are the center of waste generation and the pinnacle of energy usage for a modern hospital, producing more than 30% of a hospital's total waste and using an average of 6% more energy per square foot than all other hospital departments. [1]
- OR sustainable improvement studies have traditionally focused on one of two main aspects: surgical tray optimization or waste management.
- Past studies have reviewed tray optimization savings and have performed audits on waste segregation. However, waste segregation awareness and employee satisfaction has been underassessed.
- As an effort to increase the scope of sustainable improvement in the healthcare sector, this study aims to combine the two aspects of modern OR sustainability and implement a comprehensive optimization of waste segregation and surgical instrument inventory optimization.

Methods



Figure 1. Neurosurgery trays from the four different surgeries included in this study. 1A) Depicts the implant trays for a thoracolumbar fusion case. 1B) "Basic Spine" tray for anterior cervical discectomy and fusion (ACDF) case before incision. 1C) Setup table and instrument tray for a lumbar laminectomy case. 1D) Disorganized post-operation "Basic Spine" instrument tray for a posterior cervical fixation case.

Stakeholder Perception & Satisfaction Assessment

- A questionnaire was created based on the Utrecht Work Engagement Scale-17 [2]. Two additional questions regarding proper operating room waste segregation and the current inventory of surgical tray instruments were added.
- The questionnaire was sent electronically to staff members (n = 45) within our sustainability coalition including neurosurgeons, nurses, and staff responsible for surgical instrument sterilization.

Surgical Tray Inventory Optimization Metrics

- Specific inventory reductions
 - Total number of instruments in each tray and the associated weight
 - Tray assembly times and associated labor cost savings
- Operational efficiency
 - Surgical operation delay duration and frequency

Waste Management Metrics

- The weight of Regulated Medical Waste (RMW), Non-Regulated Medical Waste (non-RMW), and anesthesia-related waste were recorded for each surgical operation.

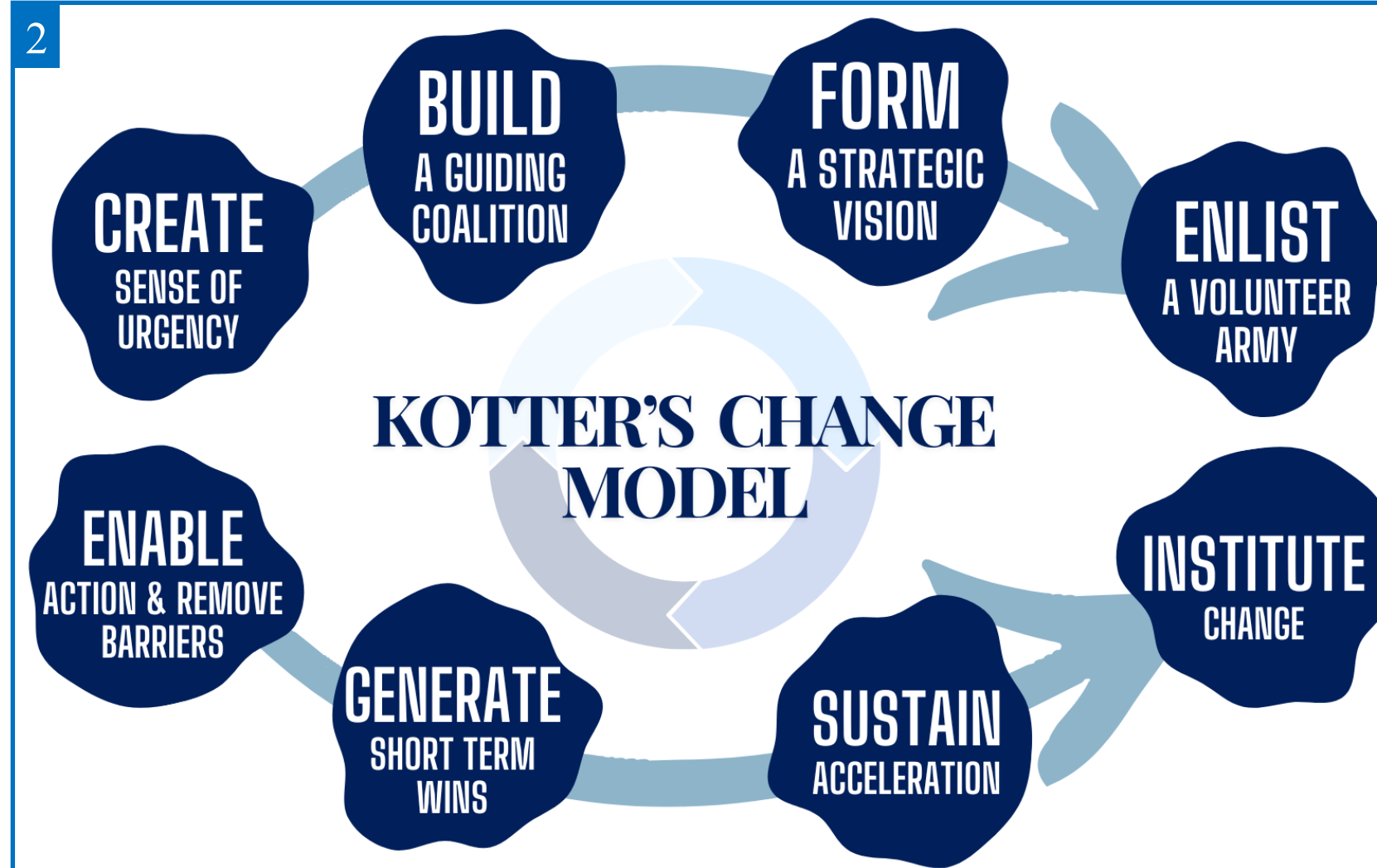


Figure 2. Schematic illustration of Kotter's Change Model (KCM). The overall structure of the model is based on Dr. John Kotter's 8-Step Model for leading change. It starts with creating a sense of urgency and proceeds left to right across the two rows.

Results

Kotter's Change Model Application

CREATE SENSE OF URGENCY	BUILD A GUIDING COALITION
Surveyed staff about baseline concern regarding OR sustainability and provided information about the harmful effects of waste.	Assembled a multidisciplinary group of stakeholders across various departments.
FORM A STRATEGIC VISION	ENLIST A VOLUNTEER ARMY
Created and disseminated a technical protocol.	Conducted meetings to promote volunteer opportunities.
ENABLE ACTION	GENERATE SHORT-TERM WINS
Successfully mitigated financial barriers through staff engagement.	Quickly reduced instrument sets deemed to be easily interchangeable.
SUSTAIN ACCELERATION	INSTITUTE CHANGE
Conducted frequent sustainable practice meetings to integrate new staff.	Planning to broaden scope across the hospital system to maintain a sustainable culture.

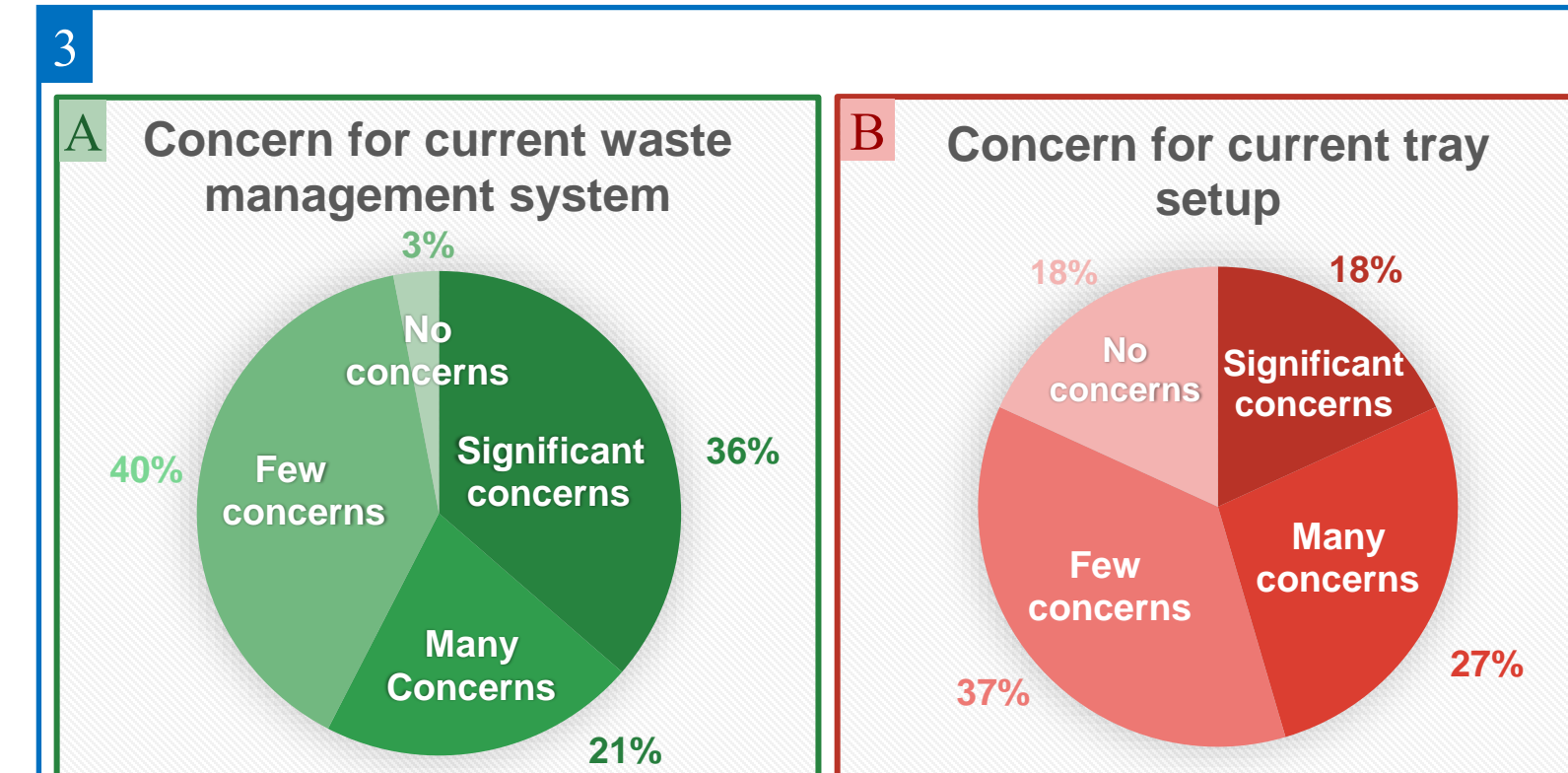


Figure 3. Concern assessment survey results. 3A) The current level of concern for the medical waste management system and 3B) the surgical tray setup, respectively. Approximately 50% of employees sampled had Many concerns or Significant concerns for both practices.

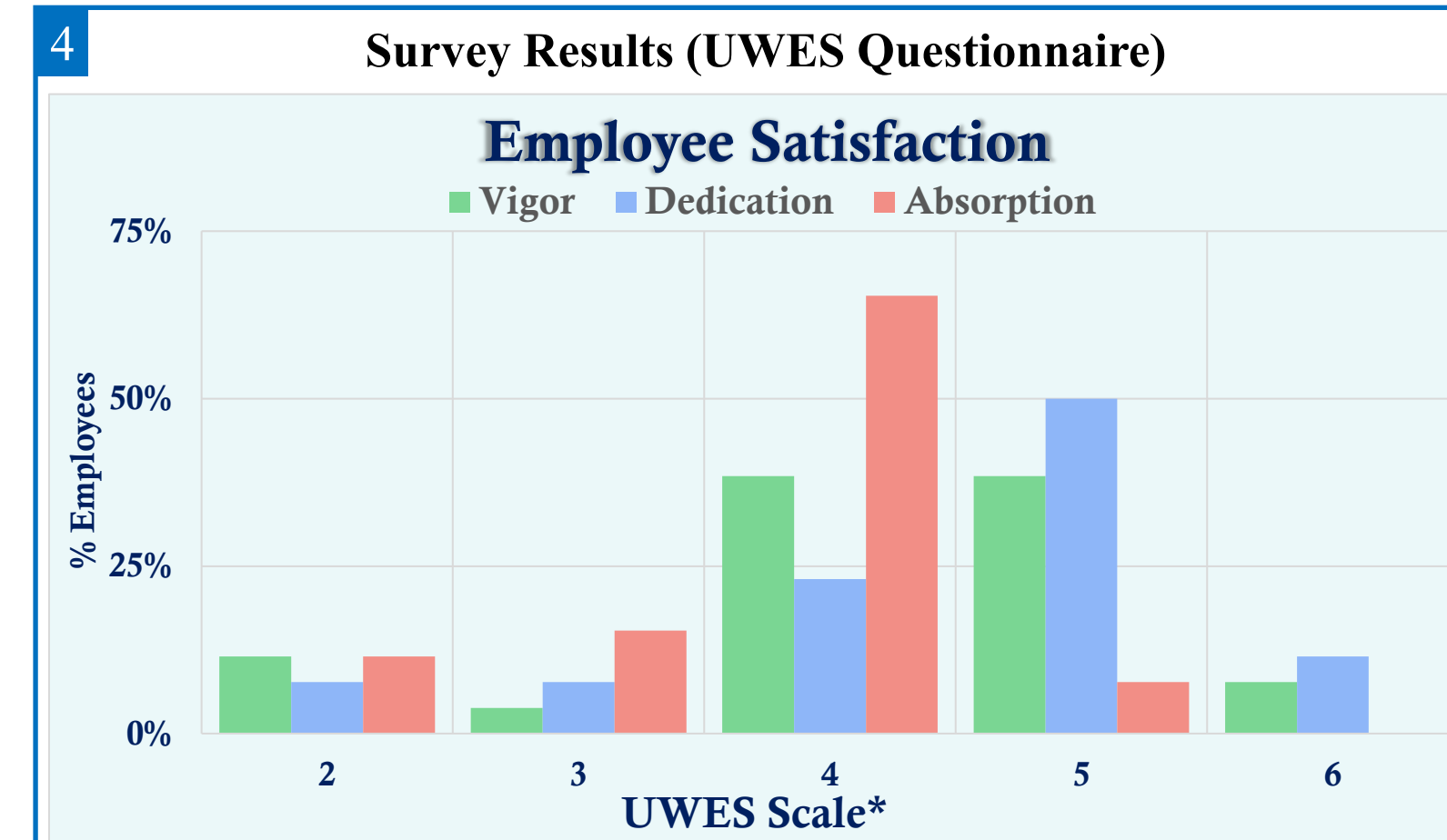


Figure 4. UWES Questionnaire survey results. Absorption, Vigor, and Dedication. The UWES-17 measures positive psychological factors in the workforce. Vigor & Dedication are derived from classic psychological burnout metrics, Exhaustion and Cynicism, and Absorption measures proactive attention and flow during one's work. The questionnaire was adapted from the Work & Well-being Survey (UWES) and measured on a 7-point Likert scale. 0 – 6 correspond to Never, Almost never, Rarely, Sometimes, Often, Very Often, and Always, respectively. [3] *The scale depicted does not include 0 & 1 due to 0 responses indicating a 0.

Surgical Tray Optimization

Surgery	Instrument count	Assembly time* (hours)	Weight (kg)
ACDF†	284	3.5	29.7
Lumbar Laminectomy	186	2.0	33.4
Thoracolumbar Fusion†	172	1.9	34.4
Posterior Cervical Fusion†	183	2.1	33.4

Table 1A) Average baseline surgical tray inventory in the neurosurgery department

Surgery	% Instrument Reduction	% Labor time saved	% Weight reduction
ACDF†	19	17	20
Lumbar Laminectomy	31	24	27
Thoracolumbar Fusion†	11	9	14
Posterior Cervical Fusion†	31	23	29

Table 1B) Reductions made and calculated percent savings for labor time and weight for each of the four surgeries.

*Assembly times are shown as the mean time across N = 26 tray assemblies

†Implant trays were not included as part of the data collection

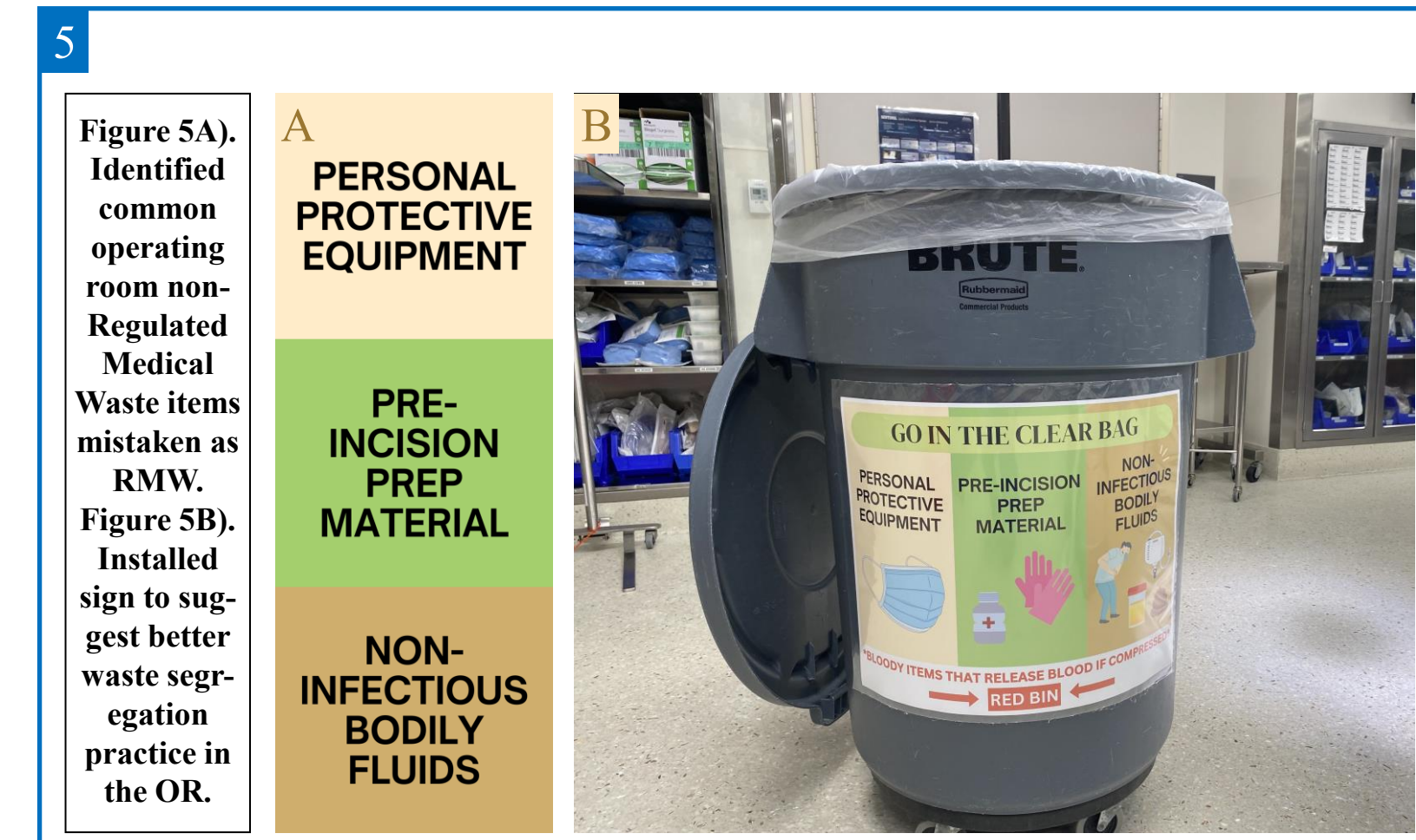


Figure 5A). Identified common operating room non-Regulated Medical Waste items mistaken as RMW. Figure 5B). Installed sign to suggest better waste segregation practice in the OR.

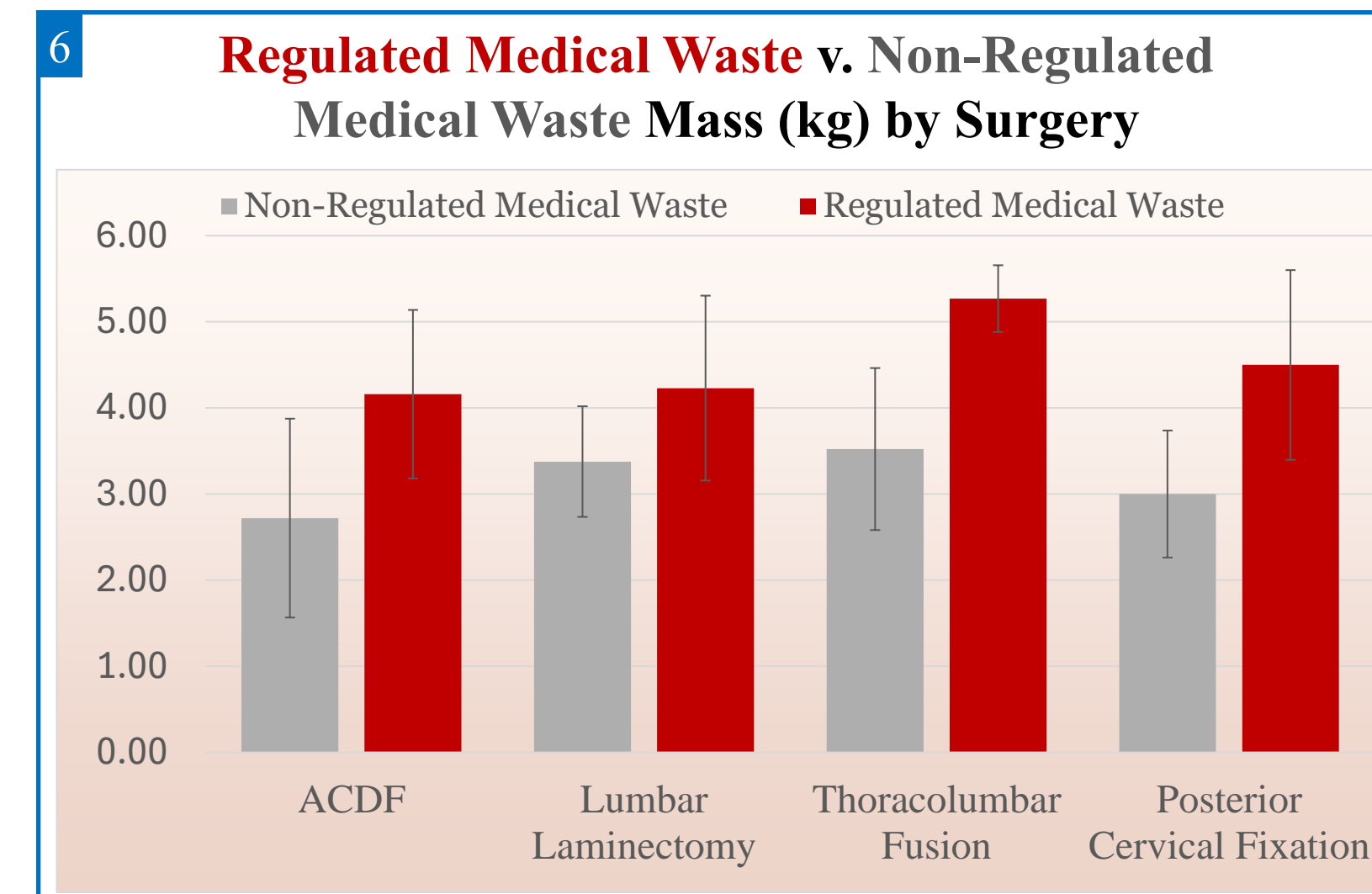


Figure 6 depicts the mass of non-Regulated Medical Waste (non-RMW) in grey and Regulated Medical Waste (RMW) for each of the four surgeries. Non-RMW and RMW were collected in pairs for ACDF (N = 10), Lumbar Laminectomy (N = 13), Thoracolumbar Fusion (N = 9), and Posterior Cervical Fixation (N = 9). The current waste audit shown above details the current ratio of RMW to non-RMW as ~3:2. Considering the Occupational Safety and Health Administration's regulations, this study can be furthered with proper waste segregation awareness dissemination. [4] As detailed by the KCM, waste segregation posters have been installed in the OR.

Discussion and Conclusion

- Kotter's Change Model was adapted to create improve OR sustainability.
- OR surgical instrument tray inventories were optimized, and proper waste segregation education was implemented.
- Labor cost savings were successfully achieved.
- Limitations of this study included the single-center setting and financial barriers in the Central Processing Department to optimally improve surgical tray efficiency

References and Acknowledgements

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