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# Unseen Emissions: The Carbon Footprint of Knee Arthroscopy

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# Faculty Disclosure Information

- Cassandra Lee:
  - Speaker for Genzyme, Johnson & Johnson
  - Board of directors member for AAOS, AOSSM, AANA
  - All relevant financial disclosures have been mitigated
- The other authors have no disclosures

# BACKGROUND

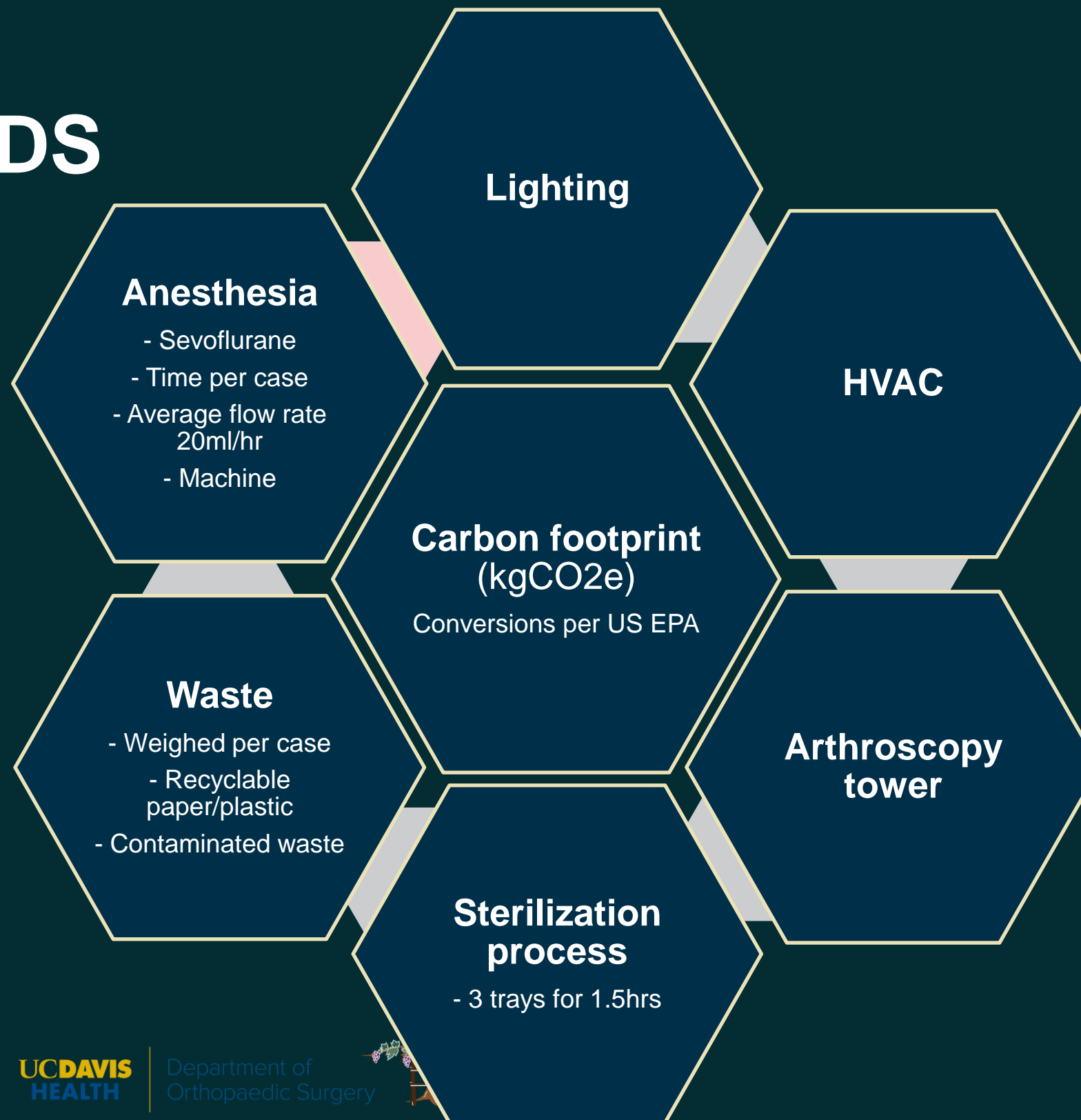
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- US health sector: 8.5% of nation's carbon emissions
- Environmental sustainability in orthopaedic surgery is an increasing area of interest
- Arthroscopic partial meniscectomy (APM) – most common orthopaedic procedure in the US (>500,000 cases annually)

**AIM: Quantify the carbon dioxide equivalent emissions (CO<sub>2</sub>e) of APM**



# METHODS



- Isolated APM cases included
- OR measured to be 528sq ft.
- Energy consumption estimated using institutional data & manufacturer manuals
- Energy calculations made using average time per case

# RESULTS

- 10 APM cases included
- Mean anesthesia time = 73.4 mins  $\pm$  10.4
- Mean total waste = 15.7lb  $\pm$  4.5 (7.1kg  $\pm$  2.0)
- Mean recyclable paper/plastic waste = 2.0lb  $\pm$  1.9 (0.9kg  $\pm$  0.9)
- Mean contaminated waste = 13.8lb  $\pm$  2.7 (6.2kg  $\pm$  1.2)
- No waste was actually recycled

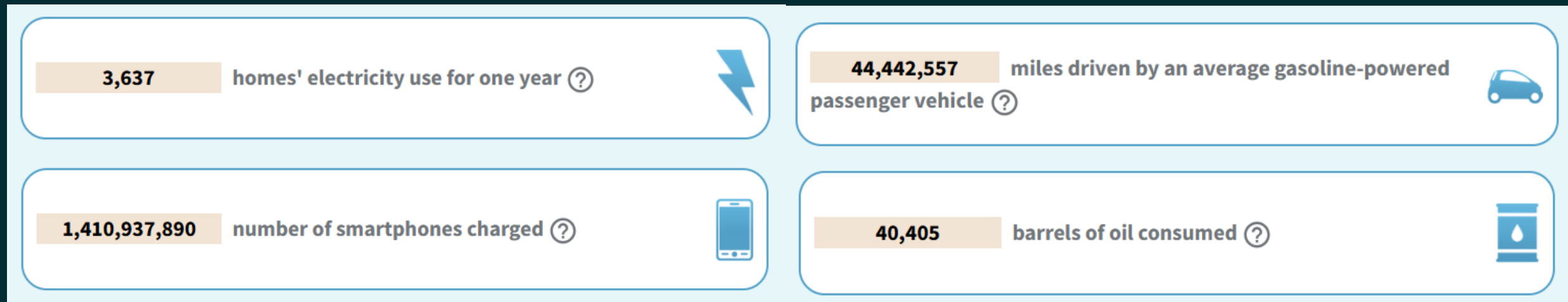


# RESULTS

Mean Carbon Emissions Per Arthroscopic Partial Meniscectomy				
Category		Units per case	kgCO2e*	% of total case kgCO2e
Anesthesia	Sevoflurane	20ml/hr	4.77	13.67%
	Anesthesia Machine	2.94kWh	0.70	2.01%
HVAC	Heating, ventilation, air-conditioning	12.37kWh	2.90	8.31%
Lighting	Lighting	2.37kWh	0.56	1.60%
Waste	Total solid waste	7.13kg	25.0	71.55%
Sterilization	Steam sterilizer	0.30kWh	0.07	0.20%
Arthroscopy Tower	Pump, camera, shaver system, monitors	3.91kWh	0.93	2.66%
Total			34.90	100%
*Calculated using the US EPA Greenhouse Gases Equivalencies calculator				
All values based on average case time of 73.4mins in a 528sq ft OR				

# RESULTS

- Based on 500,000 cases annually = 17452 metric tons CO<sub>2</sub>e
- Equivalent to CO<sub>2</sub>/greenhouse gas emissions from:



- Equivalent to carbon sequestered by:



# CONCLUSION

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- 35kgCO<sub>2</sub>e generated per APM
- Main contributor of carbon emissions was waste
- To reduce emissions and the overall carbon footprint:
  - 1) Optimize waste disposal processes
  - 2) Increase recycling
  - 3) Develop appropriate reusable options



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