

Designing the ICU for Environmental Sustainability

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About the Houston Methodist Center for Critical Care

One Center Systemwide



- ❖ Between **21,000 - 23,000 patients** come through all Houston Methodist ICU's and IMUs on a yearly basis.
- ❖ Approximately **every 5th patient** at Houston Methodist comes through the ICUs systemwide.



23,000+
Patients Annually



8
Hospital Locations +
Virtual ICU



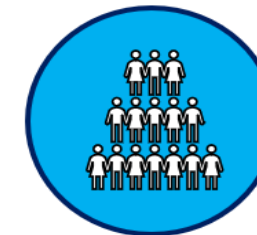
420+
ICU & IMU Beds
Systemwide



90+
Intensivists



125+
Advanced Practice
Providers (APP)



900+
ICU Nurses



250+
Trainees/Fellows/Residents
/Observers



Many More+++
Faculty/Staff/Pharmacy/Ethics/
Physical Therapy/Psychology/Social
Workers/etc.

The Journey

This is how we felt when we started our Green ICU Journey...

- *No awareness*
- *NO plans*
- *NO engagement*
- *NO measurement*
- *NO accountability*





Where is the evidence?

“In God we trust; all others must bring data”

--W. Edwards Deming

Green ICU Initiative: Publication

Masud et al. *Critical Care* (2024) 28:154
<https://doi.org/10.1186/s13054-024-04937-9>

Critical Care

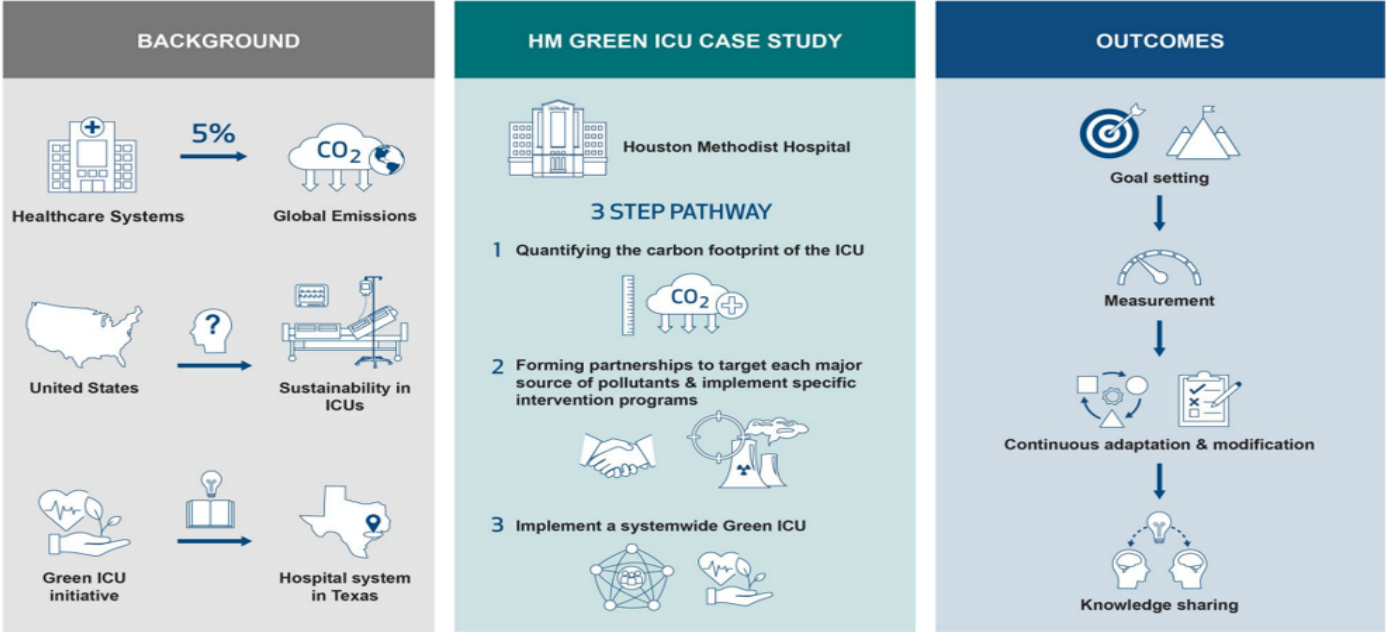
PERSPECTIVE

Open Access

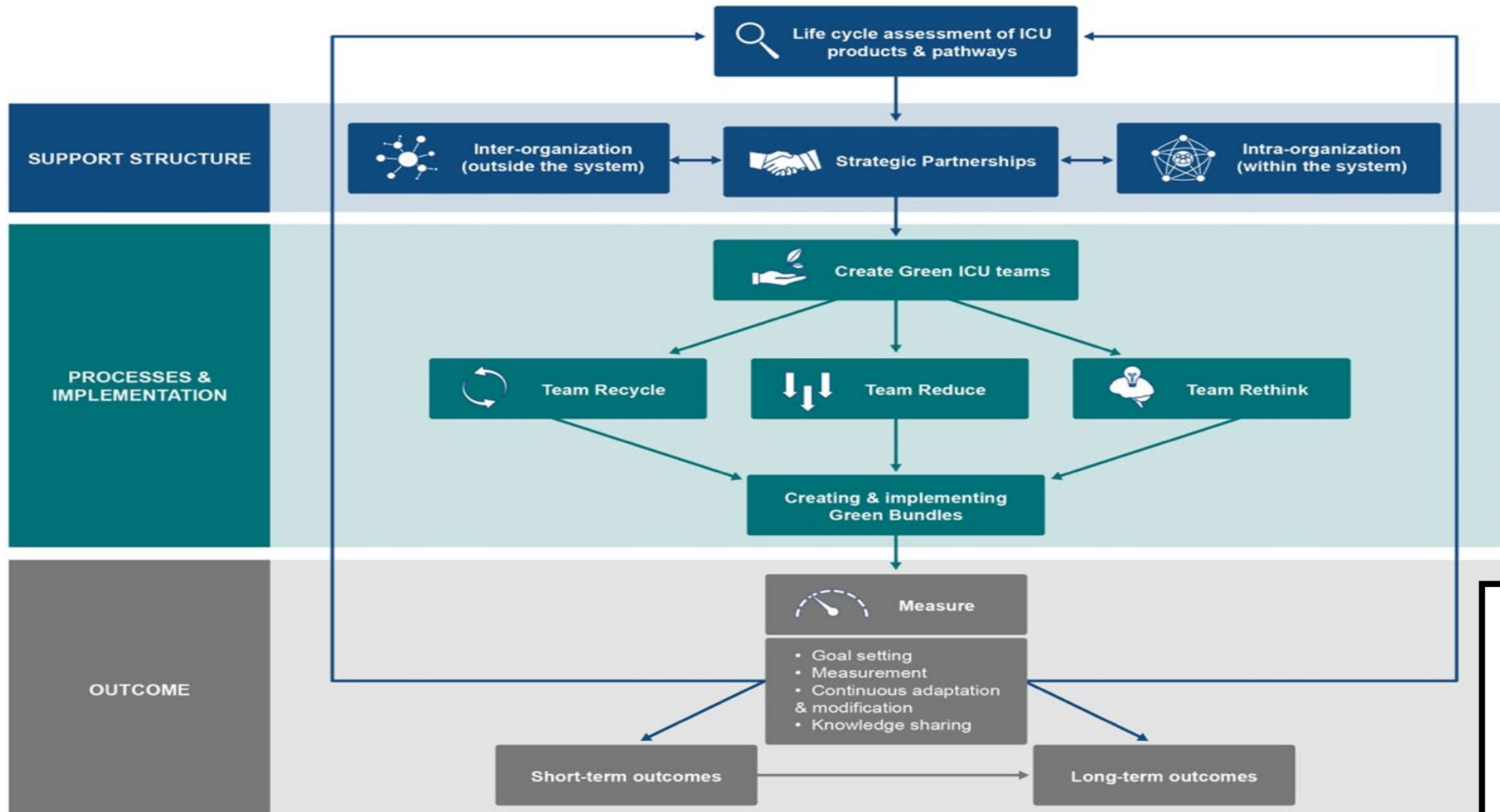


Past, present, and future of sustainable intensive care: narrative review and a large hospital system experience

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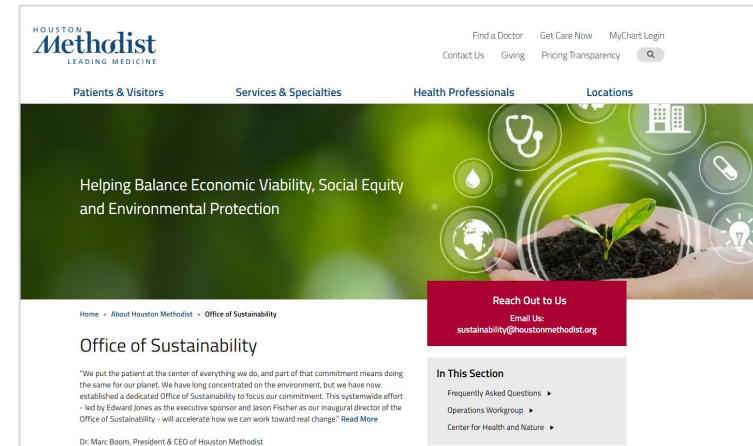


Proposed Pathway for Sustainable (GREEN) ICUs



Initial Strategic Partnerships & Engagement

Internal Engagement



External Engagement



Internal Engagement

- We gained leadership support and started talking about it at every opportunity:
 - ICU unit level meetings
 - System ICU level meetings
 - Medical & Executive leadership
 - Board Presentations
 - Created FOMO (fear of missing out) –thinking and doing things outside the box, the right thing to do, make it interesting and NOT added work!
 - Green ICU Initiative Internal Recognition/Awards



Green ICU Initiative: WHY the Center for Critical Care is in it for the long haul. . .



Patient and Local Communities



Innovation & Research



Leading Medicine in Critical Care



Healthcare Team



Environmental Dividend



Financial Dividend

Green ICU: Why is this important?

Healthcare contributes approximately 5% of worldwide greenhouse gas (GHG) production (Lenzen et al. 2020). Some regional variation exists. For instance, in the United States, the carbon footprint of the healthcare system is approximately 10% of the national GHG emissions. *This means many, many lives are impacted!*

Within healthcare systems, hospitals and pharmaceutical sectors combined have the largest carbon footprint (approximately 60%), and within hospitals, intensive care units (ICUs) are carbon hotspots contributing three times the GHG emissions as acute care units per bed day (Prasad et al. 2022).

Estimate of the carbon footprint in a U.S. hospital showed 138 kg CO₂-e per bed day for ICU patients (Prasad et al. 2022). This corresponds to the emissions of a car driven 500 to 1000 km per patient per day

It translates to almost 100, Million CARS driven per DAY GHG equivalent

Green Team

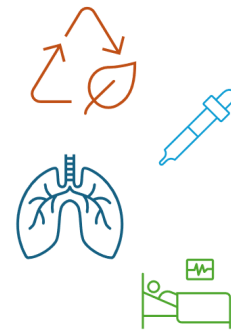
(Woodland Campus)

Vision Statement

"Our vision is to create a culture of environmental responsibility that enhances professional development while reducing our ecological footprint, ensuring a healthier planet for future generations. We will lead the way in sustainability within healthcare by empowering employees and fostering community connections- because **as Houston Methodist employees, sustainability starts with us. "**

Green Team

Green ICU Workgroups In Action



Green ICU Workgroups

Project 1: HMM CVICU

- Megan Gooch, MD, is leading initiatives in waste management with a particular focus on optimizing dialysis waste processes.

Project 2: HMM MICU

- Christopher Cortes, MD, and Latonya Perry, Nursing Director, are spearheading initiatives in waste management and promoting efficient oxygen utilization.

Project 3: HM Willowbrook

- Manni Padmanabhan, Nursing Director, is collaborating with Medline on innovative waste management strategies, focusing on reusing location-specific supplies and repurposing them into other practical items.

Project 4: HM The Woodlands

- Alisha Estay, Nursing Director, is leading initiatives in waste management and conducting assessments to optimize ICU supply usage.

Project 5: Houston Methodist Baytown

- Aditya Uppalapati, MD, and Patrick Laird, Nursing Director, are driving initiatives in waste management and promoting the efficient use of oxygen.

Project 7: Pharmacy

Systemwide. . .

Location/Unit	Representative
HMM	
CVICU	Megan Gooch MD
CICU	Manjunath Muddaraju MD Konya Keeling-Johnson MD Prakruthi Voore MD
MICU	Christopher Cortes MD Latonya Perry (Nursing Director)
NICU	Sunila Ali (Nursing Director)
SLICU	Michele Layne-Harden
Woodlands	Alisha Estay (Nursing Director)
Willowbrook	Manni Padmanabhan (Nursing Director)
Sugar Land	Michaela Taylor (Nursing Director) Betty Gonzalez (Nursing Director)
Clear Lake	John Resendiz
Baytown	Zary Hashemi MD Patrick Laird (Nursing Director)
West	Pinky Shani, PHD (Nursing)
Cypress	Carlie Sharp Matt Rominger

Team Reduce

Houston Methodist Reprocessing Program Overview (CY2024 YTD)

Including system Supply Chain stakeholders and Nursing Directors.

Program Expansion & Collection Optimization

•**Expand Recycling Scope:** Identify additional recyclable materials in clinical areas.

•**Increase Collection Points:** Place more recycling bins in high-traffic areas to maximize participation.

•**Staff Training:** Conduct workshops and educational sessions to ensure proper waste segregation.

•**Ineligible items to PVC recycle:** PVC recycling program at Houston Methodist collects and recycle post-patient PVC items such as nasal cannulas, oxygen tubing, and saline bags.

Reprocessing Program Highlights:

- 99.98% overall quality rating; reprocessed devices meet FDA standards

- 5,000+ SKUs across multiple categories: Orthopedics, ENT, Cardiology, Patient Care

Sustainability Impact:

- 109,756 devices collected, 18,973 lbs of waste diverted, 127 metric tons CO₂ avoided

New Initiatives for 2024:

- DVT Sleeve Blended Program reducing 28,146 lbs of waste annually

- Patient Transfer Mattress Conversion launching system-wide in Oct 2024

Weaning Oxygen

The Green ICU Oxygen Conservation Project

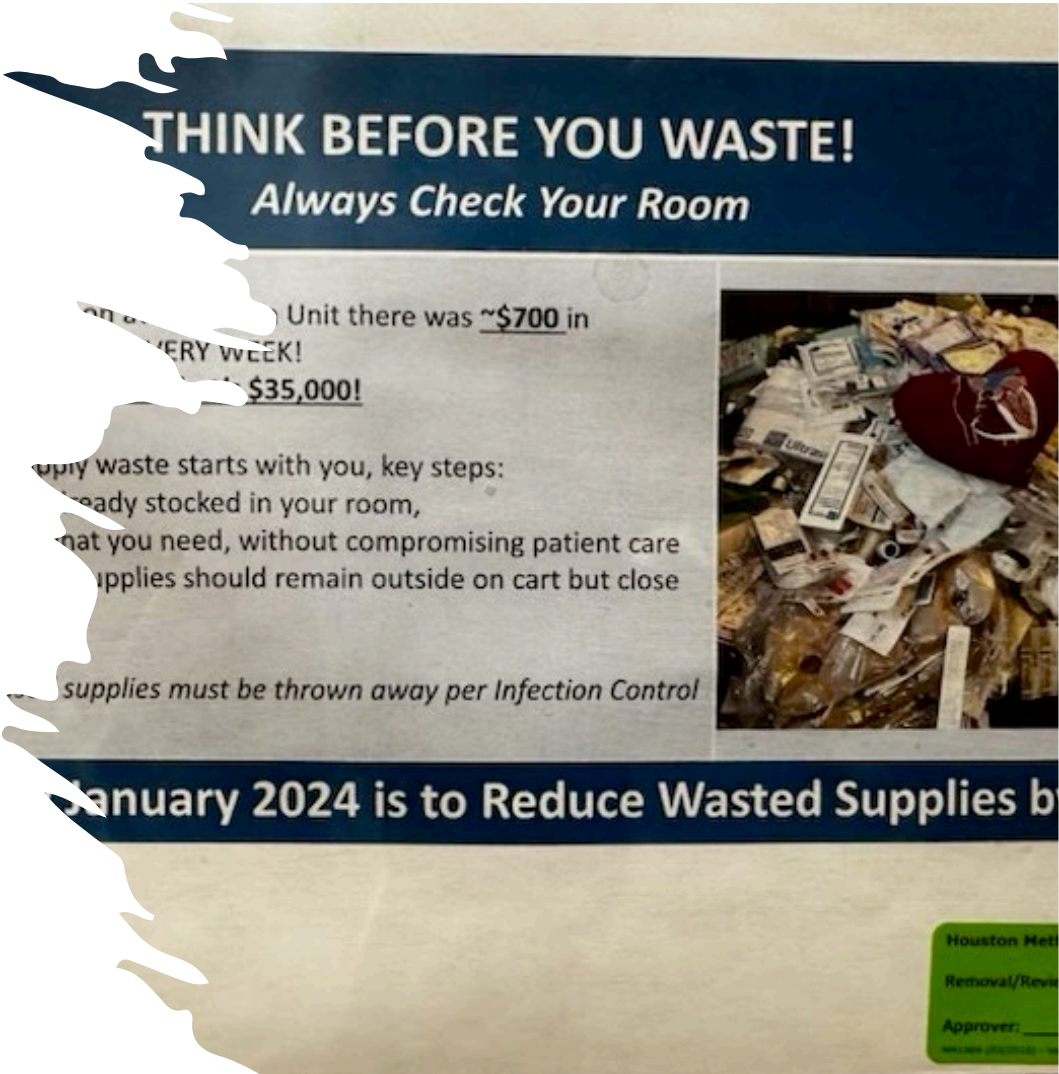
Christopher J. Cortes, MD
2024

HOUSTON
Methodist
LEADING MEDICINE

The Cost of Not Weaning Oxygen

- Prolonged
 - Ventilator days
 - ICU LOS
 - Hospital LOS
- Oxygen toxicity
 - Observed in animal models with prolonged exposure (> 48 hours) to high FiO₂ (>60%)
- Expensive
- Wasteful

Green ICU Initiative Internal Awareness/Reduction



Quantity does not always equal Quality

What we have done so far...



Batch Preparation vs. On-Demand Preparation



Intravenous infusions may be compounded in a batch based on flow rates documented in Epic

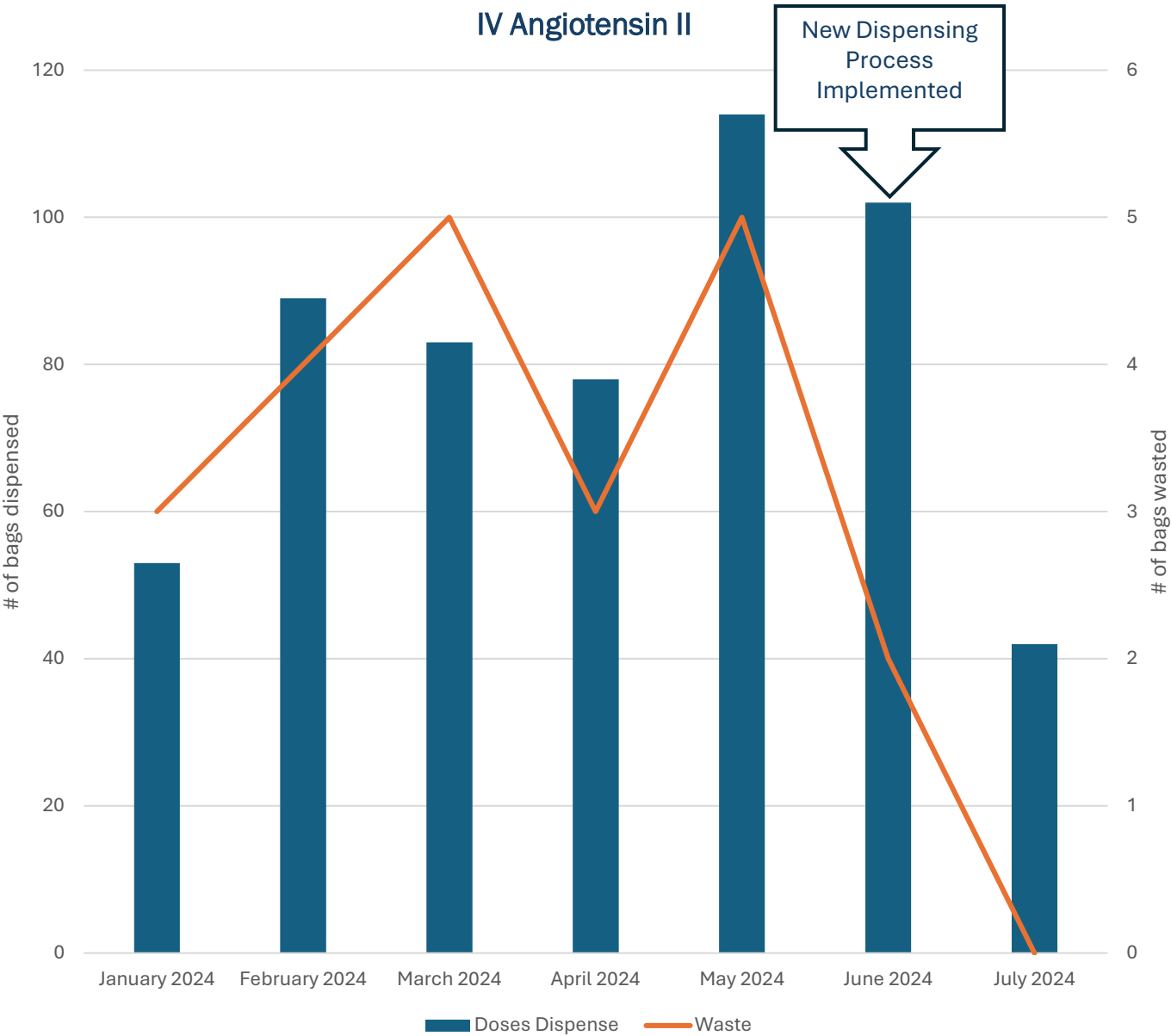
Angiotensin II (2.5 mg/250 mL) ~\$1500/bag



Converted process in June 2024 to move to on-demand requests for IV bags of medication

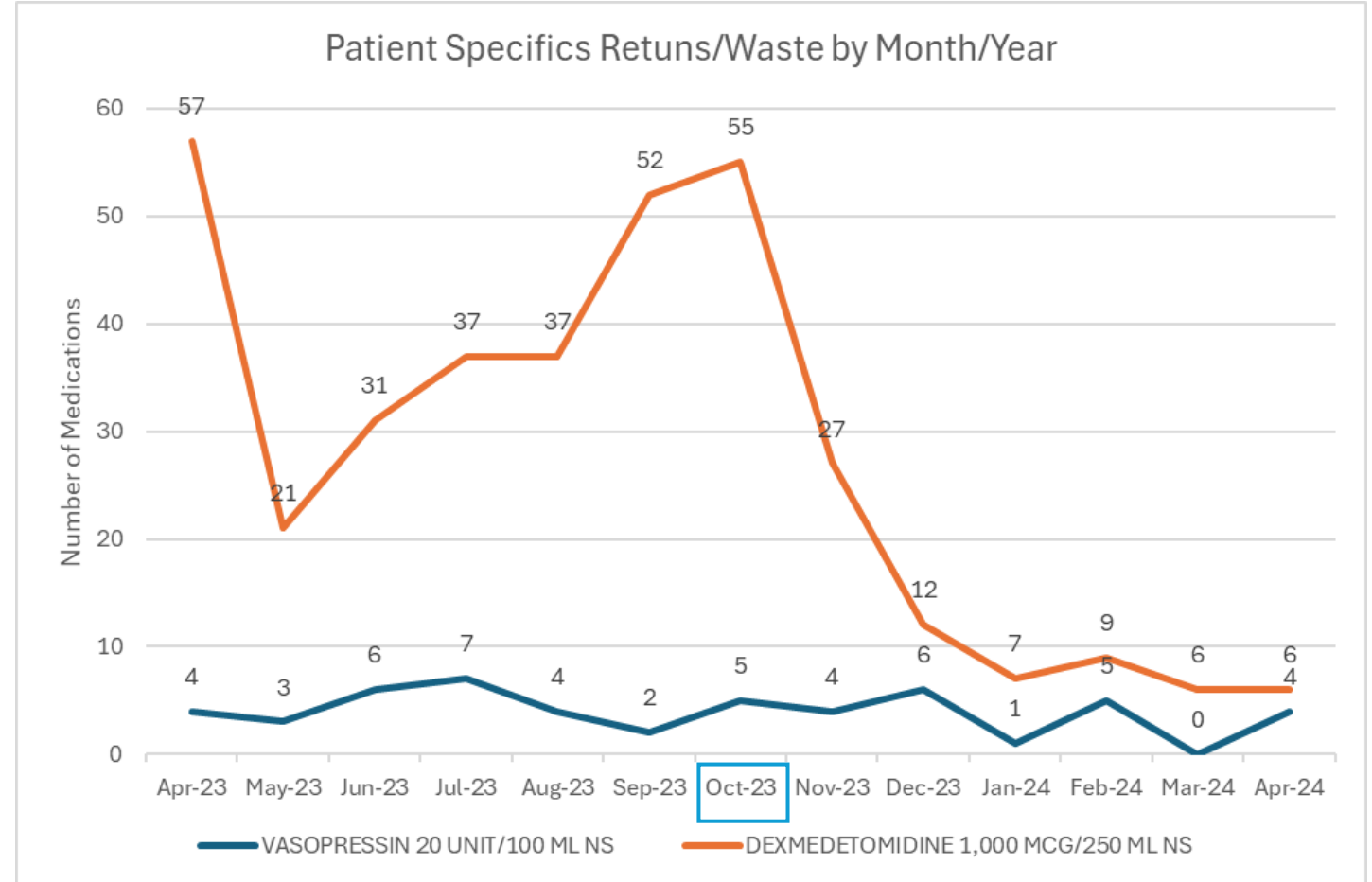
Overall waste reduction went from 4.8% to 1.4% after new process

On Demand Dispensing



Extension of Beyond-Use Dating (BUD)

- Vasopressin and dexmedetomidine have been stocked in medication fridges in WT ICU units after October 2023
- Overall decrease in wasted/returned bags after October 2023 for both medications



Team Recycle



Center for Critical Care I CARE in Action

Join the Center for Critical Care as we celebrate National Critical Care Awareness and Recognition Month by supporting health heroes in developing countries.

MEDICAL BRIDGES

Saturday, May 18
9 A.M. - 12 P.M.

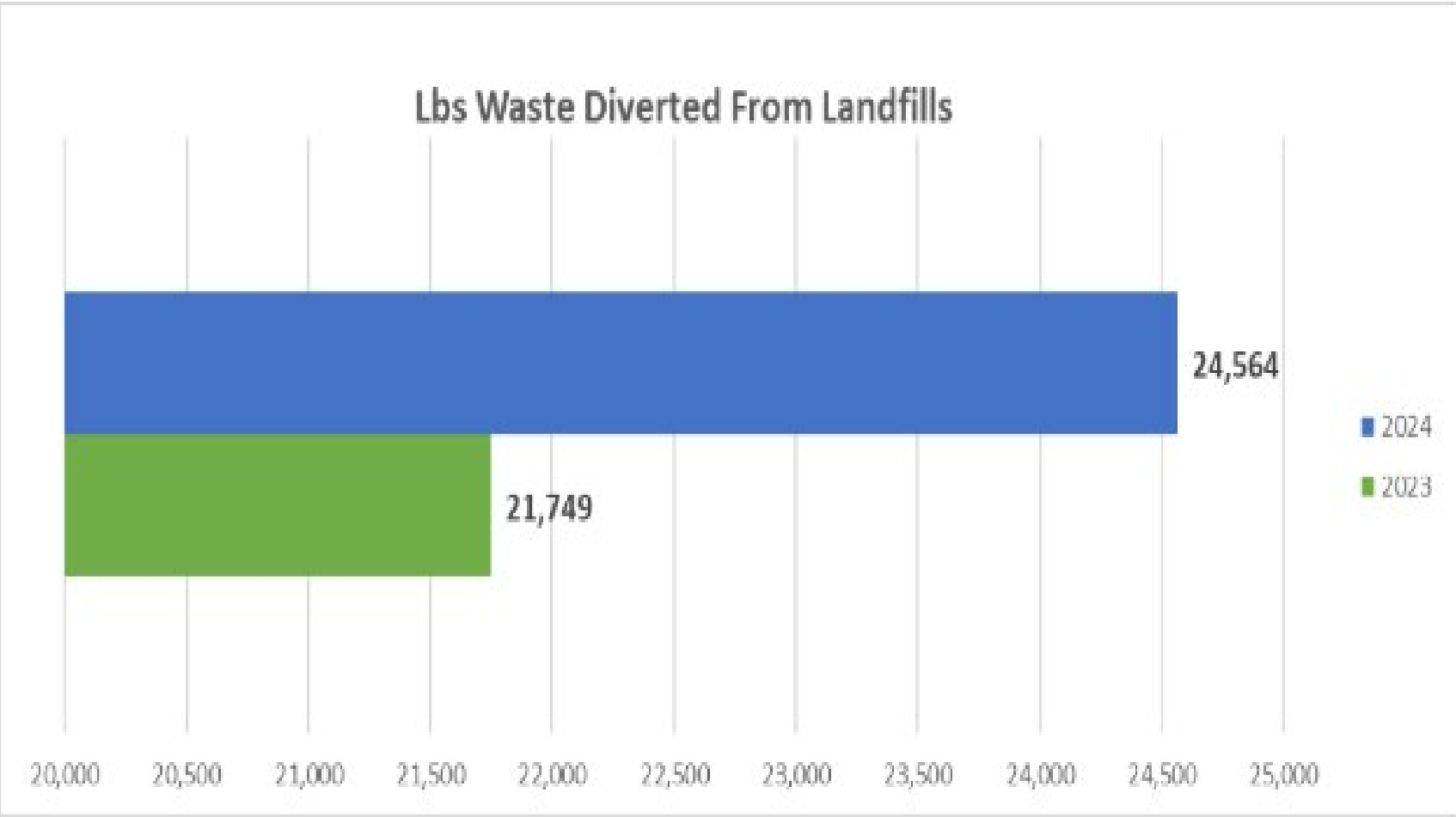
To confirm your attendance and find out more about this worthy cause, please register

Keep it Simple + On-Going Communications

As an entity, we utilize 700,000 flushes a year, with a potential of 15,000 diverted from the landfill to recycling. For the ICU, the annual impact is around 1600 pounds diverted from the landfill to Stericycle.



More than 2 Millions dollars saved



TEAMRETHINK



LAB DATA

RADIOLOGY DATA

VICU (virtual ICU)

1-year Cumulative Lab Order(5 ICU)

Volume- Cost \$\$\$\$\$\$ / GH Impact ?

	ICU 1	ICU2	ICU 3	• ICU 4	ICU 5	GRAND TOTAL
POC Glucose	79670 (23%)	93930 (27%)	41404 (12%)	69944 (20%)	59569 (17%)	344517
Magnesium	15809 (20%)	19252 (24%)	16465 (21%)	13880 (18%)	13818 (17%)	79224
Phosphorus	15770 (21%)	18061 (24%)	15742 (21%)	13658 (18%)	13511 (18%)	76742
CBC With Platelet and Differential	15107 (25%)	13690 (23%)	10543 (17%)	10547 (17%)	10559 (17%)	60446
Basic Metabolic Panel	14748 (26%)	13663 (24%)	7101 (13%)	13458 (24%)	6994 (12%)	55964
Arterial Blood Gas	11801 (25%)	14843 (32%)	5431 (12%)	7668 (17%)	6684 (14%)	46427

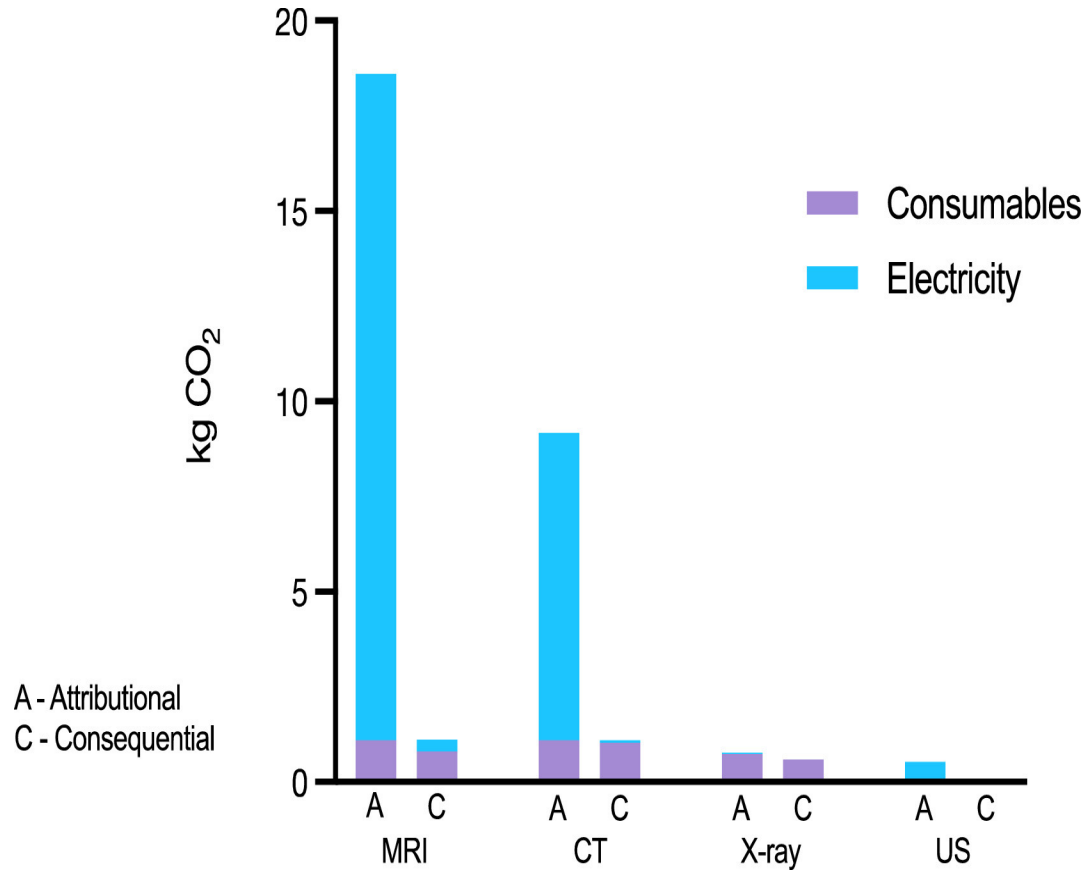
One Year Radiology Volume of 5 ICU's

CO₂e contribution of single scan

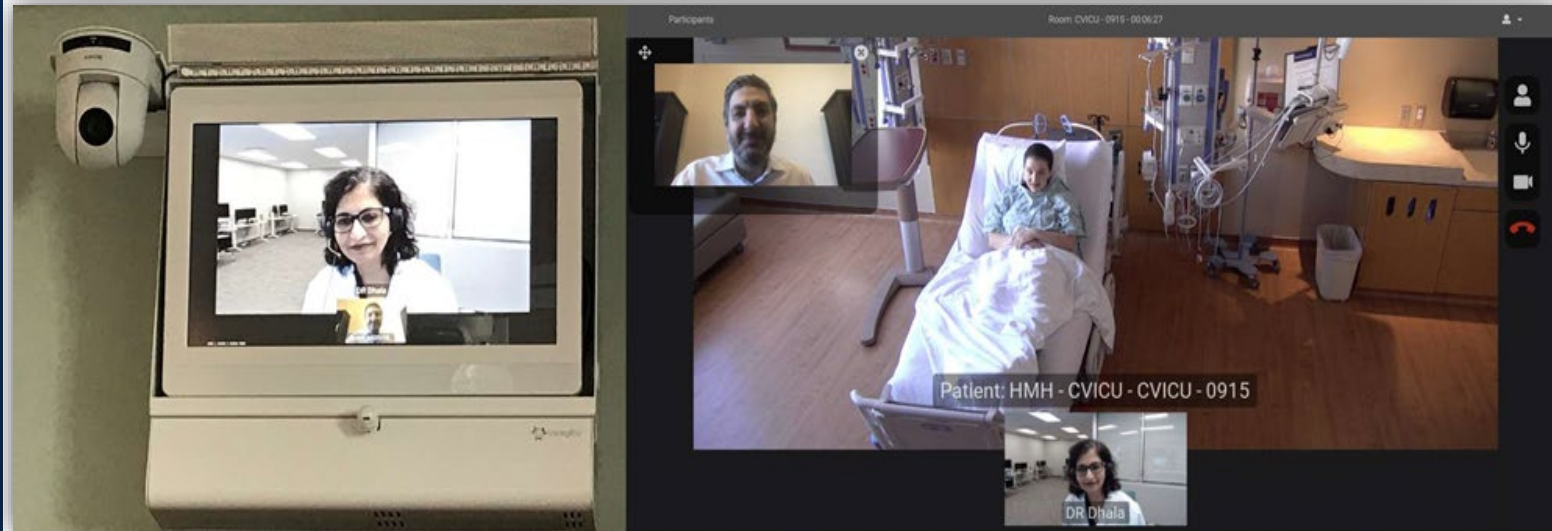
- Chest X-rays
- CT scans
- MRI

- Routine = 38000 +
- Stat = 15,000 +
- Total = 53000+

- Do we need that many ?
- Part of Order sets ?
- Cost to patient and system ?
- GH impact



Houston Methodist Virtual ICU (VICU) 2020 —less staff, Improve quality, Less ICU admissions —tc

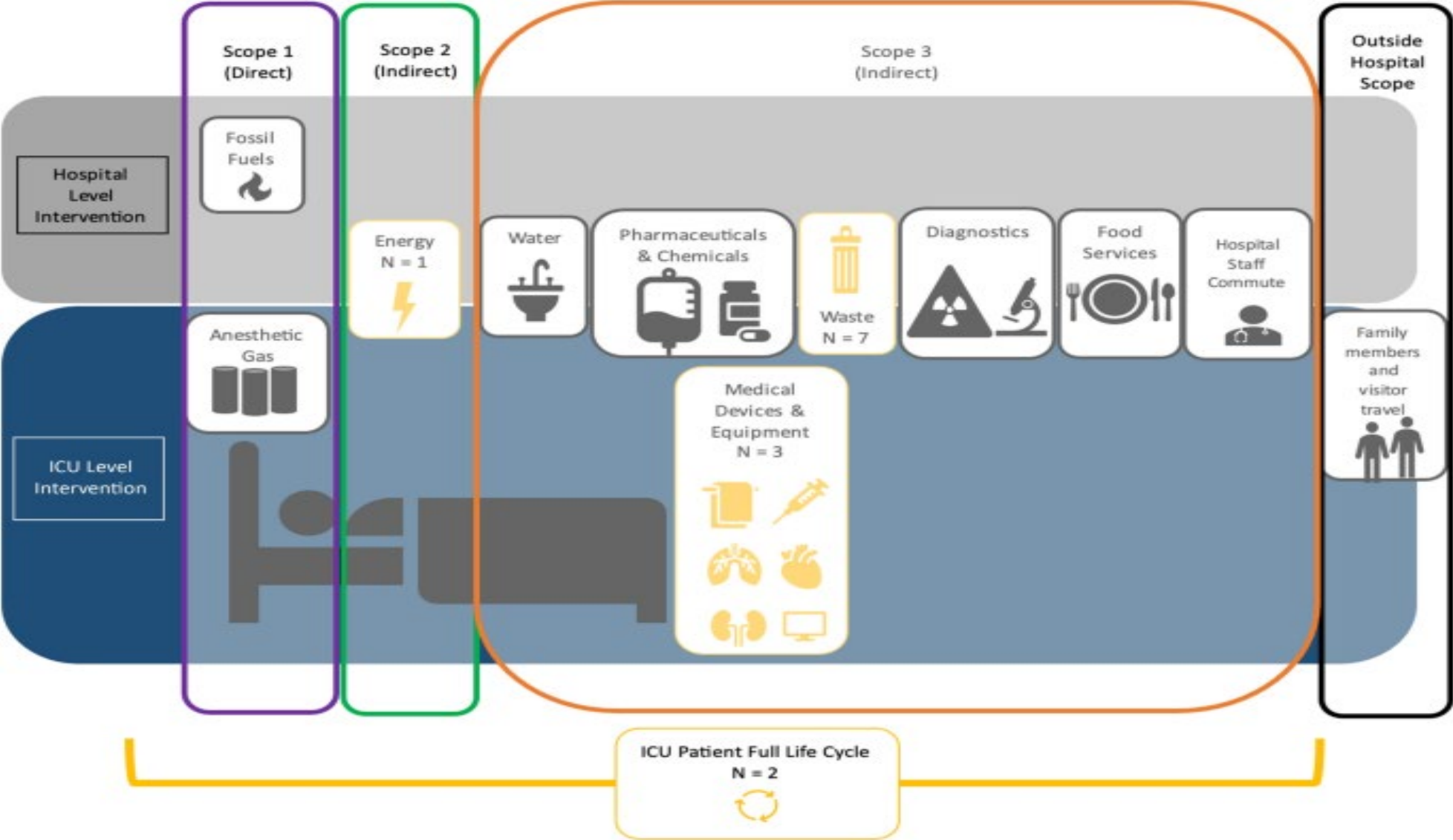


MEASUREMENT



A holistic approach...

ICU Patient



One AMC footprint

- **Scope 1 + 2**
 - 166,954 MTCO₂e
 - **Scope 3**
 - 834,770 MTCO₂e
- When you combine Scope 1+2+3 Emission Equivalent
- One AMC- per FTE, are app 4 times higher than Walmart

Scope 3 & Combined Estimates

+ Benchmarking

Combined Emissions Estimates	
Scopes 1 & 2	166,954 MTCO ₂ e
Scope 3 Projection (80%)	~ 834,770 MTCO ₂ e
Total Emissions	~ 921,402.6 MTCO ₂ e
Per Equivalent Patient Day	~ TBD
Per Full Time Employee	~ 31.3 MTCO ₂ e/FTE

Kaiser Permanente (2021)

~ 4,565,623 MTCO₂e

~ 15.01 MTCO₂e/FTE

Walmart (2021)

~ 14,000,000 MTCO₂e

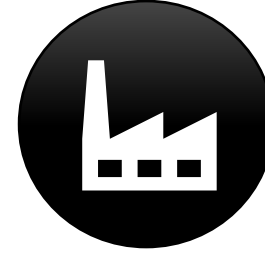
~ 6.07 MTCO₂e/FTE

One AMC- per FTE, are app 4 times higher than Walmart

Greenhouse Gas Equivalents

Scope 1 & 2 Emission Equivalents

166,954 MTCO₂e



183,996,103
Pounds Coal



18,786,317
Gallons Gas



21,752
Yearly Home
Energy Use



386,534
Barrels Oil



Joint Statement on Environmental Sustainability in Critical Care

Environmental factors exert substantial influence in determining the quality of human health and wellbeing, underscored by the imminent and pressing effects of global climate change.

The healthcare sector, even while dedicated to protecting and promoting human health, contributes a significant portion to greenhouse gas emissions.

Intensive care units (ICUs) are a key resource-intensive component of the healthcare setting with a significant carbon footprint.

Through the principles of recycling, reducing, and rethinking, the environmental impact of ICUs can be modified (without detriment to patient safety and quality) to mitigate the effect of greenhouse gas emissions to create sustainable (Green) critical care operations.

We, as leaders in intensive care, resolve to uphold: (a) a shared vision for a *Green Intensive Care* focus worldwide; (b) a high standard for sustainable practices in our intensive care units; and (c) efforts to promote the importance of sustainable critical care practices through impactful initiatives, advocacy, education, and training. The views expressed in this joint statement may not reflect the official position or stance of our organization.

Affirmed by:

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Katri V. Typpe

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ICU leaders from these institutions have joined the collaborative.



United in our mission to minimize waste and reduce the carbon footprint in ICUs through recycling, reducing, and rethinking.



Collaborative: E-MAIL


hmcenterforcriticalcare@houstonmethodist.org

Complete the Survey



Help Us Create Green ICUs


Do you have a role in an intensive care unit (ICU)? Are you passionate about creating a more sustainable future in healthcare? Join us in shaping environmentally friendly and efficient ICUs while maintaining the highest standards of patient care.

 Take a brief survey (10-15 minutes) to share your experiences and insights on:


Current daily practices and best practices for sustainability in ICUs.

Barriers and facilitators to achieving sustainability.

Your responses are confidential and will provide invaluable guidance in reducing the ecological footprint of healthcare systems.

 Before participating, please review the informed consent document.

Survey Link: <https://lnkd.in/gprCxbe5>

 This survey is conducted by independent researchers and has been approved for distribution by the Society of Critical Care Medicine (SCCM). However, it is not affiliated, endorsed, or officially connected with SCCM beyond email distribution.

Let's create a healthier planet together—one ICU at a time.

Thank you for your time and contribution toward a more sustainable future in healthcare!

Houston Methodist Center for Critical Care

#SustainabilityInHealthcare

#GreenICUs

#HealthcareInnovation

#EcoFriendlyC

Houston Methodist Center for Critical Care

2025 Inaugural Green ICU Conference

September 17th, 2025

The 2025 Green ICU Conference offers a dynamic platform for exchanging ideas and fostering collaboration to advance sustainable healthcare practices.


Date: September 17th, 2025

Location: Houston, TX

More details will be shared as the event approaches.

For inquiries, please contact:

Marco Hernandez

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Designing a Green ICU is Not Just About the Building...



Centennial Tower's 14th floor will feature an outdoor rooftop garden complete with trees and landscaping to provide patients, visitors and staff with an outdoor respite in the heart of the Texas Medical Center.



Everyone Needs a Motivation



Like father like daughter



Green ICU Awareness, and Action:
Come Join US !!

Think BIG, Start SMALL
Build Unity, Build Trust

**HOPE
DIFFERENTLY**

