

ENVIRONMENTAL STEWARDSHIP IN THE INTENSIVE CARE UNIT

**A roadmap for a more
sustainable practice**



PURPOSE AND SCOPE

Climate change is the biggest threat to humanity in the modern day. Almost every sector in our society has contributed to the climate crisis in one way or another – and the health care system is no exception. We are only just beginning to understand the ways in which human health can be profoundly impacted by the state of our planet.

The purpose of this guidebook is not to serve as a comprehensive roadmap to achieving a net-zero ICU. Rather, it serves as a primer to kickstart the process of achieving a more sustainable practice.



TABLE OF CONTENTS

Health Care and the Climate Crisis	4
Rewards and Risks for Acting Now	5
Action Items	6
<i>Leadership</i>	6
<i>Education</i>	6
<i>Supply Chain</i>	6
<i>Drugs & Devices</i>	7
<i>Buildings & Energy</i>	8
<i>Food</i>	8
<i>Transportation</i>	8
<i>Natural Systems</i>	8
Glossary	9
Key Resources	10
References	11
Contributors	12



HEALTH CARE AND THE CLIMATE CRISIS

WHY IS THIS IMPORTANT?

The recent global COVID-19 pandemic has taught us that we can focus the attention of the health care system on a clear purpose when there is a looming threat. Climate action is required from all sectors of the economy including healthcare. This effort is crucial in order to achieve the net-zero carbon emissions goal by 2050, which was established by the Canadian government. In addition, building climate resilience among health care institutions and their supply chains is urgently needed as they are already being impacted by a changing climate.

In Canada, health care systems contribute 5% of greenhouse gas (GHG) emissions, which are higher than the entire airline and shipping industries. This puts Canada as one of the worst per-capita healthcare polluters in the world. Accordingly, the CMA has advocated for the need to achieve a net-zero health care system. The influence that health care can have in reducing emissions by others is significant and should not be dismissed.



New accreditation standards for governing boards as well as federal, provincial and local regulations, are requiring senior leaders to consider environmental stewardship in their strategic plans. This will affect enterprise risk management plans, capital investment plans, procurement policies and practices, and budgeting. In the future, recruitment and retention of young professionals will depend on the alignment of organizational priorities and commitments to shared values of social and environmental justice.

Health care governing boards, senior executives, and clinical staff all play a key role that extends beyond the boundaries of their organizations. As highly respected leaders, their actions can positively influence staff, patients, visitors, suppliers, and entire communities. There is a high level of public contact and interaction with the health care system; therefore, the system itself should provide an exemplary commitment to environmental stewardship.

HEALTH CARE NEEDS TO ACKNOWLEDGE THE NEEDS OF PEOPLE AND THE PLANET

REWARDS AND RISKS FOR ACTING NOW

REWARDS



- Leadership in your local community
- Positive staff culture and engagement
- Decisions made now will lock you into your future net-zero pathways (ie. new boilers, PPE contracts)
- Secure access to medical product supply chain with a focus on reusables
- Increase in infrastructure resilience
- Align with best practices: sustainable habits and clinical best practices are often aligned, resulting in a mutually beneficial workflow

ABILITY TO MEET NEW STANDARDS



- New accreditation standards for leadership (2021) and governing bodies (2022)
- New carbon reduction regulations
- An imperative to adapt to climate change (now) and build resilience (for the future)

FISCAL RISKS

- Carbon tax: 600% increase expected this decade
- Climate inaction can demoralize staff, leading to decreased efficiency



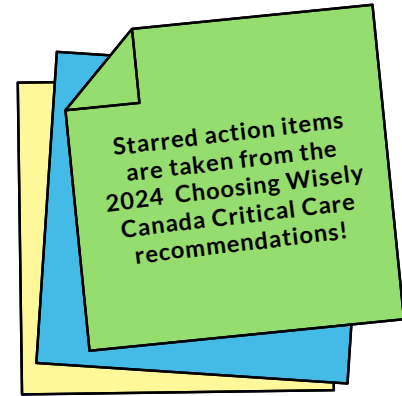
HEALTH SYSTEM RISKS

- Needing to respond to a climate emergency in:
 - Operational services
 - Health services

ACTION ITEMS

LEADERSHIP

- Set **sustainability goals** within the department and ensure they are well communicated to all team members [1]
- Appoint a multidisciplinary panel of **“Green Leaders,”** both in the hospital and the ICU itself [1, 7]
- Conduct **regular audits** to monitor progress and ensure that all sustainability goals are on track to be achieved [1]
- Ensure that an **open forum** exists for all team members to voice their opinions regarding sustainable decision-making in the ICU [1]



A Beginner's Guide to Green Teams in the ICU prepared by ANZICS is a helpful resource to get started


EDUCATION

- Consider incorporating discussions about sustainability at staff induction, into **journal clubs** or grand rounds, and other curricula for trainees [1]
- Assemble a list of concise, accessible **“Green ICU” resources** for all department members to reference
- Conduct **QI initiatives** to examine ways in which the quality or delivery of sustainability education can be improved [1]








SUPPLY CHAIN

- Advocate for strict environmental criteria to be included in **procurement contracts** with suppliers (e.g. minimal-waste product packaging) [1]
- Keep track of product **expiry dates** and ensure that products that are to expire sooner are used first; re-evaluate expiry dates for products to see if they can be **extended** [1]
- Customize daily restocking of items** to the nursing requirements and **avoid bringing excess equipment into the patient rooms** if they will require disposal after patient transfer or discharge → avoids waste of unused supplies [2, 9, 15] ✨
- Adopt **customized procedure kits** that maximize the number of reusable items in them
- Consider switching to **reusable ICU equipment** such as video laryngoscope blades, face masks, and circuits; implement **PVC reclaiming programs** for IV bags and oxygen tubing

- Avoid single-use plastics when **stainless steel or molded fiber alternatives** are available; examples include stainless steel kidney basins and molded fiber bedpans
- Advocate for purchasing of **pre-filled syringes** for commonly-used medications such as vasopressors, since they have longer shelf-lives [1]
-  Consider purchasing **reusable PPE, drapes, and linens** such as incontinence sheets [4, 8, 15]
- Use **smaller-volume blood collection tubes** when blood must be drawn since laboratory equipment typically only requires ~0.5 mL of blood for analysis [5]
- Promote IV fluid stewardship and ensure that the fluid requirements of a patient are matched to the **smallest allowable bag size** (e.g. if the patient needs 500 mL, then do not use a 1 L bag) [6, 11]

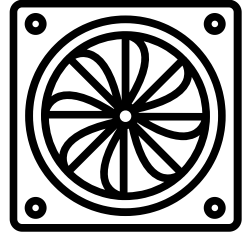
Minimize **routine bloodwork** and **daily CXRs** for ventilated patients. If bloodwork is to be ordered, ensure that it aims to **answer a clinical question** (e.g. avoid unnecessary ABGs) [12, 13]

DRUGS AND DEVICES

- Promote **deprescribing** practices and ensure medications prescribed in the ICU are **deprescribed at discharge** [1, 15] 
- Opt for oral/enteral medications** over intravenous delivery if deemed to be equally safe and effective [15] 
- Adopt a robust **antibiotic stewardship** program, including de-escalation, oral alternatives, guideline-based prescribing, and appropriate medication disposal
- Avoid replacing ventilator tubing** or suction catheters unless they are visibly soiled; consider extending IV lines and infusion tubing to seven days [10, 15] 
- Consider leaving **emergency “rescue” drugs unopened** until needed, but in the immediate vicinity should they be required [1]
- Avoid routine RBC transfusions** in hemodynamically stable patients with **hemoglobin above 70 g/L** (higher thresholds may be permissive for cardiac surgery, orthopedic surgery, ECMO, TBI, or active cardiovascular disease states) [15] 
- Ensure that drugs and sharps waste are disposed of correctly → **half-filled syringes should not be emptied into sinks** [1, 16]
- Avoid the use of **metered dose inhalers** in the ICU, in favour of greener inhalers, ventilators, or nebulizers [1, 16]
- Reuse disposable **oxygen saturation probes, blood pressure cuffs, and sequential compression devices** [1]
- Prioritize goals of care conversations** to minimize the use of life supportive interventions that do not align with the patient's wishes → **aligns with best practices and decreases environmental burden** [15] 
- Avoid the use of **volatile anesthetics** for sedation of patients [16]
- Consider low-dose **peripherally-delivered vasopressors and inotropes** for some patients

BUILDINGS & ENERGY

- ✦ Minimize sedation as per best practices to reduce ventilator days and length of ICU stay [15]
- ✦ Enact policies with respiratory therapy, nursing, and physician input that prioritize daily spontaneous breathing trials and awakening trials when eligibility criteria are met to further reduce ventilator days [15]
- Consider closing doors, curtains, and blinds when not in use to reduce the unnecessary requirement for air conditioning [1]
- Consider switching to energy-efficient LED lightbulbs if not already in use, turn off lights when not in use, and switch to motion-activated lights [1]
- Switch off HVAC for isolation rooms when not in use
- Monitors and other devices (e.g. computers, printers) should be turned off/put in sleep mode when not in use [1]

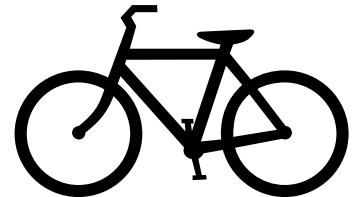


FOOD

- Avoid using single-use plastic food and drink containers [1]
- Consider choosing plant-based enteral or parenteral nutrition [1]

TRANSPORTATION

- Consider holding academic or patient meetings online rather than in person to minimize unnecessary travel [1]
- Consider investing in EV charging stations or parking spots for carpoolers [1]
- Provide discounts on parking rates for staff who choose to commute to work via more sustainable means (e.g. EV, carpool)
- Consider biking, walking, or taking public transit to/from the hospital or arranging ride-share opportunities for staff → provide the infrastructure (e.g. bike racks) for staff who choose to bike [1]



NATURAL SYSTEMS

- Consider the addition of green spaces to the ICU for patients, family members, and caregivers [8]

GLOSSARY

Accreditation Standards - Accreditation Canada surveys hospitals to rate them on the extent to which they meet national standards for quality and hospital operations. New Standards regarding environmental stewardship were adopted for leadership in 2021 and for governing bodies in 2022.

Circular Economy - A systematic approach to economic development designed to benefit business, society and the environment. It moves beyond recycling to keeping products in use, eliminating waste streams and regenerating natural systems.

Climate Adaptation- Measures which are taken to protect a community or an ecosystem from the impacts of climate change.

Climate Mitigation- Measures which are taken to decrease or prevent the emission of heat-trapping greenhouse gases into the atmosphere.

Divesting Foundation Funds - Most hospitals have millions invested in their foundations, thus, by moving money from standard portfolios to low-carbon portfolios, significant greenhouse gases are saved.

Green Hospital Scorecard - The annual benchmarking survey of environmental performance carried out by the [Canadian Coalition for Green Health Care](#) provides both comparative and retrospective information for participants.

Greenhouse Gas (GHG) Emissions - GHGs are made up of carbon dioxide (CO₂), nitrous oxide (N₂O), methane (CH₄) and fluorinated greenhouse gases (F-GHGs).

HVAC Systems - Heating, Ventilation and Air Conditioning (HVAC) systems that generate most of hospitals' GHG emissions.

Nature-based solutions- Implementing sustainable designs and natural features into the built environment to promote adaptation and resilience. These solutions would include natural grasses, pollinator gardens, rain gardens, trees and green roofs.

Net-zero - Achieving a balance between the greenhouse gas emissions put into the atmosphere and those taken out. CO₂ emissions make up over 80% of GHGs and can be broken down into Scope 1 direct emissions (i.e. heating and cooling), Scope 2 indirect emissions (i.e purchased from utilities), and Scope 3 emissions generated from the operations of the company (i.e. supply chain, travel). In order to prevent the worst climate damages, global net human-caused emissions of carbon dioxide (CO₂) need to fall by about 45 percent from 2010 levels by 2030, reaching net-zero around 2050.

Sustainable Prescribing - This involves optimizing medications for patients, typically resulting in less medications prescribed. Also, in some cases, prescribers can switch from one medication to another one which produces less GHGs. For example, switching inhalers.

Sustainable Procurement - Building environmental sustainability factors into the rating system for the acquisition through purchase or lease of real property, goods or other products, works or services.

ORGANIZATIONS WITH KEY RESOURCES

LEADERSHIP

- **Leadership strategy** - https://greenhealthcare.ca/wp-content/uploads/2024/11/EN_Streamline-your-journey-guidebook_2024.pdf
- **Divesting from fossil fuels, investing in green energy** - <https://greenhealthcare.ca/phase-out-fossil-fuel-investments/>

EDUCATION

- **Choosing Wisely Canada** - <https://choosingwiselycanada.org/recommendations/>
- **Calculating your footprint** - <https://healthcareclimateaction.org/checkup>

SUPPLY CHAIN

- **Procurement contracts** - <https://sustainabilityadvantage.com/sp/case/>
- **Reusable gowns & waste sorting** - <https://cascadescanada.ca/resources/sustainable-perioperative-care-playbook/>
- **Reusable items & OR pick lists** - <https://sustainablehealthcare.org.uk/what-we-do/green-surgery-challenge>
- **PVC reclaiming** - <https://www.vinylinstituteofcanada.com/medical-pvc-recycling-pilot-program-pvc-123/>

BUILDINGS AND ENERGY

- **OR ventilation setbacks** - <https://www.enerlife.com/wp-content/uploads/2017/06/Enerlife-OR-Ventilation-Best-Practices-Guide-April-2017.pdf>
- **New buildings** - <https://www.cagbc.org> (see 'zero-carbon')
- **Energy manager, heating systems, and LED lights** - <https://practicegreenhealth.org/topics/energy/energy>

DRUGS AND DEVICES

- **Deprescribing strategy** - <https://www.deprescribingnetwork.ca/>
- **Anesthetic gases** - <https://www.peachhealthontario.com/drugs-and-devices>
- **Equipment reprocessing** - <https://www.stryker.com/us/en/sustainability.html>

FOOD

- **Plant forward diets** - <https://www.nourishleadership.ca/sustainable-menus>
- **Composting** - <https://greenhealthcare.ca/wp-content/uploads/2017/07/CCGHC-Organic-Waste-Case-Study-June17-2013-FINAL.pdf>

TRANSPORT

- **Active Transport** - <https://cape.ca/resource/active-travel-toolkit-en/>
- **EV chargers** - <https://chasecanada.org/wp-content/uploads/2021/03/ZEV-BACKGROUND-ENG.pdf>

NATURAL SYSTEMS

- **Green space** - <https://bcgreencare.ca/wp-content/uploads/2021/10/Green-Design-for-Climate-Resilience-and-Well-being.pdf>

RESILIENCY

- **Healthcare Facility Resiliency Toolkit** - <https://greenhealthcare.ca/climate-change-resiliency-toolkit/>

MORE KEY GREEN ORGANIZATIONS

- <https://synergiesanteenvironnement.org>
- <https://nordicshc.org/>
- **ANZICS Sustainability Toolkit** - A beginners guide to sustainability in the ICU
ABN: 19 657 679 556 ISBN: 978-1-876980-56-6

REFERENCES FOR FURTHER READING

1. [A beginners guide to sustainability in the ICU](#) ABN: 19 657 679 556 ISBN: 978-1-876980-56-6.
2. See KC. Improving environmental sustainability of intensive care units: A mini-review. *World J Crit Care Med.* 2023 Sep 9;12(4):217-225. doi: [10.5492/wjccm.v12.i4.217](#). PMID: 37745260; PMCID: PMC10515098.
3. Varangu L, Cowan K, Amin O, Sarrazin M, Dawson M, Rubinstein E, Miller FA, Hirst L, Trbovich P, Waddington K. Reusable personal protective equipment in Canadian healthcare: Safe, secure, and sustainable. *Healthc Manage Forum.* 2023 Jul;36(4):207-216. doi: [10.1177/08404704231168752](#). Epub 2023 May 15. PMID: 37186690.
4. Siegal DM, Belley-Côté EP, Lee SF, et al. Small-Volume Blood Collection Tubes to Reduce Transfusions in Intensive Care: The STRATUS Randomized Clinical Trial. *JAMA.* 2023;330(19):1872–1881. doi:[10.1001/jama.2023.20820](#).
5. Touw, H., Stobernack, T., Hunfeld, N.G.M. et al. Size does matter. Sustainable choice of intravenous bags. *Intensive Care Med* 49, 1529–1530 (2023). <https://doi.org/10.1007/s00134-023-07240-3>
6. Van Iperen ID, Maas J, Spronk PE. Greenery and outdoor facilities to improve the wellbeing of critically ill patients, their families and caregivers: things to consider. *Intensive Care Med.* 2023. Oct;49(10):1229-1231. doi: [10.1007/s00134-023-07185-7](#). Epub 2023 Aug 23. PMID: 37610484; PMCID: PMC10556109.
7. Trent, L., Law, J. & Grimaldi, D. Create intensive care green teams, there is no time to waste. *Intensive Care Med* 49, 440–443 (2023). <https://doi.org/10.1007/s00134-023-07015-w>
8. Griffing, Evan, and Michael Overcash. “Reusable and Disposable Incontinence Underpads: Environmental Footprints as a Route for Decision Making to Decarbonize Health Care.” *Journal of nursing care quality* vol. 38,3 (2023): 278-285. doi:[10.1097/NCQ.0000000000000697](#)
9. Yu A, Baharmand I. Environmental Sustainability in Canadian Critical Care: A Nationwide Survey Study on Medical Waste Management. *Healthc Q.* 2021 Jan;23(4):39-45. doi: [10.12927/hcq.2020.26394](#). PMID: 33475491.
10. Rickard, Claire M et al. Effect of infusion set replacement intervals on catheter-related bloodstream infections (RSVP): a randomised, controlled, equivalence (central venous access device)–non-inferiority (peripheral arterial catheter) trial. *Lancet.* 2021. Apr 17;397(10283):1447-1458. doi: [10.1016/S0140-6736\(21\)00351-2](#). PMID: 33865494.
11. Hawkins, W Anthony et al. “Fluid Stewardship During Critical Illness: A Call to Action.” *Journal of pharmacy practice* vol. 33,6 (2020): 863-873. doi:[10.1177/0897190019853979](#)
12. Pilowsky JK, Lane K, Learmonth G, Walsh O, Scowen C, Williams L, Nguyen N; APTIC Investigators. Environmental impact of a blood test reduction intervention in adult intensive care units: A before and after quality improvement project. *Aust Crit Care.* 2024 Sep;37(5):761-766. doi: [10.1016/j.aucc.2024.03.006](#). Epub 2024 May 15. PMID: 38755050
13. Walsh OM, Davis K, Gatward J. Reducing inappropriate arterial blood gas testing in a level III intensive care unit: a before-and-after observational study. *Crit Care Resusc.* 2023 Oct 18;22(4):370-377. doi: [10.51893/2020.4.OA10](#). PMID: 38046871; PMCID: PMC10692580.
14. Limphaibool N, Bowden K, Walters H. Shutdown protocols for IT-reducing energy waste in medical practice. *BMJ.* 2024 Jul 30;386:e079056. doi: [10.1136/bmj-2023-079056](#). PMID: 39079717.
15. [Choosing Wisely Canada](#) Critical Care Recommendations.
16. [Choosing Wisely Canada](#) Climate Action Recommendations.

CONTRIBUTORS

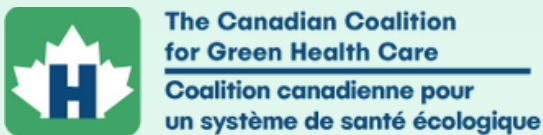
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