CFMS HEART'S PRIMER ON GREENING HEALTHCARE FOR HEALTHCARE STUDENTS

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PROJECT GREEN HEALTHCARE

PROJET VERT LA SANTÉ

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GREENING HEALTHCARE

IN THIS REPORT:

INTRODUCTION

Climate change has been identified as the largest global health threat of the 21st century, and tackling it could be our greatest health opportunity (1). The mean annual temperature in Canada has increased by 1.7˚C between the years of 1948-2016 (2). Rising temperatures deleteriously impact the health of Canadians by contributing to the increased severity and frequency of heat-waves, floods, and wildfires as well as a prolonged allergy season and shifting distributions of infectious diseases (3-7). Healthcare systems are significant contributors to climate change, with Canadian healthcare being the third-highest greenhouse gas emitter worldwide (1). The Canadian healthcare system is responsible for 4.6% of total national greenhouse gas emissions, which has been linked to 23,000 disability-adjusted life years lost annually (8). Thus, in the coming years, healthcare systems will be required not only to care for populations experiencing negative climate change-related health impacts, but also to mitigate their own environmental footprints.

The World Health Organization (WHO) has emphasized that since “health systems constitute a significant share of many national economies, they can therefore make an important impact to overall sustainability by taking into account [their] environmental impacts (9).” The 2019 Lancet Countdown on Health and Climate Change Policy Brief for Canada, in association with the Canadian Medical Association (CMA), has recommended to “establish a sustainable healthcare initiative that … support[s] Canada’s healthcare sector in reducing greenhouse gas emissions and preventing pollution-related deaths, consistent with healthcare’s mandate to ‘do no harm' (10). In addition, a joint position statement published by the Canadian Coalition for Green Healthcare (CCGHC), the CMA, the Canadian Association of Physicians for the Environment (CAPE) and other healthcare organizations has called on “health care organizations to pledge to minimize the negative impact of their activity on the environment and to seek solutions to existing barriers,” and “individuals working in the health sector to both model and advocate for environmentally responsible approaches to delivering healthcare without compromising patient safety and care" (11).

As future healthcare leaders, it is important to learn about climate advocacy and embed sustainability into your practice and lifestyle. The purpose of this document is to help you understand the nature by which our healthcare system and decisions as healthcare providers relate to the climate crisis, and inspire you to generate climate-conscious changes in your local healthcare institutions and communities. We will discuss the variety of healthcare systems- and practice-related sources of climate impact, and suggest specific and actionable strategies to mitigate these effects. We will also provide some practical tips on how to mobilize with social justice at the heart of your climate advocacy, build a productive team environment, conduct informal needs assessments, and perform your quality improvement projects. Taken together, we hope that this document will inspire and equip you with the skills and knowledge to prioritize providing green healthcare during training and throughout your career.

WE LOOK FORWARD TO WORKING TOGETHER WITH YOU TO REDUCE THE ECOLOGICAL IMPACTS OF THE CANADIAN HEALTHCARE SYSTEM. THANK YOU FOR CHOOSING TO JOIN US ON THIS JOURNEY.

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1. ENVIRONMENTAL IMPACT OF THE GLOBAL AND CANADIAN HEALTHCARE SYSTEMS

Health Care Without Harm estimates global healthcare emissions to represent 4.4% of worldwide carbon emissions (12). Greenhouse gas and particulate matter emissions from healthcare systems have increased by 29% and 9% respectively between 2000 and 2015, largely related to the doubling of global healthcare expenditures (13). The Canadian healthcare system emitted 33 million carbon dioxide equivalents between 2009 and 2015, or 4.6% of the national total (8). This compares to 6.3% in the United Kingdom (14), 7% in Australia (15), and 10% in the United States (16).

Global healthcare emissions can be divided into three categories: direct emissions from healthcare facilities, indirect emissions from the production and transport of sources of energy (electricity, heat, steam, and cooling), and upstream and downstream emissions from production, transport, consumption and disposal of goods and services that healthcare systems consume (Figure 1) (12). When viewed in this way, the third category, related to supply chains, comprises the vast majority of the global carbon footprint from healthcare systems (71%) (12). Direct emissions from hospitals account for only 17%, while indirect emissions from energy production account for 12% (12).

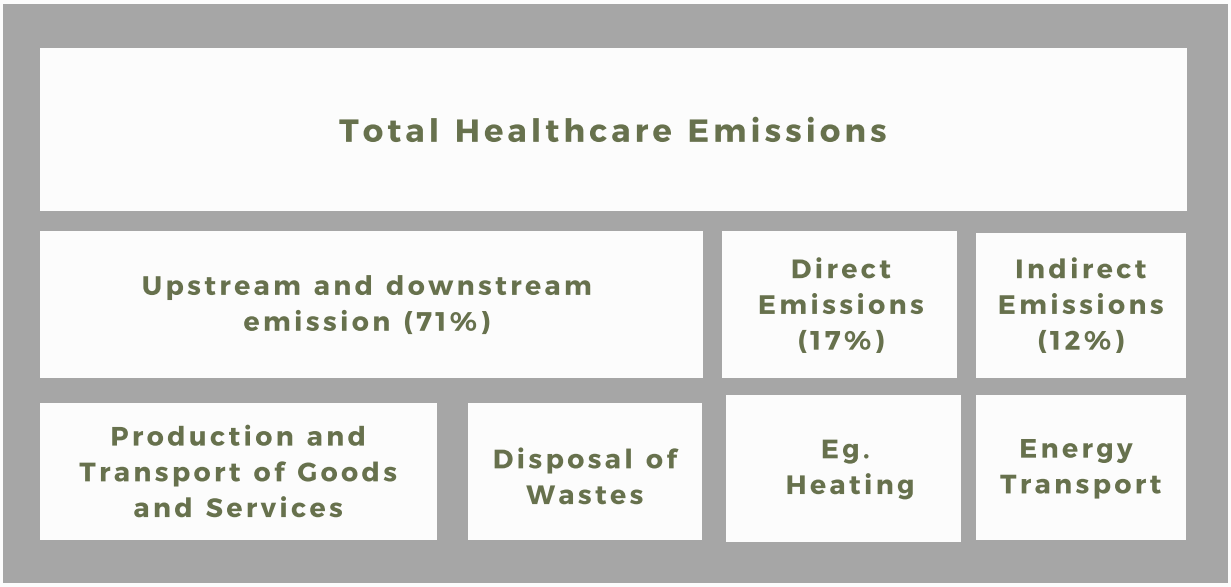

FIGURE 1: BREAKDOWN OF TOTAL HEALTHCARE EMISSIONS BY EMISSION TYPE.

Many industries, such as energy or agriculture, contribute to healthcare emissions in one or more of these categories. For example, energy in the form of natural gas or electricity used to heat hospitals would create direct emissions (category 1), whereas the same commodities used in the production, transport and disposal of other items necessary for hospital function, such as plastics, would be examples of upstream and downstream emissions (category 3). The energy industry, including electricity, oil and gas, and coal power, accounts for more than half of global healthcare carbon emissions (12). In Canada, electricity accounts for 22% of total healthcare emissions and oil and gas account for another 17% (8). The agricultural and the pharmaceutical industry are other important contributors, representing 9% and 5% of healthcare emissions (12). Interestingly, anesthetic gases and metered dose inhalers also account for 0.6% and 0.3% of healthcare emissions respectively (12).

The breakdown of healthcare emissions by industry and source reveals which interventions to prioritize to achieve the most significant reductions in health systems-related climate impacts. As such, high yield interventions may include sourcing more sustainable energy, such as wind or solar, and incorporating climate consciousness into purchasing and procurement. Another essential intervention is the incorporation of circular economy initiatives (explained in detail later) to drive the continuous recovery and regeneration of resources. Finally, many opportunities exist for grassroots greening healthcare projects within healthcare facilities themselves, and are often driven by healthcare practitioners. These initiatives not only reduce the total emissions generated from healthcare system activities, but make it clear to hospital administrators and the public that healthcare providers value environmental sustainability. We will discuss these and other opportunities for change in later sections of this toolkit.

2. MEASURING THE CARBON FOOTPRINT OF HEALTHCARE INSTITUTIONS

2.1 Ecological Footprint

Ecological footprint is defined as the total area of productive land and water required on a continuous basis to produce the resources consumed and to assimilate the wastes produced by a specified population. The ecological footprints of at least two Canadian hospitals, Lion's Gate Hospital in Vancouver, British Columbia, and London Health Sciences Centre in London, Ontario have been previously measured.

CASE STUDY

Lion's Gate Hospital in Vancouver, which occupies 3.95 hectares of land, has an ecological footprint of 2,841 hectares, 719 times larger than its actual size (17). For this hospital, ecological footprint was calculated from the total energy used, goods and services required for operations, materials required for the building's original construction, and footprint generated by medical waste. The ecological footprint of Lion's Gate Hospital dwarfs that of the city of Vancouver, which has an ecological footprint 180 times larger than the city's actual size. This highlights the resource intensive nature of hospitals (18).

The ecological footprint of the London Health Sciences Center was found to be 63,074 global hectares, 384 times larger than its actual footprint (19). The most significant contributors were capital items (see below) and utilities, which accounted for 35% and 31% of the hospital's total footprint respectively. Short life materials and waste (11%) and patient and staff transport (6%) were also notable contributors (19).

DEFINITIONS

CAPITAL ITEMS: Assets that hospitals purchase to perform repeated functions. Examples include heating, ventilation and air conditioning (HVAC) systems, imaging machinery, and sterilization equipment. As these "big purchases" are responsible for the largest portion of hospital energy use and greenhouse gas emission, climate consciousness when sourcing this equipment and climate preferred purchasing practices are major opportunities for greening our healthcare system.

Several resources exist for calculating your own ecological footprint. An example can be found at: www.footprintcalculator.org.

2.2. Measuring Impact by Resource and Emission Source

Hospitals in Canada are encouraged to calculate their carbon footprint through the Canadian Coalition for Green Healthcare's Green Hospital Scorecard. Metrics included in the scorecard are: energy, water, waste, pollution reduction, corporate leadership, transportation, food, and anesthetic gasses. The scorecard asks for the total amount of each commodity used and then generates a score based on the hospital's size and patient capacity. The tool also inquires about the presence of climate-conscious initiatives and infrastructure in the facility, such as systems for efficient generation and/or recycling of resources (eg. solar panels). Please see Section 6: Resources and Helpful Links to download the PDF version form of the CCGHC Green Hospital Scorecard. We highly encourage healthcare students to look through this document, as it discusses almost every facilities-based change that hospitals can undertake to become more green. We have also highlighted some of the unique opportunities for implementation of programs, policies, and green infrastructure below.

PROGRAMS

Does the healthcare facility have _____?

- A green team with full time staff
- Training for staff on waste, water, and energy management
- A program to encourage staff to actively participate in energy saving initiatives
- An initiative to conduct climate resiliency and vulnerability assessments of the facility
- An environmentally sustainable food supply program
- A food waste management program
- A telemedicine program
- An anesthetic gas reduction or recycling program

POLICIES

Does the healthcare facility have _____?

- A corporately recognized environmental mandate with clear environmental targets and systems to track relevant data
- A policy that recognizes climate change as an issue of concern
- A policy for environmental preferred purchasing of hospital supplies, which may include circular economy initiatives
- A policy to select more environmentally preferred materials for hospital construction/renovation

GREEN INFRASTRUCTURE

Does the healthcare facility have _____?

- Renewable energy options
- On-site energy generation (distributed generation)
- Technologies for waste reduction, reuse, or recycling
- Infrastructure to encourage green transportation (bike storage, electric vehicle charging stations etc.)
- Technology to capture and recycle anesthetic gases

3. IDEAS FOR GREENING YOUR HEALTHCARE INSTITUTION

3.1. Green Hospital Policies and Practices

As mentioned previously, the most significant contributors to healthcare institutions' environmental footprint are capital items and utilities (19). Decisions around big-ticket-item purchasing and utility usage are often made at a high level within hospital administration. To ensure that environmental sustainability is being considered alongside cost-effectiveness in these decisions, it is important for established "green teams" to work with hospital policy makers to create high-impact ecological footprint-reduction programs. Healthcare students are well positioned to advocate within green teams on the generation of relevant policies and programs. Our unique role allows us to observe and reflect on sustainability best practices implemented at different institutions as we rotate through many services in different healthcare settings during our educational journeys. Some of the most important practices and policies are highlighted above and in the CAPE's Climate Change Toolkit for Health Professionals, Module 6: Taking Action on Climate Change at Health Facilities. We have also included some ideas of initiatives most amenable to medical student advocacy.

POTENTIAL HEALTHCARE STUDENT QUALITY IMPROVEMENT PROJECTS

- If one does not exist, promote the formation of a green team at your hospital.
- Encourage your hospital to generate a corporate policy on climate change mitigation and ensure that they track their climate impact yearly.
- Petition your hospital to develop an environmentally-preferred purchasing and sustainable procurement policy.
- Promote purchasing of energy efficient capital items such as HVAC systems and waste processing machinery.
- Encourage your institution to provide training and opportunities for staff to participate in energy and waste reduction programs.
- Distribute surveys to understand employees' desire for climate-positive change, and specific areas that they feel will be the highest impact.

3.2. Circular Economy

Suppliers profit when hospitals must continuously buy new products. As a result, suppliers are incentivised to sell non-recyclable and/or non-refurbishable supplies. These include single use or short-term items as well as longer term capital items. The production, use and disposal of these products is ultimately responsible for the majority of the environmental impact of the healthcare industry (12). This linear use of resources can be summarized as take (extracting resources), make (creating products), use, and dump (generating waste) (Figure 2). However, recent shifts in the attitudes of certain companies have enabled new opportunities to engage in a circular economy, whereby resources are used for as long as possible, with minimal value extracted during use, and maximal effort directed toward reprocessing and regenerating products. This promotes the triple bottom line of people, profit, and planet.

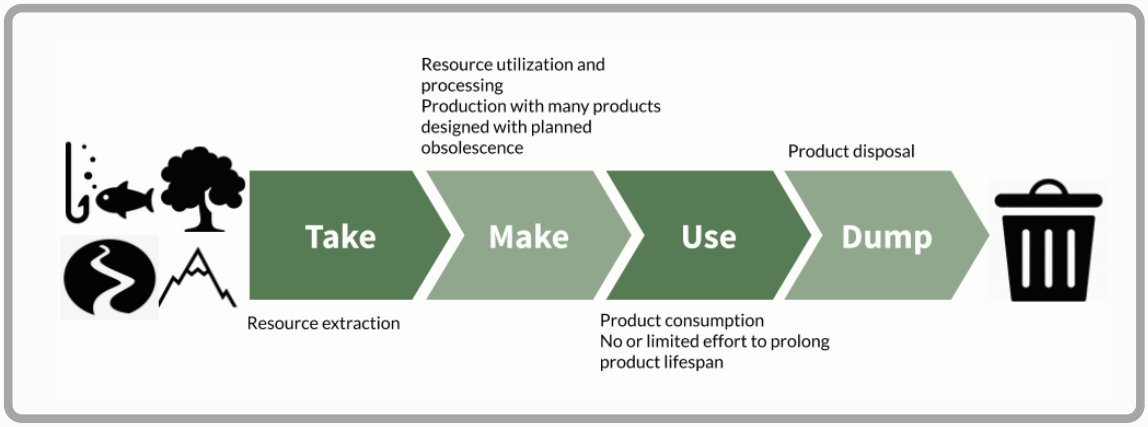

FIGURE 2: LINEAR ECONOMY MODEL

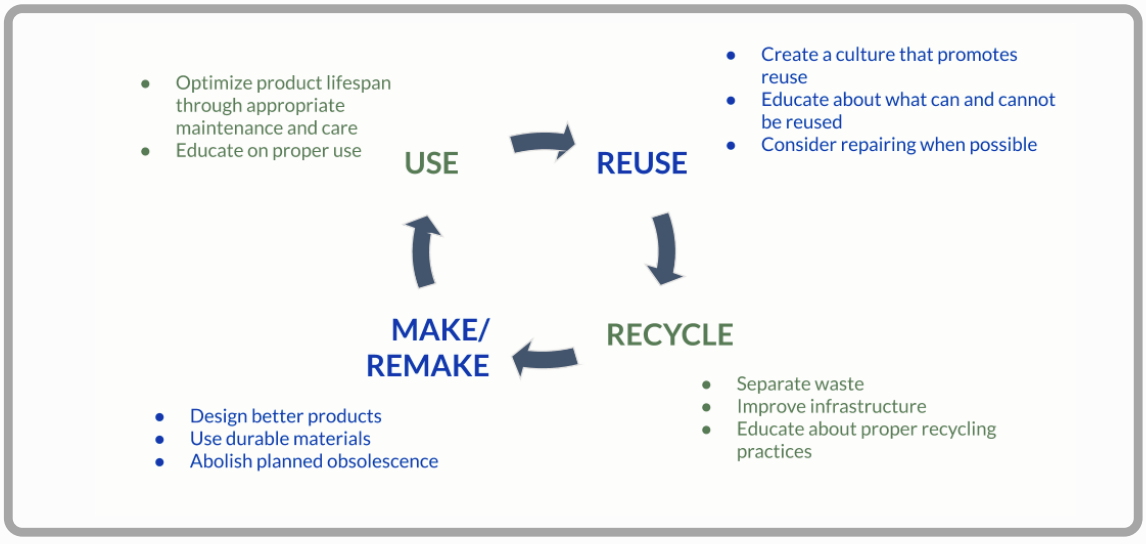

FIGURE 3: CIRCULAR ECONOMY MODEL

The COVID-19 pandemic has put great pressure on global supply chains of medical devices and equipment, providing substantial impetus for healthcare systems to engage in a circular economy to preserve precious resources (20):

CASE STUDY

The COVID-share initiative, developed by the CCGHC, partners those in need and those in supply of medical equipment to enable sharing of excess, reclaimed, or unused resources across the country (http://covidshare.ca/).

Canadian research has shown that a low cost thermal decontamination protocol for N95 respirators can inactivate SARS-CoV-2 and *Escherichia coli* bacterial inoculate and permit their safe reuse (21).

These examples of circular economy practices both enhance the resilience of the Canadian healthcare system to further supply demands and reduce its ecological footprint. Post pandemic, endless opportunities will exist to promote circular economy practices. Physicians and other healthcare providers are well-positioned to advocate for the implementation of circular economy practices post-pandemic; practitioner preference (both related to usage features and other factors, such as environmental impact) can have a strong weight on product purchasing.

Several other examples of circular economy initiatives have already been implemented in our healthcare system. Some have been designed locally by certain healthcare facilities, whereas others are being promoted across a larger scale by stakeholder companies:

CASE STUDY

Technology companies such as Phillips, which are major suppliers of healthcare imaging equipment, are taking significant steps forward in providing recycled and refurbished capital items. They are also changing ownership models to be supplier-centered, such that manufacturers have more of an incentive to limit costs of production and refurbish rather than replace whenever possible.

Grand River Hospital in Kitchener, Ontario, partnered with a third party reprocessing company to reprocess single use operating room tools like surgical trocars. This partnership was made free of cost to the hospital, and resulted in reduction of the cost of waste by $1900 and accumulation of $1000 of purchasing credits in less than a year (22).

POTENTIAL HEALTHCARE STUDENT QUALITY IMPROVEMENT PROJECTS

- Promote circular economy partnerships between your hospital and its suppliers through your green team. Advocate for hospital suppliers to design products without a “take, make, use, dump” mindset.
- Consider starting your own circular economy initiative: identify a potentially reusable product that is traditionally discarded after use. There may be a local company interested in repurposing these, for selling back to the hospital at a discount.
  - Examples: Single use surgical supplies, disposable pediatric pulse oximeters, PPE, and IV bags, syringes, and other plastics.
- Identify local healthcare institutions who are already engaging in circular economy initiatives. You may be able to bridge their corporate partners and enable the scale up of these circular economy practices to other healthcare facilities.
- Implement the validated thermal decontamination method to permit N95 mask reuse.

3.3. Energy Consumption

Energy is the single largest contributor to our healthcare system’s carbon footprint, being used in supply chains and directly in facilities. Hospitals account for 4.1% of the total energy used by commercial and institutional buildings nationally, despite only representing 0.2% of total buildings by number (23). Much of the opportunity for reducing healthcare sector energy consumption is at the level of the decisions made by hospital administration and engineering services departments, as explained earlier. Examples include environmental preferred purchasing and procurement, circular economy, sourcing of renewable energy, switching to more energy-efficient capital items, and incorporating sustainability in engineering designs. We encourage you to find ways to get involved in this high-level decision-making through green teams.

Opportunities also exist to directly reduce hospitals’ energy consumption. Programs that encourage staff to be actively involved in energy management are well positioned to significantly reduce healthcare institution energy bills:

CASE STUDY

Through staff engagement and other low-cost initiatives such as the installation of movement sensors and dimmers, Horizon Health Network in New Brunswick reduced energy costs by $1 million, energy usage by over 21.8 million kilowatt hours, and greenhouse gas emissions by 2,500 tonnes in three years (24).

Reducing energy use in low occupancy locations within hospitals is another encouraging opportunity to minimize consumption:

CASE STUDY

The Markham Stouffville hospital successfully reduced energy usage by implementing schedules for fans and lighting throughout under-used areas of the hospital and converting to LED lights (25).

The Grand River Hospital in Kitchener-Waterloo, Ontario installed a new heating system that was programmed by an in-house building automation system technician to align their use with wing and room occupancy patterns. They were able to reduce their hospital's energy consumption by 16.5% between 2012 and 2013, resulting in $850,000 of cost savings and eliminating 1,201 tonnes of greenhouse gas emissions (26).

It is also important to target energy intensive facilities within hospitals, such as operating rooms (ORs). The control of environmental parameters such as temperature, airflow, and humidity within ORs can be very energy intensive, but is not necessary when they are not in use. In fact, an estimation of Canadian national OR occupancy rates during the years of 2013–2014 found that Canadian ORs were not occupied by patients or being prepared and cleaned 30% of the time between the hours of 8 a.m. and 4 p.m. (Canadian Institute for Health Information, 2015) (27):

CASE STUDY

A green initiative at Providence St. Peter Hospital in Washington state was able to reduce energy use in its ORs by reducing its ventilation system output by 60% during the times when they were unoccupied (28).

A similar effort in the Vancouver General Hospital found that turning off the ventilation systems in unused operating rooms in the middle of the night or on weekends cut their energy use by half (29).

POTENTIAL HEALTHCARE STUDENT QUALITY IMPROVEMENT PROJECTS

- Develop energy reduction policies in conjunction with hospital administration through green teams, including environmentally preferred purchasing, sourcing of renewable energy, and efficient engineering designs.
- Create hospital education resources to encourage staff to actively participate in energy use reduction, including developing energy reduction campaigns such as placing “Turn-me-off” reminder stickers for light switches and computers.
- Purchase and install motion sensors to turn off lights in infrequently-used locations.
- Contribute to funding the switch to energy efficient LED lighting.
- Develop ‘power down’ programs to turn off or turn down all OR lights, anaesthesia, lights, ventilation, and equipment not in current use such as during the middle of the night or on weekends.

3.4. Waste, Pollution, and Toxin Management

Healthcare facilities produce large amounts of waste, and much of it requires special handling due to toxic, chemical, and radioactive contamination (Figure 3). However, it is estimated that 85% of hospital generated waste is non-toxic, and does not require energy intensive processes to be disposed of, such as incineration for biohazardous waste (30). Initiatives centered around the three “R”s, reduce, ruse, and recycle, can decrease total waste production, divert waste from landfill, and minimize the amount of waste that requires energy intensive processing.

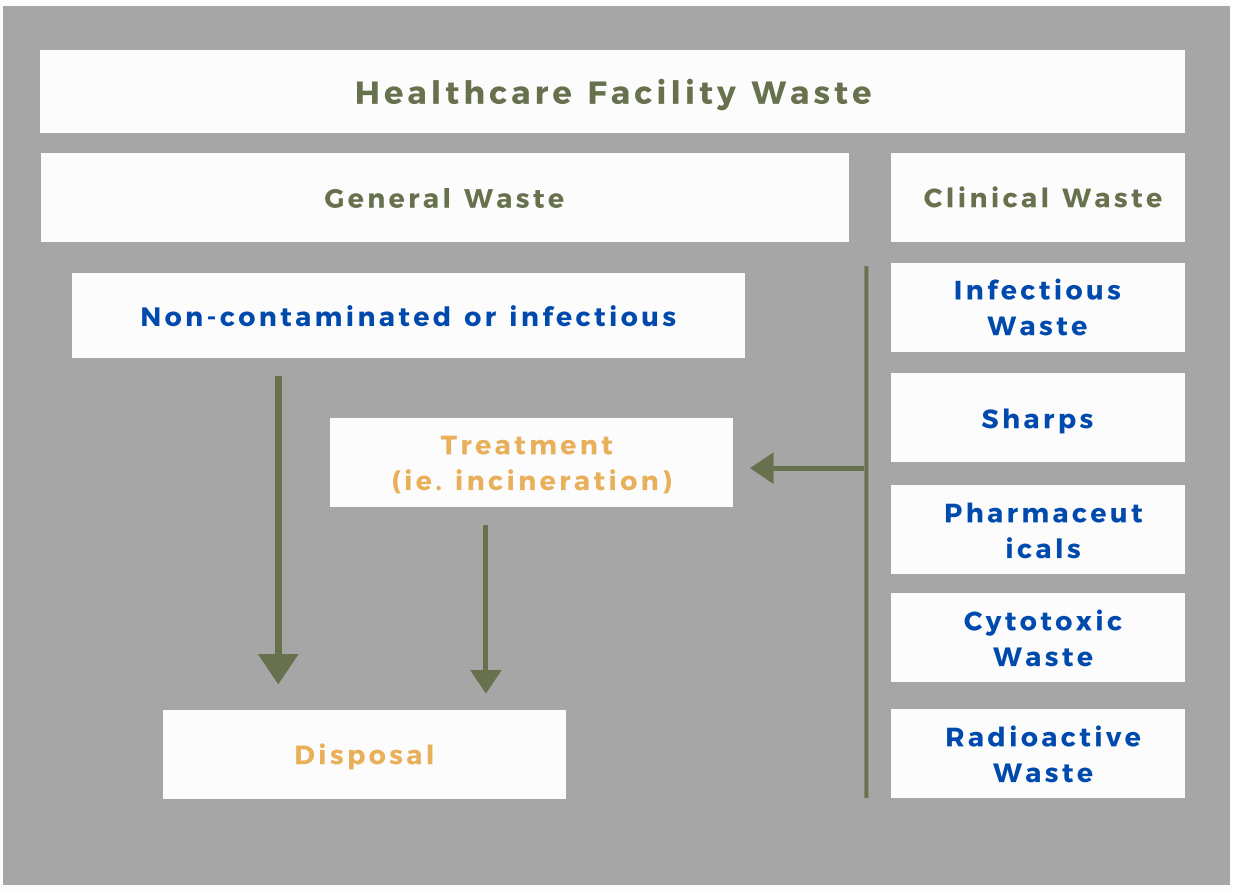

FIGURE 4: TYPES OF WASTE PRODUCED IN HEALTHCARE FACILITIES.

3.4.1 Operating Room Waste

It is estimated that the operating rooms are responsible for between one-quarter and one half of all waste produced in hospitals (31). There are many opportunities for reducing OR waste and greening ORs in general, as summarized in these excellent reviews (32-34).

A) RECYCLING

A large amount of operating room waste has been shown to be recyclable, particularly during the pre-operative set up period, as surgical instruments and tools are removed from their sterile packaging. This has been established across the surgical services. Of the preoperative waste produced in otolaryngology-head and neck surgery and orthopedic operative procedures, 89.7% and 74% was found to be recyclable respectively (35-36). An analysis of OR waste generated from 237 operations performed over one week at the Western Hospital, Melbourne, Australia found that only 258 kg (55%) of the 517 kg of recyclable waste generated was properly recycled (37).

A quarter of waste generated from ORs was found to be associated with anesthesia, of which 58% is recyclable (38). However, a recent national survey administered to the members of the Canadian Anesthesiologists' Society found that only 30.2% of respondents recycled at work (39). Encouragingly, this same study found that 97.5% of anaesthesiologists are willing to recycle at work and 69.1% of respondents indicated an interest in obtaining further education on the topic (39).

B) REDUCING

Improving waste segregation between biohazardous and normal solid waste is a significant opportunity for reducing the ecological footprint of operating rooms. Disposing of biohazardous waste requires incineration processes that consume significantly more energy, cost 10 times than normal solid waste disposal, and release dioxins, toxic chemicals that are harmful to human and environmental health (40). A case study identified that up to 92% of waste disposed through the biohazardous stream was found to be nonhazardous (41). Evidence suggests that this inappropriate streaming of waste is related to lack of healthcare professional awareness in what waste should be considered biohazardous (32):

CASE STUDY

The Green Operating Room Committee at the Carolinas Medical Centre (CMC) reduced the amount of waste placed into red biohazardous waste collection bags by 75%, amounting to cost savings of $60,000 USD annually, after observing that OR staff were throwing away any item that touched a patient into these red bags. They achieved this through educational programming and strategic placement of smaller biohazardous bins in corners of operating rooms, further from general waste bins (42).

Another interesting opportunity to reduce waste production and energy use is through targeting overage. This describes unused surgical supplies that are discarded or must be resterilized after use. Personalizing surgical packs to surgeon preferences can significantly decrease overage:

CASE STUDY

Personalizing surgical packs at the University of Minnesota Medical Center resulted in a cost savings of $81,278 and diversion of 5332 pounds of waste (28,42).

C) REUSING

Many opportunities exist for replacing single use with reusable items in operating roms. Examples include washable linens, rigid containers instead of sterile plastic wrap, reusable gel padding, and refillable sharps containers (33):

CASE STUDY

The University of Maryland Medical Center diverted 138,748 pounds of waste in 2010 by using reusable linens, saving $38,000 in waste hauling costs (28).

3.4.2 Non-Operating Room Waste

Each type of initiative to reduce waste in operating rooms can be adapted to the rest of the hospital. Close observation of any ward or department can identify items that can be reused, that are frequently discarded improperly, or for which overuse occurs:

CASE STUDY

An intriguing example is the “Gloves are off” campaign that was implemented at Great Ormond Street Hospital in England. Through training, awareness, and engagement, this program reduced glove use by 21 tonnes in ten months, saving £90,000. Within a year of the program’s launch, glove use was decreased by one third, or a total of 3.7 million non sterile gloves per year (44).

Finally, pharmaceutical waste constitutes a significant portion of toxin production by the healthcare system. Proper disposal of unused drugs is essential to decrease pharmaceutical contamination of our water systems. Working with pharmacy and nursing teams to ensure drug disposal systems are optimized is an excellent project idea for healthcare students.

POTENTIAL HEALTHCARE STUDENT QUALITY IMPROVEMENT PROJECTS

- Develop educational programs to reduce the overuse of disposable items such as personal protective equipment.
- Audit OR waste streams and develop educational programs to help OR staff correctly identify recyclable, normal solid, and biohazardous waste and properly dispose of these distinct waste streams.
  - Consider consulting this excellent implementation module developed by Practice Greenhealth: Implementation Module: Medical Plastics Recycling in the OR.
- Purchase and place recycling bins with obvious and educational labelling:
  - In OR suites, in more convenient locations than biohazardous waste bins.
  - At all nursing stations.
  - At any locations with a printer, ensuring there are signs differentiating these bins from confidential document shredding bins.
- Purchase reusable equipment to replace single-use items (e.g. linens, sharps containers, and rigid supply containers in operating rooms).
- Develop personalized surgeon packs to decrease overage in operating rooms. The same can be done for any frequently used supply kit in other wards and departments.
- Identify and partner hospitals with single-use item reprocessing companies.
- Develop or pilot a drug disposal program in a hospital or individual ward.

3.5. Food, Food Waste, and Water

The food that patients eat while in hospital not only has the potential to contribute to their healing process but also sets an example for what they should be eating once they are discharged. Promoting the procurement of healthy and sustainable food, alongside strategic food waste management programs, is essential to greening healthcare facilities. An international commission of 37 scientists from 16 countries describe a 'Planetary Health Diet' that maximizes human health as well as environmental sustainability (45). Widespread adoption of this 'Planetary Health Diet' has been estimated to prevent 10.9-11.6 million premature deaths related to climate change per year in addition to the lives that are saved medically (46).

The Planetary Health Diet recommends a dramatic reduction of global red meat consumption by at least 50% and a 2-fold increase in overall consumption of legumes, nuts, fruits and vegetables. These recommendations, which are aligned with the 2019 Canadian Food Guide's Eat Well Plate, are intended to address the detrimental environmental impact of the meat industry (47). For example, recent research has shown that animal products are responsible for 72 to 78% of global agricultural emissions (48). Many hospitals have started implementing programs to reduce meat consumption:

CASE STUDY

The Montefiore Health System in New York developed healthier and more sustainable hospital menus offering more plant-based options, educated patients on the health benefits of a plant-based diet using posters and brochures, and held weekly farmer's markets featuring locally-sourced food for sale, cooking demonstrations, and information about storing and preparing ingredients (49).

In 2014, Johns Hopkins Hospital adopted the "less meat, better meat" strategy, which allowed the hospital to reduce their meat purchasing by 15% and reinvest their savings into procuring healthier, more sustainably produced meats (50).

Additionally, up to 50% of food served at healthcare institutions is thought to be discarded (51). Organic waste from healthcare facilities constitutes an estimated 17% of total waste produced, yet as little as 2% of it is recycled or composted (52). On or off-site composting is essential to divert food waste from landfill:

CASE STUDY

St. Michael's hospital in Toronto has diverted 264 tonnes of organic waste to external composting facilities each year, accounting for 24% of its recyclable waste produced (52).

Water conservation is another important target for greening healthcare. Awareness campaigns to reduce water consumption amongst staff have a significant ability to decrease total water usage in healthcare facilities. Other potential interventions are the installation of low flow and water conserving plumbing systems, refillable water bottle stations, and engineering water conserving irrigation systems for lawns and landscaping:

CASE STUDY

Kingston Health Sciences Center was awarded the Ontario Health Association Water Conservation and Protection Award award for installing water conserving plumbing and faucet systems that reduced total water usage by 25% (53).

St. Peter Hospital in Olympia, Washington upgraded to water-conserving steam-sterilization units and water-free anesthesia gas pumps, and modified many other capital items to save 5.9 million gallons of water or $140,000 per year (54).

The Santa Rosa Memorial Hospital in California phased out single-use water bottles at catering events, patient areas, and nursing units, and saved the hospital $66,000 annually (55).

POTENTIAL HEALTHCARE STUDENT QUALITY IMPROVEMENT PROJECTS

ENVIRONMENTALLY-SUSTAINABLE FOOD

- Start a community garden at a hospital.
- Develop campaigns in hospital cafeterias and dining areas explaining the health benefits of a plant-based diet and the updated 2019 Canadian Food Guide.
- Advocate for the increased representation of fresh produce as well as nutritionally-dense and minimally-processed foods on hospital menus.
- Host farmers markets with local organizations to increase the availability of locally-sourced organic and/or fresh produce.
- Recommend your hospital administration to sign onto the Cool Food Pledge (https://www.coolfoodpledge.org/overview).

FOOD WASTE REDUCTION

- Improve the composting of food waste directly in healthcare facilities through placing compost bins and partnering with compost companies.
- Replace disposable dishes in cafeterias with compostable or recyclable options.
- Install multi-stream waste disposal systems in strategic locations (e.g. cafeterias, patients lounges) within hospitals.

WATER CONVERSATION

- Advocate for water conserving plumbing and capital items as part of your hospital's green team.
- Install water bottle filling stations to reduce the use of single-use water bottles.
- Developing campaigns to raise water awareness amongst hospital staff. This includes reducing personal water use and reporting leaking faucets.

ADDITIONAL RESOURCES:

- LeanPath Website: https://www.leanpath.com/about/. A company that works with medical facilities to reduce food waste.
- Healthcare without Harm: "Healthy Food in Health Care" Initiatives Home Page: https://noharm-uscanada.org/issues/us-canada/healthy-food-health-care

3.6. Transportation

In 2018, transportation was responsible for 25% of Canadian greenhouse gas emissions. This was second only to the oil and gas industry itself at 26% (56). Programs that promote climate-friendly transportation, or eliminate the need for transportation altogether amongst staff and patients, can contribute to decreasing healthcare emissions. Hospitals should also be actively promoting the use of zero-emissions vehicles by providing charging stations for use at their facilities.

CASE STUDY

The Vancouver General Hospital Cycling Center provides an excellent indoor bicycle parking and change facility for staff to use. Of note, the need for an initiative like this was identified through a staff survey (57).

Reducing the need for patient transport can be also achieved through telehealth platforms. It has been estimated that telemedicine appointments can decrease emissions by 40-70 percent when compared to commutes to appointments with single occupancy vehicles (58). In addition, telemedicine can lower costs for patients by eliminating commutes and potential opportunity costs of missed work, and expand access to healthcare, particularly in underserved and remote communities (59-60). The COVID-19 pandemic has resulted in a large shift of healthcare to virtual visits. Physicians and healthcare students should be encouraged to continue using these platforms post-pandemic when feasible and clinically-safe.

POTENTIAL HEALTHCARE STUDENT QUALITY IMPROVEMENT PROJECTS

- Contribute to funding the construction of locked or indoor bicycle storage facilities.
- Coordinate 'Take the stairs campaigns' by posting creative signs in stairwells or painting health information (such as calories burned) on stairs themselves.
- Campaign to discourage idling by posting signs in parking lots and at drop-off locations.
- Promote telehealth by encouraging staff physicians to offer telehealth services when it is safe and feasible for patient care to do so.
- Work with hospital administration and/or green teams to construct zero-emission vehicle charging stations in hospital parking lots.

4. CHOOSING GREENER HEALTHCARE PRACTICES

4.1. Choose dry-powdered inhalers over metered-dose inhalers in the maintenance therapy of obstructive lung disease

Inhaler-delivered corticosteroids and bronchodilators generally come in two forms, metered dose inhalers (MDIs) and dry-powdered inhalers (DPIs), with similar clinical and cost-effectiveness. A recent assessment suggests that physicians generally have no preference between MDIs and DPIs and that patients prefer devices that are “simple and easy to follow" (61). However, MDIs are an important contributor to healthcare’s climate footprint; 3.1% of the carbon footprint of the English National Health Service has been estimated to be associated with the use of MDIs (62). Research has shown that MDIs produced 20–30 times larger carbon footprints than the DPIs, a difference largely attributable to the hydrofluorocarbon-based propellant used in MDIs (63). Taken together, DPIs should be preferred to MDIs for the maintenance therapy of asthma or COPD, but any decision to start or change to a DPI must be conducted in accordance with a shared decision-making framework (64). This evidence-based decision aid for patients with asthma developed by the United Kingdom’s National Institute of Health and Care Excellence (NICE) can help you select the most suitable inhaler modality with your patients (65).

4.2. Isoflurane and sevoflurane should be favoured to desflurane use for surgical anaesthesia

Some anaesthetic gases used for surgical procedures are also potent greenhouse gases, and are often vented into the outside community from Canadian hospitals. Research has shown that desflurane has an atmospheric lifetime of 21 years and traps 15-20 times more heat than other anaesthetic gases such as isoflurane and sevoflurane (66-67). Canadian hospitals could restrict the use of desflurane and nitrous oxide anesthetic gases only to cases where they will significantly benefit patients relative to alternative anaesthetic formulations.

The user-friendly smartphone application available in both Android and iOS formats, “Anaesthetic Impact Calculator”, developed by the Association of Anaesthetists can be used to perform real-time calculations on the carbon footprint and cost of the chosen inhaled anaesthetic and demonstrate the differential impact of choosing different gases and lower gas flows (68). Campaigns to encourage use of this “Anaesthetic Impact Calculator” could help anaesthesiologists better visualize the environmental impacts of their choices during cases and may encourage lower anaesthetic gas flows and reduced utilization of desflurane during procedures. Also, improved uptake of anesthetic gas capture and reutilization in hospitals around Canada, such as the partnership between the University Health Network in Toronto and Blue-Zone Technologies, can also further reduce the ecological impacts of anesthetic care and the costs of purchasing of anesthetic gas products (69).

5. STEPS TO MOBILIZE EFFECTIVELY FOR GREENER HEALTHCARE

It is absolutely normal to be passionate about climate action but unsure of what is needed to successfully implement a greening healthcare initiative. In fact, if you are like most of us, you may not even know where to start. However, greening healthcare does not have to be complicated, especially if actions are taken to identify like-minded allies, perform a needs assessment to propose a solution that specifically addresses an observed problem, and seek out colleagues and hospital administrators who are well positioned to facilitate the changes you aim to make. In this section, we hope to show you how to implement an impactful greening healthcare project in five simple steps.

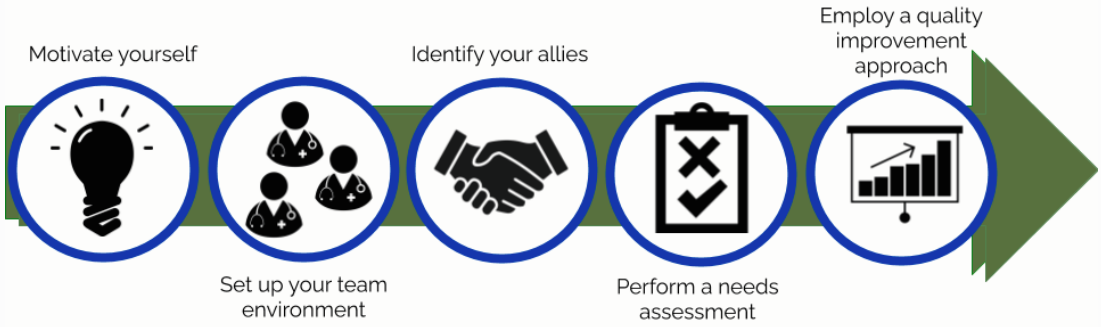

FIGURE 5: 5 STEPS TO MOBILIZE EFFECTIVELY FOR GREENING HEALTHCARE

5.1. Motivate yourself and ensure that social justice lies at the heart of your climate action

When starting a greening healthcare project, it is important to reflect on your motivations and expectations; know why you are doing this and what you hope to get out of it. Effective climate action needs to be centered on social justice, as climate change disproportionately impacts Indigenous, Black and other racialized bodies (70). This is certainly related to the fact that heavily polluting infrastructure tends to be clustered near communities of colour, and that the land fundamental to the health of Indigenous peoples is being undermined by continued industrial consumption and exploitation (71-72). Thus, all recovery efforts must prioritize equity and seek to address structural and systemic racism.

Remember that the effects of reducing the environmental footprint of our healthcare system are threefold: not only are you contributing to mitigating climate change and rejuvenating our environment, but you will also be reducing health inequities and advancing the health and resilience of our communities. These latter two points are what will incentivise hospital stakeholders to work with you towards greener healthcare, so don't forget to constantly emphasize and reemphasize them.

THOUGHTS TO CONSIDER:

- Establish unique personal goals for engaging in your greening healthcare project. Know that your work may be a springboard off which you are able to act as an environmental advocate throughout your career.
- Healthcare institutions want to work with you. Most facilities are eager to advertise their success stories in reducing climate impact, and having these projects completed by healthcare students only adds to the praise.
- Most healthcare facilities already have the personnel, motivation, and capacity to reduce their environmental impact. However, change is often realized slowly. You can be the final push that accelerates the healthcare institution towards sustained greening healthcare action.
- Many of us are settlers on the unceded traditional territories of our Indigenous communities. Consider how you can prioritize the long-held Indigenous conceptions of planetary health and ways of knowing centered on the interconnectedness of all living things into your work. This can start by reading these practical recommendations for integrating Indigenous knowledge systems into sustainable healthcare (73).
- Inform yourself on environmental racism and how to confront it (74). This can start by reading Dr. Waldron's book that explores the impacts of environmental racism on Indigenous and Black communities in Canada, *There's Something In The Water*, or by watching its accompanying film version (75). Consider how you can build a diverse team that involves racialized voices typically under-represented in the climate action discourse.

5.2. Set up a team environment conducive to success

Working in teams offers unique advantages in pooling and complementing the unique skills and diverse perspectives held by each team member. This is particularly important in the context of greening healthcare project teams, that will likely consist of healthcare students at different stages of their education. For example, increased clinical experience by more senior students may be better suited for idea generation, whereas junior students may have the time and flexibility conducive to conducting greening healthcare projects.

THOUGHTS TO CONSIDER:

- Build your unique team culture. Establish a collective identity by taking time during your first team meeting to name your team and if relevant, suggest potential logo designs.
- Set expectations through an informal team agreement which clearly articulates group goals, values and norms. This should also outline communication and reporting channels as well as professional accountability related to attendance and behaviour. As the project may evolve over time, consider revisiting this group expectations document iteratively.
- Decide upon and delegate your key roles (examples include the leader/facilitator, recorder, prioritizer, and time keeper). As the project may evolve over time, consider revisiting these roles and their delegations iteratively.
- Establish a tentative but clear timeline including short-term and long-term outcome objectives.
- Prepare and carefully record meeting minutes documents. Consider setting aside 1-2 minutes at the end of each team meeting to reflect on the meeting and give space for participants to make suggestions to improve future meetings.

5.3. Identify your allies

Greening healthcare may not be often talked about in break rooms or between patients. Without you knowing it, other healthcare providers and hospital staff at your institution may have a greening healthcare project ongoing or be interested in working with you on one. In addition, you will need to earn buy-in from certain key hospital stakeholders to make any initiative possible. Identifying a diverse group of allies is key to conducting an effective and long-lasting greening healthcare project.

THOUGHTS TO CONSIDER:

- Does your institution have a **green team**? If so, these will be your people. If not, consider making one with the allies identified in the subsequent points! Ensure that your green team is advocating for and implementing the practices and policies highlighted above.
- Who is making green changes to their practice already? For example, take note of a nurse who goes the extra mile to recycle or the doctor who is reducing their prescribing of metered dose inhalers.
- What green projects are already underway at your hospital, and who is leading them? These may be published online (see the following example from Hamilton Health Sciences https://www.hamiltonhealthsciences.ca/share/environmental-impact/)
- Identify and map out your stakeholders. These are individuals or groups that are impacted or can contribute to your project. Create a stakeholder database of names, emails, phone numbers and other contact information.
- Consider partnering with your hospital's environmental services and/or purchasing department. These groups often make the bulk of decisions that affect an institution's climate performance.
- Consider an informal survey to actively seek out potential allies among the healthcare staff and employees at your institution. This can also assess overall interest in greening healthcare at the facility. If you are able to connect with a senior clinician and/or administrator at your institution, they can often help you to distribute surveys and any other marketing material.

5.4. Perform a needs assessment to articulate your problem and proposed solution

Holistic analysis of the problem that your team is aiming to address is essential to make meaningful and lasting impacts. In addition, your proposed solutions will have barriers and facilitators to implementation that are specific to the local milieu of your target healthcare institution. Take the time to elicit these context-dependent variables by researching your target institution and speaking with its staff. This will help you determine which greening initiatives and solutions are most compatible to your local context and purpose.

THOUGHTS TO CONSIDER:

- Research your hospital's 5 or 10 year plan and see if there are any broad institutional sustainability goals that your project can align itself to. If so, highlight this plan when speaking to hospital leadership or administration and borrow from their vocabulary.
- Clearly define the problem and form an explicit problem statement. What is the source of climate impact that you are trying to change and what factors are contributing to it? Has anyone already taken any steps to remedy the problem? If so, what barriers have they faced and what successes have they had?
- Brainstorm a spectrum of potential solutions. Speak to local stakeholders and the green team to better understand which of these potential solutions are most feasible to implementation in the institution's local context.
- Consider the feasibility of your proposed solution. How much individual effort from hospital employees is required to implement your solution? When less effort is needed and the impacts are easily apparent, your initiative is more likely to be long-lasting and sustainable.
- Consider the local context of your proposed solution. If you are aware of a nearby institution that is more green than your target facility, you may be able to adapt their practices to your own. This is particularly true if initiatives rely on external partners, such as waste companies.

5.5. Approach your sustainability project with a quality improvement lens by establishing outcome metrics and constantly tracking your progress

Quality Improvement (QI) in healthcare is an iterative process by which care is continuously improved for patients. Health Quality Ontario (HQO) stresses nine attributes of high quality health systems, of which greening healthcare contributes to many, most notably efficiency and focus on population health (76). Please see Section 6: Resources and Helpful Links to review the quality improvement guide published by HQO, an excellent resource around which to model your green quality improvement projects. In accordance with the HQO's "Model for Improvement," quality improvement must be centered on established quality metrics, as only what is measured can be improved. Thus, it is crucial to take the time to reflect on meaningful outcome measures that can capture or estimate your impacts and iteratively use those as benchmarks to measure your progress towards your ecological sustainability goals. Keep in mind that these outcome measures do not have to be quantitative; in fact, rich qualitative outcome information can be gleaned through interviews and surveys. Effective documentation of impact can even permit the publication of your quality improvement efforts in scholarly journals.

THOUGHTS TO CONSIDER:

- Set SMART Goals for green quality improvement that are Specific, Measurable, Attainable, Relevant and Time-Bound.
- Determine potential quality outcomes measures to assess your impact. This will help you quantify change over time and permit the comparisons of your successes to others. These do not only have to be measured by the resource you are targeting. Changes in attitudes, knowledge, and behaviours can be quantified too, particularly through surveys.
- With the spectrum of ideas that you have identified in the previous step, conduct small, brief pilots of each of them and assess their impact on your quality outcome measures. This iterative process of rapid cycle improvement (Plan → Do → Study → Act) will help you systematically determine the most suitable green quality improvement approach for further development and/or scale-up (76).

THOUGHTS TO CONSIDER:

- Consider quantifying other sources of climate impact unrelated to your area of focus such as energy use, waste production, and water consumption. This will help you keep an eye and ear out for future greening projects.
- Monitor the attitudes and interests of other hospital employees to engage in further greening healthcare projects. Your initiative may be a motivation for other, larger green changes to occur.
- Reflect on your work. Greening healthcare is only one way that clinicians and medical students can decrease their environmental impact. Ensure that you are modelling and incorporating positive environmental change into both your personal and professional life, and encourage patients to do the same.

6. RESOURCES AND HELPFUL LINKS

CANADIAN ASSOCIATION OF PHYSICIANS FOR THE ENVIRONMENT

Climate Change Toolkit for Health Professionals:
https://cape.ca/campaigns/climate-health-policy/climate-change-toolkit-for-health-professionals/

CANADIAN COALITION FOR GREEN HEALTHCARE

A) Green Hospital Scorecard: https://greenhealthcare.ca/wp-content/uploads/2019/09/2019-Green-Hospital-Scorecard-Survey-Entries.pdf
B) Green Office Toolkit: https://greenhealthcare.ca/green-office-toolkit/
C) Green Facility Toolkit: https://greenhealthcare.ca/ghgwater/

CENTRE FOR SUSTAINABLE HEALTH SYSTEMS

Sustainability Snapshot Series:
https://www.sustainablehealthsystems.ca/snapshot-series

HEALTH CARE WITHOUT HARM

Health Care's Climate Footprint Report:
https://noharm-global.org/sites/default/files/documents-files/5961/HealthCaresClimateFootprint_092319.pdf

HEALTH QUALITY ONTARIO

Quality Improvement Guide:
https://www.hqontario.ca/portals/0/documents/qi/qi-quality-improve-guide-2012-en.pdf

UNIVERSITY OF WESTERN ONTARIO

People, planet and profits: the case for greening operating rooms:
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3503903/

JOINT POSITION STATEMENT TOWARDS AN ENVIRONMENTALLY SUSTAINABLE HEALTH SECTOR:

https://greenhealthcare.ca/wp-content/uploads/2015/04/Joint-Statement-CCGHC.pdf

WORLD HEALTH ORGANIZATION

Operational framework for building climate resilient health systems:
https://www.who.int/globalchange/publications/building-climate-resilient-health-systems/en/

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