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Review

Combating climate change in the clinic: Cost-effective strategies to decrease the carbon footprint of outpatient dermatologic practice



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ABSTRACT

There have been numerous studies highlighting the negative impact that climate change has already had and is expected to continue to have on patients and their health. Notably, the health care industry has been identified as a major contributor to the global carbon footprint, highlighting a major opportunity for practitioners to intervene. However, the large majority of the literature on strategies to reduce health care's contribution to climate change focuses solely on the inpatient setting. We review a variety of strategies for clinicians in the outpatient setting to adjust their practices to combat climate change. Summarizing the best evidence from other industries and translating recommendations from the literature on inpatient practice, we identify a wide range of opportunities for intervention, many of which are easy to implement and cost-effective. These general strategies to reduce both the carbon footprint and monthly operating costs of an outpatient clinic should be of interest to any practicing physician, both dermatologists and nondermatologists.

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Introduction

In their September 2019 report, Health Care Without Harm reported the first-ever global estimates of health care's contributions to climate change (Karliner et al., 2019; Salas and Solomon, 2019). The group reports that the health sector is responsible for an alarmingly large proportion of the global climate footprint, constituting 4.4% of global net emissions. Given this estimate, if the global healthcare sector were considered as an independent country, it would rank fifth in total carbon emissions. Health care in the United States alone would rank 13th, emitting more greenhouse gases (GHG) than the entire United Kingdom. Health care constitutes a major contributor to climate change, and changes to health care infrastructure and practice are crucial in stemming the progress of climate change (Eckelman and Sherman, 2016).

In addition to the benefits for our planet, this effort would have direct benefits for patients. In their latest prediction, the World Health Organization estimated that climate change will cause 250,000 deaths per year between 2030 and 2050 (World Health Organization, 2014). Health care's contributions to these health effects have already been documented: The 613 million metric tons of carbon dioxide equivalents emitted by the U.S. health care system in 2013 alone have been projected to cause between 123,000 and 381,000 disability-adjusted life-years in future health damages (Eckelman and Sherman, 2018). Given health care's major role in GHG emission and the associated health effects of these emissions, there is an opportunity for health care professionals to identify and address the underlying behaviors and systematic contributors to the sector's substantial carbon footprint in an effort to mitigate these detrimental effects.

Outpatient health care energy use, which corresponds to most dermatology practice settings, is higher by square foot than in the inpatient setting (Mills, 2011). Outpatient clinics and providers, who provide the majority of health care in the United States, are estimated to represent a quarter of all of health care-associated energy consumption (Bernstein et al., 2003; McKenney et al., 2010). Although much of the current literature with respect to reducing the carbon footprint of health care is focused on the inpatient setting, there is a growing body of literature regarding outpatient clinical settings. Herein, we review the existing recommendations for mitigating health care's contribution to climate change. In the process, we identify practical opportunities and strategies to combat climate change in the outpatient setting.

Opportunities for intervention

To mitigate health care's contribution to climate change, the sector's major modifiable sources of GHG emissions must first be identified. To this end, a number of U.S.-based and international organizations, including Health Care Without Harm, My Green Doctor, and Practice Greenhealth, have outlined various opportunities and strategies for intervention in both the inpatient and outpatient setting (see also *Greening the Office*, another article in this special issue on climate change that provides links to these various organizations and their resources). Herein, we discuss the two categories of modifiable behaviors that are most relevant for outpatient practice: energy consumption and waste management.

Perhaps the most immediately actionable area for reduction in GHG production in the outpatient setting is energy consumption. Energy consumption can be divided into two domains. The first domain consists of plug-and-process load (PPL) energy use, which is the energy derived from electrical outlets, and currently represents a third of energy use in commercial buildings (McKenney et al., 2010; Salas and Solomon, 2019). In an analysis of PPL energy use patterns in outpatient practices, the National Renewable

Energy Laboratory identified the top energy-using spaces as the provider breakroom, nurse/work stations, and examination rooms (Sheppy et al., 2014). Notably, in this analysis, dermatology ranked second among the specialties examined with respect to regular energy use on a weekly basis. The second domain of energy consumption comprises general lighting, heating, ventilation, cooling, and water heating, which together constitute the majority of energy consumption in commercial buildings.

What can health care professionals do to reduce this energy use? Practice Greenhealth divides energy reduction practices into two major categories: demand-side management (or decreasing the use of energy within the building) and supply-side management (or replacing conventional energy generated by fossil fuel combustion with more sustainable energy sources, such as solar, hydroelectric, or other renewable sources; Table 1). Importantly, as with many sustainability efforts, some of these interventions may be more costly to implement than traditional approaches, but they have repeatedly been demonstrated to be cost-saving in the long run (Brooks et al., 2018; Lorenzi, 2018). Practice Greenhealth offers a free resource to inform these initiatives, and My Green Doctor provides easy-to-follow workbooks and instructions to implement these changes (My Green Doctor, 2017a; 2017b; Practice Greenhealth, 2017).

Energy

Commissioning

Commissioning is defined as the process of ensuring that a building's operating systems are optimized for energy-efficient performance. These processes can involve simple procedures, such as ensuring that thermostats and other sensors are properly calibrated and matching building settings to actual use with respect to hours and occupancy. They can also involve more complex procedures, such as replacing or repairing equipment that is malfunctioning, not installed correctly, or the wrong size for the building. By some estimates, the commissioning of an outpatient health care facility can result in a 15% reduction in energy use and produce cost savings within a year (Mills, 2009).

Lighting modifications

One simple adjustment that can result in meaningful savings is replacing conventional incandescent or fluorescent-tube lighting with light emitting diode lighting, which uses 75% less energy and lasts 25 times as long (U.S. Department of Energy, 2014). Similarly, installing light-adjustment technologies to automatically turn off lights when a room or area is empty or based on the amount of natural light present has been reported to result in 24% to 28% reductions in light-associated energy use (Williams et al., 2013). The U.S. Department of Energy reports that replacing just five lightbulbs with more energy-efficient bulbs can result in a cost savings of \$75 per year (U.S. Department of Energy, 2014).

Heating and cooling

Energy Star reports that heating and cooling typically account for a quarter of a building's energy use. Just as with lighting, employing occupancy-sensors to trigger these systems can result in a substantial amount of energy savings. These systems are also prone to becoming less efficient over time, and their performance and efficiency can be augmented with regular maintenance and cleaning (Energy Star, 2008). My Green Doctor recommends setting office thermostats to 74°F (23 °C) in the summer and 68°F (20 °C) in the winter (My Green Doctor, 2017a), a policy that the American

Table 1
Recommended interventions to decrease the carbon footprint of outpatient dermatology clinics.

Intervention	Implementation
Commissioning	<ul style="list-style-type: none"> • Calibrate, improve, or replace energy-inefficient building systems with greener alternatives. • Ensure proper function of thermostat sensors; schedule thermostat to function only during business hours and operations. • Replace or repair malfunctioning equipment or system components that are not the appropriate size for the building.
Lighting modifications	<ul style="list-style-type: none"> • Replace energy-inefficient conventional incandescent or fluorescent-tube lighting with compact fluorescent lamps or light emitting diode lighting • Install light-adjustment technologies to automatically turn off lights when a room or area is empty or based on the amount of natural light present.
Heating and cooling	<ul style="list-style-type: none"> • Activate heating and cooling systems only when rooms or building areas are populated. • Set office thermostats to 74°F (23 °C) in the summer and 68°F (20 °C) in the winter for optimal energy consumption. • Consider turning off water heating systems.
Reduce standby energy use	<ul style="list-style-type: none"> • Remind clinic employees to turn off or unplug all computers, chargers, and lights at the end of the day. • Adjust computer settings to automatically enter a hibernating or shutdown state after a set period of time of inactivity.
Replace appliances with energy-efficient alternatives	<ul style="list-style-type: none"> • Substitute energy-inefficient machines with greener alternatives, including appliances such as computers, monitors, printers, scanners, external power adaptors, copiers, fax machines, digital duplicators, mailing machines, and water coolers.
Supply-side interventions	<ul style="list-style-type: none"> • Purchase energy collected from wind, hydroelectric, biomass, or solar sources. • Install photovoltaic solar cell panels to collect and use renewable energy onsite.
Recycling and environmentally preferable purchasing	<ul style="list-style-type: none"> • Use 100% recycled paper. • Purchase products with less packaging that are free of harmful components, such as latex, polyvinyl chloride, and di-ethyl-hexyl phthalate.
Water conservation and water-related waste	<ul style="list-style-type: none"> • Replace washroom toilets and faucets with alternatives that use less water, such as those that are marked with the U.S. Environmental Protection Agency's WaterSense label. • Replace disposable Styrofoam cups with biodegradable or recyclable cups.
Reduce regulated medical waste	<ul style="list-style-type: none"> • Clearly indicate which materials are considered medical waste according to the Occupational Safety and Hazard Administration's bloodborne pathogens standard. • Replace toxic cleaning products with nontoxic alternatives.

Medical Association also endorses ([American Medical Association, 2017](#)). Because dermatology patients often must change into a gown for a skin examination, there is the potential for discomfort during colder times of the year, which can be mitigated by asking patients to bring articles of clothing (e.g., jacket, sweatpants, or a bathrobe) that they can wear in addition to the gown when not being examined.

Water heating also requires a considerable amount of energy and may not be necessary. In one case, the Escambia County Health Department in Florida recognized that there was no evidence of health benefits of hot water use, motivating them to turn off the water heaters in the county's five clinics ([Howard, 2013](#)). This simple intervention resulted in thousands of dollars saved per year and eliminated one of the major sources of energy use in those buildings.

For clinics in colder climates, where shutting off water heaters may not be an option, turning down the temperature to which water is heated is a cost- and energy-effective alternative. It is estimated that 3% to 5% of the cost of an energy bill can be cut for every 10°F that the water heater's thermostat is lowered ([U.S. Department of Energy, 2014](#)).

Reducing standby energy use

Standby energy use refers to energy used by technologies, such as computers and printers, that are in standby mode or turned off but remain plugged in. The [U.S. Department of Energy \(2011a\)](#) has reported that standby energy use can account for up to 5% of a building's total electrical plug load. As a result, one way to immediately reduce energy use and save on energy costs is to promote an unplug policy, reminding practice members to turn off or unplug all computers, chargers, and lights at the end of the day ([Carroll et al., 2009](#); [U.S. Department of Energy, 2011a](#)). Because computers draw 94% less energy when in a hibernating state compared with when idle, adjusting one's computer settings to auto-

matically enter a hibernating or shutdown state after a set period of time would also provide significant reductions in energy usage, particularly during periods when generally not in use, such as overnight and on weekends ([Shameer et al., 2015](#)). Alternatively, this standby energy consumption can be addressed by using power strips with an automatic shutoff feature that senses when a device has entered a standby or off mode and stops drawing energy. Notably, office buildings have been reported to be unoccupied as much as 75% of the hours in a year, suggesting that these interventions can result in a significant decrease in overall energy use ([Lobato et al., 2012](#)).

Replacing appliances with energy-efficient alternatives

By replacing energy-inefficient office devices with more efficient equipment, outpatient facilities can decrease associated energy use from anywhere between 30% and 75% ([U.S. Department of Energy, 2011a](#)). Available devices include computers, monitors, printers, scanners, external power adaptors, copiers, fax machines, digital duplicators, mailing machines, and water coolers. The provider breakroom has also been identified as a top source of energy use in outpatient clinics ([Sheppy et al., 2014](#)); thus, replacing old appliances in the breakroom with newer, more energy-efficient ones is also a major opportunity for energy and cost savings.

Supply-side interventions

Whereas demand-side interventions center on changing how energy is used, supply-side strategies focus on changing where energy is derived from. Outpatient facilities can do this either by purchasing renewable energy (e.g., wind, hydroelectric, biomass, or solar energy) or by installing renewable energy procurement technologies onsite. The types of renewable energy available to practices vary by region, and local utility companies can inform

practice managers about which energy types are a viable option (U.S. Department of Energy, 2011b).

The main method for onsite renewable energy generation is solar power. Practices can install photovoltaic solar cell panels to generate a portion of the facility's energy or replace traditional water heaters with solar-powered water heaters (see also *Greening the Office*, another article in this special issue on climate change that provides links to these various organizations and their resources).

Waste

The health care industry also contributes to GHG emissions through a lack of recycling, the disposal of reusable or repurposable medical products, suboptimal water usage, and the misdirection of regular waste into regulated medical waste processing.

Recycling and environmentally preferable purchasing

Recycling and purchasing recycled goods are additional ways that medical professionals can decrease waste in health care as well as minimize the negative impacts of producing new or potentially harmful products. Recycling can be promoted in a practice by increasing the number of recycling bins and installing clear signage and guidance nearby (Ryan-Fogarty et al., 2016). For example, by using 100% recycled paper, health care facilities can support a manufacturing process with 44% lower energy use, 37% less GHG emissions, and half as much solid waste and water use (Kwakye et al., 2011).

Greener product purchasing also has implications for patients and public health (Sutherland et al., 2018). By switching to safer cleaning products, converting to products with less packaging that are free of latex, polyvinyl chloride, and di-ethylhexyl phthalate, health care practices can also prevent allergic reactions and reduce asthma exacerbations, eye damage, burns, and indirect contamination of the water supply.

Water conservation and water-related waste

Water use can also be optimized to reduce waste and cut operational costs. *My Green Doctor* (2017b) estimates that adoption of water conservation practices can reduce water consumption by up to one-third, with broad cost benefits from lower water, sewer, and energy bills to lower maintenance costs. These benefits can be obtained by replacing washroom toilets and faucets with water-efficient alternatives, such as those marked with the U.S. Environmental Protection Agency's WaterSense label, and designating toilets that use 20% less water and sinks that use 30% less water, thereby saving resources and cutting costs without compromising performance (Grumbles, 2008). Water-related waste can also be addressed by replacing disposable Styrofoam cups with cups that are biodegradable or made from recyclable plastic.

Reducing regulated medical waste

Regulated medical waste (RMW), including plastics, chemicals, paper, food, needles, packaging, and electronic equipment, is ultimately buried or incinerated, polluting the air and water supplies (Healthier Hospitals). RMW contains numerous toxic components and its disposal is 5 to 10 times more expensive than that of non-regulated waste. Importantly, there is a relatively limited scope of materials that constitute RMW and must be disposed of accordingly. Disposing of items that are not RMW with regular trash can reduce the increased carbon footprint of RMW processing for these items. Specifically, RMW is defined by the U.S. Occupational

Safety and Hazard Administration's bloodborne pathogens standard as:

Liquid or semi-liquid blood or other potentially infectious materials; contaminated items that would release blood or other potentially infectious materials (OPIM) in a liquid or semi-liquid state if compressed; items that are caked with dried blood or other potentially infectious materials and are capable of releasing these materials during handling; contaminated sharps; and pathological and microbiological wastes containing blood or OPIM (U.S. Occupational Safety and Hazard Administration, 2017).

Another modifiable contributor to RMW is toxic cleaning products, which can be replaced with nontoxic alternatives to decrease hazardous waste. To decrease the frequency of inappropriate disposal of nontoxic material into RMW bins, outpatient clinics can draw from a number of strategies outlined by the Practice Greenhealth's Healthier Hospitals Initiative, including clear signage and smaller RMW containers (Practice Greenhealth, 2015).

Conclusion

Health care is a top contributor to climate change, which is predicted to cause significant morbidity and mortality in the coming decades. Health care professionals are committed to the notion of "first, do no harm," which extends to limiting any indirect negative consequences of their medical practice. Herein, we have outlined a number of behaviors and interventions that health care providers can implement to reduce their practice's carbon footprint, many of which also provide a financial benefit in the form of reduced utilities and equipment costs. By employing these strategies—and, crucially, by sharing them with patients so that they may employ them as well—health care professionals can promote a more sustainable, healthier, and more accessible form of medical practice.

Conflict of Interest

None.

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