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Estimating greenhouse gas emissions from the health sector in Canada: Mind the gap

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Abstract

Healthcare is a surprisingly large contributor to climate change, responsible for a significant quantity of global Greenhouse Gas (GHG) emissions. Global commitments to achieve "net zero" health systems, including by the federal government in Canada, suggest a growing need to understand and mobilize capacity for GHG emissions estimation across Canada's health sector. Our analysis highlights efforts by public sector healthcare organizations in Canada to estimate an increasingly broad scope of GHG emissions, building on longstanding efforts to report or reduce energy-related emissions from facilities. It also identifies why such efforts will not be sufficient. Developing capacity for routine system-wide greenhouse gas emissions estimation can help Canada's health systems to better understand their progress, including through international comparison. Yet emissions estimation is itself an investment, one that should not displace efforts to reduce the full scope of pollutants from the healthcare enterprise, and to build a truly sustainable health system.

Introduction

As a resource-intensive sector, healthcare is a surprisingly large contributor to climate change, even as growing climate instability threatens health and the safe and effective delivery of health services.[1,2] Indeed, healthcare is responsible for approximately 4.6% of Global Greenhouse Gas (GHG) emissions as well as a similar proportion of economy-wide emissions in Canada.[3,4]

Awareness of these challenges has increased attention to the types of GHG emissions for which healthcare is responsible, alongside growing commitments to drastically reduce the full scope of these emissions. The English National Health Service (NHS) gained international attention with a 2020 commitment to be the world's first "net zero" national health service, accounting for a comprehensive set of directly and indirectly controlled emissions.[5] Then, as part of the 2021 United Nations Climate Change Conference, COP26, the United Kingdom (the host nation), the World Health Organization (WHO), and other partners introduced the Health Program (now the WHO Alliance for Transformative Action on Climate & Health, ATACH) to seek country commitments to deliver climate resilient and sustainable, low carbon health systems, accounting for emissions from the supply chain.[6] As part of this commitment, countries were to deliver a baseline assessment of the full scope of health system GHG emissions.[6] Ambitious countries were also to define a timeline to "net zero" for these emissions.[7]

National commitments to address healthcare emissions have accelerated since. Recent examples include France's 2023 roadmap, with time-bound objectives to reduce the environmental impact of the healthcare sector.[8] Also in 2023, Australia released the National Health and Climate Strategy, which will establish consistent reporting of healthcare GHG emissions and a reduction trajectory.[9] Other countries have created voluntary commitments to encourage healthcare institutions to reduce their GHG emissions, and more still have decarbonization policies that are not specific to, but still have implications for, healthcare.[10] While high-income countries have particular responsibility for decarbonization, given their elevated per capita emissions, decarbonization efforts are not limited to these countries. Indeed, multiple Low- and Middle-Income Countries (LMIC) participate in the ATACH program,[11] and the Aga Khan Health Services, which manages health operations in several LMIC, was tasked to aim for "net zero" operations as early as 2019.[12]

Because of the size and energy intensity of hospitals, there is a common misconception that healthcare's GHG emissions come principally from the energy required to operate healthcare infrastructure. However, most healthcare emissions are not closely controlled by healthcare organizations. Specifically, under the Greenhouse Gas Protocol that is used to support consistent GHG emissions reporting across sectors,[13,14] most healthcare emissions (generally more than 60%) are considered "scope 3."[4,15,16] Scope 3 emissions derive from the products and services that are used to deliver care, including drugs, devices, supplies, equipment, travel, chemicals, and building materials. Thus, the global Health Program commitment from COP26, which included "supply chains," marked a step-change in decarbonization efforts within healthcare, requiring that healthcare assume responsibility for the full scope of its carbon pollution (Figure 1).

What is the state of health sector emissions estimation in Canada?

In addition to accelerating ambition for healthcare decarbonization, recent global initiatives have brought Canada's federal government to the table. Indeed, the Canadian government signed on to the

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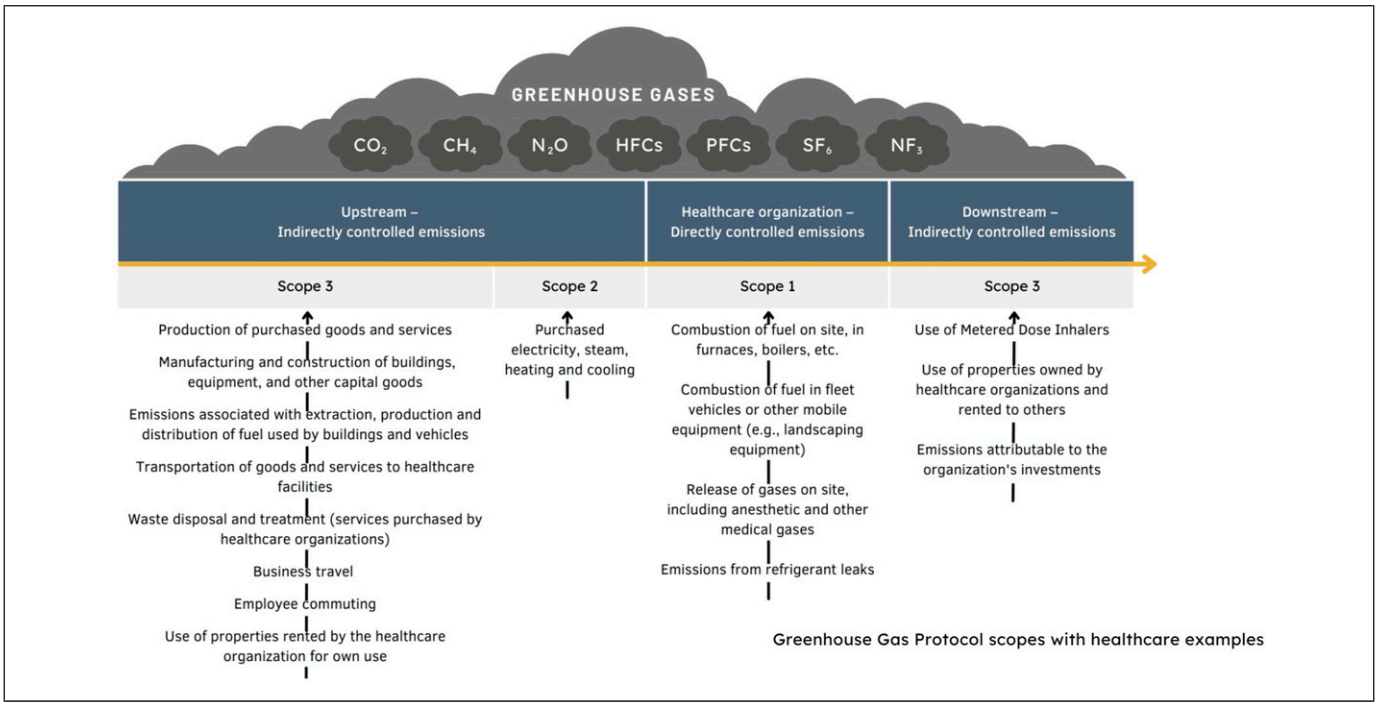

Figure 1. Greenhouse gas protocol scopes with healthcare examples.

COP26 Health Program commitments in the fall of 2021;[17] this commitment was reinforced at subsequent international climate conferences (e.g., COP28). Canada did not originally include a target date for reaching "net zero" health system emissions;[18] however, it appears that a "net zero" target date of 2050 has been recently added to Canada's ATACH commitments.[11] In a deeply decentralized federation, where federal commitments of this nature do not bind the provinces,[19-21] these moves raise important questions about how comprehensive emissions estimation can be achieved across the country.

Our current understanding of Canada's health sector emissions derives from academic research published in 2018, which identified energy use for public hospital operations, pharmaceutical manufacturing, and the production of medical supplies as the key drivers of emissions.[4] The analysis was based on established models of national economic activity, with emissions estimated from public and private spending on healthcare—an important breadth, as we discuss later.

In countries such as England, which have decarbonization roadmaps for the health sector, such "top down" estimation forms only one component of the total picture. Alongside spend-based estimates that enable whole-system benchmarking and analysis, more granular "bottom up" information about specific activities is also generated, drawing from product, service, or organizational activity information (e.g., litres of anaesthetic gas or fuel used).[16] When combined with data about the GHG emissions associated with each activity, a more detailed picture emerges to guide practice and policy change.

To gain an understanding of the capacity to estimate healthcare emissions in Canada, CASCADES (Creating a Sustainable Canadian Health System in a Climate Crisis)—a knowledge sharing and capacity building initiative funded by Environment and Climate Change Canada—coordinated a pan-Canadian consultative process. Over the course of 2022, CASCADES began consultation with experts responsible for estimating GHG emissions in their healthcare facilities (ranging from single hospitals to multiple facilities owned and operated by health authorities and integrated health and social service centres), eventually leading to discussions and deliberations through a series of workshops with participants from across the country. For information on these workshops and participants, please see the report and implementation-support resource ("playbook") on the current state of GHG emissions estimation in Canadian healthcare organizations[22,23] generated from this work.

In what follows, we briefly synthesize findings from this process, to characterize the current state of GHG emissions estimation in healthcare across Canada, identifying who is positioned to report what emissions. We then review why current efforts will be insufficient to capture the full scope of GHG emissions for all of Canada's health systems. Finally, we close with suggestions for how these lacunae can be filled, and the importance of looking beyond GHG emissions in the transition toward a more sustainable health system.

Who is reporting what emissions?

A focus on facility-based and energy-related emissions

Most efforts to monitor, report, and mitigate GHG emissions in healthcare have been related to facilities, with responsibility for this work residing in facilities management departments. Indeed, efforts to reduce costs from energy use, as well as regulatory requirements related to GHG emissions and energy, have

encouraged large healthcare facilities (and some small ones), to estimate their energy-related emissions. Thus, emissions from purchased energy (e.g., electricity and steam—"scope 2") and direct emissions from on-site or owned buildings or equipment (e.g., gas boilers or fuel for vehicles—"scope 1") are routinely estimated across much of the country.

Requirements to report GHG emissions from healthcare play some role in this but are variable across the country and limited in scope. The federal Greenhouse Gas Reporting Program covers scope 1 energy-related emissions and targets high emission facilities—thus, a small number of healthcare facilities report under this program.[24] Provincial GHG reporting programs also target facilities with high scope 1 emissions, with different Carbon Dioxide Equivalent (CO2e) thresholds,[25-29] which may have implications for a small number of healthcare facilities. Finally, some provinces require healthcare organizations to report GHG emissions as broader public sector entities, not limited to high emitting facilities. In Ontario, these inventories cover energy-related emissions[30] and in British Columbia, a broader set of emissions are also reported, including those from buildings, purchased energy, vehicles, and the production of purchased paper.[31]

Interest in GHG emissions beyond the energy baseline

Based on input from the informants consulted by CASCADES,[22] there is growing interest in expanding the estimation of GHG emissions in healthcare to include not only energy-related emissions but also additional sources. Additional types of emissions that may be most ready for inclusion in regular estimates include additional directly controlled emissions, specifically on-site medical and anaesthetic gases (volatile anaesthetic gases, nitrous oxide, and hydrofluorocarbon emissions from the use of metred dose inhalers—scope 1), and select travel-related emissions (business travel and road-registered vehicles—scopes 3 and 1, respectively), as well as a small subset of additional "scope 3" emissions (i.e., off-site waste treatment and purchased paper), in alignment with the requirements or policy commitments of several jurisdictions[32,33] (see Table 1).

Table 1. Current GHG emissions estimation and opportunities for expansion.

Type of emission	Currently tracked and estimated	Potential for regular estimation
GHG Protocol scope 1		
On-site energy combustion	Across multiple jurisdictions	Already included
Mobile combustion from company/fleet vehicles	In some jurisdictions (when applicable)	High
Anesthetic and medical gases	In some jurisdictions	High
Use of metered-dose inhalers	Rarely	High
Fugitive emissions from refrigerant losses	In some jurisdictions	Some potential
GHG Protocol scope 2		
Purchased energy	Across multiple jurisdictions	Already included
GHG Protocol scope 3		
Business travel	In some jurisdictions	High
Patient travel	Not regularly estimated	Some potential
Visitor travel	Not regularly estimated	Less potential
Employee commuting	In some jurisdictions	Some potential
Waste treatment and disposal	In some jurisdictions	High
Purcahsed paper (Purchased goods and services)	In some jurisdictions	High (as an introduction to emissions tracking for other purchased goods)
Upstream transportation and logistics	Not regularly estimated	Less potential
Other scope 3 categories, e.g. • Other purchased goods and services • Investments • Fuel and energy related activities (not included in scope 1 and 2) • Use and end-of-life of sold products (e.g. from hospital pharmacies)	Not regularly estimated	Some potential, with variability between categories

Extending routine estimation to a wider set of emissions, particularly those in the supply chain, would be challenging and potentially less worthwhile, given limitations in available data, and the time intensity of data gathering. Some organizations have nonetheless completed, or are working toward, more detailed GHG inventories. Reasons for doing so vary, and can include their potential to drive engagement and commitment to change across the organization,[34,35] to identify priority areas for reduction,[36,37] or as baselines for ongoing monitoring and to guide roadmaps and other plans for GHG emission reduction.[38,39]

Can current efforts capture the full scope of emissions?

No matter how ambitious different healthcare organizations are becoming about estimating their GHG emissions, no care delivery organization can assess the full scope of health system emissions. This limitation arises for three main reasons: first, because not all facilities are included within emission estimation efforts; second, because not all emissions are facility-based; and third, because not all emissions are under the remit of a public authority (Figure 2).

The first challenge arises from differences in healthcare organization across the country, which leads to the routine estimation of emissions from different kinds of facilities. In provinces like Ontario, healthcare's GHG emissions are estimated by independent hospital corporations, some of whom house non-hospital services such as primary care clinics, long-term care facilities or research institutes. However, many of Ontario's small facilities and non-hospital healthcare facilities are not captured in these estimates. Outside Ontario, the relevant public authorities are accountable for a wider set of healthcare emissions. In most provinces, health authorities are responsible for estimating emissions, and they typically include public health, community health services, and some long-term care facilities in their remit, and may include some primary care clinics, thus incorporating these facilities within their estimates. In Quebec, the main responsible actors are the integrated health and social service centres (organized as CISSS/CIUSSS), which are responsible for a broad array of health and social service facilities.

The second reason for partial estimation is that a focus on facility-based emissions leaves many emissions unaccounted for. This is so even in provinces with a wider network of facilities covered by the responsible authorities, and even if these public authorities estimate the full scope of emissions for which there are financially accountable. Consider important emissions associated with outpatient drugs, devices and supplies. Pharmaceuticals are estimated to account for approximately 25% of emissions in Canada[4] and 30% in England.[16] While some of these are procured by and administered within hospitals, most are prescribed to people in the community and would not be captured in facility-based emissions estimates, no matter how expansive.

GAP ANALYSIS - TRACKED AND REPORTED EMISSIONS

	Rarely Included	Sometimes Included	Almost Always Included
Type of facility	Private long-term care facilities Private optometry clinics Private dental clinics Private rehabilitative clinics Emergency response/ Paramedic services Most primary care clinics	Long-term care facilities Home and community care agencies Primary care clinics Public health units Corportate/Administrative offices Health research/education facilities	Publicly funded hospitals
Type of emission	Most purchased goods and services; e.g. • pharmaceuticals • medical devices Patient and visitor travel Upstream transportation and distribution Other scope 3 catergories	Business travel Employee commuting Directly controlled emissions from anesthetic and medical gases Purchased paper Waste treatment	Combustion of fuel on-site Combustion of fuel in vehicles Purchased energy
Type of care	Privately financed care (e.g. optometry, rehabilitative care) Private home care	Long-term care Primary care Outpatient secondary care	Tertiary and quaternary care

Figure 2. Gap analysis—tracked and reported emissions.

The third reason for partial estimation of healthcare emissions is that not all such emissions are publicly managed or financed. Services that are secured in the community—beyond the remit of facility-based emissions estimation—but publicly financed or managed might be estimated by provincial and territorial drug, device, and home care plans. Yet services for which public authorities are not responsible would remain unaccounted for. This includes privately financed emissions such as most optometry care, dental care, or community-based rehabilitative care as well as private retirement homes and home care. It might be argued that such emissions are not the responsibility of public authorities. Yet privately financed emissions "count" in efforts to deliver a "net zero" health system, both because they manifestly occur, and because privately financed services have the potential to either increase or decrease emissions from publicly financed services.[40] There may be different financial budgets—public and private—but there is only one carbon budget.

Conclusion

For Canada to meet the commitment to create a "sustainable low carbon health system" made at COP26, a baseline assessment of GHG emissions, which includes supply chains, is required.[6] Currently, capacity to routinely estimate healthcare's GHG emissions in Canada resides primarily within facilities and for energy-related emissions (scope 2 and some scope 1, see Table 1). This capacity can be extended and there are implications for health leaders. Indeed, there is opportunity to learn from organizations that have already started to estimate the full scope of emissions for which they are financially accountable (across scopes 1, 2, and 3). Ultimately, however, there is a need for system-wide emissions estimation, to account for the variable ways that healthcare is organized across the country, the critical emissions that take place outside healthcare facilities, and the many emissions for which public authorities are not financially accountable.

There are many opportunities to close these several gaps. First, healthcare organizations across the country can be supported in their efforts to do this work through standardized and shared approaches to data collection and analysis. No standard approach to estimating GHG emissions in healthcare exists, leading to variation in how emissions get tracked and reported. Health leaders can prioritize increasing methodological consistency to help with benchmarking efforts between organizations and jurisdictions. Efforts to establish an organizational baseline will also support year over year comparisons. Activity and financial data are already collected across jurisdictions in a standardized way through the Canadian Institute of Health Information,[41] and this could support GHG estimation. A majority of GHG emissions are in the supply chain, but limited information on emissions from suppliers makes these estimations difficult. Working with policy-makers to require suppliers to provide standard data on their emissions would increase the availability of information while removing the burden of onerous estimation efforts for healthcare organizations. Existing work to identify targets for suppliers with respect to their GHG emissions[42] can be built upon, and ATACH, through its Supply Chains Working Group could provide additional support. Health leaders can also include emissions criteria in their supplier selection processes, third party risk management programs, and supplier performance/relationship management programs—though data quality and implementation issues warrant careful attention. To capture the activities beyond the financial purview of health authorities, hospitals and other large facilities, provinces, and territories will need to engage. They are well placed to generate estimates of emissions from outpatient and home and community-based care that are publicly financed, supplemented with information about emissions associated with privately paid-for services, so that system-wide estimates can be comprehensive.

While these efforts proceed, it is important to recall that GHG emissions should not be the only environmental metric that healthcare tracks and manages. Attention to GHG emissions does not necessarily reduce other environmental and health harms associated with the healthcare sector.[43] Sustainability metrics should be linked to reporting on healthcare quality and performance and include metrics like quantifying health-damaging pollutants and reducing overuse.[44] Resources on different approaches to embedding sustainability in organizational strategy and performance, including those from CASCADES,[45] can provide direction. Even when GHG emissions cannot be readily estimated, emphasizing reductions in purchasing and consuming, and supporting innovations in care delivery, can lead to decarbonization. Health leaders can create a culture of sustainability in their organizations, set meaningful targets and pursue sustainability in system enablers (like infrastructure and waste) as well as through innovations in care delivery. Ultimately, leaders must prioritize opportunities to pursue mitigation and adaptation in the same action, in efforts to build "a health system that improves, maintains, or restores health, while minimizing negative impacts on the environment and leveraging opportunities to restore and improve it, to the benefit of the health and well-being of current and future generations."[46]

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References

1. Balbus JM, McCannon CJ, Mataka A, Levine RL. After COP26 — putting health and equity at the center of the climate movement. *N Engl J Med*. 2022;386(14):1295-1297. doi:10.1056/NEJMp2118259
2. Berry P, Enright P, Varangu L, et al. Adaptation and health system resilience. In: *Health of Canadians in a Changing Climate: Advancing Our Knowledges for Action*. Government of Canada; 2022. https://changingclimate.ca/health-in-a-changing-climate/chapter/10-0/
3. Romanello M, Walawender M, Hsu SC, et al. The 2024 report of the Lancet Countdown on health and climate change: facing record-breaking threats from delayed action. *Lancet*. 2024;404(0):1847-1896. doi:10.1016/S0140-6736(24)01822-1
4. Eckelman MJ, Sherman JD, MacNeill AJ. Life cycle environmental emissions and health damages from the Canadian healthcare system: an economic-environmental-epidemiological analysis. *PLoS Med*. 2018;15(7):e1002623. doi:10.1371/journal.pmed.1002623
5. National Health Service England. *Delivering a "Net Zero" National Health Service*; 2022. https://www.england.nhs.uk/greenernhs/wp-content/uploads/sites/51/2020/10/delivering-a-net-zero-national-health-service.pdf. Accessed May 4, 2023.
6. World Health Organization. COP26 Health Programme: country commitments to build climate resilient and sustainable health systems. 2021. https://cdn.who.int/media/docs/default-source/climate-change/cop26-health-programme.pdf?sfvrsn=cde1b578_10. Accessed March 9, 2023.
7. Fankhauser S, Smith SM, Allen M, et al. The meaning of net zero and how to get it right. *Nat Clim Change*. 2022;12(1):15-21. doi:10.1038/s41558-021-01245-w
8. Gouvernement francais. Feuille de route-Planification écologique du système de santé français. 2023. https://sante.gouv.fr/IMG/pdf/planification-ecologique-du-systeme-de-sante-feuille-de-route-mai-2023.pdf. Accessed June 27, 2023.
9. Australian Goverment. National health and climate strategy. 2023. https://www.health.gov.au/sites/default/files/2023-12/national-health-and-climate-strategy.pdf. Accessed February 21, 2024.
10. Hough E, Cohen Tanugi-Carresse A. Supporting decarbonization of health systems—a review of international policy and practice on health care and climate change. *Curr Environ Health Rep*. 2024;11(2):266-278. doi:10.1007/s40572-024-00434-x
11. World Health Organization. Alliance for transformative action on climate and health (ATACH). In: *Country Commitments*; 2024. https://www.who.int/initiatives/alliance-for-transformative-action-on-climate-and-health/country-commitments. Accessed November 29, 2024.
12. Achieving net zero. How our health operations are slashing carbon emissions while saving thousands. Aga Khan Development Network. https://the.akdn/en/resources-media/whats-new/our-stories/achieving-net-zero-how-our-health-operations-are-slashing-carbon-emissions-while-saving. Accessed June 27, 2024.
13. World Resources Institute and World Business Council for Sustainable Development, World Business Council. The greenhouse gas Protocol: a corporate accounting and reporting standard. 2004. https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf. Accessed June 28, 2024.
14. World Resources Institute and World Business Council for Sustainable Development. Greenhouse gas protocol: corporate value chain (scope 3) accounting and reporting standard. 2011. https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf. Accessed April 28, 2023.
15. Eckelman MJ, Huang K, Lagasse R, Senay E, Dubrow R, Sherman JD. Health care pollution and public health damage in the United States: an update. *Health Aff*. 2020;39(12):2071-2079. doi:10.1377/hlthaff.2020.01247
16. Tennison I, Roschnik S, Ashby B, et al. Health care's response to climate change: a carbon footprint assessment of the NHS in England. *Lancet Planet Health*. 2021;5(2):e84-e92. doi:10.1016/S2542-5196(20)30271-0
17. Hacket F, Petrin-Desrosiers C, Kalogirou M, Buse C. The lancet countdown on health and climate change policy brief for Canada 2023. 2023. https://policybase.cma.ca/viewer?file=%2Fmedia%2FPolicyPDF%2FPD24-01.pdf#page=1. Accessed November 29, 2024.
18. Canadian Medical Association. CMA policy summary - environmentally sustainable health systems in Canada. 2022. https://policybase.cma.ca/viewer?file=%2Fmedia%2FPolicyPDF%2FPD23-02.pdf#page=1. Accessed March 20, 2024.
19. OECD, Korea Institute of Public Finance. Blöchliger H, Kim J, eds. *Fiscal Federalism 2016: Making Decentralisation Work*. Paris: OECD; 2016. doi:10.1787/9789264254053-en.
20. Becklumb P. Federal and provincial jurisdiction to regulate environmental issues. 2013. https://lop.parl.ca/sites/PublicWebsite/default/en_CA/ResearchPublications/201386E
21. Marchildon GP, Allin S, Merkur S. *Health Systems in Transition: Canada*. 3rd ed. Toronto, ON: University of Toronto Press; 2021.
22. Nowlan J, Machane S, Miller F. Report: greenhouse gas emissions estimation in Canadian healthcare systems. 2023. https://cascadescanada.ca/resources/ghg-report/
23. Nowlan J, Machane S, Miller F. Greenhouse gas emissions estimation in Canadian healthcare. 2023. https://cascadescanada.ca/resources/greenhouse-gas-emissions-estimation-in-canadian-healthcare-playbook/
24. Environment and Climate Change Canada. Facility greenhouse gas reporting: overview of 2020 reported emissions. 2022. https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/facility-reporting/overview-2020.html. Accessed April 14, 2023.
25. Government of Alberta. Alberta regulation 251/2004 emissions management and climare resilience act: specified gas reporting regulation. 2022. https://kings-printer.alberta.ca/1266.cfm?page=2004_251.cfm&leg_type=Regs&isbncln=9780779836338&display=html. Accessed July 3, 2024.
26. Government of Newfoundland and Labrador. Newfoundland and labrador regulation 116/18 - management of greenhouse gas regulations under the management of greenhouse gas act. 2018. https://assembly.nl.ca/Legislation/sr/regulations/rc180116.htm#3_. Accessed July 4, 2024.

27. Government of Ontario. O. Reg. 390/18: greenhouse gas emissions: quantification, reporting and verification. 2018. Ontario.ca. https://www.ontario.ca/laws/view. Accessed July 4, 2024.
28. Gouvernement de Québec. Q-2, r.15 - Règlement sur la déclaration obligatoire de certaines émissions de contaminants dans l'atmosphère. 2011. Accessed July 4, 2024. https://www.legisquebec.gouv.qc.ca/fr/document/rc/q-2,_r_15
29. Government of Saskatchewan. Management and reduction of greenhouse gases (reporting and general) regulations, M-2.01 reg 2. 2018. https://publications.saskatchewan.ca/#/products/90973. Accessed July 4, 2024.
30. Government of Ontario. O. Reg. 507/18: broader public sector: energy reporting and conservation and demand management plans. 2018. https://www.ontario.ca/laws/regulation/r18507. Accessed May 1, 2023.
31. Government of British Columbia. Carbon neutral government regulation. 2008. https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/392_2008. Accessed April 14, 2023.
32. Alberta Health Services. Environmental sustainability policy. 2020. https://extranet.ahsnet.ca/teams/policydocuments/1/clp-ahs-environmental-sustainability-1185.pdf. Accessed April 28, 2023.
33. British Columbia Ministry of Environment and Climate Change Strategy. B.C. Best Practices Methodology for Quantifying Greenhouse Gas Emissions: for public sector organizations, local governments and community emissions. 2020. https://www2.gov.bc.ca/assets/gov/environment/climate-change/cng/methodology/2020-pso-methodology.pdf. Accessed April 28, 2023.
34. Webster RJ. Climate action, staff engagement, and change management: a paediatric hospital case study. *Healthc Manag Forum*. 2023;36(4):195-198. doi:10.1177/08404704231165482
35. Mobilizing health system sustainability through greenhouse gas estimation.; 2024. Accessed July 4, 2024. https://www.youtube.com/watch?v=sS5abxGLC-A
36. Synergie Santé Environnement. Bilan des émissions de gaz èa effet de serre générés par les activités du CISSS de Laval (scopes 1, 2 et 3) - État de situation & axes d'amélioration. 2022. https://www.lavalensante.com/fileadmin/internet/cisss_laval/CISSS_de_Laval/Developpement_durable/SSE_2022_Rapport_LAVALFINAL.pdf. Accessed May 4, 2023:52.
37. Centre hospitalier de l'Universite de Montreal. Plan d'action 2024-2027 pour la décarbonation du CHUM: Santé environnementale et carboneutralité. https://www.chumontreal.qc.ca/sites/default/files/2024-04/Plan_d%27action_Carboneutralit%C3%A9_2024-2027_VExterne.pdf. Accessed June 28, 2024.
38. Interior Health Authority. Climate change and sustainability roadmap 2023-2028. https://www.interiorhealth.ca/sites/default/files/PDFS/interior-health-climate-change-sustainability-roadmap-2023-2028.pdf. Accessed June 28, 2024.
39. Fraser Health Authority. Fraser health planetary health strategy 2023-2028. 2023. https://www.fraserhealth.ca/-/media/Project/FraserHealth/FraserHealth/Health-Topics/Climate-and-environment/Planetary-Health-Strategy-Report-Final-2023-09-19.pdf. Accessed July 4, 2024.
40. Miller F, Xie E. Toward a sustainable health system: a call to action. *Healthc Pap*. 2020;19(3):9-25. doi:10.12927/hcpap.2020.26377
41. Canadian Institute for Health Information. Data holdings. 2023. https://www.cihi.ca/en/access-data-and-reports/data-holdings. Accessed May 24, 2023.
42. National Health Service England. Suppliers. Greener NHS. https://www.england.nhs.uk/greenernhs/get-involved/suppliers/. Accessed September 25, 2024.
43. Lenzen M, Malik A, Li M, et al. The environmental footprint of health care: a global assessment. *Lancet Planet Health*. 2020;4(7):e271-e279. doi:10.1016/S2542-5196(20)30121-2
44. Hensher M, McGain F. Health care sustainability metrics: building A safer, low-carbon health system. *Health Aff*. 2020;39(12):2080-2087. doi:10.1377/hlthaff.2020.01103
45. CASCADES. *Strategy & Performance for Sustainable Health Systems*. CASCADES Canada; 2024. https://cascadescanada.ca/action-areas/strategy-performance/. Accessed December 16, 2024.
46. Environmentally sustainable health systems: a strategic document. 2017. Accessed November 29, 2024. https://www.who.int/publications/i/item/WHO-EURO-2017-2241-41996-57723