

Reducing Healthcare's Carbon Footprint with Sustainable Transportation Initiatives

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Executive Summary

The climate crisis is a public health emergency. Global heating, extreme weather events, and air pollution are increasing the risk of illness and death due to infectious and noncommunicable diseases, injury, worsening food insecurity, and climate anxiety that is detrimentally affecting mental health. The increasing incidence of droughts, sea level rise, and loss of biodiversity are adversely impacting the environment, which in turn causes negative repercussions in human health.


Even though the healthcare industry exists to care for those who are ill, the industry itself contributes to the climate crisis by emitting greenhouse gases. In fact, the healthcare sector contributes up to 4.6% of total greenhouse gas emissions globally and around 5% of total greenhouse gas emissions in Canada. Healthcare transportation, including business travel and supply chain logistics, accounts for 7% of the healthcare industry's greenhouse gas emissions.

Decreasing greenhouse gas emissions is beneficial for public health and for the environment. Policies to lower greenhouse gas emissions would result in fewer premature deaths and disability-adjusted life years (DALYs) lost. Plants and wildlife would have a greater chance of survival as well, thereby reducing biodiversity loss.

In order to improve population health as well as the health of the environment, healthcare facilities have been working to decrease their carbon footprint, including through transportation measures. Many facilities and healthcare authorities are implementing sustainable transportation initiatives to reach that goal. Co-benefits of these strategies are improved mental and physical health for staff members and cost savings for employers.

Fraser Health has a yearly goal of carbon neutrality, which it reaches through emissions reduction and the purchase of offsets. One of the strategies that Fraser Health has in mind to attain that objective is to increase the staff's sustainable transportation usage from the current 29.5% (in 2020) to 50% by 2030. The health authority has existing incentives in place to help them reach that goal including cycling webinars, some bicycle storage and end-of-trip facilities, and a 15% subsidy for public transportation. However, more needs to be done in order to reach Fraser Health's 2030 sustainable transportation goal.

One of the main barriers to increasing sustainable transportation usage is that a significant amount of Fraser Health's catchment area is not as easily accessible by sustainable transportation as



other more urban areas such as Vancouver. Additionally, many staff drive their private vehicles as they are more convenient than sustainable transportation options if staff have to work off-site during the day. Lastly, the health authority does not have information about its baseline transportation-related greenhouse gas emissions.

Case studies of sustainable transportation initiatives were reviewed and summarized in order to inform strategy and action to increase sustainable transportation uptake by Fraser Health staff. Some promising initiatives include educating commuters about cycling and bicycle maintenance and financial incentives for staff who use sustainable commuting options. Recommendations to Fraser Health are based on these case studies.

By implementing these cost-effective recommendations, Fraser Health will gain the potential of having a healthier, happier, and more productive staff. Most importantly, if Fraser Health can reduce its greenhouse gas emissions, the health authority will be contributing to the improvement of environmental and population health for the Lower Mainland.

Introduction

The climate crisis threatens the environment and public health. Global heating is causing environmental degradation and loss of biodiversity which raise the likelihood of infectious disease outbreaks and food insecurity. Intense heat, extreme weather events, and air pollution detrimentally affect human health, increasing the risk of noncommunicable diseases (NCDs). The risk is not equally distributed; marginalized communities are more likely to be impacted by climate change. The healthcare system is tasked with addressing the inequitable health impacts of climate change to support population health while maintaining a high standard of care. However, the healthcare system also has to come to terms with the fact that while it provides care to the surrounding community, it is also emitting greenhouse gases and exacerbating climate change. The more people that require care resulting from impacts of climate change, the more that healthcare facilities in turn negatively impact the environment and climate, ultimately resulting in more adverse health events in the community.

As the healthcare industry grapples with how to adapt to the current and future effects of climate change, more healthcare systems are turning to environmentally sustainable practices to reduce their impact on the environment and improve population health overall. One example is the National Health Service (NHS) in the United Kingdom (U.K.), and they have initiated the “Greener NHS” program with the goal of reaching net zero emissions by 2040 (National Health Service, n.d.-b). Another example is Health Care Without Harm (HCWH), a worldwide organization that helps healthcare facilities decrease their carbon footprint via mitigation, resilience, and leadership with the “Health Care Climate Challenge” (Health Care Without Harm, 2022). Both the NHS and HCWH focus on transportation as a means of reaching their climate goals and reducing environmental impact. The NHS aims to have a zero-carbon non-emergency patient transport fleet by 2035 (National Health Service, n.d.-a), and HCWH recommends promoting active travel and public transportation among staff (Health Care Without Harm, n.d.). This document will examine how to advance sustainability in healthcare by reducing greenhouse gas emissions via promotion of sustainable transportation, with a focus on active transportation.

Definitions

- ❖ Greenhouse gases (GHGs): Carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and fluorinated gases are the four main GHGs, and CO₂ is the most prevalent of the four (United States Environmental Protection Agency, 2015a). For example, in the United States in 2020, CO₂ comprised 79% of GHG emissions, followed by CH₄ at 11%, N₂O at 7%, and fluorinated gases at 3% (United States Environmental Protection Agency, 2015a). Most GHGs are released by fossil fuel combustion, livestock emissions from manure and enteric fermentation, and land-usage change such as deforestation (United States Environmental Protection Agency, 2015b). GHGs cause global heating by creating a greenhouse effect where heat is trapped in the atmosphere, thus amplifying climate change (Government of Canada, 2022b; United States Environmental Protection Agency, 2015b).
- ❖ Global Warming Potential (GWP): “It is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of CO₂. The larger the GWP, the more that a given gas warms the Earth compared to CO₂ over that time period. The time period usually used for GWPs is 100 years” (United States Environmental Protection Agency, 2016). For example, CO₂ has a GWP of 1 because it is the reference gas, CH₄ has an estimated GWP of 27-30 over 100 years and N₂O has a GWP of 273 over 100 years (United States Environmental Protection Agency, 2016).
- ❖ CO₂ equivalents (CO₂e): The most common measurement of GHG emissions is in CO₂e, where the emissions of the gas in question are multiplied by the gas’s GWP (United States Environmental Protection Agency, 2015b).
- ❖ Sustainable transportation: Sustainable transportation does not have a standardized definition.
 - It “refers to any means of transportation that is ‘green’ and has low impact on the environment” including carpooling, car sharing, and electric and hybrid vehicles (City of Vaughan, 2022).
 - “It refers to modes of transportation that have a smaller net impact on the environment or transportation infrastructure than cars and heavy trucks, or a near-zero net impact” (Government of Canada, 2017).
 - “Sustainable transportation refers to low- and zero-emission, energy-efficient, affordable modes of transport, including electric and alternative-fuel vehicles” (Office of Energy Efficiency and Renewable Energy, n.d.).
 - A combination of the above definitions: Sustainable transportation encompasses forms of transportation other than single-occupancy vehicles that use only gas or diesel. Examples are active transportation, public transportation, carpooling, car sharing, electric vehicles, and hybrid

vehicles. Sustainable modes such as active and public transportation have health co-benefits whereas the use of private vehicles does not (Tsuji & Shiojima, 2015; United States Department of Transportation, 2015a, 2015b).

- ❖ Active transportation: Active transportation includes any type of fully or partially human-powered transit (Government of Canada, 2012; United States Department of Energy, n.d.; United States Department of Transportation, 2015a). Micromobility counts as active transportation, where one uses a device that is “partially or fully motorized, low-speed (typically less than 30 miles [48 kilometers] per hour), and small size (typically less than 500 pounds [230 kilograms] and less than 3 feet [1 meter] wide)” (Price et al., 2021). Walking, wheel-chairing, biking, skateboarding, e-biking, and e-scooter are examples of active transportation (United States Department of Energy, n.d.; United States Department of Transportation, 2015a).
- ❖ Multi-modal transportation: Multi-modal transportation involves “various modes (walking, cycling, automobile, public transit, etc.) and connections among modes” (Litman, 2021). Multi-modal transportation commonly occurs when using active transportation to cover the first- and last-mile gap when taking public transit (United States Department of Energy, n.d.).

Background

Healthcare and transportation GHG emissions

It should be noted that “no systematic global standard for measuring the GHG emissions of the healthcare sector exists, but a number of healthcare systems in the UK, US, Australia and around the world are working to measure and reduce their GHG emissions” (Watts et al., 2018). Also, each nation has its own method of collecting GHG emissions data, so it is difficult to compare studies between countries (Watts et al., 2019). For “The Lancet Countdown” from 2019, Watts et al. used a standardized measure of GHG emissions from the healthcare sector created by WIOD and EXIOBASE, two multi-region input-output (MRIO) models covering forty to forty-seven countries. Watts et al. combined the MRIO data with WHO expenditure data for 187 countries (2019). However, the authors did not include land use change when calculating healthcare GHG emissions (Watts et al., 2019). Therefore, the limitations of the data collected for this report should be acknowledged.

Worldwide

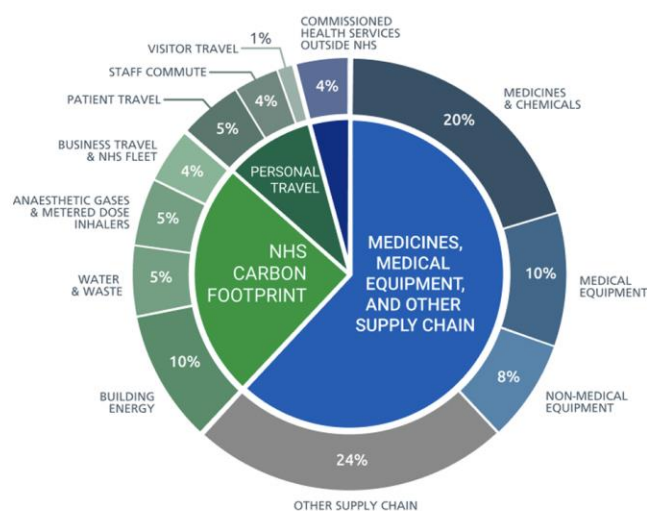
- ❖ *Healthcare emissions*: The healthcare industry emits GHGs via several sources which include transportation, energy consumption, and the manufacturing, use, and disposal of medical products (Karliner et al., 2019). GHG emissions are derived not only from direct energy and fuel consumption, but also indirectly due to conversion of land for production of medical goods (Lenzen et al., 2020). Globally, GHG emissions from the healthcare sector accounted for 4.6% of total global GHG emissions in 2016 (Watts et al., 2019).
- ❖ *Healthcare transportation emissions*: Transportation—including business travel, operational transport, and supply chain logistics—accounts for 7% of healthcare GHG emissions (Karliner et al., 2019).

U.K.

- ❖ *Healthcare emissions*: In the U.K., the healthcare industry accounts for 3.2% of total GHG emissions (Tomson, 2015).
- ❖ *Healthcare transportation emissions*: Regarding GHG emissions from healthcare transportation, one source states that 3.5% of all road traffic is from patients, their visitors, healthcare staff, and NHS suppliers (National Health Service, 2020b), while another source states that it is 5% (Lenzen et al., 2020). Of the NHS’s total GHG emissions, 14% can be attributed to car travel: business travel and

fleet transport (4%), patient travel (5%), visitor travel (1%), and staff commutes (4%) (National Health Service, 2020b).

Figure 2: Sources of carbon emissions by proportion of NHS Carbon Footprint Plus



(National Health Service, 2020b)

Canada

- ❖ *Healthcare emissions:* In 2014, 5.2% of total GHG emissions in Canada came from the healthcare industry (Karliner et al., 2019). Eckelman et al. found that healthcare GHG emissions between 2009 and 2015 averaged 4.6% of total emissions (2018). Even though Canada's GHG emissions comprised less than 2% of global GHG emissions from 2005 through 2019, Canada is one of the highest GHG emitters per capita in the world (Government of Canada, 2022b). In fact, Canada ranked third (out of forty seven countries) in healthcare GHG emissions per capita GDP in 2016 (Watts et al., 2019).
- ❖ *General transportation emissions¹:* Transportation in general was responsible for 24% of all GHG emissions in Canada in 2020 (Government of Canada, 2022a).

British Columbia (B.C.)²

- ❖ *General GHG emissions:* In 2019, B.C. emitted 12.9 tons of CO₂e per capita, which was 33% less than the national average of 19.4 tons of CO₂e per capita (Canada Energy Regulator, 2022). That same

¹ The percentages of healthcare transportation GHG emissions in Canada could not be found.

² Data specifying GHG emissions in B.C. from the healthcare sector in general and from healthcare transportation could not be found.

year, the province's GHG emissions comprised 9.1% of Canada's total GHG emissions (Canada Energy Regulator, 2022).

- ❖ *General transportation emissions:* Transportation is the largest emitting sector of GHGs in B.C., comprising 37% of all provincial GHG emissions in 2019 (Canada Energy Regulator, 2022).

Fraser Health Authority

- ❖ *GHG emissions:* In 2007, Fraser Health emitted 36,596 tons of CO₂e (GreenCare, 2021a). In 2020, the health authority had a goal of emitting less than the 34,766 tons of CO₂e released in 2007, but it instead increased its emissions to 39,876 tons of CO₂e (GreenCare, 2021a).
- ❖ *Transportation emissions:* Mobile fuel combustion from "fleet and other equipment" accounted for 76 tons of CO₂e in 2020, less than 1% of all emissions (GreenCare, 2021a). Service delivery and some supply chain transport were included in these emissions, but they did not encompass staff commutes, patient travel, or visitor travel (E. Lomax, personal communication, June 2022). Moreover, personal vehicle usage for business purposes was not included in the emissions (E. Lomax, personal communication, June 2022). Based on the worldwide estimation of transportation accounting for 7% of healthcare GHG emissions, one could surmise that Fraser Health's transportation emissions in 2020 were approximately 2,791 tons of CO₂e.

Impacts of GHG emissions

Environmental

As the Earth's temperatures increase due to GHG emissions, there are more frequent severe and extreme weather events such as floods, hurricanes, tornadoes, and heat waves (Government of Canada, 2022b). Droughts become more common, and the melting of polar caps exacerbates sea level rise (Government of Canada, 2022b). Plant and wildlife species perish if they are unable to adapt, thereby detrimentally affecting food security and biodiversity (Government of Canada, 2022b). Permafrost thaws, which only serves to expedite the global heating process as carbon previously trapped in the frozen ground is released (Government of Canada, 2022b).

Public health

GHG emissions and resulting rising temperatures increase risk of death due to dehydration, heat stroke, and injury from extreme weather events (Government of Canada, 2022b). Worsening heat along with air pollution exacerbate the incidence of NCDs such as cardiovascular disease (CVD) and cancer

(CA) (Government of Canada, 2022b). Food-, vector-, and rodent-borne diseases also surge as warm seasons grow longer, wildlife habitats are destroyed, and predator numbers decline (Barbier, 2021; Government of Canada, 2022b; O'Bryan et al., 2020). Global heating and extreme weather events also exacerbate food insecurity due to crop failure (IPCC, 2019). Additionally, climate anxiety and weather event-related trauma deteriorate mental health (Government of Canada, 2022b). GHG emissions also contribute to air pollution which has been linked to respiratory illness, cardiac disease, and lung cancer (World Health Organization, 2019). In 2016, there were approximately 15,300 premature deaths attributable to air pollution in Canada and 1,900 in B.C. (Government of Canada, 2021). Emissions just due to transportation alone contributed to more than 1,000 premature deaths in Canada due to air pollution in 2015 (Canadian Medical Association, 2019). Marginalized populations, including BIPOC, children, low-income individuals, and the elderly, are among those who are most vulnerable to the impacts of GHG emissions, air pollution, and climate change (Government of Canada, 2022b; World Health Organization, 2019).

A detrimental feedback loop forms where the healthcare industry releases GHGs while providing care for patients, worsening climate change (Lenzen et al., 2020). Healthcare needs increase as a result, which escalates healthcare provision and thereby leads to more GHG emissions (Lenzen et al., 2020). Indeed, in Canada, healthcare sector GHG emissions cause the annual loss of approximately 23,000 disability-adjusted life years (DALYs) (Eckelman et al., 2018).

Feedback Loop:



Co-benefits of reduced GHG emissions

Reducing GHG emissions will help the world meet the 2015 Paris Agreement's target of keeping global average temperature from rising 1.5°C above pre-industrial levels (Chestney & Chung, 2018). In order to achieve this goal it is estimated that countries must commit to carbon neutrality by mid-century (Chestney & Chung, 2018). It is critical to meet these climate targets in order to improve air quality and human health.

A co-benefit of emissions reduction is a decrease in air pollution, resulting in improvement in air quality (West et al., 2013). Human health improves as a result, which lowers DALYs and premature deaths worldwide (Gao et al., 2018). West et al. did a study that compared two models predicting GHG emissions: the Representative Concentration Pathway 4.5 (RCP4.5) scenario where interventions are implemented versus the reference scenario which is business-as-usual (2013). The RCP4.5 scenario showed that cutting GHG emissions could potentially prevent 0.4 million premature deaths from cardiopulmonary disease and lung cancer due to air pollution worldwide by 2030, 1.1 million by 2050, and 1.5 million by 2100 (West et al., 2013).

Percentages of deaths and quantity of DALYs reduced by mitigating GHG emissions vary country to country (Gao et al., 2018). For example, a study conducted in London, U.K. and Delhi, India revealed that the interventions to lower GHG emissions by combining active transportation with low-emission motor vehicles reduced 7,439 DALYs in London and 12,995 in Delhi relative to business-as-usual projections for 2030 (Woodcock et al., 2009). In a New Zealand study, researchers found that switching 5% of vehicle-travelled kilometers to cycling could avert 122 premature deaths and reduce transport-related GHG emissions by 0.4% (Lindsay et al., 2010). The reduction in premature deaths would be due to better air quality as well as the increase in physical activity with cycling (Lindsay et al., 2010).

Other climate policies to curtail GHG emissions have health co-benefits as well, such as initiatives to reduce red meat intake and incorporate more plant-based foods into diets (Karlsson et al., 2020). Lowering livestock production reduces GHG emissions, and eating more plant-based foods is associated with a lower risk of NCDs such as CVD and colorectal CA (Karlsson et al., 2020). Additionally, policies such as moving away from fossil fuels and adopting renewable energy contribute to decreasing GHG emissions and lower the amount of heat released into the atmosphere. The energy source transition mitigates global heating and the urban heat island effect, thereby reducing heat-related deaths and illnesses (Harlan & Ruddell, 2011).

Sustainable transportation

Impact of sustainable transportation on GHG emissions

Choosing sustainable modes of transportation reduces GHG emissions. For example, choosing a sustainable alternative to a single-occupant vehicle just one day a week can reduce GHG emissions by 20% (GreenCare, n.d.-a). Carpooling with one other person cuts GHG emissions in half (GreenCare, n.d.-a), and taking public transit, cycling, or walking can reduce GHG emissions to almost nothing (GreenCare, n.d.-a).

The roles of active and multi-modal transportation in sustainable transportation

Sustainable transportation is normally accompanied by another form of transportation. For example, “transit users are also walkers by definition, because buses and trains seldom offer door-to-door service. Since a car is rarely available at the end of a transit trip, the likelihood of walking between two intermediary destinations is potentially high” (Lachapelle & Frank, 2009). Also, studies have shown that public transportation users have higher levels of physical activity “because every public transportation trip is a multi-modal trip. Most people who use public transportation walk to or from stops and stations or make other trips by foot during the course of their day” (United States Department of Transportation, 2015a).

Co-benefits of active transportation

Health

Active transportation is a way to meet the WHO Physical Activity Guidelines for adults 18-64 years old to reduce risk of NCDs (Neumeier et al., 2020; Vairo et al., 2017). The amount of exercise recommended is 150 minutes of moderate exercise per week or 75 minutes of vigorous physical exercise (Neumeier et al., 2020; Vairo et al., 2017). One study in Bristol, U.K. showed that approximately 70% of University of Bristol staff who actively commuted to work via cycling or walking logged an average of 120 minutes of activity per week (Brockman & Fox, 2011). Additionally, active transportation improves cardiovascular health and reduces BMI (Vairo et al., 2017).

Only 18% of Canadian adults are meeting the WHO guidelines, and they spend an average of 1.9 hours per week using active modes of transportation (Government of Canada, 2018). Physical inactivity is the fourth leading risk factor for premature deaths in Canada, so increasing physical activity via active

transportation could contribute to improving the health and lifespan of the Canadian population (Government of Canada, 2018).

Work productivity and absenteeism

Research has shown that there is a positive correlation between a staff's physical activity and their productivity at work (Puig-Ribera et al., 2017; Winnipeg Regional Health Authority, n.d.). Not only that, but "there is a large body of evidence indicating that people who are engaged in active transportation to work are healthier, happier, have better workplace attendance records" (Winnipeg Regional Health Authority, n.d.). A study in Cambridge showed that cycling commuters were absent due to illness approximately one less day per year compared to non-cycling commuters (Mytton et al., 2016). In the Netherlands, another study revealed that absenteeism due to illness was one less day on average for cycling commuters than non-cycling commuters (Hendriksen et al., 2010). In fact, a longer cycling commute correlated with a smaller number of days out of work due to illness (Hendriksen et al., 2010).

Staff recruitment/retention due to commuter benefits

In a Gallup poll from 2021, 70% of job hunters in the U.S. expressed that the environmental record of a company played a part in determining if they would accept a job from that company, and 24% stated that it was a major factor (McCarthy, 2021). Therefore, it stands to reason that employers who offer commuting benefits to their staff "gain a competitive edge in employee recruitment and retention" (United States Environmental Protection Agency, 2006). Examples of commuter benefits to increase active transportation with cycling would be providing infrastructure for bicycles and end-of-trip facilities, allowing for more relaxed dress codes, and providing financial incentives such as a kilometric allowance (a similar idea to a kilometric reimbursement for using one's personal vehicle) (Boschetti, 2017; Winnipeg Regional Health Authority, n.d.). Also, retention allows employers to save money as they do not have to leave positions vacant while paying to hire and train employees (Lobell, 2019).

Cost savings to the employer

Sustainable transportation saves employers money. Three cost-saving factors have already been mentioned above: less absenteeism, improved productivity, and reduction in employee turnover. Additionally, providing commuter benefits to staff is cost-effective because those benefits have greater long-term cost savings than straight salary increases for employees (United States Environmental Protection Agency, 2006). Also, if more staff are opting for sustainable transportation for their commutes then less parking is needed, thereby allowing employers to pay for fewer parking spaces (United States Environmental Protection Agency, 2006).

B.C. and sustainable transportation

Even though B.C. is the third most populous province in Canada, it only accounted for 9.2%³ of GHG emissions nationally in 2020 (Government of Canada, 2022a; Statistics Canada, 2022). B.C.'s low GHG emissions are in part due to the province's reliance on hydropower as a main source of power (Canada Energy Regulator, 2022). Regardless, the B.C. Government is committed to lowering GHG emissions. The Climate Change Accountability Act in 2007 made a commitment to reduce GHG emissions to 40% below 2007 levels by 2030, 60% by 2040, and 80% by 2050 (Government of British Columbia, n.d.). In the Act, B.C. asserted that part of the plan to bring down GHG emissions would include lowering transportation GHG emissions by 27-32% below 2007 levels by 2030 (Government of British Columbia, n.d.). Additionally, the B.C. government has required all new construction and renovation of public sector buildings - which includes healthcare facilities - to be LEED Gold certified or equivalent since 2007 (Ministry of Environment and Climate Change Strategy, 2017).

In 2021, the B.C. Government released the CleanBC: Roadmap to 2030 strategy, which declared a goal of decreasing single-occupancy vehicle transportation and increasing usage of sustainable transportation (Government of British Columbia, 2021). By 2030, the targets are to reduce travel by vehicles by 25% and increase active and public transportation uptake by 30% (in comparison to 2020) (Government of British Columbia, 2021). Regarding the healthcare industry, the plan also discusses having businesses reduce fleet emissions by 40% and building emissions by 50% by 2030 (Ministry of Environment and Climate Change Strategy, 2022). Beyond 2030, the Government of B.C. seeks to increase active and public transportation by 40% by 2040 and by 50% by 2050 (Government of British Columbia, 2021).

Fraser Health and sustainable transportation

Goals

Fraser Health has a goal of carbon neutrality each year which is achieved by paying carbon offset for all emissions produced from building utilities, fleet, and paper purchasing (GreenCare, 2021a). The health authority aims to increase sustainable transportation usage among its staff to 50% by 2030

³ B.C. emitted 61.7 megatons of CO₂e and Canada emitted 672 megatons of CO₂e in 2020 (Government of Canada, 2022a)

(GreenCare, n.d.-b). It is recognized that some staff will always require single-occupancy vehicles for commuting due to mobility, family, work, and other factors (GreenCare, 2021b).

Current Status

In 2020, 29.5% of Fraser Health staff commutes used sustainable transportation, even though the goal was 35% (GreenCare, n.d.-b). Active transportation accounted for 5.9% of all commutes, whereas cycling and walking accounted for 1.4% and 4.5% respectively. It was reported that staff cycling commutes decreased in 2021 to 1.2% (GreenCare, 2022).


Existing infrastructure and incentives

Fraser Health has some cycling infrastructure in place to promote active commuting, and they have initiated other incentives to increase staff uptake of sustainable transportation usage. For instance, Integrated Protection Services (IPS) has compiled the bicycle infrastructure for short- and long-term storage and end-of-trip (EOT) facilities for each of the Fraser Health facilities as a baseline to know where to implement improvements⁴. Also, GreenCare has provided online links to free bicycle webinars, access to a video education series for cycling in the city, and a Metro Vancouver cycling map (GreenCare, n.d.-c). Regarding other incentives for improving usage of other types of sustainable transportation, Fraser Health provides 15% subsidies for monthly public transportation passes, free hospital shuttles, subsidies for two car-sharing programs, free three-hour electric vehicle charging, and instructions on how to form a carpool (GreenCare, n.d.-c; Integrated Protection Services, 2021).

Barriers

Although commuting via sustainable transportation provides many benefits, there are barriers and limitations to adopting this form of commuting. First, the Fraser Health catchment area is large, and many of the staff and patients traveling to Fraser Health facilities are faced with long-distance travel in areas that lack convenient public transportation or safe infrastructure for walking or cycling, especially in rural municipalities. Potential commuters may have fear or safety concerns due to lack of experience cycling in traffic (Government of British Columbia, 2019b; Vairo et al., 2017). Also, per GreenCare, staff have perceptions of public transit being inconvenient and just as expensive as driving, and they may not be aware of potentially workable public transit or active commute options (GreenCare, n.d.-a). Additionally, some staff need to work off-site during the work day and feel that it is more convenient to

⁴ See Appendix A: Bicycle Storage per Full-Time Equivalents in 2021 at Fraser Health Facilities



use their own car (GreenCare, n.d.-a). Moreover, some staff are concerned about how the dress code can be prohibitive for active transportation and that one needs to be in good shape or young to participate in active transportation to work (GreenCare, n.d.-a).



Opportunities: Case studies of sustainable transportation initiatives

Sustainable transportation case studies were sourced by consulting databases for published literature such as PubMed, Google Scholar, and the Simon Fraser University library catalogue. Grey literature was reviewed as well, including government reports, health authority reports, media articles, and organizational websites. These case studies will be described in the table on the following pages.

Healthcare on a roll

Healthcare providers (HCPs) on bicycles

HCPs can travel to see patients faster and easier without the hassle of car traffic or parking, and healthcare facilities can improve their carbon footprint.

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| Sussex, U.K.: Community Foundation Trust (National Health Service, n.d.-c) | The local Community Foundation Trust has purchased one pool e-bike and three e-bikes dedicated to specific clinical teams for a clinic in Sussex, U.K. The e-bikes are normally used for patient home visits. Thus far, staff have travelled a total of 8,000 miles and have prevented the release of approximately two tons of CO ₂ . |
| Exeter, U.K.: Co Bikes trial (Exeter News Blog, 2021) | Co Bikes, an e-bike sharing company, trialed the use of their bikes with general practitioners (GPs) at a clinic in Exeter, U.K. The trial was funded by the Devon County Council and a grant from the Department of Transport. The e-bikes were used for home visits. Not only were the GPs' trips more climate-friendly, but they also inspired patients to increase their physical activity. |
| Cornwall, U.K.: GPs purchased an e-bike fleet (Reid, 2020) | A clinic of sixteen GPs in Cornwall, U.K. purchased a fleet of e-bikes for commuting as well as home visits. The e-bikes significantly cut down on the time that it takes to travel to and find parking at patients' homes, and it helps the clinic cut its carbon emissions. |

Healthcare supply delivery by e-cargo bike

Healthcare supply delivery via e-cargo bikes can decrease delivery supply time and help healthcare facilities improve their carbon footprint.

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| Oxford, U.K.: Pedal and Post (Bowden, 2021) | Pedal and Post, a bicycle delivery business in Oxford, U.K., has been using e-cargo bikes to deliver over 25,000 medical supplies from Baxter Healthcare, the local medical supplier, to hospitals in the area. These medical supplies include chemotherapy, antibiotics, and intravenous nutrition. The company switched from one van that would make multiple runs between sites to three cargo bikes that make five to six runs per day. The delivery run times have decreased by 50%, and the company has saved approximately ten tons of CO ₂ . Additionally, transporting medications such as chemotherapy are no longer dependent on the amount of traffic. |
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| <p>Newcastle, U.K.: ZMOVE and the NHS (National Health Service, 2020a)</p> | <p>Due to an impending Clean Air Zone going into effect in Newcastle city center, the Newcastle Hospitals NHS Foundation Trust trialed an e-cargo bike delivery service with ZMOVE, a locally-based low-carbon courier company. The trial ran from October through December of 2019, and the e-cargo bikes replaced a diesel van courier service that ran between two city center hospital campuses. The e-cargo bike service transported items such as medical specimens and laundry, and it ran for twenty hours per week with twenty five stops across an eight mile route. The results noted after the three-month trial were a savings of 212kg of CO₂e, a reduction of air pollution by 463g of carbon oxides, £6,250 (approximately \$9,788 CAD), and more parking space for NHS staff and patients.</p> |
| <p><i>Cycling incentives and perks</i></p> | |
| <p><u>Cycling classes at work</u> <i>Learning more about how to commute in traffic and in bad weather can help staff feel more comfortable to try out cycling commutes.</i></p> | |
| <p>Vancouver, B.C.: Vancouver Coastal Health (VCH) and HUB Cycling (Vancouver Coastal Health, 2022)</p> | <p>VCH partners with HUB cycling, a cycling advocacy group in Metro Vancouver, to offer in-class and on-road bicycle training for riders who would like more experience learning how to ride in traffic.</p> |
| <p>Vancouver, B.C.: HUB Cycling (HUB Cycling, 2022b)</p> | <p>HUB offers itself for hire for workplace cycling workshops in the Metro Vancouver area. Some topics covered are city cycling, bicycle maintenance, e-biking, and fall and winter cycling.</p> |
| <p><u>Bicycle maintenance workshops at work</u> <i>Keeping the bicycles in good condition helps staff maintain their active commutes, promotes health, and decreases their carbon footprint (Ride On Treats NHS Staff to Free Bike Checks, 2021).</i></p> | |
| <p>Devon, U.K.: Ride On Cycling for All and the NHS (Ride On Treats NHS Staff to Free Bike Checks, 2021)</p> | <p>Ride On Cycling for All was awarded £4,000 (approximately \$6186 CAD) by the South West Water Community Fund Project in Devon, U.K. to give free bicycle checks by bicycle mechanics to 198 NHS staff at their community hospitals between June and October of 2021.</p> |

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| Vancouver, B.C.: VCH (Vancouver Coastal Health, 2022) | VCH hosts bicycle maintenance workshops in the spring and fall. Sometimes, a mechanic is brought in to provide basic tune-ups while commuting staff work. |
| <u>Flexible dress code</u> | |
| San Diego, CA: Mixte Communications, a Bicycle Friendly Business (Garcia, 2018) | Mixte Communications was deemed a Bicycle Friendly Business by the League of American Bicyclists in 2018. Besides providing bicycle storage and end-of-trip facilities, cycling classes, and staff workshops on bicycle maintenance, Mixte also implemented a flexible dress code that accommodates cycling commuters. |
| Financial incentives | |
| <u>Direct payment</u> | |
| <i>Cycling saves companies parking costs, improves companies' carbon footprints, and promotes health among the commuting staff (Kalinowski, 2013).</i> | |
| U.K.: Wardman et al.'s 2007 model (Wardman et al., 2007) | "Payment for cycling to work does appear to have a large impact on the demand for cycling. A payment of £2 [approximately \$3 CAD] per day is not far from achieving a doubling of the amount of cycling and has a larger impact than the ideal but unachievable scenario of cycling to work being spent entirely on completely segregated cycleways. It would yield a 5.4% reduction in car demand, increasing to a very appreciable 23.6% for a £5 [approximately \$7.75 CAD] daily payment. A number of studies have clearly shown the low perceived status of cycling in some locations... It is possible that the provision of monetary incentives, however undertaken, could go a long way towards rectifying such negative status by providing a degree of economic value to the activity." |
| Cleveland, Ohio, U.S.: The Cleveland Museum of Natural History (Ohio Department of Health, 2019) | In northeast Ohio, every year the Greater Cleveland Regional Transit Authority, the Northeast Ohio Areawide Coordinating Agency, and Sustainable Cleveland award medals to local businesses who support sustainable transportation. In 2018, a silver medal went to The Cleveland Museum of Natural History for providing incentives to their staff for commuting via sustainable transportation. Employees could earn up to \$50 per month for commuting via transit, cycling, carpooling, or walking. |

Kilometric allowance

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| U.K.: Government-supported kilometric allowance program (Allan, 2020; Government of the United Kingdom, n.d.-a) | Staff who cycle during work using their own bicycle receive twenty pence (approximately \$0.32 CAD) per kilometer tax-free. The allowance can come from the employer; if the employer does not offer this (or offers less than this), then the employee can claim tax relief through Her Majesty's Revenue and Customs. |
| Toronto, ON: The Bursting Silver technology company (Kalinowski, 2013; Rhee, 2013) | Bursting Silver employees who cycle to meetings with consultants are paid twice what they would be paid if they were driving a car: \$1 CAD per kilometer versus \$0.50 CAD. |
| The Netherlands: Government-supported kilometric allowance program (Government of the Netherlands, 2020) | Employers may pay employees a tax-free allowance of €0.19 (approximately \$0.25 CAD) per kilometer, which is the same rate that staff receive if they are commuting by car. |
| The Netherlands: De Kruijf study about the impact of a local e-bike incentive (de Kruijf et al., 2018) | Participants had to meet the following criteria: at least 50% of their commutes were by car, their commuting distance had to be at least three kilometers, they had to be working in North Brabant, and they had to be between 18-65 years old. They were given €0.15 (approximately \$0.20 CAD) per kilometer for riding their e-bike during peak traffic hours and €0.08 (approximately \$0.10 CAD) per kilometer for riding their e-bike during off-peak traffic hours, and could earn a maximum of €1,000 (approximately \$1,306 CAD). Commuter behavior was analyzed at one month and again at six months. The study mentioned that participants had purchased their e-bikes, but there was no mention of financial assistance in purchasing the e-bikes. Results showed that e-bike usage increased from 0% to 68% after one month and up to 73% after six months. |
| Belgium: Government-supported kilometric allowance program (Goffinet, 2021; Haubold, 2017; Roetynck, 2022) | Belgium started their financial incentive scheme for cycling commuters in 1999. According to research by the European Cyclists' Federation, Belgian cycling commuters increased by 30% between 2011 and 2015. Starting on January 1, 2022, Belgian cycling commuters can receive up to €0.25 (approximately \$0.33 CAD) per kilometer tax-free from their employer. Per SD Worx, a human resources company based in Belgium, the percentage of cycling commuters has decreased since the start of COVID-19, mainly because many white-collar workers began to work from home. For instance, 22% of all Belgian employees received the allowance, dipping to 14% in 2021. According to a Federal Public Service Mobility and |

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| | Transport survey of 2,000 Belgian adults published in 2020, 66% of cycling commuters receive a kilometric allowance. |
| France: Government-supported kilometric allowance program (Boschetti, 2017; De Clercq, 2018) | Employers can pay cycling commuters €0.25 (approximately \$0.33 CAD) per kilometer tax-free. Civil servants can earn up to €200 per year and private company employees can earn up to €400 per year. During the pilot program in 2014-2015, cycling increased by 50% in the first few months but then went up to 125% after the first year. During the first six months of the program, it was estimated that there was a reduction in CO2 emissions by 2.7 tons. |
| <u>Bicycle rental and reimbursement programs</u> | |
| U.K.: Cycle to Work scheme (Allan, 2020; Ballinger, 2020; Department for Transport, 2019; Swift et al., 2016) | <p>The program started in 1999 as a part of the Finance Act to encourage workers to commute to work via bicycle. There are multiple ways that an employer can participate in the Cycle to Work Scheme:</p> <ul style="list-style-type: none"> ❖ Employees pay their employer monthly to rent a bicycle, a tricycle, a cycle with four or more wheels, or an e-bike, plus/minus cycling safety equipment to use for commuting. The rent is tax-free and usually deducted from the employees' salaries. The employees can then purchase the cycle and safety equipment that they have been using at the end of the rental period (usually twelve to eighteen months). ❖ Employers give tax-free loans to their employees (similar to a salary advance) so that they can purchase a cycle for active travel. ❖ Employers can purchase a fleet of cycles for staff to use during work. <p>Employees can save up to 40% of the cost of a commuter bicycle due to reduced income tax and National Insurance. Providers exist that can help companies navigate how to provide incentives for their employees in the Cycle to Work Scheme.</p> <p>In a 2016 report, Swift et al. stated that 183,423 people in 2014 participated in the scheme, up 11.6% from participants in 2013. In a Cycle to Work employee survey in 2015, respondents indicated that due to the Cycle to Work Scheme 9% of non-cyclists started to commute via cycle, 57% of cyclists increased their commute via cycle; and average weekly cycling mileage increased, especially among previous non-cyclists and occasional cyclists⁵. The evidence was not conclusive that the Cycle to Work Scheme significantly</p> |

⁵ Please see Appendix B: "Weekly distance cycled to work, before and after the cycle-to-work scheme"

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| | impacted the volume of cycling commuters, and the authors did not know if the survey represented all Cycle to Work Scheme users. However, the authors mention that other surveys had revealed similar results, thereby indicating that cycling incentives can have a positive effect on the volume of cycling commuters. Also, official transportation data showed that miles cycled in the U.K. had increased over 2% per year around the time that this study was published. Moreover, data from the Cycle to Work Alliance revealed that there was a 120% increase in bikes purchased via scheme from 2019 to 2020. |
| U.S.: Bicycle Commuter Tax Benefit program (Szczepanski, 2013) | Employees can be reimbursed up to \$20 USD (approximately \$26 CAD) per month by their employer for “reasonable expenses incurred by the employee in conjunction with their commute to work by bike.” The reimbursement is <i>not</i> tax-free, and it cannot exceed \$240 USD (approximately \$312 CAD) per year. Reasonable expenses include a cycle, lock, helmet, maintenance, and parking. To qualify, employees must use their cycles for commuting at least three days per week, and they cannot receive other transportation benefits. |
| Luxembourg: Government subsidy for bicycles and e-bikes (Oglesby, 2021) | Luxembourg residents can be reimbursed by the government for 50% of their bicycle or e-bike purchase up to €600 (approximately \$784 CAD). |
| Nelson, B.C.: Municipality-supported loan for bicycles and e-bikes (BC Cycling Coalition, 2021) | Nelson residents can borrow up to \$8,000 CAD per household to purchase a bicycle or e-bike. The loan is provided by the municipality-owned hydro utility, and borrowers can choose to pay it off in two or five years. It is not specified whether the loan has interest or not. |
| B.C.: The SCRAP-IT® Program (SCRAP-IT, 2022) | A car owner can receive a \$750 CAD rebate in exchange for scrapping their car at an approved drop-off scrap yard in B.C. |
| <i>Sustainable commuting program initiatives</i> | |
| Vancouver, B.C.: Sustainable Commuting Program for city employees (City of Vancouver, n.d.-b) | This program is funded by charging city employees market-rates for parking at all city hall parking lots. This program offers rebates for public transportation passes, incentives for carpooling (including reserved parking), rewards for commuting via active transportation (such as gift certificates for rain gear), cycling classes, subsidized bicycle tune-ups and a “Guaranteed Ride Home” program for employees who become ill or have an emergency. |

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| Greater Toronto and Hamilton Area (GTHA), ON: Smart Commute Program (Smart Commute, 2022) | This program works with employers in the GTHA to provide their employees with carpool ride-matching, subsidized public transportation, active transportation programs, telework programs, and “Emergency Ride Home” programs for illness, an emergency situation, a bicycle breakdown, unscheduled overtime, or if a carpooling partner is unexpectedly unavailable. |
| Active transportation events | |
| B.C.: Move Commute Connect (Government of British Columbia, 2019b) | Representatives from the Government of B.C. met with various stakeholders online and in person to discuss development of a strategy for active transportation, resulting in the “CleanBC Move Commute Connect: What We Heard Report.” Participants recommended expanding events such as “Go by Bike Week,” car-free days, and bike rodeos to increase awareness and uptake of active transportation with cycling. |
| B.C.: Go by Bike Week (GoByBike BC, 2022; HUB Cycling, 2022a) | GoByBike BC Society and Hub Cycling promote “Go by Bike Week” events twice per year. GoByBike BC Society is province-wide and Hub Cycling serves Metro Vancouver. |
| Nelson, B.C.: Bike Rodeo (HealthySchools BC, 2022) | B.C.’s Health Promoting Schools Coordinator teamed up with the Nelson Police Department, Nelson Regional Sports Council, Save-On-Foods, ICBC, Kidsport, and a local Public Health Nurse to |
| Demand responsive transport (DRT) | |
| U.K.: “Stagecoach Connect” mobile app and the NHS (Government of the United Kingdom, n.d.-b; Hall, 2021; <i>Via Transportation</i> , 2020; WSP, 2021) | DRT is a service that provides shared transportation for passengers who specify their pick-up and drop-off locations; it can be a useful transportation method in rural areas where public transportation options are not as prevalent. DRT can decrease GHG emissions by replacing private vehicle transportation, and can also aid passengers in safely getting to public transport hubs. “Stagecoach Connect” is a DRT service that started during COVID-19 in May of 2020 as a free option to transport NHS staff to and from the hospital during early and late hour shifts (when public transportation options are low which increases the likelihood of commuting via private vehicle). The service is a collaboration between NHS hospital trusts, municipalities, and ViaVan. Staff can pre-book a seat on the “Stagecoach Connect” mobile app and the service directs them to a “virtual bus stop” where a bus picks them up and takes them to work. |

Government-run transportation plans

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| <p>B.C.: Move Commute Connect (Government of British Columbia, 2019a, 2022)</p> | <p>The goals of the province’s plan are to: double the percentage of active transportation trips by 2030, implement a “Vision Zero” plan to reduce injuries and deaths due to cycle collisions with cars to zero, put into place incentives (such as the SCRAP-IT® program) to increase active transportation, and improve infrastructure with municipalities and the B.C. Active Transportation Infrastructure Grant Program (formerly known as BikeBC) to increase accessibility to active transportation B.C.</p> |
| <p>Vancouver, B.C.: Active Transportation Plan (City of Vancouver, n.d.-a)</p> | <p>The high-level goals of the city’s plan are to market walking and cycling, increase active transportation among children traveling to school, provide peer support to help new riders, educate drivers on how to share the road with cyclists, and host promotional events such as a “Go by Bike Week,” a bike rodeo to teach about cycling and bicycle maintenance, and short-distanced group rides.</p> |
| <p>Surrey, B.C.: Vision Zero Surrey Safe Mobility Plan (City of Surrey, n.d.)</p> | <p>In Surrey, approximately 12,000 people are injured and twenty people are killed yearly due to traffic collisions. Pedestrians and cyclists are two of the more vulnerable groups. Compared to someone driving a car, pedestrians are forty-two times more likely to die in a crash in Surrey, and cyclists are fifteen times more likely to die.</p> <p>The plan’s short-term goal is to reduce injuries due to car collisions by at least 15% by 2023, and its long-term goal is to eventually reduce injury collisions to zero. Some of the measures that will be taken are speed enforcement, better road design to slow drivers down, and design that prioritizes pedestrian and cyclist safety.</p> |

Recommendations

Baseline information

Fraser Health needs to obtain baseline information about its transportation-related GHG emissions. There is some data on fleet emissions, but this does not include staff commuting, staff usage of their personal vehicles for business-related travel during the workday, patient travel, or visitor travel. Without that information, Fraser Health will not be able to show the impact of the promotion of sustainable transportation among their staff on the health authority's GHG emissions.

Financial incentives

The case studies and programs explored above may give some ideas to Fraser Health for increasing uptake of active transport among staff via financial incentives. For instance, the 2013 study by de Kruijf et al. and the 2007 model by Wardman et al. showed that kilometric allowances can promote staff commuting via active transportation. Other monetary incentives have indicated a positive effect on cycling commutes, such as the U.K.'s Cycle to Work Scheme where commuters can essentially rent-to-own their own bicycles, and Luxembourg's government subsidy of bicycle and e-bike purchases. Fraser Health may consider implementing similar incentives by providing a kilometric allowance or a rent-to-own plan. Additionally, the health authority can raise awareness of the B.C. SCRAP-IT® Program to encourage staff to scrap their car in exchange for a reimbursement on a new e-bike. Fraser Health may consider the possibility of providing a subsidy, maybe even matching the SCRAP-IT® reimbursement.

Providing cycling fleets

Purchasing cycling fleets for staff to use has multiple benefits. E-bikes are a popular option, as they provide clinical staff with quick mobility for home visits without much fatigue and with the benefit of not having to shower or change clothes before seeing patients. E-cargo bikes are a practical choice for staff to deliver medical supplies to Fraser Health sites. Staff can arrive faster to their destinations due to the ability to avoid heavy traffic and to not have to look or pay for parking. Also, if a clinical staff member can use a bicycle at work, they may not feel the pressure to come to work in a personal vehicle since they won't have to use their own vehicle for home visits. The use of bicycles improves Fraser Health's carbon footprint and promotes physical and mental health among cycling staff.

Classes, events, and dress codes

In-person cycling classes for staff such as those offered by HUB Cycling can help boost the confidence of novice cyclists and cyclists of any level who are uncomfortable with riding in car traffic. Classes that specialize in teaching how to ride in fall and winter may improve the likelihood that staff will opt to commute via cycle on cold and rainy days. Events organized by the health authority such as group-rides, “Go By Bike Week,” “Bike to Work Day,” car-free days, and bicycle maintenance clinics can increase awareness of active commuting as well as bolster community connections. Additionally, if staff have a flexible dress code that allows them to feel more comfortable commuting via cycling, they may be more likely to cycle to work.

Commuting programs: Sustainable commuting programs and Demand Responsive Transport (DRT)

Fraser Health can collaborate with municipalities to implement a sustainable commuting program and DRT. The health authority can join with the City of Vancouver in order to learn how to implement a sustainable commuting program. Having the benefit of a Guaranteed/Emergency Ride Home would most likely increase the possibility of staff commuting via active transportation since they would be ensured a safe ride home in case of illness, emergency, or other unforeseen situations. Also, Fraser Health may want to consider financially supporting benefits and initiatives in a similar manner to the City of Vancouver via parking charges. For DRT, the health authority may want to look to the example in the U.K. where staff were given the option of shared transportation to commute to work. DRT can meet the transportation need for staff who live in rural areas, as it will have the potential to decrease their private vehicle usage and improve Fraser Health’s carbon footprint.

Bicycle Storage

In order to increase the number of cycling commuters, Fraser Health could add cycling storage (Integrated Protection Services, 2019; Stinson & Bhat, 2004). Per IPS, long-term bicycle storage needs to cover at least 20% of full-time equivalents during peak hours (Integrated Protection Services, 2019). Bicycle storage promotes staff commuting via cycling, and none of the Fraser Health facilities meet the IPS standard for bicycle storage⁶ (Stinson & Bhat, 2004). However, Fraser health facilities vary widely in location, and some campuses are more difficult to access than others, especially if they are rural.

⁶ Please see Appendix A: Bicycle Storage per Full-Time Equivalents in 2021 at Fraser Health Facilities


Therefore, a facility in an urban setting, such as Burnaby Hospital, may be more realistic to aim for the IPS bicycle storage recommendation than a rural facility such as Chilliwack General Hospital.

Safer cycling infrastructure

Some bicycle routes, especially in rural areas, do not have the adequate cycling infrastructure to commute to the workplace safely. If employees have to travel long distances to work and it seems like the commute is dangerous due to lack of safe infrastructure, they are less inclined to cycle (Stinson & Bhat, 2004). Research has shown that appropriate cycling infrastructure en route encourages cycling commutes (Stinson & Bhat, 2004). The WHO has written about effective interventions to improve cycling safety such as segregated bicycle lanes, bicycle network development, street lights, slower vehicle traffic, and helmet legislation (World Health Organization, 2020). Fraser Health could collaborate with municipalities to improve the cycling infrastructure around their facilities to promote commuting active transportation. Additionally, B.C. and Surrey both have Vision Zero plans to reduce pedestrian and cycling injuries and deaths due to car collisions. Since Surrey is one of the municipalities served by Fraser Health, the health authority could collaborate with the City of Surrey to assist in improving the infrastructure in the intersections that Surrey is focusing on.

Conclusion

GHG emissions contribute to climate change and air pollution, both of which harm human health. The healthcare industry releases GHG emissions, thereby detrimentally impacting the health of those that the industry is attempting to care for. There are many direct and indirect sources of healthcare sector GHG emissions, including transportation. If the healthcare industry adopts more sustainable practices, GHG emissions will reduce and environmental and human health will improve. One way to decrease GHG emissions in the Lower Mainland is by promoting the usage of sustainable transportation among Fraser Health employees. Programs and incentives have been put into place worldwide to encourage sustainable commuting, and there is some evidence that these measures have been effective. Sustainable transportation initiatives present an opportunity to reduce the health authority's carbon footprint. In particular, staff who engage in active commuting would be healthier, more productive, and more likely to maintain their employment with the organization. Fraser Health should implement practices similar or identical to the case studies discussed above in order to increase the use of sustainable transportation for workplace travel and commuting. Adoption of such practices offers Fraser Health further opportunity to serve as a role model for the reduction of GHG emissions in



the healthcare sector, contribute to B.C.'s climate goals, and advance environmental and population health.

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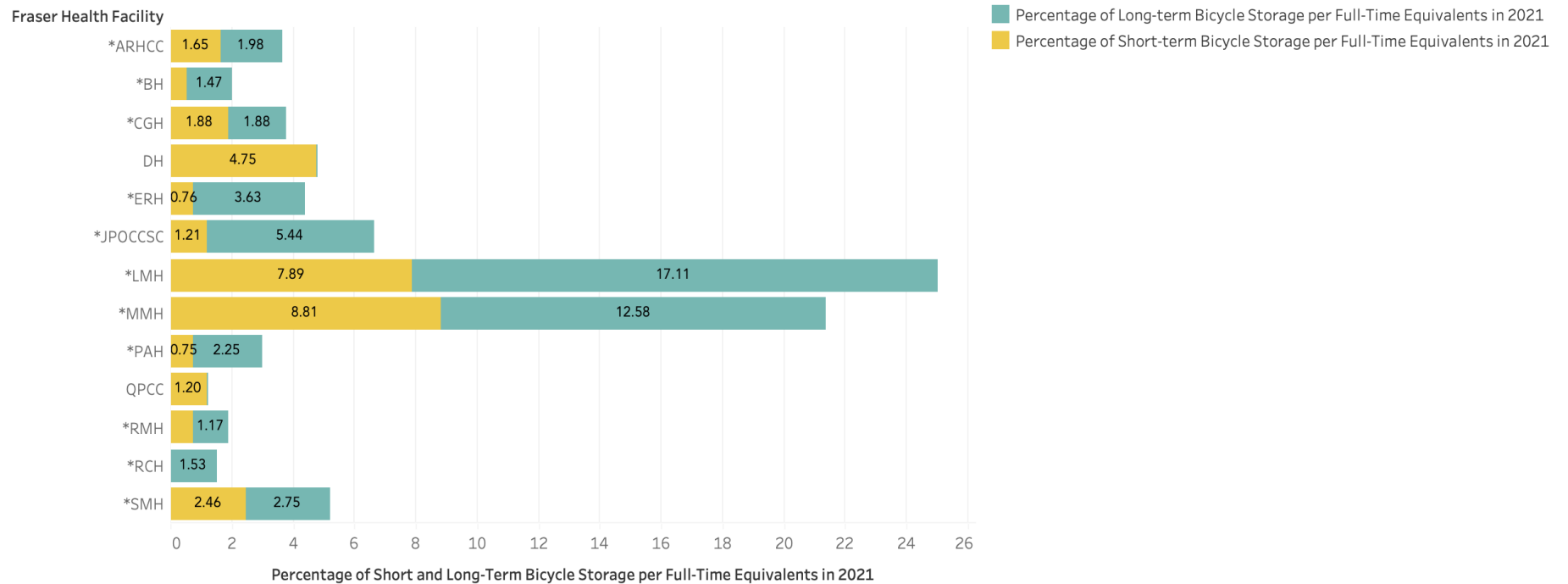
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Appendix A

Bicycle Storage per Full-Time Equivalents in 2021 at Fraser Health Facilities



ARHCC = Abottsford Regional Hospital and Cancer Centre, BH = Burnaby Hospital, CGH = Chilliwack General Hospital, DH = Delta Hospital, ERH = Eagle Ridge Hospital, JPOCCSC = Jim Pattison Outpatient Care Centre and Surgery Centre, LMH = Langley Memorial Hospital, MMH = Mission Memorial Hospital, PAH = Peace Arch Hospital, QPCC = Queens Park Care Center, RMH = Ridge Meadows Hospital, RCH = Royal Columbian Hospital, SMH = Surrey Memorial Hospital

*indicates if the Fraser Health facility has End-of-Trip (EOT) facilities (showers plus either bicycle cages or rooms)

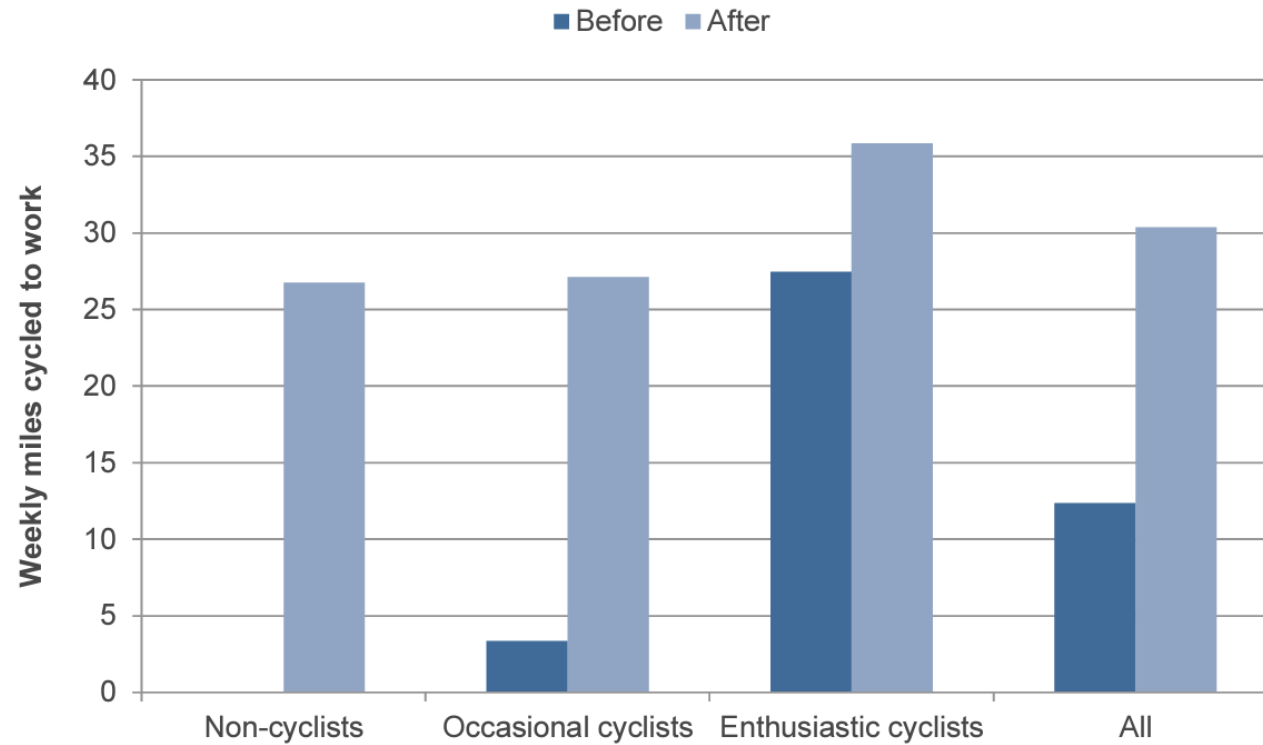
BH Percentage of Short-Term Bicycle Storage per Full-Time Equivalents in 2021 = 0.52%

RMH Percentage of Short-Term Bicycle Storage per Full-Time Equivalents in 2021 = 0.73%

Data received from Integrated Protection Services

Appendix B

Figure 3: Weekly distance cycled to work, before and after the cycle-to-work scheme



N= 12,542

Source: Cycle to Work employee survey 2015

(Swift et al., 2016)