

Reducing the carbon footprint of inhalers

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A recent study showed that among students tasked to write an essay, those who used ChatGPT had the lowest brain engagement, displaying weaker executive function. Are we eroding our ability to think for the sake of convenience? “The outsourcing of thought to artificial intelligence” begins on page 126.

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Burned-out physicians spent more time at work than did nonburned-out physicians ($P < .001$); 100% of surgeons who worked 81 to 100 hours per week screened positive for burnout. “High prevalence of burnout and moral distress in orthopaedic surgeons: A Canadian cross-sectional survey study” begins on page 128.

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Menopause, revisited: Who's still afraid of hormones?

Night sweats, insomnia, hot flashes, mood swings, brain fog—these are just a few of the symptoms people with ovaries may experience with menopause. While I teach medical students that the depletion of ovarian reserve and the decline in estrogen production in midlife are physiologic, I always emphasize that physiologic does not mean painless.

It now appears that, after decades of women suffering in silence, the topic of menopausal hormone therapy is back in public conversation—in a meaningful way.

Three years ago, in an editorial for the *BCMJ* [2023;65:76], I wrote “Menopause: Is the media going to set the record straight?” I was referring to the fear that followed the early termination of the Women’s Health Initiative (WHI) hormone therapy trials in 2002 and 2004.^{1,2} As many will recall, the group of women assigned to combined oral conjugated equine estrogen (Premarin 0.625 mg/day) and oral medroxyprogesterone acetate (Provera 2.5 mg/day) for more than 5 years experienced a higher risk of invasive breast cancer, 8 cases per 10 000 woman-years in absolute risk terms. Yet it was the relative risk of 1.26 that dominated headlines and, alongside concerns about coronary heart disease, led to the conclusion

that the risks outweighed the benefits.³

In the years since, there have been reanalyses of the WHI data, further research on hormone therapies, and meaningful shifts in prescribing trends, including a preference for transdermal estrogen. New therapeutic options have also emerged. In November 2025, the US Food and Drug Administration removed the black box warnings related to breast cancer, stroke, dementia, and cardiovascular disease.⁴

Current consensus holds that menopausal hormone therapy is the most effective treatment for vasomotor symptoms and genitourinary syndrome of menopause, with additional benefits for bone health. For most healthy symptomatic women younger than 60 years of age and within 10 years of menopause onset, the benefits outweigh the risks.⁵

We have exited the post-WHI fear era. Are clinicians keeping up?

Following the sharp decline in hormone therapy use after 2002, many physicians who trained during that period had limited exposure to prescribing it and little demand to build experience. The result is a persistent knowledge gap at a time when patient interest is resurging. This is an ideal

moment to re-engage with the evidence. For a condition that will affect over 1 million women in our province, this is continuing medical education time well spent.⁶

There are many excellent resources to support clinicians who are updating their knowledge; a few of my favorites are listed in the **Box**.

A growing number of virtual menopause clinics have also emerged in recent years.^{7,8} Their success—offering both private-pay and provincially covered visits—speaks to the unmet demand for timely menopause care in Canada. BC Women’s Hospital and Health Centre recently opened the Complex Menopause Clinic for patients whose needs cannot be met by community providers.⁹

Menopause: The social movement

Menopause is no longer just a medical diagnosis; it is also a social movement. It is part of a broader cultural shift in which women are rejecting stigma and passivity in favor of openness and empowerment.¹⁰ Increasingly, they are not waiting for physicians to come around. Instead, they are driving menopause into the mainstream themselves.

Consider Melani Sanders, a social media personality (@justbeingmelani on Instagram) and founder of the We Do Not Care Club, who has given voice to thousands of women navigating menopause and perimenopause. Her widely shared reflections—on everything from unmade beds to arm fat—capture a growing irreverence toward expectations that once kept women silent.¹¹

Menopause may be having a moment, but for patients, access to informed, individualized, evidence-based care still lags. As physicians, we can close that gap by bringing the openness, curiosity, and confidence to menopause care that our patients are already demanding. ■

—Caitlin Dunne, MD

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Dr. Lawrence Yang
Family Doctor, Surrey

Health Data Coalition

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BOX. Educational resources for physicians.

- **UBC CPD: This Changed My Practice:**
 - *Menopause: Don't Sweat it: Part 1 – Symptoms*
 - *Menopause: Don't sweat it: Part 2 – Therapies*
- **BCMJ articles:**
 - “Managing menopause Part 1: Vasomotor symptoms” (2022;64:344-349)
 - “Managing menopause Part 2: Hormone therapy and breast cancer, cardiovascular disease, and premature ovarian insufficiency” (2022;64:350-353)
- **Canadian Menopause Society:** *Menopausal Hormone Therapy (MHT) Products in Canada* (www.canadianmenopausesociety.org)
- **MQ6: Interactive Treatment Algorithm** (<https://mq6.ca/mq6-interactive-algorithm/>)



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Shining light on permanent daylight saving time and health

“British Columbia is going to change our clocks just one more time—and then never again.” Premier David Eby delivered this announcement on 2 March 2026, just ahead of the annual springing forward of the clocks, which had been implemented in British Columbia for decades.¹ And indeed, early on the morning of 8 March 2026, BC timekeeping permanently moved from Pacific Standard Time to Pacific Daylight Time.

What does this mean for our health? Evidence shows that twice-yearly time changes can disrupt sleep.² This is hardly surprising to anyone who has struggled to get up in the morning the day after springing forward each year. Lost sleep

due to time changes in the spring has been linked in some research to increased rates of motor vehicle crashes, while impacts on mental health have been observed following time changes in both spring and fall.³ Premier Eby’s announcement asked that we think of the children, observing that “every parent knows that changing clocks twice a year causes a significant amount of chaos on already busy lives.”⁴

Researchers studying the issue largely agree that a policy to eliminate time changes is a good move from a health perspective. But why a move to permanent daylight saving time, rather than permanent standard time? After all, standard time, as the name suggests, is the default. For the most part, under standard time, we see the sun at its highest point at noon, keeping midday aligned with its intuitive noontime correlate. The popularity of daylight saving time is linked, in large part, to there being additional daylight hours in the evening during the affected months—an extra hour for outdoor sports and recreation, time spent in parks, and safer outdoor play for children. It is easy to see the appeal of an extra hour of evening daylight during the winter.

But wait—stop the clock. Just hours after the announcement of permanent daylight saving time in BC, news coverage began to explore the dark side of this policy. Annoyingly enough, that extra hour of daylight in the evening comes with an extra hour of darkness in the morning.⁵ Under permanent daylight saving time in Vancouver, for example, sunrise will come after 8 a.m. for almost 4 months of the winter and later than 9 a.m. for about 1 month. The effect will be even more pronounced in communities farther north. This will mean a lot of dark mornings for BC residents.

Sleep experts have described health harms that may arise as permanent daylight saving time decouples the timing of waking from the sunrise. Our circadian rhythms rely heavily on exposure to morning light to start our days,² and disruptions to sleep patterns and related impacts on concentration and mood are important impacts. Many experts suggest that the healthy way to eliminate twice-yearly time changes would be permanent standard time rather than permanent daylight saving time.⁵

It is challenging to quantify the health benefits of an added hour of sun on a beach, baseball field, or balcony, let alone to tally up the apples and oranges of social and recreational gains versus circadian rhythm disruptions. Reaching public-health consensus on these options, let alone general public consensus, may be as hard as reaching consensus on a preference for sunrises or sunsets. Where we do have strong agreement is that an end to changing our clocks will be welcome and positive for health. As a society, we should anticipate, study, and mitigate specific harms and make the most of that extra daylight. ■


—Michael Schwandt, MD, MPH, FRCPC

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Holistic medicine—Benefits for the physician and the patient

Being a long-time supporter of holism in medicine, I was pleased to read the editorial on holistic Indigenous medicine¹ but was chagrined to read the article about our pediatrician colleagues' struggles with pediatric mental health.² The editorial on Indigenous health spoke of a proud and empowered re-emergence into a larger, more inclusive Two-Eyed Seeing medical model. Pediatricians, on the other hand, seem to be sinking into heartbreak and dispiritedness. Would more helpers be the solution? Who could afford them? I think that as heartfelt practitioners, we are all stymied at this point. What will this 60% of the pediatrician population look like in 10 to 15 years? Who will family physicians be seeing in their offices?

Most Indigenous medicine philosophies (e.g., First Nations, Taoist, Vedic, Tibetan) are wisdom based and holistic. They originate from a nondual experience of reality. From that point of view, the world is sacred, interconnected, friendly (i.e., discerning but not against), and generous (i.e., basically good). What if medical students were continuously exposed to and tutored in this path of self-cultivation (i.e., "Physician, heal thyself"; e.g., Ken Wilber's integral theory to grow up, clean up, wake up, and show up, or other traditional models found in tantra, shamanism, etc.) alongside their traditional Western training? It boggles the mind! Yet, marinating in this Two-Eyed Seeing approach for 6+ years might strengthen young physicians, giving them resilience and humor—the heart and the spirit we are seeking—and enabling them to stand in the chaos of suffering

and proclaim "I am the doctor and I am the medicine."

—Jim Tucker, MD
Victoria

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The Health Professions and Occupations Act makes a health care system built on trust, respect, and collaboration less achievable

I'm a physician practising in British Columbia, and, for the first time in my career, I find myself questioning whether this profession is still worth it.

When I chose medicine, I believed it was a calling. I grew up watching my father (also a physician) dedicate himself to our community. He worked long hours helping people through the most difficult moments of their lives, sacrificing his sleep, his weekends, and time with our family. Yet he was valued, trusted, and respected for it. This example shaped my life. I have spent over a decade in university and put my family into hundreds of thousands of dollars of debt to serve my community in the same way.

Today, however, the relationship between physicians and the health care system is eroding. The Health Professions and Occupations Act (HPOA) reinforces the message that physicians are adversaries who must be controlled and punished, rather than professionals who should be trusted and supported. Many of the changes

imposed by the HPOA weren't openly discussed with physicians, or even patients. Among other things, the HPOA replaces elected College of Physicians and Surgeons of British Columbia representatives with government appointees. It then allows these appointees to impose fines or even seek imprisonment for infractions. It removes meaningful appeal processes and expands bureaucratic oversight. It allows appointees to access medical records without a court order. It seems to suggest that individual physicians, rather than overburdened and mismanaged systems, are the problem with our health care system. To many physicians, this does not feel like reform; it feels like mistrust.

This sentiment is particularly painful given what we have been asked to endure in recent years. During the pandemic, physicians stepped forward when our communities needed us most. We accepted reassignments to high-risk environments, jeopardizing our personal safety to protect the public. I contracted COVID-19 while reassigned to a critical-care ward and passed it on to my family before vaccines were available.

We accepted these risks because we believed that medicine was a calling, and we honored the trust placed in us. Now it feels like that trust has been eroded.

The reality is that practising medicine in BC is already difficult. Physicians are not employees, but independent contractors. We are responsible for our clinic rent, staff salaries, medical equipment, and supplies. We have no paid vacation, sick leave, or health care benefits. Furthermore, we are not protected by the Employment Standards Act or WorkSafeBC. We may work

28 to 72 hours at a time without protected breaks to eat or sleep.

Despite this, many of us stay in medicine, because the work matters. However, legislation like the HPOA threatens to break our commitment. When the system treats physicians like potential offenders rather than partners in care, it creates moral injury. It signals that dedication, sacrifice, and expertise are not valued.

At a time when BC is facing physician shortages, discouraging physicians seems counterproductive. If the work becomes riskier and less valued, many physicians will leave. Speaking as both a physician and a patient, I want a health care system built on trust, respect, and collaboration. But I believe that legislation like the HPOA makes this less achievable.

—A. Vallee, MA, MD
Victoria

Medical students' perspectives on long-term care

As second-year medical students, we visited a local long-term care home and witnessed the challenges faced by both residents and staff. Conversations with residents deepened our understanding of their daily lives and the essential role these facilities play, while discussions with staff highlighted the strain placed on the system by limited resources and a lack of physician availability. One resident shared that they had waited nearly 2 years for placement. While Canada's physician shortage is well documented, experiences like this reflect a broader issue: growing demand for long-term care is outpacing the system's capacity to provide it.

By 2028, more than one-fifth of Canada's population will be over 65 years of age, intensifying demand for long-term care services.¹ In British Columbia, the number of publicly subsidized long-term care beds per 1000 adults 75 years of age and older has fallen from 77 beds in 2015–2016 to 58 beds in 2024–2025, indicating a widening gap between demand and available care.² At the same time, the number of people waiting for long-term care has more than

tripled, rising from 2381 individuals in 2016 to 7212 in 2025.²

These delays have consequences beyond the long-term care sector. Many seniors who require long-term care remain in hospital beds while awaiting placement, classified as alternate-level-of-care patients. In BC, seniors account for 80% of alternate-level-of-care cases, underscoring the close link between alternate-level-of-care shortages and hospital overcrowding.² Prolonged hospital stays can contribute to poorer health outcomes for older adults, including functional decline, increased infection risk, and worsening mental health, while simultaneously limiting access to acute care beds for others.

Workforce shortages further compound these system pressures. Long-term care residents often have complex medical needs that require consistent physician oversight. However, many facilities struggle to recruit and retain physicians willing to practise in long-term care settings. Administrative demands, travel between facilities, and on-call responsibilities can make long-term care practice difficult to sustain, particularly in the broader context of family physician shortages.³

Encouragingly, BC has introduced initiatives through the Family Practice Services Committee to support the long-term care physician workforce. The Long-Term Care Initiative provides funding for after-hours availability, quality improvement, and compensation for physicians serving as most-responsible providers.⁴ Together, these measures aim to strengthen continuity of care, support clinicians, and reduce unnecessary hospital transfers.

As medical learners, we believe that increasing exposure to long-term care during training may help address this challenge. Early and meaningful engagement in long-term care settings can foster clinical competence, empathy, and a deeper understanding of the needs of older adults. Expanding clinical placements and elective opportunities within long-term care could encourage more trainees to consider careers caring for this vulnerable population.

Ensuring timely access to long-term care is essential, not only for the well-being and dignity of older adults, but also for the resilience of the health care system. Addressing long-term care capacity, workforce support, and training opportunities will be critical as Canada prepares for the growing demands of an aging population.

—Ava Hughes, BSc

—Raha Masoudi, BSc

—Ava Cornell, BSc

—Savannah Swann, MSc

Medical Students, University of British Columbia Faculty of Medicine

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Resilience: Beyond the stiff upper lip

Like many of you, I come from a generation of physicians who were taught—implicitly and explicitly—to keep a stiff upper lip. Medicine was demanding, exhausting, and emotionally heavy, but those realities were framed as part of the job. Stress, burnout, and moral injury came with the territory, and the unspoken expectation was that you simply got on with it. You worked harder, stayed later, and carried on. We've all seen where that approach has led us.

It has produced extraordinary clinicians, but it has also come at a cost. Too many colleagues have quietly struggled. Too many have left practice earlier than planned. Too many have felt isolated, depleted, or disconnected from the very work that once gave them meaning. If *resilience* is defined as the ability to keep going at all costs, then perhaps it's time to revisit what we mean by the word.

Over the years, I've developed a framework I refer to as the Thompson Five. It reflects my belief that physicians truly thrive—not just survive—when they pay attention to five interconnected domains. Ignore one, and the whole structure becomes unstable.

Self

This is the foundation of everything else. If *we* are not okay, it is difficult—if not impossible—to ensure that others are. That may sound obvious, but for many of us, it runs counter to how we were trained. We learned to put ourselves last, to push through fatigue, and to normalize levels of stress that would be unacceptable in almost any other profession.

Caring for oneself is not indulgence or weakness; it is a professional responsibility. It means acknowledging limits, attending to physical and mental health, and creating space for rest and reflection. When we neglect this domain, the consequences inevitably ripple outward—to our families, our patients, and our colleagues.

Family

Family looks different for each of us. It may be a partner, children, parents, close friends, or chosen family. Whatever form it takes, family represents safety, grounding, and perspective.

For me, that place of safety is my wife, Emma, and our sons, William and Ben. I couldn't go out and do the work I do—clinically or as a leader—if I didn't know I belonged to them. Family reminds us that we are more than our professional roles. It anchors us when medicine feels overwhelming and celebrates us when work alone cannot.

When family relationships are neglected, resilience erodes. When they are nurtured, they become a powerful source of strength.

Patients

The trusted relationships we have with our patients are at the heart of why most of us chose medicine in the first place. Each of us entered this profession because we care and want to improve people's lives.

When systems fail, when workloads become unsustainable, and when administrative burdens crowd out human connection, it is often these relationships that suffer first. And when they do, our sense of purpose is threatened. Protecting time, space, and energy for meaningful patient

relationships is not just good care; it is also a vital component of physician well-being.

Community

Community can take many forms. It may be a group of physician colleagues, a department, a hospital, a professional organization, or the broader community in which we live and work. What matters is the sense of belonging and shared purpose.

Medicine has traditionally rewarded independence, but resilience is rarely built alone. Through community, we share burden, learn from one another, and find collective strength. With the power and commitment of community, we can effect change that none of us could achieve individually.

The system of care

Finally, there is the system itself. As physicians, we want a functional system of care—for our patients and for ourselves. When the system is fragmented, under-resourced, or misaligned with clinical realities, moral injury follows. While medical leaders have a particular responsibility to advocate for and help build better systems, this work does not belong to leaders alone. From whatever position we hold, each of us has a role to play in identifying problems, proposing solutions, and pushing for improvement.

Resilience, then, is not about stoicism or endurance. It is about balance, connection, and shared responsibility across these five domains. It is my belief that if we hold these five columns in balance, we will not only survive, but also thrive in the work we do. Keep well. ■

—Adam Thompson, MD
Doctors of BC President

The outsourcing of thought to artificial intelligence

Are we eroding our ability to think for the sake of convenience?

Esther Kaye, MSc

Artificial intelligence (AI) large language models (LLMs) have seen a rapid introduction into medical education, with a positive reception overall, largely due to their effective marketing as tools for efficiency. The alacrity of AI's introduction without stringent guidelines or restrictions demands careful consideration of the potential consequences. We should think about how we are outsourcing our ability to learn, write, and think critically to AI, without fully realizing the implications.

The technological capabilities of AI are growing rapidly, and it is becoming more of a constant feature of students' lives. For example, GPT-4.5, released in February 2025, can act as a personal tutor, and OpenEvidence, a medical search engine for clinical decision support, has more than 40% of physicians in the United States logging daily use.¹ OpenAI has released additional tools for ChatGPT—ChatGPT Health, Emergency Medicine GPT, and study mode—stating on its website that “ChatGPT is becoming one of the most widely used learning tools in the world.”²

Anecdotally, AI is largely well received among my peers. I have seen some use ChatGPT in the library to answer medical questions, and many recommend

putting learning objectives into ChatGPT to summarize and answer questions. I have heard only one concern: it can sometimes provide inaccurate information. As a result, I decided to try using it for a few months, and at first it seemed useful.

One recent study showed that among students tasked to write an essay, those who used ChatGPT had the lowest brain engagement, displaying weaker executive function.

It saved me time by expediting information searches, answering questions, and solving problems that I had trouble grasping. Then I started noticing something problematic. I was finding it difficult to remember what I had read a month prior so that I could apply it. I wondered whether I was having a harder time coming up with my own ideas, and I was feeling less creative. I needed to take a step back to reflect on what I had let happen in my life. I was unknowingly letting this tool take over my thinking. If a tool is something that helps you carry out a task, is AI even really a tool?

One recent study showed that among students tasked to write an essay, those who used ChatGPT had the lowest brain engagement, displaying weaker executive function.³ Another study showed that young learners exhibited lower critical thinking scores with frequent AI use, highlighting a “cognitive laziness” side effect, whereby

learners offload their cognitive responsibilities to the AI tool.⁴ In medicine, when a patient case is presented, the question of differential diagnosis arises. OpenEvidence and ChatGPT can offer a concise answer, and new functions allow LLMs to give step-by-step guidance on how to reach that answer. This instructs users how to think through a problem without having to pause and think for themselves. Without these tools, when an answer is not apparent, we face cognitive friction, having to evaluate information to reach a hypothesis. That uncomfortable pause can strengthen critical thought, forcing us to embrace the idea of inquiry, make sense of information, and question conclusions.⁵ If we outsource our thinking to AI for the sake of ease, it can slowly erode our ability to think critically to understand medicine and the world around us.

Because AI can summarize information into easily digestible packets, we quietly lose our ability to find information across numerous sources, synthesize our own conclusions, and generate new ideas. Additionally, AI can undermine our ability to articulate our thoughts in discussions and in writing. Frankly, it is easier to prompt an LLM to write something than to actively think, consider how we want to communicate, coherently express our interpretations, organize our writing, and revise. Having AI replace our ability to write can make us gradually dependent. If two people have a discussion in which both use AI to communicate, are they communicating with each other or with AI?

As AI creeps into people's lives, we may not grasp the resulting dependency or the

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loss of intellectual autonomy—the ability to use our mind to navigate situations and make decisions. Suppose that one day doctors simply ask AI for patient management steps and trust the results more than their own judgment, a behavior of overreliance already demonstrated in students.⁶

Currently, there is no oversight of the use of AI in medical education; there are no guidelines, rules, or warnings. Not only does AI hallucinate false information to appeal to users,⁷ but it has also been demonstrated to possess capabilities of deceptive behavior.⁸ As AI evolves at a pace that organizations cannot keep up with, how can students decipher what is accurate or not as they try to form baseline knowledge? Additionally, a study from Microsoft noted a correlation between a user's confidence in AI and lower self-reported critical thinking,⁹ raising concerns about how younger learners can gauge confidence amid the constant release of new LLMs.

Medical trainees are introducing AI into their education, regardless of whether it is directly incorporated into their curriculum. We need to promote discourse that helps students develop their critical thinking skills and question whether AI is an aid to learning or whether it will destroy our cognitive abilities and, eventually, pilot the replacement of learners. Many medical professionals and students deny the possibility that AI will replace doctors. What makes us so confident? And what are we prepared to do about it? ■

Competing interests

None declared.

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High prevalence of burnout and moral distress in orthopaedic surgeons: A Canadian cross-sectional survey study

Systemic interventions are urgently needed for orthopaedic surgeons experiencing high levels of burnout to maintain physician well-being and quality patient care.

Cameron J. Leong, BSc, Harpreet Chhina, PhD, Anthony Cooper, MBChB, FRCSC

ABSTRACT

Background: Physician burnout is increasingly recognized as a critical issue with serious consequences for physician well-being, patient care, and the health care system. Orthopaedic surgeons are particularly susceptible to burnout due to numerous stressors surrounding work and personal obligations. The objective of this study was to determine the prevalence of, and risk factors for, burnout in Canadian orthopaedic surgeons.

Methods: Anonymous online surveys were administered to orthopaedic surgeons identified via the senior author's university and the Canadian Orthopaedic Association's mailing list. The survey included the Maslach Burnout Inventory, the Measure of Moral Distress for Health Care Professionals, and demographic questions. Risk factors for burnout were identified using a multivariate logistic regression

model. Associations between risk factors and depersonalization and emotional exhaustion were assessed using a multivariate linear regression model.

Results: In total, 215 participants responded to the survey (response rate of 19.6%). Of those, 62.8% (135/215) screened positive for burnout. When adjusting for other factors, moral distress was identified as a risk factor for burnout (odds ratio = 1.03, 95% CI, 1.02-1.05, $P < .001$). Older age was negatively associated with burnout (odds ratio = 0.97, 95% CI, 0.94-0.99, $P = .02$). There was no association between burnout and work hours, administrative burden, sex, or level of training.

Conclusions: This is the first national study to quantify burnout and moral distress among Canadian orthopaedic surgeons using full-length validated instruments. The high prevalence of burnout, along with the strong association with moral distress, highlights the urgent need for systemic interventions targeting physician wellness.

Background

Occupational burnout is defined by a high level of emotional exhaustion, depersonalization, and a low sense of self-achievement.¹ Burnout is most commonly measured using the Maslach Burnout Inventory (MBI), a validated self-reporting instrument that measures levels of each of the three domains of burnout.¹ Physician burnout has negative consequences for the physician, their family,

their patients, and the health care system as a whole. Physicians who are burned out are more likely to make medical errors and have a detached view of their patients, which leads to a lower quality of patient care.² Burnout negatively impacts the health care system by reducing physician productivity, increasing physician turnover, and reducing access for patients, which leads to increased costs.³ One study estimated that in the US alone, the annual cost of physician turnover and reduced clinical hours was approximately US\$4.6 billion.⁴ In addition, burnout is highly comorbid with mental health issues, such as major depressive disorder, anxiety disorders, and substance use disorders. A US-based survey conducted in 2014 showed that burned-out physicians were more likely to suffer from depression and substance use disorders and were at higher risk for suicide.⁵

Physicians in the US are at a greater risk for burnout than the general population. Shanafelt and colleagues found that physicians had a 40% greater risk for occupational burnout and were 30% less satisfied with their work-life integration compared with other occupations.⁶ Thus, the relatively high prevalence of physician burnout and its negative consequences on the physician, their patients, and the health care system clearly highlight the importance of preventing it.

Similarly, in Canada, burnout levels are high among practising physicians of all specialties. The 2021 Canadian Medical

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Association National Physician Health Survey estimated that 53% ($n = 3864$) of physicians in Canada experienced at least one indicator of burnout (e.g., high depersonalization, emotional exhaustion).⁷ This figure was even higher for residents, with 58% of residents experiencing at least one indicator of burnout. For all respondents, there was a 22% increase in the prevalence of burnout since the previous National Physician Health Survey was conducted in 2017. Risk factors for burnout included identifying as a woman, being under the age of 54 years, having fewer years in practice, and practising in isolated or rural areas.

Other studies have identified moral distress as another important risk factor for burnout.⁸ Moral distress is defined as the inability of an individual to act according to their ethical or moral beliefs due to internal and external constraints.⁹ In health care, this often happens when providers recognize what they believe is the ethically correct course of action but are prevented from following it, which leads to feelings of frustration, guilt, and powerlessness.

Only a limited number of systematic reviews and meta-analyses have evaluated burnout among orthopaedic surgeons. Van Niekerk and colleagues¹⁰ conducted an umbrella review of burnout in orthopaedic surgeons, which included eight systematic reviews and eight narrative reviews. The rates of burnout in the studies reviewed varied from 16.2% to 85.1%. Three reviews noted that residents were at greater risk for burnout than attending surgeons.^{2,11,12} Compared with other specialties, orthopaedic surgeons had a similar or slightly lower risk for burnout. No subgroup analysis was performed to determine the prevalence of burnout by country. In 2020, Kollias and colleagues conducted a national survey of orthopaedic attending surgeons and trainees across Canada, using the Expanded Physician Well-Being Index; 55.4% of attending surgeons and 40.0% of trainees screened positive for distress.¹³

The objective of this study was to estimate the national prevalence of burnout in orthopaedic surgeons and identify risk

factors for burnout. Although prior studies have investigated distress in Canadian orthopaedic trainees, to our knowledge, this is the first study to comprehensively assess burnout and moral distress at a national level using validated instruments. Given the increasing recognition of moral distress as a driver of burnout, particularly post-pandemic, there is a need for timely data to monitor burnout levels and inform wellness strategies.

To our knowledge, this is the first study to comprehensively assess burnout and moral distress at a national level using validated instruments.

Methods

Study participants

This study was designed as a national cross-sectional study using data collected from August 2023 to October 2024. Trainees and attending-level orthopaedic surgeons associated with the senior author's university and the Canadian Orthopaedic Association were invited to participate in the study. Anonymous online surveys were administered through Research Electronic Data Capture (REDCap).^{14,15} Participants were asked to complete demographic questions, the MBI, and, optionally, the Measure of Moral Distress for Health Care Professionals (MMD-HP).¹⁶ The MMD-HP includes an open-ended question that asks participants to identify any factors that may cause them moral distress. Participants were also asked about the number of hours worked per week, the number of hours spent on administrative tasks per week, their level of training, and their academic affiliation.

In concordance with published literature, a participant was screened positive for burnout if their emotional exhaustion score was 20 or higher or their depersonalization score was 10 or higher.¹⁷ If a participant was

screened positive for burnout, they were given a warning message at the end of the survey informing them that they were at risk for burnout. All participants were given a list of wellness resources compiled by the Canadian Medical Association, including links to crisis hotlines.¹⁸

Data analysis

Data were analyzed using R and SPSS.^{19,20} Using the Shapiro-Wilk test, the distribution of the MMD-HP score ($W = 0.915$, $df = 110$, $P < .001$), the MBI depersonalization score ($W = 0.946$, $df = 215$, $P < .001$), and the MBI personal accomplishment score ($W = 0.901$, $df = 215$, $P < .001$) did not fit normal distributions. However, the distribution of the MBI emotional exhaustion score was normally distributed ($W = 0.987$, $df = 215$, $P < .040$). Work hours per week ($W = 0.939$, $df = 187$, $P < .001$) and administrative burden ($W = 0.871$, $df = 187$, $P < .001$) were also non-normally distributed. Therefore, the Mann-Whitney U test was used to compare MMD-HP scores, work hours per week, and administrative burden in burned-out versus nonburned-out respondents.

We fit a logistic regression model to identify risk factors and protective factors for screening positive for burnout. An unadjusted model and a model adjusted for all other variables were both analyzed. Variables used in the analysis included level of training, sex, academic affiliation, MMD-HP score, age, number of hours worked per week, and number of hours spent on administrative tasks per week. To analyze the association between emotional exhaustion and depersonalization and other variables, we fit adjusted linear regression models.

Results

In total, 215 participants responded to the survey (19.6% response rate). Demographic characteristics of survey respondents are summarized in **Table 1**. Overall, 62.8% (135/215) of respondents screened positive for burnout. The study population consisted of 28 trainees (residents and fellows), 186 attending surgeons, and one participant who

TABLE 1. Demographic characteristics of survey respondents.

Characteristic	Not burned out (N = 80) n (%)	Burned out (N = 135) n (%)
Training level		
Trainee	8 (28.6)	20 (71.4)
Attending	71 (38.2)	115 (61.8)
Prefer not to answer	1 (100.0)	0 (0)
Gender		
Man	55 (37.4)	92 (62.6)
Woman	21 (35.0)	39 (65.0)
Other or prefer not to answer	4 (50.0)	4 (50.0)
Sex		
Male	56 (37.3)	94 (62.7)
Female	22 (36.1)	39 (63.9)
Prefer not to answer	2 (50.0)	2 (50.0)
Age group, in years		
< 40	10 (22.6)	27 (77.4)
40–49	19 (36.5)	33 (63.5)
50–59	15 (35.7)	27 (64.3)
60+	15 (62.5)	9 (37.5)
Prefer not to answer	21 (35.0)	39 (65.0)
Province or territory		
Alberta	9 (37.5)	15 (62.5)
British Columbia	14 (38.9)	22 (61.1)
Manitoba	0 (0)	6 (100.0)
New Brunswick	< 5 (< 6.3)*	6 (66.7)
Newfoundland and Labrador	< 5 (< 6.3)*	< 5 (< 3.7)*
Northwest Territories or Yukon	< 5 (< 6.3)*	< 5 (< 3.7)*
Nova Scotia	< 5 (< 6.3)*	< 5 (< 3.7)*
Ontario	17 (36.2)	30 (63.8)
Prince Edward Island	< 5 (< 6.3)*	0 (0)
Quebec	13 (52.0)	12 (48.0)
Saskatchewan	< 5 (< 6.3)*	5 (83.3)
Prefer not to answer	13 (28.3)	33 (71.7)
Specialty		
Trauma	27 (31.8)	58 (68.2)
Foot and ankle	12 (34.3)	23 (65.7)
Pediatrics	11 (37.9)	18 (62.1)
Upper extremity	12 (31.6)	26 (68.4)
Sport medicine	19 (38.8)	30 (61.2)
Reconstruction	28 (40.6)	41 (59.4)
Tumor	< 5 (< 6.3)*	< 5 (< 3.7)*
Spine	6 (50.0)	6 (50.0)
Other	4 (26.7)	11 (73.3)
Prefer not to answer	< 5 (< 6.3)*	< 5 (< 3.7)*
Call ratio		
No call taken	9 (60.0)	6 (40.0)
1 in 2	2 (44.4)	2 (50.0)
1 in 3	3 (50.0)	2 (40.0)
1 in 4	8 (25.0)	24 (75.0)
1 in 5	5 (17.9)	23 (82.1)
1 in 6	19 (45.2)	23 (54.8)
1 in 7	14 (43.8)	18 (56.3)
1 in 8	11 (47.8)	12 (52.2)
1 in 9	1 (7.1)	13 (92.9)
1 in 10+	8 (44.4)	10 (55.6)
Prefer not to answer	0 (0)	2 (100.0)
Hours worked per week, median [IQR]	55 [50-60]	60 [50-70]
Hours per week spent on administrative tasks, median [IQR]	5 [4-10]	10 [5-15]

* Combined to preserve anonymity.

chose not to disclose their level of training. Of those, 61.8% (115) of attending surgeons and 71.4% (20) of trainees screened positive for burnout. The median MBI emotional exhaustion score was 28 (IQR = 18–38) for attending surgeons and 28 (IQR = 20–36) for trainees. In contrast, the median MBI depersonalization score was 9 (IQR = 4–15) for attending surgeons and 11 (IQR 7–19) for trainees.

The median MMD-HP score was 52 (IQR = 33–87) for nonburned-out physicians and 134 (IQR = 91–186) for burned-out physicians ($P < .001$) [Table 2]. Among burned-out physicians, 32.9% (24/73) reported that they were considering leaving their position due to moral distress [Table 2]. Burned-out physicians spent more hours per week on administrative tasks than did nonburned-out physicians ($P = .002$) [Figure 1]. Burned-out physicians also spent more time at work than did nonburned-out physicians ($P < .001$); 100% of surgeons who worked 81 to 100 hours per week screened positive for burnout [Figure 2].

An adjusted logistic regression model identified the MMD-HP score as positively associated with burnout (odds ratio = 1.03, 95% CI, 1.02–1.05, $P < .001$). Older age was negatively associated with burnout (odds ratio = 0.97, 95% CI, 0.94–0.99, $P = .02$). In the unadjusted model, academic affiliation was negatively associated with burnout. Additionally, hours worked per week and time spent on administrative tasks per week were positively associated with burnout. However, these associations were not significant when adjusting for other factors. Neither sex nor level of training was significant in either model.

Linear regression adjusted for other factors showed a positive association between the MMD-HP score and the MBI emotional exhaustion score ($\beta = 0.09$, 95% CI, 0.05–0.12, $P < .001$). Age was negatively associated with emotional exhaustion ($\beta = -0.35$, 95% CI, -0.64 to -0.07, $P < .018$). No other factors were significantly associated with emotional exhaustion.

With respect to associations with depersonalization, the MMD-HP score ($\beta = 0.05$, 95% CI, 0.04-0.07, $P < .001$) and male sex ($\beta = 3.5$, 95% CI, 0.56-6.50, $P = .023$) were positively associated with depersonalization. Age ($\beta = -0.18$, 95% CI, -0.33 to -0.04, $P < .014$) and academic affiliation ($\beta = -3.39$, 95% CI, -0.17 to 0.02, $P = .031$) were negatively associated with depersonalization. No other factors were significantly associated with depersonalization.

The top three root causes of moral distress were experiencing a lack of administrative action or support for a problem that was compromising patient care; experiencing compromised patient care due to a lack of resources, equipment, and/or bed capacity; and being unable to provide optimal care due to pressures from administrators or insurers to reduce costs [Table 3]. Other causes of moral distress reported in open-ended answers included long surgical wait times, conflict and bullying in the workplace, frustration with leadership, and dishonest behavior of colleagues.

Discussion

Moral distress and burnout

In this national cross-sectional study, the prevalence of burnout among orthopaedic surgeons who responded to the survey was 62.8%. Moral distress was positively associated with burnout, emotional exhaustion, and depersonalization. These results suggest that the prevalence of burnout in Canadian orthopaedic surgeons is alarmingly high, and moral distress may play a role in precipitating it.

The reported prevalence of burnout in orthopaedic surgeons varies significantly across studies. An umbrella review of 26 studies reported a prevalence of burnout ranging from 16.2% to 85.1%.¹⁰ This substantial heterogeneity in results may be explained partially by the variety of tools used to measure burnout, the different definitions of burnout used, and the spatial and temporal variability of study populations. The gold standard instrument for screening for burnout is the MBI; however, due

TABLE 2. Results of the Measure of Moral Distress for Health Care Professionals (MMD-HP).

Characteristic	Not burned out (N = 39) n (%)	Burned out (N = 73) n (%)
MMD-HP score, median [IQR]	52 [33-87]	134 [91-186]
Have you ever left or considered leaving a clinical position due to moral distress?		
No, I have never left or considered leaving a position	33 (84.6)	32 (43.8)
Yes, I considered leaving but did not leave	4 (10.2)	31 (42.5)
Yes, I left a position	2 (5.1)	10 (13.7)
Are you considering leaving your position now due to moral distress?		
No	37 (94.8)	49 (67.1)
Yes	2 (5.2)	24 (32.9)

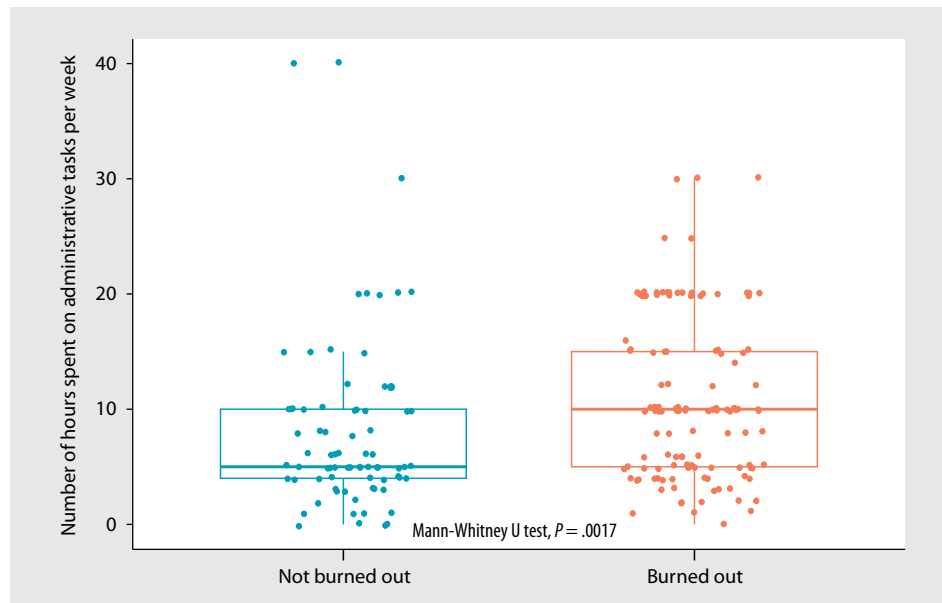


FIGURE 1. Self-reported number of hours spent on administrative tasks per week, by burnout status.

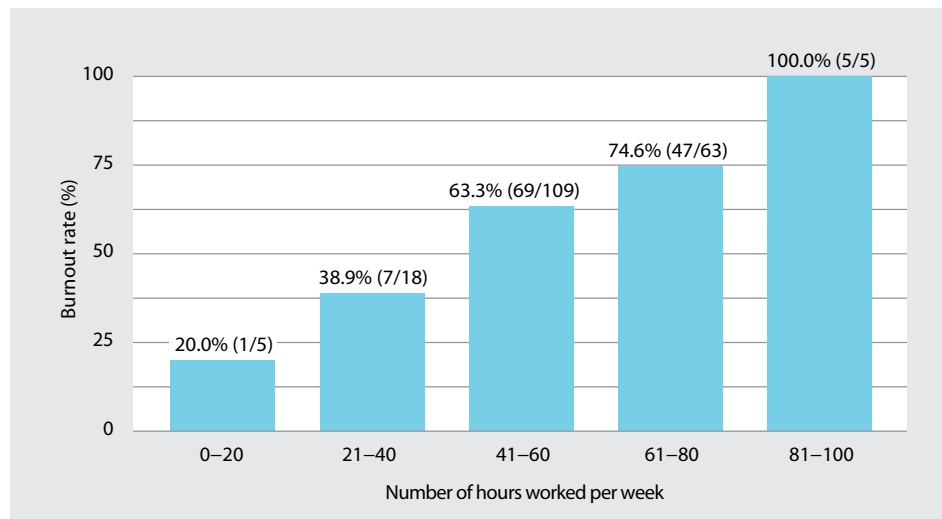


FIGURE 2. Burnout rate versus the number of hours worked per week.

TABLE 3. Ranked root causes of moral distress.

Measure of Moral Distress for Health Care Professionals (MMD-HP) item	Not burned out (N = 39)		Burned out (N = 73)	
	MMD-HP score, mean (SD)	Rank	MMD-HP score, mean (SD)	Rank
18. Experience lack of administrative action or support for a problem that is compromising patient care.	7.5 (5.7)	1	12.0 (5.2)	1
17. Experience compromised patient care due to lack of resources/equipment/bed capacity.	7.4 (5.9)	2	11.8 (5.4)	2
4. Be unable to provide optimal care due to pressures from administrators or insurers to reduce costs.	4.4 (4.4)	3	9.5 (5.9)	3
16. Be required to care for more patients than I can safely care for.	2.8 (4.1)	8	8.7 (5.8)	4
19. Have excessive documentation requirements that compromise patient care.	4.3 (5.0)	4	8.7 (6.1)	5
9. Watch patient care suffer because of a lack of provider continuity.	3.7 (3.7)	5	8.0 (5.5)	6
14. Witness low quality of patient care due to poor team communication.	3.3 (3.0)	6	7.7 (5.5)	7
13. Be required to work with other health care team members who are not as competent as patient care requires.	3.2 (3.7)	7	7.0 (5.7)	8
7. Be required to care for patients whom I do not feel qualified to care for.	1.2 (1.9)	17	6.6 (5.5)	9
20. Fear retribution if I speak up.	2.4 (4.5)	9	6.6 (6.1)	10

to the lengthy nature of the instrument, it is not used by all researchers. For instance, an abbreviated two-item version of the MBI and other tools for measuring distress, such as the Expanded Physician Well-Being Index, have been used to increase response rates.^{13,21} Consequently, researchers use different definitions and cutoffs for burnout, which introduces further heterogeneity in the prevalence of burnout reported in different studies.

In our study, younger age was a risk factor for burnout. This is consistent with the results of previous studies.^{2,7} However, our findings are not fully concordant with previous research, which cites trainee status, female sex, lack of academic affiliation, increased hours worked per week, and increased administrative burden as risk factors.²²⁻²⁵ In our study, there was a strong trend between hours worked per week and prevalence of burnout. This trend, in addition to the narrow confidence interval and near-significant *P* value, suggests that although hours worked may not be a statistically significant risk factor, it may still have clinical significance.

Our study suggests there is a strong association between moral distress and

burnout, which is concordant with the limited findings from previous research. Notably, in our study, 56.2% of surveyed orthopaedic surgeons who screened positive for burnout had either left or considered leaving due to moral distress. This suggests that moral distress may play a role in further exacerbating the existing physician shortage in Canada. Likewise, moral distress has also been found to be associated with higher levels of burnout in critical care providers and internists.^{8,26} A survey of 479 physicians during the COVID-19 pandemic also found a correlation between moral distress and burnout; however, the pandemic may have played a role in precipitating both burnout and moral distress.²⁷ The root causes of moral distress include many scenarios that can be stressful to physicians; this makes it difficult to discern whether there is a causal link between moral distress and burnout. There is a complex interplay between moral distress, negative work-home interactions, and other risk factors, which may all contribute to burnout.²⁸ Overall, saying that moral distress is a cause of burnout is an oversimplification and discounts other variables at play.

Interventions to address burnout

Given the high prevalence of burnout in orthopaedic surgeons and other physicians, strategies to address burnout are of utmost importance for physician well-being and to improve quality of care for patients. However, published research on this subject is limited. Previous researchers have described a top-down approach to promoting surgeon well-being. It prioritizes interventions at the institutional level, followed by seeking professional support services; individual practices are the final and least-emphasized layer of intervention.²⁹

Institutional-level interventions target workload, workflow, autonomy, and reduction in administrative burden. They are generally more efficacious than individual-level interventions that address burnout.³⁰ For instance, efforts to streamline electronic health record systems, including incorporation of the use of medical scribes and electronic health record training, have shown benefits in reducing administrative burden and, subsequently, physician burnout.³¹ However, modifications to electronic health record systems that focus on data-entry automation or revision of electronic health record forms and

workflow were not consistently associated with a reduction of burnout.³¹ Additionally, there has been increasing interest in the use of ambient artificial intelligence (AI) scribes to aid in medical documentation during clinical encounters. These AI scribes listen in on clinician–patient interactions and use large language models to automate documentation of clinic notes. A large RCT of two AI scribe applications showed improvements in physician burnout and task load and reduced time spent documenting compared with manual documentation.³² A multicentre quality improvement study also showed that the use of ambient AI scribe technology had a positive effect on burnout and reduced administrative burden.³³

Several RCTs have shown that peer support discussion groups are also effective in reducing burnout and depressive symptoms and improving job satisfaction in practising physicians.^{34,35} In this institutional-level intervention, physicians are supported by having employer-provided protected time to participate in facilitated group discussions that promote well-being and distress management. This suggests that self-facilitated peer support group meetings are an effective low-cost strategy to improve physician well-being and reduce burnout.

Other interventions have focused on the use of professional assistance in developing self-directed reliance and emotional regulation strategies. Professional coaching is an example of such an intervention; it involves one-on-one coaching provided by trained coaches who support physicians in improving self-awareness, motivation, and self-efficacy.³⁶ An RCT of 79 internal medicine attending physicians found that one-on-one coaching was associated with a long-lasting 13.4% absolute reduction in burnout, whereas burnout increased by 11.1% in a control group of physicians.³⁶ Other studies have explored the establishment of wellness teams consisting of counseling and psychiatric support services. Regular meetings with trained counselors have shown potential in reducing burnout in medical residents.³⁷

Individual-level interventions are the least effective in managing burnout but still play an important role when used in addition to institutional-level interventions. An RCT found that mindfulness-based meditation was effective in reducing burnout, stress, and anxiety in orthopaedic surgery residents at a single institution.³⁸ Other individual interventions include stress management workshops and exercise programs.^{39,40} Weight and colleagues explored

**Overall,
individual-level
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treating burnout.**

the effects of a 12-week team-based incentivized exercise program on quality of life and burnout in a cohort of 1060 residents and fellows.³⁹ Fewer regular exercise program participants screened positive for burnout compared with nonparticipants, although this result was not statistically significant.³⁸ Overall, individual-level interventions should be used as an adjunct to institutional-level interventions in treating burnout.

Study limitations

The primary limitation of our study was our response rate of 19.6%, which may have led to nonresponse bias. It is possible that surgeons who were experiencing higher levels of burnout were more compelled to respond due to personal relevance or, conversely, were less likely to respond due to emotional exhaustion. Despite the modest response rate, it is comparable to other physician health surveys, including the 2021 Canadian Medical Association National Physician Health Survey (response rate of ~18%).^{7,13} Second, our study was cross-sectional in nature and did not explore changes in burnout or moral distress over time. Last,

while interventions to address burnout are important, further research is needed to investigate the efficacy of specific interventions within the context of orthopaedic surgery. Given the association between moral distress and burnout, interventions aimed at addressing moral distress may be effective in concurrently reducing moral distress and burnout. Interventions should follow a top-down approach, which should include institutional-level interventions in addition to individual-level interventions.

Our study also had several strengths. This was the first national study to estimate the prevalence of and identify risk factors for burnout in orthopaedic surgeons in Canada. In addition, the use of the full-length MBI, a validated instrument and the widely accepted gold standard for measuring burnout, enhanced the validity of our findings. We also investigated a wide range of potential risk and protective factors for burnout, thereby providing a holistic view of the survey respondents. ■

Conclusions

Nearly two out of three surveyed orthopaedic surgeons were screened as burned out. Moral distress and younger age were positively associated with burnout. Addressing burnout is important for physician well-being and providing quality patient care.

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Ethics approval and consent to participate

Research ethics approval was obtained from the University of British Columbia Children's and Women's Research Ethics Board (H22-03652).

Competing interests

None declared.

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Reducing the carbon footprint of inhalers: Pharmacist-led screening of inhaler regimens at an outpatient respirology clinic

As climate change becomes an increasingly pressing concern and more patients become conscious of their carbon footprint, options for reducing the health care–related carbon footprint are a priority for both patients and health care professionals.

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ABSTRACT

Background: Inhaler medications are a cornerstone of treatment for respiratory diseases but are associated with substantial greenhouse gas emissions.

Methods: In this quality improvement project, we implemented pharmacist-led screening of inhaler regimens at our outpatient respirology clinic to assess for more environmentally friendly modifications. Patients were first screened by a pharmacist, who flagged them for respirologist review if potential modifications to their regimens were identified. The respirologist then intervened as appropriate.

Results: In total, 106 patients were pre-screened by a pharmacist, 88 were flagged

for respirologist review, and 68 had changes made to their inhaler regimen. The average reduction in greenhouse gas emissions per patient screened was 200 gCO₂e per day. The total reduction in greenhouse gas emissions for all screened patients was 19 208 gCO₂e per day, the equivalent of driving 79 km per day in a standard gasoline-powered passenger car.

Conclusions: This project highlights the substantial reductions in greenhouse gas emissions that can be achieved through pharmacist-led screening of inhaler regimens.

Background

Climate change is an issue of significant international concern, and the health care sector is a major contributor. In 2021, health care–related air pollution contributed to an estimated 4.6 million disability-adjusted life years.¹ In Canada, health care accounts for 4.6% of the country's total greenhouse gas emissions.² Inhaler medications, a mainstay of treatment for common respiratory conditions such as asthma and chronic obstructive pulmonary disease, account for a considerable proportion of these emissions. Metered-dose inhalers commonly use a propellant to deliver a set amount of medication. These propellants contain hydrofluorocarbons, greenhouse gases that are released with each use. For instance, a typical dose (two puffs) of a salbutamol

metered-dose inhaler releases 282 g of carbon dioxide equivalents (CO₂e),³ the equivalent of driving 1.16 km in a standard gasoline-powered passenger car.⁴ In the UK, metered-dose inhalers are estimated to account for 3.1% of the health care–associated carbon footprint.⁵ A review of community inhaler prescriptions in the Fraser Health region from 2016 to 2021 indicated that the annual carbon footprint of inhalers was 8478 tonnes of CO₂e,⁶ the equivalent greenhouse gas emissions of driving 2000 gasoline-powered passenger cars for 1 year or powering 1100 homes for 1 year;⁴ metered-dose inhalers accounted for more than 98% of those emissions.⁶ During that period, almost twice as many metered-dose inhalers as nonmetered-dose inhalers (dry powder inhalers and soft mist inhalers combined) were dispensed in the Fraser Health region.⁶ In contrast, metered-dose inhalers account for less than 20% of inhaler sales in some European countries,⁷ which demonstrates that it is possible to reduce the use of metered-dose inhalers.

In this quality improvement project, we conducted pharmacist-led screening of inhaler regimens of outpatients at our respirology clinic to identify more environmentally friendly potential modifications. We subsequently examined the impact of this change on inhaler-associated greenhouse gas emissions.

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This article has been peer reviewed.

Methods

We conducted plan-do-study-act (PDSA) cycles of pharmacist-led screening of inhaler regimens of outpatients at the lung health clinic at the Jim Pattison Outpatient Care and Surgery Centre in Surrey, BC. The mandate of this multidisciplinary clinic is to educate, diagnose, and treat respiratory diseases. The clinic has administrative staff, respiratory therapists, and respirologists. Our study sought to integrate pharmacist expertise into the existing multidisciplinary team. The pharmacist was involved in the clinic 2 days per week (Thursdays and Fridays) over a 4-month period (January to April 2024). Prior to each clinic day, the pharmacist screened every other patient scheduled for a follow-up appointment. Screening consisted of reviewing patients' electronic medical records to identify previous diagnoses and investigations, such as pulmonary function tests, X-rays, and CT scans. Medication dispensing history was also reviewed via PharmaNet. Initially, the pharmacist focused on patients with unconfirmed diagnoses for follow-up assessments, but with ongoing PDSA cycles, they prioritized those with confirmed diagnoses, because it was a more efficient use of limited pharmacist resources. A list of key questions was developed to clarify the patients' respiratory symptoms, obtain vaccination history, assess inhaler affordability, and determine the exact number of weekly doses of as-needed inhalers and daily doses of scheduled inhalers. This information was shared with respiratory therapists to ensure consistent patient assessment. On clinic days, patients were seen first by the respiratory therapist (as availability permitted), then by the pharmacist, who asked them the designated questions, reviewed their pulmonary function tests to confirm their diagnosis, and documented their medication usage. Patients whose inhaler regimens could potentially be switched to more environmentally friendly inhalers were flagged for further review by the respirologist. The pharmacist provided recommendations, such as switching to more environmentally friendly inhalers, reducing usage of

as-needed inhalers, reviewing inhaler technique, optimizing the use of long-acting and inhaled corticosteroids, and providing education on appropriate metered-dose inhaler disposal. These recommendations were then reviewed by the respirologist, who made interventions as appropriate.

Data analysis

We calculated greenhouse gas emissions per inhalation using data from CASCADES Canada⁸ to determine the difference between each patient's greenhouse gas emissions prior to and after their appointment. The pharmacist then calculated the total greenhouse gas emissions of each patient's daily inhalations prior to the clinic visit and compared them with those postclinic visit. The Box shows an example of how greenhouse gas emissions were calculated based on reported inhaler use.

Results

In total, 106 patients were prescreened by a pharmacist, of which 96 (91%) attended the clinic. Of the patients who attended the clinic, 88 (92%) were flagged for physician review, and 65 (68%) had changes made to their inhaler regimen by a physician [Figure 1]. Three (3%) patients who were not flagged also had changes made to their inhaler regimen by a physician.

The total reduction in greenhouse gas emissions during the project for all patients who were screened by a pharmacist and attended the clinic was 19 208 gCO₂e per day [Table]. The average reduction per

BOX. Example calculation of greenhouse gas emissions based on reported inhaler use.

If a patient was using 12 inhalations per week of salbutamol, the calculation would be as follows:

$$12 \text{ inhalations per week divided by 7 days} = 1.71 \text{ inhalations per day}$$

$$1.71 \text{ inhalations per day multiplied by } 141 \text{ gCO}_2\text{e per actuation} = 241.71 \text{ gCO}_2\text{e per day}$$

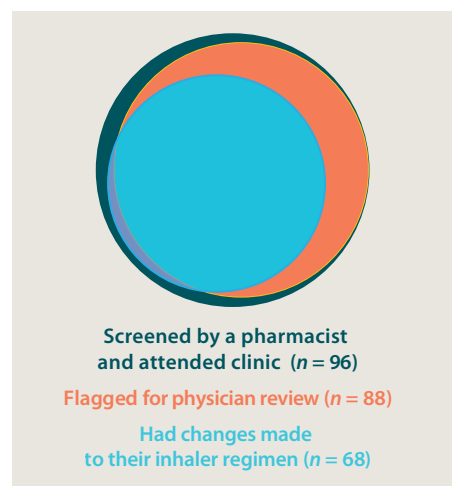


FIGURE 1. Number of patients who were screened by a pharmacist and attended the clinic (n = 96), who were flagged for physician review (n = 88), and who had changes made to their inhaler regimen (n = 68).

patient was 200 gCO₂e per day for patients who were screened by a pharmacist and attended the clinic and 280 gCO₂e per day for patients who had changes made to their inhaler regimen [Table]. The

TABLE. Inhaler-related greenhouse gas (GHG) emissions during the project (January to April 2024).

	Preclinic GHG emissions (gCO ₂ e per day)	Postclinic GHG emissions (gCO ₂ e per day)	GHG emissions reduction (gCO ₂ e per day)
Patients who were screened by a pharmacist and attended the clinic (n = 96)			
Total GHG emissions	37 796	18 588	19 208
Average GHG emissions per patient (SD)	394 (540)	194 (320)	200 (432)
Patients who had changes made to their inhaler regimen (n = 68)			
Total GHG emissions	30 646	11 579	19 067
Average GHG emissions per patient (SD)	450 (583)	170 (283)	280 (492)

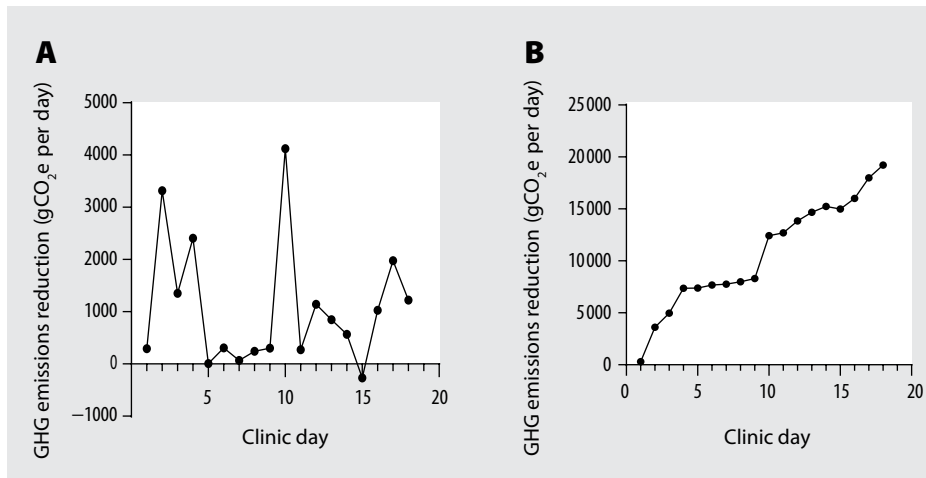


FIGURE 2. (A) Reduction in greenhouse gas (GHG) emissions for all patients who were screened by a pharmacist and attended the clinic, per clinic day; **(B)** cumulative reduction in GHG emissions during the project (January to April 2024).

postclinic change in greenhouse gas emissions per patient ranged from an increase of 359 gCO₂e per day to a decrease of 2758 gCO₂e per day. Greenhouse gas emissions of two patients (1.9%) increased by more than 200 gCO₂e per day after their clinic visit; these appeared to be astronomical data points. Both patients underwent escalated management for suboptimal control of their airway conditions. Excluding these two patients, the postclinic change in greenhouse gas emissions per patient ranged from an increase of 53 gCO₂e per day to a decrease of 2758 gCO₂e per day. Overall, the greenhouse gas emissions of 91% of patients decreased after their clinic visit. **Figure 2A** shows the total reduction in greenhouse gas emissions of all patients who were screened by a pharmacist and attended the clinic, per clinic day; **Figure 2B** shows the cumulative reduction during the project. **Figure 3** shows the average preclinic and postclinic greenhouse gas emissions of all patients who were screened by a pharmacist and attended the clinic, per clinic day.

Discussion

Pharmacist-led review of inhaler regimens at our centre reduced inhaler-associated greenhouse gas emissions by an average of 19 208 gCO₂e per day, the equivalent of driving a standard gasoline-powered passenger vehicle 79 km per day, or 29 000

km per year.⁴ These results demonstrate the potential of integrating pharmacists into a specialty respiratory clinic workflow to reduce inhaler-associated greenhouse gas emissions. This intervention could be considered in any practice in which inhalers are prescribed or pharmacists are part of a multidisciplinary team. More broadly, this project highlights the reduction in greenhouse gas emissions that could be achieved if the carbon footprint of inhalers is considered. Previous studies conducted in five European countries showed that the inhaler-associated carbon footprint could be reduced by as much as 89% by changing inhaler prescribing practices.⁹ Similarly, other models have estimated that switching from metered-dose inhalers to other more environmentally friendly inhalers could result in carbon savings of up to 85% to 93%.^{10,11} Models based on Fraser Health data have shown that different prescribing scenarios for inhalers could result in up to a 78% reduction in annual greenhouse gas emissions.⁶

Adjusting prescribing practices to favor inhalers with lower greenhouse gas emissions could also result in cost savings for health care systems. A model based on data from England indicated that drug costs could be reduced by Can\$14.9 million annually for every 10% of metered-dose inhalers that are replaced with dry powder

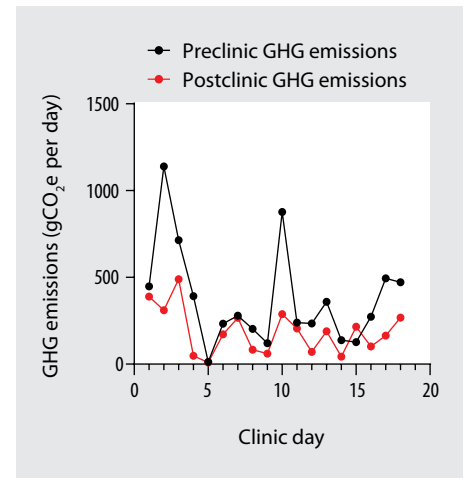


FIGURE 3. Per-patient average preclinic and postclinic greenhouse gas (GHG) emissions of all patients who were screened by a pharmacist and attended the clinic, per clinic day.

inhalers,¹² although extrapolation of this study to BC is limited by differences in drug cost models. However, there may be other ways in which different prescribing scenarios could lead to cost savings locally, such as improved disease control as a result of inhaler regimen optimization. This in turn could lead to a decrease in the use of reliever medications and in overall health care use. A culture shift in which prescribers favor more environmentally friendly options could also lead to stronger provincial purchasing power in negotiating lower costs of more environmentally friendly inhalers. **Figure 4** lists common inhalers available in British Columbia and their local cost. Assessment of the local cost effect of different prescribing scenarios should be considered in future studies.

One of the theoretical concerns with modifying inhaler regimens is the potential loss of disease control. While we did not collect specific data on disease control, previous studies have shown no differences in the clinical efficacy of metered-dose inhalers and dry powder inhalers.¹³⁻¹⁵ In a UK-based randomized control study, adult outpatients with symptomatic asthma either were switched to a combination of an inhaled corticosteroid and a long-acting beta agonist dry powder inhaler or continued their usual care.¹⁶ A *post hoc* analysis on a subset of 2236 of those patients found

Common inhalers available in BC and their costs










Short-acting bronchodilators

Ventolin pMDI salbutamol  100 mcg: \$21 pMDI	Atrovent pMDI ipratropium  20 mcg: \$36 pMDI	Teva-Salbutamol pMDI salbutamol  100 mcg: \$18 Low-volume pMDI	Ventolin Diskus salbutamol  200 mcg: \$26 DPI	Bricanyl Turbuhaler terbutaline  0.5 mg: \$24 DPI	Combivent Respimat ipratropium/salbutamol  20/100 mcg: \$49 SMI
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ICS maintenance therapy

Qvar pMDI beclomethasone dipropionate  50 mcg: \$64 100 mcg: \$113 pMDI	Flovent pMDI fluticasone propionate  50 mcg: \$51 125 mcg: \$78 250 mcg: \$145 pMDI	Alvesco pMDI ciclesonide  100 mcg: \$76 200 mcg: \$118 pMDI	Pulmicort Turbuhaler budesonide  100 mcg: \$58 200 mcg: \$102 400 mcg: \$144 DPI	Aermony RespiClick fluticasone propionate  55 mcg: \$32 113 mcg: \$49 232 mcg: \$68 DPI	Asmanex Twisthaler mometasone furoate  200 mcg: \$59 400 mcg: \$103 DPI	Flovent Diskus fluticasone propionate  100 mcg: \$51 250 mcg: \$78 500 mcg: \$115 DPI	Arnuity Ellipta fluticasone propionate  100 mcg: \$69 200 mcg: \$128 DPI
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ICS/LABA maintenance therapy

Zenhale pMDI mometasone/formoterol  100/5 mcg: \$132 200/5 mcg: \$160 pMDI	Advair pMDI fluticasone propionate/salmeterol  125/25 mcg: \$149 250/25 mcg: \$207 pMDI	Wixela Inhub fluticasone propionate/salmeterol  100/50 mcg: \$64 250/50 mcg: \$71 500/50 mcg: \$97 DPI	Advair Diskus fluticasone propionate/salmeterol  100/50 mcg: \$126 250/50 mcg: \$150 500/50 mcg: \$208 DPI	Symbicort Turbuhaler budesonide/formoterol  100/6 mcg: \$102 200/6 mcg: \$129 DPI	Breo Ellipta fluticasone furoate/vilanterol  100/25 mcg: \$138 200/25 mcg: \$208 DPI	Atectura Breezhaler mometasone furoate/indacaterol  80/150 mcg: \$51 160/150 mcg: \$61 320/150 mcg: \$77 DPI
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Covered by BC PharmaCare



Special Authority required



Not covered by BC PharmaCare

pMDI = pressurized metered-dose inhaler

DPI = dry powder inhaler

SMI = soft mist inhaler

ICS = inhaled corticosteroid

LABA = long-acting beta agonist

Please refer to www.bcinhalers.ca for up-to-date information.

Drug prices are approximate and sourced from www.drugsearch.ca—a free online tool showing BC drug prices with dispensing fees. This resource does not include all available inhalers or all information on each inhaler. Please refer to the product monographs before prescribing.

Resource adapted with permission from CASCADES Canada—an initiative led by the Centre for Sustainable Health Systems.

FIGURE 4. Common inhalers available in British Columbia and their costs. Up-to-date information is available at www.bcinhalers.ca.

Source: This is an updated version of Figure 3 from “Climate impact of inhaler therapy in the Fraser Health region, 2016–2021” by Liang and colleagues [*BCM J* 2023;65:122-127].

that there was no loss of asthma control, and there was a more than 50% reduction in carbon emissions when patients were switched from a metered-dose inhaler to a dry powder inhaler maintenance therapy.¹⁶ The Salford Lung Study, from which that *post hoc* analysis was derived, was an industry-sponsored randomized control trial that was meant to closely simulate real-world conditions; thus, it was designed to be generalizable and relevant to routine clinical practice. However, modifying inhaler regimens for nonclinical reasons, such as environmental impact, is a complex issue that can lead to a variety of outcomes. A systematic review of 21 real-world studies that examined the ramifications of inhaler switches for nonclinical reasons on patients with chronic obstructive pulmonary disease or asthma identified improved disease control in five data sets ($n = 7530$) but worsened disease control in one data set ($n = 1648$).¹⁷ The same review found heterogeneity in data sets regarding the effect of switching inhaler regimens on exacerbation rates.¹⁷ Notably, only 8 of the 21 studies provided patients with training on inhaler technique prior to switching, although it was unclear whether training was provided in 11 of these studies.¹⁷ Providing adequate training and close clinical follow-up are crucial elements in successful inhaler switches. Woodcock and colleagues,¹⁶ who found no loss of asthma control with inhaler switching, provided patients with education on inhaler technique in addition to regular monitoring for adverse events. An abundance of evidence has demonstrated a link between worsened disease control and inhaler technique errors,¹⁸⁻²² this underscores the importance of both patient education and appropriate patient characteristics for the proposed inhaler type. For instance, dry powder inhalers require generation of sufficient peak inspiratory flow to facilitate optimal medication delivery,²³ a feat that can be challenging in patients with severe pulmonary disease. Thus, future studies of environmentally driven inhaler regimen modifications, especially in BC, should not only examine patient-relevant outcomes,

such as exacerbation rates, hospitalization rates and emergency department visits, and symptom control, but also incorporate education and assessment of inhaler technique at regular intervals to facilitate successful transitions. Collection of longitudinal data could also facilitate assessment of patient adherence to their new regimen. Indeed, a major limitation of this project was that data were obtained from only a single point in time for each patient.

Educating patients about the environmental impact of their medications and involving them in shared decision making are indispensable.

As-needed inhalers are commonly metered-dose inhalers, the type associated with the largest carbon footprint. As a result, variations in metered-dose inhaler usage can greatly affect greenhouse gas emissions. Usage can vary with physical activity, inhaled exposures, and other factors that may not remain consistent, which makes it more challenging for patients to estimate their as-needed inhaler usage. The effects of seasonal variations on respiratory diseases such as asthma can also affect usage. We collected data from mid-winter to early spring, which somewhat limits the extrapolation of results to other seasons. Having patients fill out inhaler usage diaries could help mitigate some of the uncertainty associated with reporting their usage. Similarly, a major limitation of our methodology was the reliance on patient self-report for quantifying inhaler usage, particularly since patients were asked to estimate their as-needed inhaler usage. To mitigate this, we cross-referenced patient-reported usage with PharmaNet records. However, even with cross-referencing, there was still recall bias.

We identified 18 patients for whom changes to their inhaler regimen led to increases in greenhouse gas emissions. However, this occurred in only a minority of cases (19% of patients who attended the clinic), and for most of those patients (16), the increase in greenhouse gas emissions was small, ranging from an increase of 0.16 to 53.00 gCO₂e per day. Therefore, we believe that under most circumstances, inhaler regimen optimization will lead to reduced greenhouse gas emissions.

We did not examine the reasons that inhaler regimens were modified; for example, inhaler regimen changes could have been made solely to reduce greenhouse gas emissions or to improve disease control. If future projects examine the rationale behind inhaler regimen modifications, this would help elucidate how many changes would not have been made without pharmacist screening and would subsequently lead to a more accurate assessment of the impact of this intervention.

We had funding to conduct PDSA cycles with pharmacist services only 2 days per week and screened half the patients who attended the clinic on those 2 days. Future PDSA cycles with expansion of pharmacist services beyond 2 days per week could yield further learning. Some centres may not have the resources available to integrate a pharmacist into their routine workflow. While we believe education of physicians on the environmental impact of inhalers should be widely promoted, pharmacist screening of inhaler regimens, in line with the current trend of enlisting physician extenders, helps reduce the cognitive workload of physicians, particularly since environmental impact is not commonly considered in treatment decisions.

Finally, educating patients about the environmental impact of their medications and involving them in shared decision making are indispensable. Incorporating a pharmacist into the clinic workflow helped facilitate patient education in our fast-paced clinic environment.

Conclusions

One important learning point we gleaned from consultation with patient advisors is that more and more patients have become conscious of their carbon footprint. As climate change becomes an increasingly pressing concern, exploring options to reduce the health care-related carbon footprint is more of a priority for both patients and health care professionals than ever before. Our study demonstrates the potential of integrating routine pharmacist-led screening in respiratory clinics to reduce inhaler-related greenhouse gas emissions, thus highlighting a practical intervention that can help address this critical global issue. ■

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Competing interests

None declared.

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Appropriate use of diagnostic tests in medical practice

A review of five Choosing Wisely recommendations pertaining to infectious diseases diagnosis and management.

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ABSTRACT: Inappropriate use of diagnostic tests is common in medical practice. There is a tendency for clinicians to overinvestigate or order unnecessary tests that either do not impact medical care or potentially harm the patient. Excessive testing is common for several reasons, including fear of missing a diagnosis, limited time during patient visits, patient expectations, and institutional pressures. However, overtesting generates superfluous and misleading clinical data, leads us down the wrong path, causes unnecessary anxiety, and produces extra medical waste. I review my top five recommendations from Choosing Wisely relevant to both outpatient and inpatient management of infection.

Diagnostic stewardship is the process of optimizing the ordering, performance, and reporting of diagnostic tests to enhance the diagnosis and management of infections.¹ In other words, this process promotes prioritizing the right test for the right patient at the right time to elicit the right therapeutic

action, with the goal of delivering the best evidence-based care, improving antibiotic use, reducing adverse effects, and decreasing unnecessary use of health care resources. Knowledge and understanding of pretest and posttest probabilities, false positives and false negatives, and test accuracy are key to implementing diagnostic stewardship strategies. Overtesting is the most common form of inappropriate testing, with 40% to 60% of tests deemed unnecessary, leading to overdiagnosis, overtreatment, and increased risk of patient harm.^{1,2} In one study, half of test results did not prompt a change in management, and for those that did, not all changes were beneficial.² Overall, 72% of patients experienced no benefit or harm from testing.² The well-known Choosing Wisely campaign, launched in Canada in 2014 and around the globe in 2015, aims to reduce unnecessary tests, treatments, and procedures to ensure clinicians deliver high-quality care.³ Less commonly, undertesting can result in missed diagnoses and inappropriate treatment.

The typical pathway of diagnostic testing is:

1. A clinician decides that a test is needed.
2. The test is ordered.
3. A specimen is collected and transported to the lab.
4. The specimen is processed by the lab.
5. The test result is reported.
6. The clinician interprets the result.¹

Diagnostic stewardship efforts should target the clinician at steps 1, 2, 3, and 6 to be most effective at the individual level. Strategies such as education, decision support tools,

best practice alerts, test restriction, order sets, and provider feedback can optimize test ordering.

Below are five Choosing Wisely recommendations that pertain to infection diagnosis and management.

Urine cultures

Collect urine cultures from adults only if they have symptoms localizing to the urinary tract or fever, are pregnant, or are undergoing genitourinary instrumentation where mucosal bleeding is expected.⁴

Urine cultures are commonly obtained in hospitalized patients, with over 80% receiving inappropriate antibiotic treatment for asymptomatic bacteriuria.⁵ Many clinicians erroneously equate a positive urine culture with a diagnosis of a urinary tract infection (UTI) due to the misconception that the urine should be sterile.⁶ In fact, the urinary system possesses its own unique microbiome that protects humans from true infections.⁷ Therefore, unnecessary antibiotic exposure might *increase* the risk of developing a UTI. A common practice is to order a urine culture in patients with cloudy or foul-smelling urine or altered mental status, despite evidence arguing against this practice.^{8,9} Elderly patients are frequently subjected to unnecessary urine tests and overtreatment with antibiotics, because asymptomatic bacteriuria is present in up to 40% to 50% of this population.¹⁰ In those with indwelling Foley catheters, the bacterial colonization rate is near 100% after 2 weeks of catheterization.¹⁰ Antibiotic treatment in patients with delirium and

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bacteriuria without UTI symptoms does not improve mental status or functional outcomes.¹¹ Education about true UTI symptoms (e.g., dysuria, urinary frequency, hematuria, absence of vaginal discharge, irritation, flank pain, suprapubic pain) might limit inappropriate urine testing.¹² For patients with chronic indwelling Foley catheters, urine culture should be obtained only if fever, new costovertebral tenderness, rigors, or new-onset delirium without another obvious cause is present.¹³ Possible systemic solutions to combat overtesting of urine include a requirement to document UTI symptoms to obtain a urine culture, removal of urine culture from standard order sets, and processing of urine cultures only if specific criteria are met on urinalysis (e.g., pyuria).¹⁴

Blood cultures

Blood cultures should not be routinely obtained in low-yield situations when patients are not systemically septic, have a clear source of infection, and have a direct specimen for culture (e.g., urine, wound swab, sputum, cerebrospinal fluid, joint aspirate).¹⁵

Up to 40% of blood cultures are ordered unnecessarily, and up to half of all positive blood cultures represent contamination.^{1,2,16,17} Blood culture contamination is associated with significant increases in health care costs, longer hospital stays, and adverse effects, including unnecessary antibiotics and additional testing for patients.^{16,17} Over 90% of blood cultures do not grow any organisms, indicating that most blood cultures are likely not required, and only 5% identify a true pathogen.^{16,18} Infections with a low risk of bacteremia, such as cellulitis, pneumonia, and cystitis, do not routinely require blood culture testing.¹⁷ For high-risk conditions, including endovascular infections and sepsis/septic shock, the diagnostic value of blood cultures is higher.¹⁶ Blood cultures are commonly ordered to evaluate fever and leukocytosis, both of which correlate poorly with bacteremia.¹⁶ The presence of shaking chills is a more specific sign of bacteremia.¹⁹

Follow-up blood cultures are recommended only for bacteremia caused by *Staphylococcus aureus*, *S. lugdunensis*, fungi, and any organism implicated in endovascular infections.¹⁶ Routine follow-up blood cultures for uncomplicated bacteremia caused by Gram-negative pathogens such as *Escherichia coli* or *Klebsiella pneumoniae* are generally not useful, as they are infrequently positive and do not alter clinical management.²⁰ Blood cultures should be repeated only if clinical status deteriorates, suggesting a new

It is not a sufficient justification to order a test solely to satisfy one's curiosity or to alleviate anxiety if the evidence does not support its use.

infection or a nonresponse to antibiotic therapy after 72 hours since the last blood culture.²⁰ Implementing prediction models and artificial intelligence into electronic medical records to identify patients at high risk of bacteremia who would benefit from blood culture testing can promote laboratory stewardship.¹⁷

Cultures from swabs

Cultures from swabs of superficial ulcers are prone to both false positive and false negative results regarding the cause of the infection and should be obtained by proper technique only when there are clinical signs of a wound infection.⁴

Diagnosing a wound infection can be challenging. Wounds are normally colonized with bacteria, and sometimes with fungi.²¹ Wound swabs often provide misleading, distracting, and unhelpful microbiological information. Clinicians commonly equate a positive wound culture with an infection, even though the diagnosis of a wound infection is based on clinical assessment. Chronic wounds harbor a plethora of bacterial species, and their presence can reflect any combination of colonization, biofilm formation, and infection.^{21,22} Therefore,

wound cultures should be obtained only if there is clinical suspicion of infection. Otherwise, culturing wounds without signs of infection does not predict clinical outcomes.²³ Tissue biopsy, needle aspiration of wound borders, and deep cultures provide the most useful diagnostic information, but they are difficult to obtain and impractical for the average clinician.^{21,24} As a result, obtaining a wound culture with a swab, preferably using the Levine method (rotate the tip of the swab over a clean 1 cm² non-necrotic area of the wound bed for 5 seconds, using firm but gentle pressure to extract fluid from the wound tissue), ideally after the wound has been cleansed with normal saline or sterile water to avoid contamination with skin flora, is usually recommended instead.²² Depending on the quality of the specimen and how it was collected, the real pathogen(s) implicated in the infection might not grow in culture, and other times, nonpathogenic microbes grow out instead.²¹ Educating clinicians on the appropriate indication for collecting wound cultures (i.e., only when a wound infection is suspected) and on proper test interpretation can minimize patient harm and unnecessary resource use.

Procalcitonin

Procalcitonin (PCT) should be used only with guidance from an evidence-based protocol.²⁵

PCT is a frequently ordered laboratory test to diagnose infections and monitor response to treatment. However, experts have recently questioned the utility of PCT.²⁶ PCT suffers from mediocre sensitivity and specificity and is unable to reliably detect an infectious process because it may be falsely low in localized infections such as cellulitis, abscess, and empyema, and falsely elevated in noninfectious conditions, including severe trauma, major burns, and chronic renal failure.²⁶ While PCT has been shown to reduce antibiotic consumption in patients with pneumonia and sepsis in earlier randomized controlled trials, recent data show that it performs no better than usual care and might inadvertently prolong

treatment or lead to inappropriate antibiotic initiation due to misinterpretation of results.²⁷⁻³⁰ In the real world, implementing and strictly adhering to a PCT algorithm is challenging and does not mimic the tightly controlled nature of a clinical trial.³⁰ In my clinical experience reviewing cases in Fraser Health, only in a minority of situations where PCT testing is done is it clinically useful when considering the indication for testing and the impact on antibiotic management. Furthermore, in my experience, clinicians tend to err on the side of prescribing antibiotics, even when PCT testing does not support it. This biomarker often provides redundant information when other symptoms and signs suggest a bacterial infection. A laboratory test is useful only if the result can meaningfully influence decision making. Using PCT in ways unsupported by evidence can lead to confusion, unnecessary tests, prolonged antibiotic courses, and inappropriate specialist consultations.³⁰ If PCT is used, it should be reserved for inpatients with pneumonia or sepsis guided by evidence-based algorithms.³¹

Routine CD4 monitoring

Routine CD4 monitoring in patients with HIV infection with viral suppression of more than 2 years and CD4 counts higher than 500/ μ L is not necessary unless virologic failure occurs or intercurrent opportunistic infection develops.³²

CD4 lymphocyte monitoring has been the standard practice in HIV management for decades. Recent guidelines recommend against routine surveillance of CD4 counts when the viral load has been suppressed for at least 2 years and the CD4 count is above 500/ μ L, because it provides limited information and results rarely alter clinical management.³³ Choosing Wisely Canada also supports this recommendation, adding that CD4 levels should be rechecked if the viral load becomes detectable or an opportunistic infection is diagnosed.³² In HIV patients with a CD4 count above 350/ μ L, it is very unlikely for CD4 levels to drop below 200/ μ L during a period of continuous

viral suppression.³⁴ A more reliable marker of immune status is the CD4 percentage, which is less prone to wide fluctuations. Frequent measurements of CD4 levels might cause undue anxiety due to the normal variation of white blood cell counts, which can be influenced by stress, acute illness, or medications.³⁵ Yet the British Columbia Centre for Excellence in HIV/AIDS therapeutic guidelines (last revised March 2023) recommend annual CD4 monitoring for patients with a suppressed viral load and a CD4 count above 500/ μ L.³⁶ Patients with well-controlled HIV often have their CD4 levels measured when admitted to hospital for an acute illness unrelated to HIV. Testing during this time is not helpful, because CD4 levels might decline transiently and may not accurately reflect the patient's true immune status.³⁷ Substantial cost savings can be realized by curbing CD4 testing in stable HIV patients (i.e., suppressed viral load with CD4 greater than 500/ μ L).³⁷

Conclusions

Overtesting, which leads to overtreatment, is far too common in infectious diseases practice. The patient is harmed by the physical discomfort of diagnostic investigations, the inconvenience of repeated testing, and anxiety over abnormal results that are clinically irrelevant. The health care system and environment are also impacted by increased demand on limited resources, prolonged wait times for patients who need the test, and excess medical waste. It is not a sufficient justification to order a test solely to satisfy one's curiosity or to alleviate anxiety if the evidence does not support its use. Following Choosing Wisely guidelines can enhance awareness of diagnostic stewardship and its benefits for patients and the health care system. Sometimes less is more. ■

Competing interests

None declared.

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Lifestyle medicine: A tool for health creation and equity

In 2025, only 46% of adults in Canada met the recommended 150 minutes of moderate to vigorous physical activity per week. Although physical activity is a leading modifiable risk factor for many chronic diseases and all-cause mortality,¹ physicians do not regularly prescribe exercise to patients.² Doctors of BC's Council on Health Promotion has long supported exercise as medicine,³ but this can be expanded to include a more holistic approach of lifestyle medicine.

Lifestyle medicine is an evidence-based clinical discipline guided by six pillars to prevent, treat, and reverse chronic conditions: whole-food plant-predominant nutrition, physical activity, restorative sleep, stress management, positive social connection, and substance use avoidance.⁴ When implemented with sufficient intensity and support, lifestyle medicine can support meaningful reductions in cardiovascular disease, type 2 diabetes, obesity, and other noncommunicable diseases. Many of the pillars can be adapted to different cultural contexts. Social connection is foundational in many cultural worldviews, including for Indigenous Peoples, who consider belonging and kinship to be integral to health.⁵

In Canada, lifestyle medicine is situated in a population health framework that recognizes the interaction between individual agency and structural determinants. Lifestyle medicine is most powerful when its influence shifts from helping individuals make better choices to informing the design of systems that make healthy

Lifestyle medicine tools

- Canadian Academy of Sport and Exercise Medicine: Resources on medicine through movement (www.casem-acmse.org/resources/resource-directory)
- McGill University: Motivational interviewing techniques to facilitate behavior change (www.mcgill.ca/familymed/files/familymed/motivational_counseling.pdf)
- Canadian Society for Exercise Physiology: *24-Hour Movement Guidelines* (<https://csepguidelines.ca>)
- Sleepwell: Insomnia resources, including on cognitive-behavioral therapy (<https://mysleepwell.ca>)
- The "Community as Medicine" model (<https://doi.org/10.1177/15598276251325799>)

choices possible: accessible, affordable, and culturally meaningful. Despite Canada's comparative wealth, federal and provincial data consistently show that income, housing stability, food security, geography, racism, and access to primary care are social determinants from which chronic disease risk increases.⁶

Although it is easy to mention the six pillars to patients, patients must feel empowered to make behavioral changes that are sustainable and life-lasting, increasing their health span rather than merely prolonging the years lived. In addition, without attention to health inequities, lifestyle medicine can inadvertently reinforce stigma or "lifestyle blame," particularly among communities facing systemic barriers.

Lifestyle medicine is not just for the wealthy; everyone deserves access to it.⁷ The pillars of lifestyle medicine must be equitable.⁸ Reimagining the pillars as a bridge between health-based clinical care and community well-being is a tool for creating healthy communities.

Rather than assuming that patients affected by adverse social determinants of health are neither willing nor able to attempt behavior modifications, clinicians should have conversations with patients

about the powerful outcomes of even small lifestyle changes, meeting them where they are, identifying solutions together, and providing referrals to community-based organizations with resources to help.⁹ This requires community engagement, cultural competency, and the application of multilevel and intersectoral approaches.⁸ All physicians, regardless of our field, should be advising patients on essential health practices and, most importantly, taking this good advice ourselves. ■

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Council on Health Promotion Member

—Katharine McKeen, MD, MBA, FCFP
Council on Health Promotion Chair

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EcoLens: Capturing climate change through community storytelling in BC

Increasingly, climate change is shaping the health and well-being of British Columbians in visible and personal ways. Public health surveillance systems track health impacts from environmental hazards such as extreme heat and wildfire smoke, but they cannot fully reflect the lived realities of people navigating these events. To address this gap, the BC Centre for Disease Control created EcoLens (<https://ecolens.ca>), an online storytelling platform where people can upload and explore climate stories through an interactive map or themed collections.

This article is the opinion of the BC Centre for Disease Control and has not been peer reviewed by the BCMJ Editorial Board.

EcoLens is a provincial initiative that invites people to share photos and short reflections about how climate change is affecting their lives and their health [Figure]. The platform brings community-generated place-based knowledge into the broader conversation about climate change impacts and resilience. This approach builds on existing qualitative and participatory research methods, including photovoice, which uses images and narrative to support reflection and learning.¹

Why stories matter for climate change and health

The impacts of climate change are not distributed equally throughout BC. For example, rural and remote areas, Indigenous communities, people experiencing

homelessness, and isolated seniors often face greater risks.² Communities also differ in how they respond to the impacts, and the differences are not always captured in administrative data. EcoLens brings deeper dimensions of susceptibility and resilience to light through lived experiences, offering insight that can help health professionals better understand and respond to local needs.

Climate anxiety is increasingly recognized as a mental health issue in Canada.³ Research shows that climate anxiety often stems from feeling alone, powerless, or overwhelmed by abstract global threats.⁴ EcoLens provides a space where people can document local impacts and personal actions, humanizing climate change as a shared social experience rather than



ADAPTING TO THE HEAT:

“ I find myself getting anxious about the impacts of climate change, but doing something to adapt or mitigate helps me feel better. Especially something for our community, like keeping young trees watered on the boulevard, or checking in on neighbours when it’s hot.”

FIGURE. An example photo and story shared on EcoLens (<https://ecolens.ca>), demonstrating how one household has adapted to extreme heat with increased window shading.

something distant or abstract. Storytelling helps people process emotions, build collective efficacy, and regain a sense of control in the face of uncertainty.

Turning collective experience into collective evidence

As the story collection grows, we hope that EcoLens will support public health practice in several ways. Thematic insights may improve climate adaptation planning and community engagement strategies. Emerging observations can generate new research questions and catalyze future research initiatives. Lessons learned from the platform may also inform knowledge translation products and educational materials tailored to diverse audiences. Over time, EcoLens can help support more responsive and equitable decision making.

EcoLens is ultimately about connection—connecting health professionals with lived experiences, connecting communities with one another, and connecting individual

stories to broader patterns of resilience. In a time of rising climate anxiety, EcoLens offers a space for learning, reflection, and solidarity.

Call to action

As EcoLens grows, physicians have an important role to play in strengthening its reach and impact. Clinicians are often the first to hear about how climate-related events affect their patients' health and safety. By sharing the platform, physicians can help ensure that the stories collected reflect the geographic and cultural diversity of the province.

To get involved or to learn how EcoLens can support your work, contact us at ecolens@bccdc.ca. ■

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From clinic to community: Physicians bring trauma-informed practices to policing

Although physicians and police officers work in different systems, their roles intersect in important ways. Both professions regularly encounter individuals experiencing distress, and both must make decisions that affect these individuals' safety and well-being.

These shared realities brought the two professions together in May 2025 in Surrey,¹ when police officers gathered for a crucial conversation about trauma.

At a day-long workshop hosted by the Surrey Police Service, physicians and law enforcement explored how trauma-informed principles can shape interactions with vulnerable youth. Physicians were invited to lead the session for officers, civilian staff, and community partners. The training was organized following previous collaboration with psychologist Dr Jennifer Mervyn, also one of the presenters, who was identified as a strong fit to support training in trauma-informed principles for the Surrey Police Service Youth Services team, which frequently works with vulnerable populations.

Police officers are often the first point of contact when someone experiences a mental health or substance use crisis. Officers can become *de facto* gatekeepers, helping determine whether an individual needs to connect with health supports or when they enter the justice system. Greater awareness of trauma may help officers recognize distress earlier, help de-escalate situations, and support appropriate referrals.

Funding support from the Shared Care Committee (SCC), a partnership between Doctors of BC and the Government of BC, made this learning session between the SCC's Child and Youth Mental Health and Substance Use Community of Practice (CYMHSU CoP) and the Surrey Police Service Youth Services team possible.

Trauma-informed principles can shape interactions with vulnerable youth.

The workshop began with the Adverse Childhood Experiences (ACEs) working group, within the CYMHSU CoP. ACEs² are potentially traumatic experiences in childhood such as abuse, neglect, or household dysfunction that can have long-term effects on an individual's physical and mental health. Participants recognized an opportunity to share clinical knowledge about the neuroscience of trauma with professionals who frequently interact with youth in crisis.

Understanding this context can change how behavior is interpreted. Actions that appear as aggression, withdrawal, or non-compliance may instead reflect trauma responses. ACEs and historical trauma can influence brain development and how individuals perceive threat or authority. Encounters with uniformed officers may, therefore, trigger fight, flight, freeze, or fawn responses.

Shared ground between medicine and policing

Workshop presenters drew parallels between policing and the approach in clinical care.

Establishing trust, recognizing triggers, and understanding a person's history are central to effective patient care. Research also shows that positive individual, family, and community supports can mitigate the potential impacts of ACEs.³ Similar principles can guide police interactions during stressful encounters.

For officers responding to a crisis call, a trauma-informed approach may involve slowing the interaction, using calm communication, and acknowledging the individual's emotional state. Clearly explaining next steps or offering reassurance can help reduce fear and de-escalate tense situations.

Participants reflected on their own responses during difficult encounters. Rather than relying solely on enforcement, trauma-informed practice emphasizes self-awareness, empathy, and understanding the broader context behind behavior.⁴

Expanding collaboration across sectors

The workshop also brought together multiple sectors working with youth and families, including youth probation workers, school district staff, community youth mental health workers, victim services representatives, and Fraser Health staff. This format helped participants better understand each other's roles in supporting individuals who are experiencing crisis.

The workshop generated significant interest, and a similar session was scheduled for other policing jurisdictions in April 2026.

For physicians, the collaboration highlights how pervasive trauma is and how evidence-based trauma awareness can guide responses beyond clinical settings.

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SHARED CARE

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Through sharing expertise across sectors, collaboration can strengthen coordinated crisis responses and support compassionate care for vulnerable populations and providers. ■

—**Shirley Sze, MD, CCFP, FCFP**
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COHP

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Dr. Anita Ka-Fai Wong
(Langley)

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INTERIOR:
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ISLAND:
Dr. Lindsay Hawkins
(Victoria)

VANCOUVER:
Dr. Winnie Su
(Vancouver)

R2 RESIDENT AWARD (from top)

Dr. Yonabeth Nava de Escalante
(Chetwynd)

Dr. Joban Bal
(Surrey)

Dr. Ricky Tsang
(Prince George)



DR. MANOO & JEAN GURJAR AWARD: (from left)

Dr. Daniel Budgell
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Dr. Jeffrey Ding
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