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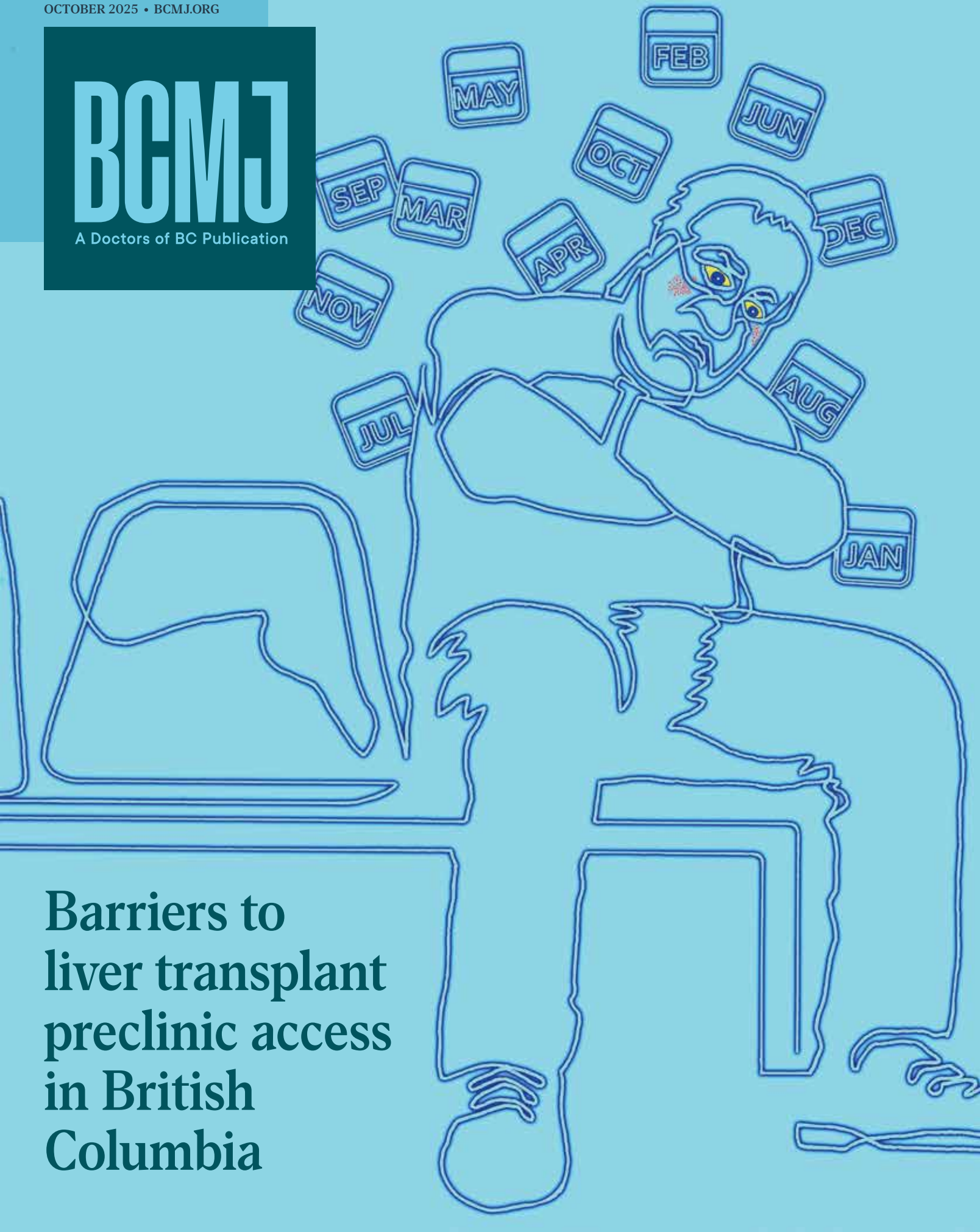

Barriers to liver transplant preclinic access in British Columbia

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In "Barriers to liver transplant preclinic access in British Columbia," the authors examine the factors that stand in the way of timely access to care. Article begins on page 288.

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ON THE COVER

Persistent regional disparities in access to liver transplantation highlights the need for localized and contextualized solutions to achieve timely and equitable care across the province. "Barriers to liver transplant preclinic access in British Columbia" begins on page 288.

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Vision: The *BCMJ* is an independent and inclusive forum to communicate ideas, inspiring excellent health care in British Columbia.

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Quality: Publishing content that is useful, current, and reliable.

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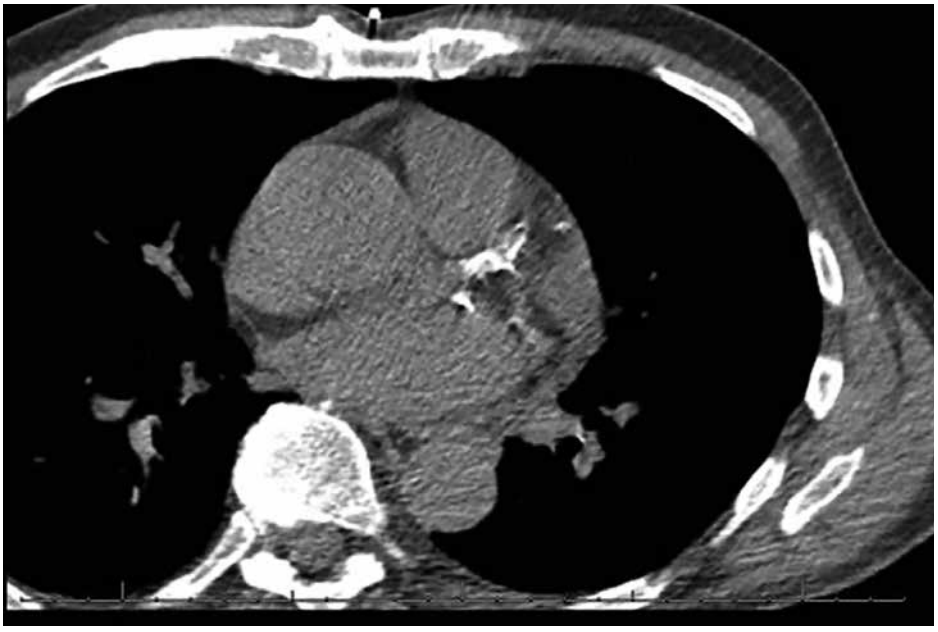

Sample coronary artery calcium scoring CT scan from the article "Early detection, lasting prevention: The significance of coronary artery calcium scores." A significant burden of calcified plaque can be seen in this patient with a high coronary artery calcium score, in both the left anterior descending artery and the left circumflex artery. Article begins on page 284.

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CLINICAL

ORIGINAL RESEARCH

Dark remedies: Gruesome tales from medicine's past

With Halloween approaching, October invites us to indulge in ghost stories. And although we pride ourselves on practising evidence-based medicine, history reminds us that our profession has seen its share of creepy cures and ghastly guidelines. Here are some of the spookiest examples that haunt medicine's past.

Bloodletting

Dating back to the time of Hippocrates (c. 460–370 BC), bloodletting was promoted as a cure for the imbalance of humors—blood, phlegm, black bile, and yellow bile. Through venesection, arteriotomy, scarification, cupping, and leeches, it was used for seizures, pneumonia, and fevers of all kinds.[1] George Washington's death in 1799, following the removal of 2.5 L of blood alongside blistering and laxatives, is now thought to have been caused by acute epiglottitis.[2] Today, therapeutic phlebotomy has a narrow role in conditions such as hemochromatosis and polycythemia vera, and medicinal leeches are used in reconstructive surgery, but the practice is no longer the grisly staple it once was.[2,3]

Trepanation

One of the oldest neurosurgical operations, trepanation involved making holes in the skull with the intention of releasing evil spirits. For centuries, the practice was likely driven by religion and mysticism but eventually evolved into a systematic approach to brain trauma in Hippocratic medicine.[4,5] While not a direct ancestor of the modern burr hole, the eerie similarity in principle—gaining access to the intracranial space—remains.

Lobotomy

Intended to reduce the symptoms of mental illness, frontal lobotomy was a type of "psychosurgery" introduced by Portuguese neurologist António Egas Moniz and neurosurgeon Almeida Lima. The procedure severed the white matter connections of the prefrontal cortex, sometimes with an ice pick–like instrument in a transorbital approach.[6] Egas Moniz won the Nobel Prize in 1949 for this "innovation" he called leucotomy, but it is now one of the most criticized medical procedures.[7] Patients were left with profound and enduring changes in function and personality, including apathy, disinhibition, and loss of initiative.[6]

Arsenic trioxide, traced back to 2000 BC, has the unique distinction of being both medicine and poison.

Arsenic and mercury treatments

Arsenic trioxide, traced back to 2000 BC, has the unique distinction of being both medicine and poison. Odorless and tasteless, it became infamous as "inheritance powder," a favored tool of royal assassins and wives wishing to rid themselves of their husbands.[8] It was prescribed for ulcers, fevers, malaria, psoriasis, and syphilis, and later inspired organoarsenic compounds such as atoxyl, which laid the groundwork for arsenic trioxide's modern use in leukemia chemotherapy.[8] Arsenic exposure is a double-edged sword, however, as therapeutic margins can be perilously thin, and chronic exposure, whether through groundwater or pharmaceuticals, increases the risk of cancers, neuropathy, and organ damage.[8]

Mercury's medicinal history is also grim. Once used for a variety of ailments, including syphilis, skin diseases, and diuretics, we now know of the neuropsychiatric consequences of mercury that made felt workers "mad as a hatter" and the toxic global impacts such as through fish exposure.[9]

Is the future of medicine less scary?

Bygone examples of medicine's horrors abound—asylums and straitjackets, radium cures, and maternal and surgical care without anesthesia or antisepsis. How were we once so confident in practices that now seem so gruesome?

The uncomfortable truth is that we still offer treatments that will, in hindsight, prove unhelpful or even harmful. Not out of malice, but because best practices evolve; sometimes the right questions are elusive, or studies are too costly or impractical. As physicians quip, not everything can be tested in a randomized trial—no one has yet randomized parachutes for skydiving.[10]

This Halloween, as ghosts and ghouls wander our streets, it's worth remembering that medicine, too, has its hauntings, and the scariest thing may be believing we've finally outgrown them. ■

—Caitlin Dunne, MD

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Elbows up for evidence, science, and health in Canada

On 28 August 2025, dozens of scientists with the United States Centers for Disease Control and Prevention (CDC) walked off the job in protest. This action, unprecedented in the history of one of the world's foremost public health institutions, was a direct response to the dismissal of CDC director Susan Monarez, who had served less than one month before being fired by the Trump administration. Immediately following Monarez's dismissal, three other senior CDC officials resigned in protest, sparking a publicized walkout by dozens of staff in solidarity.[1]

These remarkable events at the CDC represent a tipping point and reflect larger patterns: public health programs and related sciences are under fire. The late-summer CDC walkout followed months of rollbacks across several US health and scientific institutions. In addition to the CDC, the US federal administration has imposed financial cuts and restricted mandates across organizations, including the National Institutes of Health. This pattern has had significant implications and echoes worldwide, including in Canada.

The Public Health Agency of Canada (PHAC) has recently stated plans to cut approximately 10% of staff from the already-shrinking organization.[2] The federal government has described this downsizing as a "post-pandemic recalibration," following the PHAC's growth during the first 2 years of the COVID-19 pandemic. Meanwhile, the PHAC has operated without a permanent chief public health officer for several months, with no replacement yet named for Dr Theresa Tam following her June resignation.

The experience of many medical and public health practitioners during the pandemic suggests a need for reflection and strategic growth in our public health institutions, not a retreat from hard-won gains. If there has been a common lesson from issues such as the pandemic and related misinformation worldwide—from heat waves and mass casualties in British Columbia, and from wildfire smoke and asthma surges across entire regions—that lesson has been that the health emergencies we face are increasingly complex, intense, and interrelated. There is a saying among emergency planners that the best time to prepare for an emergency is when there isn't one; emergency preparedness and response are an ongoing cycle, not optional activities to be ramped up and down when politically or fiscally expedient.

Upheaval to the south highlights the necessity of a strong public health backbone for our health system.

Amid the ongoing dismantling of US health agencies, Canada can and should support our own renowned institutions. For example, vaccination is a hotly politicized issue among US health agencies, and the US CDC's globally respected Advisory Committee on Immunization Practices has seen a dangerous sequence of political firings and appointments,[3] losing public trust and further polarizing vaccine-related sentiment. In this moment, the strength of the PHAC's National Advisory Committee on Immunization is crucial, promoting evidence-based practices and influencing health systems across the country (and in some cases globally).

In British Columbia, the provincial government is conducting a review of our own health system, including regional health authorities and programs of the Provincial Health Services Authority, such as the British Columbia Centre for Disease Control and BC Cancer. The stated aim of this review is "minimizing unnecessary administrative spending and ensuring resources support frontline patient care."[4] Few will argue against adequate support for frontline care. However, health care providers know the importance of scientific guidance on emerging public health threats, including climate change; clinical research closely linked with local practice; and upstream programs to prevent illness and promote health. Upheaval to the south highlights the necessity of a strong public health backbone for our health system.

We may not be able to affect or anticipate the actions of international leaders, even when their decisions wreak havoc and harm on health outside their borders. But our own leaders in Canada can choose to move in another direction, one that continues to support the well-being of organizations that support our health. ■

—Michael Schwandt, MD, MPH, FRCPC

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Letters to the editor

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BC medical trainees' perspectives on Canadian health system improvement

In the face of increasing demands on Canada's health care system, medical trainees across British Columbia are voicing urgent and practical concerns about the future of care delivery.

In February 2024, Prime Minister Justin Trudeau and Minister of Health Adrian Dix gave health care policy speeches at the annual Vancouver Medical Association Osler Dinner. To help give medical trainees a voice at the health care policy decision-making table, we invited UBC medical students and resident physicians to submit questions and policy priorities that they would like presented to Prime Minister Trudeau and Minister Dix at the Osler Dinner. The key principles and priorities of the 61 medical students and 19 residents who responded are shared in this letter.

Federal concerns: Improve health care accessibility, technology, transparency, and physician support

Foremost among medical trainees' federal-level concerns was health care accessibility, with an emphasis on reducing wait times for specialist consultations, emergency care, and surgical procedures. Trainees also highlighted the importance of improving access in rural, remote, and underserved communities, especially in the context of mental health services for youth and marginalized populations.

Trainees called for national strategies to better prepare for future pandemics, strengthen health care infrastructure, and guide the ethical integration of emerging technologies such as artificial intelligence into clinical care. Concerns were raised about transparency and accountability in health care spending, along with calls for

In February 2024, UBC medical students and resident physicians had an opportunity to submit questions and policy priorities at the Vancouver Medical Association Osler Dinner. From left to right: Dr Lee Treanor (radiology), Dr Joban Bal (family medicine), Prime Minister Justin Trudeau, Dr Philip Edgcumbe (radiology), Ms Elsie Wang (medical student), and Dr Salina Kang (family medicine).

regulatory reforms to ensure equitable and efficient use of health care dollars.

Many students advocated for increased support for medical trainees, including tuition relief, student loan forgiveness, and programs to prevent burnout. Concerns were prominent about the brain drain of Canadian medical graduates leaving to practise abroad, along with a call for national licensure to facilitate physician mobility and service in high-need areas.

Additional key priorities included establishment of a universal pharmacare program, urgent action on the opioid crisis, and reforms to medical assistance in dying policies to strengthen safeguards for vulnerable populations.

Provincial concerns: Health and social system insufficiencies and workforce planning

Trainees expressed strong concerns about emergency department overcrowding, long wait times, and inconsistencies in health care system coordination. They also urged investment in medical education, including expanding training positions, infrastructure, and support for learners.

Trainees urged the provincial government to support the use of digital health tools to improve system efficiency but also stressed the need for equitable implementation, such as a more robust electronic health records system in BC. Furthermore, a team-based system is essential to strengthen existing primary care systems.

Another key concern was addressing the unmet social determinants of health through an intersectional equity lens, particularly for Indigenous people, individuals with disabilities, and those living in poverty. Trainees recommended expanding access to mental health housing, social infrastructure, and programs that match the province's population growth and evolving needs.

Concerns were repeatedly raised about physician burnout, particularly among residents and rural physicians, highlighting the need for urgent workforce planning and sustainable staffing strategies for the province. Parental leave support and administrative load reduction continue to be priorities for trainees.

Moving forward together

These deep concerns and proposals reflect an informed understanding and a passion for health care from trainees who are committed to meaningful change. These voices come from lecture halls, call rooms, emergency departments, inpatient wards, surgery units, and rural placements across BC, and they deserve to be part of the provincial and national dialogues.

As future physicians, we are not only preparing to practise in this system, we are also investing our lives in it. We respectfully call on policymakers, including Prime Minister Mark Carney and Premier David Eby, to engage with these priorities and work alongside health care learners to shape a system that is more accessible, equitable, and sustainable for all Canadians.

—Elsie J. Wang, BSc
UBC MD Student, Class of 2026
—Joban Bal, MD
UBC Resident Doctor
—Philip Edgcumbe, MD, PhD
UBC Resident Doctor

Why physicians need the counsel of a skilled medical librarian in the era of artificial intelligence

As a biomedical librarian with over 30 years of experience supporting British Columbian physicians, I want to highlight the critical role of the College of Physicians and Surgeons of BC (CPSBC) Library and address the profound impact of its closure in 2024, as expressed in letters from physicians and librarians to the *BC Medical Journal*.

Since 1960, CPSBC librarians have supported physicians in maintaining their medical knowledge and practice standards. My mentor, former CPSBC Library director Bill Fraser,[1] emphasized that librarians' value to medicine was undeniable, and that it could be demonstrated. As Dr Caitlin Dunne said, "In losing the Library, we've lost a valuable member of our health care team."[2] Other physicians, such as Dr Margo S. Clarke, have noted that without librarian-mediated access to full-text articles, especially for rare or emerging conditions, staying current would be more difficult.[3] Dr Teresa Marie Kope highlighted the personal impact of the Library closure, citing her reliance on librarians for searches, training, and the *Cites & Bytes* newsletter.[4] Librarians Rachael Bradshaw, Melissa Caines, and Jane Jun from the Health Libraries Association of BC said that equating library value with usage metrics was shortsighted and overlooked the value of services such as rapid clinical searches and systematic review support, which are not easily replaced.[5]

Recommendations

To preserve evidence-based support, the CPSBC should consider the following recommendations:

- Hire a consulting medical librarian for workshops. Contract a professional medical librarian to deliver regular virtual or in-person workshops on search techniques using databases like PubMed, Google Scholar, and Cochrane, as well as artificial intelligence tools like Elicit and Undermind.
- Establish a *BCMJ* column authored by a medical librarian. Create a monthly column in the *BCMJ*, authored by a contracted librarian (at professional rates), to share search strategies, introduce new tools, and provide practical guidance for integrating information skills into clinical practice.
- Hire a medical librarian to curate online resources on the CPSBC website. Develop a dedicated section on the CPSBC website with searchable guides, quick-reference tips, video tutorials, and curated links to high-quality evidence, ensuring access to reliable sources.

Evidence-based return on investment

As Dr Dunne noted, tasks such as mentoring trainees and preparing lectures for professional meetings are more time-consuming

without a librarian's support.[6] For physicians unaffiliated with UBC's medical school and without access to BC's health authority libraries, the CPSBC closure has created significant service gaps. At UBC's Biomedical Branch Library at Vancouver General Hospital, I've seen increased demand from CPSBC members—some with UBC affiliation, some without. Not all BC physicians have access to a qualified librarian or the resources of a decent medical library.

By implementing the recommended low-cost interim measures, the CPSBC can help mitigate the impact of the Library's closure and reinforce the CPSBC's commitment to evidence-based practice.

—Dean Giustini, MLS, MEd
UBC Biomedical Branch Librarian

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Fewer patients per family physician in BC is the result of intolerable working conditions

The primary care crisis in British Columbia is characterized by a decrease in the productivity of a family physician. Between fiscal years 2011–2012 and 2022–2023, patients continued 5.34 visits per capita annually, but family physicians provided 13% fewer total visits per physician, including 31% fewer longitudinal care visits **[Table 1]**.[1] For decades, family physicians complained of "intolerable working conditions" and "inflexible payment modalities that do not support multiprofessional practices."[2] Their complaints ignored, the interaction of a lack of opportunity, inadequate means, and deteriorating motivation caused a decrease in performance.[3] During the same time span, consulting specialists increased their total visits by 17.6%.[1]

The opportunity for family physicians "to perform a task"[3] in the fee-for-service system is the amount of paid time per visit, regardless of the number of disorders managed, unlike for consulting specialists, for whom "service" means managing one disorder. As disease complexity increased, more time was needed per visit but not provided. In 1977, federal funding of health care was reduced from the initially promised 50% to 23%. BC's Ministry of Health responded by reducing the annual fee-for-service increases to half the annual general inflation rates from 1997 onward.[4] The cumulative effect of that is illustrated by the reduction in constant dollar value of the family medicine in-office visit fee (code 00100) from $17 in 1982 to $32.71 in 2022. At the cumulative general inflation rate of 178.7%, it would have been $47.38 in 2022.[5] The difference of $14.67 represents a 44.9% loss of payment for the service. In 2012, family physicians had the lowest fee-for-service remuneration per average day worked and by 2023 had received the lowest annual increases.[1] That resulted in the ratio of fee-for-service earnings per average day worked of the highest-earning consulting specialist section to the Section of Family Medicine increasing from 3.5 to 4.3, a 23% increase over 11 years.[1] Increases in office staff remuneration and facilities rent in the 1990s and the cost of digitization in the 2000s further reduced after-expense incomes for family physicians.

The means to be "*capable* of performing a task"[3] consists of tools and assistants to

TABLE 1. Total family medicine visits and expenditures and per capita and physician averages in fiscal years 2011–2012 and 2022–2023.

Fiscal year	Total visits by Section of Family Medicine (millions)	Total expenditures (millions)	Visits per capita	Expenditures per visit	Physician count	Average days worked	Total visits per physician	Longitudinal care per physician
2011–2012	26.8	$932	5.36	$34.8	5147	182	5147	1730
2022–2023	28.6	$1234	5.33	$43.2	6302	184	4531	1190
Change	6.3%	32%	-0.6%	24%	22%	1.1%	-13%	-31%

TABLE 2. Total visits per family physician (2011–2012 to 2022–2023) corrected for average days worked (productivity).

2011–2012	2012–2013	2013–2014	2014–2015	2015–2016	2016–2017	2017–2018	2018–2019	2019–2020	2020–2021	2021–2022	2022–2023
5147	5013	4908	4488	4380	4264	4146	4060	4474	4544	4473	4531
100%	99%	99.3%	85.8%	86%	81.9%	80.1%	78%	83.3%	79.5%	82%	87.1%

improve efficiency. In BC, physician assistants are limited to Ministry of Health–operated clinics; all other clinic types lose out on efficiencies that can double the number of patients per family physician and reduce costs per disorder managed.[6] By fiscal year 2013–2014, family physicians had reached a relatively stable average of 5000 visits per physician annually, but in 2014–2015, there was an unexplained 13.5% decrease in visits, which was never regained **[Table 2]**.[1] In 2014, the *UBC Medical Journal* reported that most family physicians in BC had adopted electronic medical records (EMRs),[7] drawing attention to published reports that using EMRs takes more time.[8] The increased time per visit decreased opportunity, further reducing fee-for-service remuneration, and caused anxiety, depression, and burnout. The additional hardware and software that was required increased operating costs.

The motivation "to want to perform a task"[3] began to diminish slowly but relentlessly, the three domains interacting to produce a vicious cycle of ever-decreasing morale, motivation, and lost productivity. Proposed alternative explanations for decreased family physician performance, such as feminization, aging, and lifestyle balance, are inconsistent with consulting specialists' sections not experiencing similar losses of productivity.[1]

A review of BC family physicians' working conditions, going back to the inception of publicly funded health care in Canada, explains the current crisis in access to primary care. The solution is self-evident.

—Gerald Tevaarwerk, MD, FRCPC
Victoria

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Time to change the way physicians are trained in Canada

Dr Deena Case's letter [*BCMJ* 2025;67:198] about the high rate of infertility among physicians emphasized that this situation arises from the length of time it takes to train to be a physician in Canada. Consequently, the ova of female doctors are likely to exceed their best-before date prior to the time they are professionally ready to conceive.

She raises a valid observation: Is it *really* necessary that the training to become an effective physician involves so much of a person's adult life? The experience for a member of my family was 4 years to obtain an undergraduate degree and 2 years for a master's degree before acceptance into 4 years of medical school. That was followed by 5 years of specialty training and then over 2 years of subspecialty training, with 1 year out for serious health problems. That is 18 years (well over one-third of one's earning lifetime), paid for out of pocket after high school, before significant earnings begin, as well as putting oneself years behind in the housing market, with no pension to compensate at the end of a career working for the government system. Can such a setup provide the physician workforce for our country?

Next month, my niece's son enters medical school in Denmark, with nothing more than a high school diploma. No wonder the Danes are such a well-provided-for nation. Time for Canada to cut prerequisites and catch up.

—Anthony Walter, MD
Coldstream

EDITORIALS

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Gratitude

In medicine, our work is often defined by urgency. The constant demands of clinical practice, administrative responsibilities, and personal commitments can leave little room to pause. Yet moments of reflection are essential—not only to sustain our own well-being, but also to ensure that our profession remains grounded in compassion, equity, and purpose.

For me, Thanksgiving is an annual reminder to pause and reflect. Today, I'm thinking about the many colleagues I've met across the province who continue to show up with compassion, commitment, and ingenuity, despite the mounting pressures in our health care system—the dedicated physicians who step up with solutions when they notice patients can't access the care they need. Innovators like Dr Christie Chan, who secured federal funding for a mobile health unit to reach remote communities and encampments, remind us what's possible when compassion and creativity guide care delivery.

Inspiring stories of physicians who action creative solutions to health care challenges are not rare; they are the norm in BC's medical community. Yet this culture of perseverance raises a sobering question: What toll is this taking on us as individuals? Physicians today face increasing workloads, longer wait lists, and mounting administrative demands. The emotional labor of caring for patients within a strained health care system—particularly for physicians working in underserved, rural, and Indigenous communities—adds further weight to an already heavy burden.

Amid these systemic challenges, there is still much to be thankful for. I invite you to extend gratitude beyond our profession—to the families, friends, and loved ones who sustain us. Those who experience our late nights and missed holidays deserve acknowledgment. Their patience and understanding make it possible for us to meet our patients' needs. I encourage you to reconnect with them. Take the time to step away from clinical roles and embrace personal ones. Let's give ourselves permission to rest, share a meal, and be more than our work.

This culture of perseverance raises a sobering question: What toll is this taking on us as individuals?

Just as important, let's not overlook the colleagues who catch us when we falter—the mentors who listen, the peers who check in, the teams who support us. Our professional community is one of our greatest strengths, and I'm thankful to stand with all of you. Please reach out to me anytime at president@doctorsofbc.ca.

Of course, we are not passive participants in this system. We are advocates, leaders, and system builders, and our collective voice has never been more important. We've seen the power of collective action—whether advancing primary care reform, like the Longitudinal Family Physician Payment Model; standing in solidarity with colleagues, like the medical staff association in Kelowna; or raising the alarm on physician burnout.

I encourage you to take time to rest, reconnect, and reflect. Then, I invite you to engage with your divisions, medical staff associations, sections, and societies, and Doctors of BC. Our collective voice remains essential to shaping a health care system that serves every patient, every community, and every physician with dignity and respect.

To my colleagues across BC—those in hospitals and in community, both rural and urban—thank you. Thank you for your mentorship, your leadership, your expertise, and your perseverance. I hope you find time this season to reconnect with those who matter most and to acknowledge the relationships that sustain your work and well-being. ■

In solidarity and appreciation,

—Charlene Lui, MD
Doctors of BC President

Dr Kristopher Kang

The pediatrician talks about his goals as a new *BCMJ* Editorial Board member, bringing medicine into schools, and accidentally getting into Princeton.

Tara Lyon

When you ask someone how thrilling it was to get accepted to Princeton, the last answer you expect to hear is "Well, it was kind of by accident!" Dr Kristopher Kang, who recently joined the *BCMJ* Editorial Board, tells the story of his Ivy League education humbly and with humor. His academic journey and subsequent career in pediatrics have been full of unexpected twists and turns, and they speak to his passion for learning, his willingness to embrace unusual opportunities, and his love of storytelling.

Dr Kang grew up in Kamloops—a simple childhood, he says, during which he had no idea he'd end up working in medicine. "My parents still live in Kamloops. My dad was a dentist, and my mom ran his office. Really, my only link to medicine at that point in my life was being a teenager who desperately didn't want to do what my dad did," he says with a laugh.

As part of differentiating his path from those of his parents (and of his classmates), he took an opportunity to complete part of his high school education abroad. He graduated high school early and had been accepted to the University of British Columbia, but he decided to complete a 2-year international high school program in Hong Kong before attending university.

Through the high school in Hong Kong, Dr Kang learned about the Davis United World College Scholars Program, which gives students from high schools around the world financial assistance to study at a number of prestigious schools in the United States. Somewhat on a whim, he applied to the program and was accepted to Princeton. While he was excited about the educational opportunity and the prospect of being in a unique university environment, he was unaware of the true gravity of it all at the time. "As a young person, it was difficult for me to appreciate how big of a deal being accepted to Princeton was! I look back now and think how funny it was to be lying in bed at age 19, tired, and wanting to skip a morning class that was being given by someone who won a Nobel Prize . . . nowadays, I'd probably pay to hear him talk!" He chuckles at the memory. "One of my mentors in residency said, 'Education is wasted on the young,' and it's so true. At this point in my career, I'd love to have time to just study—not have to work at the same time and try to pack in CME."

We have a challenge ahead of us to make sure children aren't left behind, and part of that is making sure children are a part of the conversation. It's an important role for me as part of the *BCMJ*, and for all pediatricians in the province.

After graduating from Princeton, Dr Kang worked for a number of organizations in New York and around the world before deciding he wanted an advanced degree. This led him back to Canada to attend the UBC Faculty of Medicine, after which he specialized in pediatrics. "I've always been interested in learning about and supporting children and families," he explains. "Before I was in medicine, I was involved in work around vulnerable children who were affected by HIV/AIDS, living and working on the streets, experiencing violence, and in some cases living in armed

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conflict. After those experiences, a pediatric residency just made sense to me—having a general pediatric scope would enable me to help with problems that affect all children."

In addition to working as a general pediatrician at BC Children's Hospital, Dr Kang works with the Social Pediatrics Program in Vancouver's Strathcona neighborhood, which operates out of a townhouse converted into a clinic. "We're as low barrier as possible for a clinical practice," explains Dr Kang. "I support children and families who face systemic barriers to accessing care, working predominantly with elementary age kids at their schools."

"Schools are a powerful mechanism for engaging with families. They provide a scaffold that allows me to enter into a relationship with a family that might not otherwise have the interest, trust, or time to engage with a health care provider. It's the lowest-barrier access point for families who want to talk about their kids." The observational approach to providing care in schools—seeing kids interact with their friends and teachers in a classroom setting—allows Dr Kang to establish developmental diagnoses early, bypassing generally long waits for kids with developmental concerns to access diagnostics and supports. "We try to accelerate the process as much as possible, because the school depends on that information. If you're on a 2-year wait list for an assessment, it can be years before the school gets the information it needs to benefit your learning and provide you with the supports you need in the classroom. Accelerating that process takes a huge team effort—we work closely with nurse practitioners and nurses as well."

Dr Kang's passion for helping kids comes through when he talks about his aspirations as a member of the *BCMJ* Editorial Board. "One of the things I hope to bring to the board is to ensure that children and families do stay in focus in the literature. Addressing health care for children and families is a powerful preventive measure for health care issues that show up later in life. We have a challenge ahead of us to make sure children aren't left behind, and

part of that is making sure children are a part of the conversation. It's an important role for me as part of the *BCMJ*, and for all pediatricians in the province."

True to his nature as a lifelong learner, Dr Kang appreciates the opportunity to review and discuss the wide variety of articles submitted to the *BCMJ*. "Working with the board is such an amazing opportunity to learn things outside the pediatric domain," he explains. "I'm so focused on child health that it's hard to know what else is going on. The broad scope of the articles and the local nature of the content published in the journal is important in the medical literature, and it's great to feel like I'm a part of that."

Dr Kang's first editorial, "Beyond Kelowna: A wake-up call for child health in British Columbia," was published in the September issue [*BCMJ* 2025;67:234]. ■

Integrating planetary health into case-based learning for medical students

A pilot project demonstrates how climate change education can be integrated into an existing medical school curriculum.

A. Gangji, MEd, E. Willis, MA, A. Yee, MD, MET, J. Gil-Mohapel, MSc, PhD, V. Stoynova, MDCM, FRCPC, MHPE

ABSTRACT

Background: Climate change is a health emergency, yet many medical schools provide minimal planetary health content in their undergraduate medical curriculum. This pilot project answered the global call to recognize the impacts of climate change on human health by creating a way to address the gap in the curriculum at the University of British Columbia.

Methods: A multidisciplinary team of students, academic leadership, medical educators, and planetary health experts integrated climate change concepts into case-based learning scenarios and created patient perspective videos to supplement the cases.

Results: Planetary health concepts were integrated into four cases on topics relevant to the British Columbia context. The cases focused on identifying vulnerable patients, addressing risk factors, and managing climate-related illness. A unique feature of this pilot project was the involvement of near peers to edit the cases to target the appropriate level of complexity for the learners.

Conclusions: This pilot project demonstrates practical, strategic integration of climate change education into existing curricula. This collaborative approach, using multidisciplinary teams and patient perspectives, offers a model to prepare future clinicians for the impacts of climate change.

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Climate change is a global health emergency, with over 200 scientific journals coming together to call for action from political leaders and health professionals to recognize the impacts of climate change on human health.[1] Medical schools are an appropriate place for students to reflect on their roles and responsibilities to provide care in the era of climate change.[2] As highlighted in a 2019 *CMAJ* news story, medical students across Canada are calling for greater emphasis on planetary health in medical education, yet medical curricula often lag in incorporating this content.[3] According to one report, climate change is taught in only 15% of medical schools worldwide, and 34% of schools have no aspects of the involvement of climate in health included in either the mandatory or informal curriculum.[4] This article showcases a practical approach to curricular reform from the Faculty of Medicine at the University of British Columbia. This initiative's process and lessons provide an example for other medical educators to apply when enhancing climate change education in their programs.

Background

The UBC Faculty of Medicine has been British Columbia's main medical school for over 70 years. In keeping with medical schools across Canada, a key component of the UBC MD curriculum in years 1 and 2 is case-based learning, during which students work through a weekly patient case related to a specific topic in a small group format.[5] This teaching format emphasizes problem-solving, critical thinking, and student collaboration to address health through a biopsychosocial model.[6] In the UBC curriculum, cases spiral onto one another, and each topic is revisited, with increasing complexity, multiple times throughout years 1 and 2.[7]

Methods

We convened a multidisciplinary team of medical students and clinical faculty members with expertise in academic leadership, medical education, and planetary health to integrate climate change concepts into existing case-based learning content, focusing on identifying vulnerable patients, addressing risk factors, and managing climate-related illness. During this pilot phase, our team focused on cases of chronic obstructive pulmonary disease (COPD), kidney disease, geriatric health, and mental health. These cases were chosen, in consultation with the respective case leads, because there is strong evidence that the subject areas are impacted by climate change and are acutely relevant in British Columbia due to increased critical climate events in recent years (e.g., forest fires, heat waves). The integration was done in three stages:

1. Conducting a literature review. A medical student (A.G.) reviewed the planetary health literature related to the selected cases, with support from the planetary health expert (V.S.). Articles were chosen based on pathophysiology and common presentations for each topic, alongside specific impacts of climate change, forest fires, and increasing temperatures.
2. Editing the case-based learning content. The literature review informed the modification of case-based learning prompts and questions to integrate climate change considerations into health care and patient outcomes. For rigor, modifications were discussed and approved by the week's leads for each case. Selected references from the review were added as recommended reading for each week.
3. Incorporating patient perspectives. A medical student (E.W.) collaborated with patient partners to develop short videos, centred on patient experiences, illustrating real-life impacts of climate change on an individual's health. The videos were included in the cases.

Results: The selected cases

Chronic obstructive pulmonary disease

In 2023, BC experienced the most destructive forest fire season in recent history, involving nearly 3 million hectares of land.[8] Forest fires affect air quality by increasing acute exposure to airborne pollutants, including particulate matter and carbon monoxide,[9] which in turn leads to adverse outcomes among patients with respiratory diseases. Chronic increases in particulate matter increase the likelihood of developing COPD in adults[10] and asthma in children.[11]

To overcome the dense curriculum barrier, the new material was woven into existing elements of the curriculum rather than being added as new elements focused solely on planetary health.

Acute exposure to poor air quality also increases emergency room visits, hospital admissions, and mortality among patients with COPD.[12]

This was addressed in the UBC curriculum, as shown in **Box 1**, in a case where a patient had a COPD exacerbation. The exacerbating factor was adjusted in this case to be an environmental issue, rather than exertion. Students were also asked to discuss how forest fires could be contributing to the patient's condition, allowing students to explore the impact of critical climate events on human health.

This case was paired with an embedded video highlighting a real patient's experience of the 2003 Okanagan Mountain Park wildfire, which resulted in hospitalization and significant worsening of her asthma disease burden. Students watched the video as a group and received prompting questions to reflect on how climate change impacts quality of life.

Kidney disease

Rising average temperatures in the context of climate change worsen both acute and chronic kidney disease through increased inflammation and decreased renal blood flow.[13] Individuals performing physically demanding work outdoors, such as farmers, construction workers, plantation workers, and miners, are more likely to develop this "heat stress nephropathy."[13] Exercise in intense heat, particularly without acclimation, can cause additional stress on the kidneys through two pathways. First, higher temperatures require diversion of blood to the skin for heat dissipation, with compensatory restriction of blood flow to the kidneys. Second, increased temperatures require increased sweating for thermoregulation, resulting in an increased risk for volume and electrolyte depletion.[14]

In this case, the patient developed an electrolyte disturbance after participating in a triathlon during a heat wave. The case was modified to highlight the increasing temperatures in Prince George and the exceptionally hot weather on the day of the event **[Box 2]**.

Students were asked to research the impacts of climate change on kidney function and come to the session prepared to discuss. Students were also asked to brainstorm ways that event organizers could have better prepared for athletes who were suffering from heat stress, placing an emphasis on prevention and harm reduction.

Geriatric health

Elderly populations are increasingly vulnerable to the effects of climate change due to higher rates of chronic disease, greater sensitivity to heat, and increased use of medications that impair the ability to feel thirst, sweat, and thermoregulate.[15] This was especially evident during the 2021 heat dome in BC, where record temperatures were seen in many parts of the province over several days.[16] According to the coroner's report, 619 deaths were attributed to this extreme weather event; 90% of those who died were over 60 years of age, and two-thirds were individuals with chronic

BOX 1. **An example of changes made to a case-based learning prompt related to chronic obstructive pulmonary disease.**

John is unsure when the shortness of breath started. He has noticed it over the last 6 months ~~when he has been climbing stairs~~ with the recent local forest fires, which made it harder for him to breathe. He does report feeling fatigued upon any exertion, which dissipates quickly at cessation of effort. He attributes his shortness of breath to being unfit. When short of breath, he does not feel any chest pain. He says he sometimes hears a "wheeze" at times. He has used his wife's "blue asthma puffer" (salbutamol inhaler) but it does not work as well as it does for his wife. He reports that he will cough most days which can be productive of sputum.

How might forest fires contribute to John's condition?

BOX 2. **An example of changes made to a case background to include a planetary health focus about increasing temperatures.**

You are a third-year medical student and have just started your emergency medicine clerkship with Dr Bunson. Today, you are accompanying Dr Bunson to work in the medical tent at a long distance (Ironman) triathlon. Today would have been considered exceptionally hot in the past, but days this warm are increasingly commonplace in Prince George (see Exhibit.)

Your first patient is Rajinder Sidhu, a 34-year-old cis-gendered woman competing in her first event of this type. She is brought in by event volunteers and accompanied by her wife because she stopped to sit down during the marathon portion and was complaining of feeling dizzy and light-headed. She is slow to answer questions and appears dazed.

BOX 3. **Additional information provided in the tutor guide to incorporate geriatric health–related planetary health concerns.**

How might the elderly be at increased risk of falls during heat waves?
Heat syncope is defined as the brief loss of consciousness due to vasodilation and pooling of blood in the limbs as a result of physiological compensation to heat exposure. The elderly are at greater risk for developing this heat-related illness due to reduced cardiovascular physiological reserves, an impaired sense of thirst, and compromised regulatory systems due to degeneration with advanced age. Those taking medications such as beta-blockers or diuretics like our patient are also at greater risk. Finally, those living alone face an even greater threat. For example, during the 2021 heat dome in BC, more than half (56%) of those that passed away lived alone and 67% were age 70 or older.

illnesses that could impact mobility, such as heart failure, arthritis, and Parkinson disease.[16] Elderly individuals are also at increased risk of developing heat-related illnesses like heat syncope, which could increase the risk of falls in this population.[17]

Incorporating planetary health concepts into osteoporosis week highlights the downstream impacts of climate change on conditions not traditionally associated with planetary health. In this case, an elderly patient falls and presents to the emergency department with a fracture. She is subsequently diagnosed with osteoporosis. The original cause of the fall was tripping over a carpet; it was changed to dehydration and heat syncope, leading to the fall. Students were asked to prepare to discuss how elderly patients might be at increased risk of falls during heat waves. The accompanying tutor guide addresses heat syncope and physiological responses to heat that put elderly patients at greater risk. **Box 3** shows the additional information provided in the tutor guide for this case.

Additional risk factors, such as lack of air conditioning, low socioeconomic status, and limited social supports, are emphasized throughout the case.

Mental health

Climate change impacts mental health, contributing to conditions like climate change anxiety, both physical and mental symptoms, and apprehension about the future in response to climate change.[18] This may worsen during emergency weather events, such as the 2021 heat dome, which exacerbated climate change anxiety in British Columbians.[18] Exposure to natural disasters is also strongly associated with high psychological distress, including posttraumatic stress disorder and depression.[19] Individuals can also experience climate change anxiety even when not directly involved in a climate disaster.[20]

The case for this week was modified so the patient's anxiety disorder centred on wildfires and warming temperatures in her area. In addition to treating the patient with an antidepressant, psychotherapy, and

other lifestyle measures, the case had tutors discuss evidence-based strategies that can be used to address climate change anxiety, such as participating in community efforts to tackle climate change, including rallies, cleanup efforts, and community gardens **[Box 4]**.[21] While raising awareness of the psychological effects of climate change can be triggering, presenting this information through a collective-action lens may combat feelings of despair and hopelessness, and instead foster hope.[22,23]

This case was accompanied by a patient video that highlights a young woman's experience with climate anxiety living in Vancouver. Students were asked to review the video independently and come to the sessions prepared to discuss and reflect on her experiences.

Discussion of limitations and solutions

Key barriers in this project included having to balance the integration of climate change education with an already dense preclinical curriculum and contending with a decentralized weekly block structure. Similar concerns were raised at McMaster University when it attempted to incorporate climate change education into its medical curriculum.[25]

To overcome the dense curriculum barrier, the new material was woven into existing elements of the curriculum rather than being added as new elements focused solely on planetary health.[26] Although the siloed, decentralized structure of the program made it challenging to implement changes through a centralized process, this was addressed through direct communication and collaboration between the leads of each individual week and the planetary health team. One of the recommendations made by the group at McMaster University was to have designated individuals tasked with integrating climate change into the curriculum to ensure continuity.[25] This approach situates learning in a relevant context, endorses climate change health concerns, and promotes permanence of the curriculum change.[26]

BOX 4. An example of changes made to instructions for tutor guides to discuss solutions for a patient's climate anxiety.

Aside from antidepressant medications and psychotherapy (CBT or IPT, which would both be good options for Anna, depending on availability), Anna would likely benefit from a regular program of exercise. Both cardiovascular (aerobic) and resistance (anaerobic) exercise have been shown to be effective, although at least 30 minutes of supervised moderate-intensity exercise at least 3 times weekly for a minimum of 9 weeks is suggested. Yoga is listed as second-line therapy for mild-to moderate MDD; given that Anna already takes a yoga class, this may be a good option.

Light therapy is recommended for seasonal MDD and would not be first-line for Anna. rTMS is recommended as first line treatment in patients who have failed to respond to at least one antidepressant, although access to treatment is limited. Given that Anna's depression is not treatment resistant and she does not have acute suicidal ideation, ECT, ketamine, or rTMS would not be considered as options at this stage.

To respond to her climate anxiety, one could recommend that Anna engages in collective action such as increasing awareness about climate change or helping with evacuation efforts. This could help to increase her agency and may combat feelings of despair and helplessness and foster feelings of hope. Collective action may also help Anna connect to a larger community and bring social support both of which support mental health and well-being.

CBT: cognitive-behavioral therapy; IPT: interpersonal psychotherapy; MDD: major depressive disorder; rTMS: repetitive transcranial magnetic stimulation; ECT: electroconvulsive therapy.

Conclusions

While integrating climate change education into a demanding medical curriculum presents obstacles, the UBC experience demonstrates that strategic, collaborative, and creative approaches can effectively address the challenges and equip graduates to be environmentally responsible clinicians prepared for the health impacts of climate change. ■

Competing interests

None declared.

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Strategic, collaborative, and creative approaches can effectively address the challenges and equip graduates to be environmentally responsible clinicians prepared for the health impacts of climate change.

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Early detection, lasting prevention: The significance of coronary artery calcium scores

Coronary artery calcium scoring is a valuable tool for refining cardiovascular risk assessment, particularly in intermediate-risk individuals.

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ABSTRACT: Atherosclerosis, a chronic inflammatory disease leading to cardiovascular disease, is a major global health challenge. Coronary artery calcium scoring has emerged as a critical tool in assessing the risk of atherosclerotic cardiovascular disease by quantifying calcified plaque in coronary arteries via computed tomography scans. Coronary artery calcium scoring has been integrated into multiple guidelines for superior risk stratification and personalized treatment approaches. We discuss the basic concept of coronary artery calcium scoring, its interpretation, and the advantages and limitations of incorporating it into cardiovascular risk assessment strategies.

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Atherosclerosis, a type of chronic inflammation that is marked by the buildup of lipid-rich plaque within the walls of the arteries, is the leading cause of cardiovascular disease, including coronary artery disease, cerebrovascular disease, and peripheral artery disease.[1] As the disease progresses, it can lead to unstable atherosclerotic plaque rupture, vascular narrowing, or blockage due to platelet aggregation and thrombosis, which results in acute cardiovascular disease.[2] This pathological process begins early in life and is influenced by genetic, environmental, and lifestyle factors. Historically, atherosclerosis was observed in ancient populations, thus underscoring its long-standing impact on human health.[1] Despite advances in medical interventions and preventive strategies, atherosclerosis remains a major global health burden, which highlights the significance of early detection and effective risk assessment.[3]

Coronary artery calcium scoring

Assessment and interpretation

Coronary artery calcium scoring (CACS) is a noninvasive, specialized computed tomography (CT) scan of the heart that is used to assess the presence of calcified plaque in the coronary arteries **[Figure]**. It is used in evaluating the risk of atherosclerotic cardiovascular disease in asymptomatic patients and offers a direct measure of subclinical atherosclerosis. It requires approximately 10 minutes of patient time in the procedure room. The radiation exposure of the scan does not exceed 1.0 mSv, which is comparable to that of a screening mammography (approximately 0.8 mSv) and lower than the yearly radiation exposure (i.e., natural environmental radiation) of approximately 3.0 mSv. CACS has been incorporated into various guidelines and criteria, where clinically suitable, including those of the Society of Cardiovascular Computed Tomography and the Society of Thoracic Radiology.[4-8] The presence of calcium in the coronary arteries is strong evidence of atherosclerotic plaque.[9]

The Agatston score is the most common method for detecting "regions of interest" in the coronary arteries that contain calcium deposits. Additionally, it helps determine the overall size of lesions that are larger than 1 mm^2 and the highest calcific density of lesions that are more than 130 Hounsfield units.[10,11] The Hounsfield unit is a quantitative scale used to measure the density of various tissues on a CT scan.[12] The Agatston score is typically calculated using a CT data set with slice thickness ranging from 2.5 to 3.0 mm.[13] The Society of Cardiovascular Computed Tomography developed the Coronary Artery Calcium Data and Reporting System (CAC-DRS), which recommends reporting the total Agatston score and the regional distribution of CACS and provides risk stratification based on the quantified calcium score.[4]

To support clinical decision making, the CAC-DRS aims to create a standardized method for reporting CACS findings on all noncontrast CT scans, regardless of the reason for the scan, and for providing recommendations for future patient management. The CAC-DRS categories, based on the Agatston score, aid understanding of heart attack risk, where scores above zero guide doctors to recommend lifestyle changes such as diet adjustment, exercise, and smoking cessation. When the score is zero, there is no calcified plaque and a very low risk of a coronary heart disease event **[Table]**, which supports the decision to defer statin therapy while focusing on lifestyle modifications. A score from 1 to 99 indicates there is some calcified plaque and a mild risk of a coronary heart disease event, which supports considering statin therapy and addressing modifiable risk factors. Scores from 100 to 299 indicate there is a greater burden of calcified plaque and a moderate risk of a coronary heart disease event. Scores of 300 and higher suggest there is a large amount of calcified plaque and a moderate to severe risk of a coronary heart disease event. In this case, aggressive preventive interventions, such as moderate- to high-intensity statin therapy, the addition of other lipid-lowering medications and aspirin, and referral to a cardiologist, may be needed.[13-16] Additionally, CACS results are compared against reference data from the Multi-Ethnic Study of Atherosclerosis to determine the patient's percentile, which indicates their coronary artery calcium burden relative to others in their demographic group.[17] Age, sex, and ethnicity/race are considered in estimating the percentile.

An initial scan for risk stratification is recommended at 42 years of age for men and 58 years of age for women who have no risk factors.[18] The recommended age is 6.4 years earlier for individuals who have diabetes.[18] This implies there is a 25% likelihood of a CACS result greater than zero in women with diabetes at age 50 and in men with diabetes at approximately age 36 to 37.[18] The initial step in evaluating asymptomatic patients for primary prevention is to determine their risk of atherosclerotic cardiovascular disease by referencing risk scores such as the Framingham Risk Score, the Reynolds Risk Score, and the Pooled Cohort Equations Risk Calculator.[19]

In British Columbia, CACS is not covered under the Medical Services Plan.[20] However, select hospitals may offer the test to patients at no cost, and private diagnostic laboratories provide it for a fee. Family physicians and specialists can order the test, provided it is supported by appropriate clinical indications and considerations.

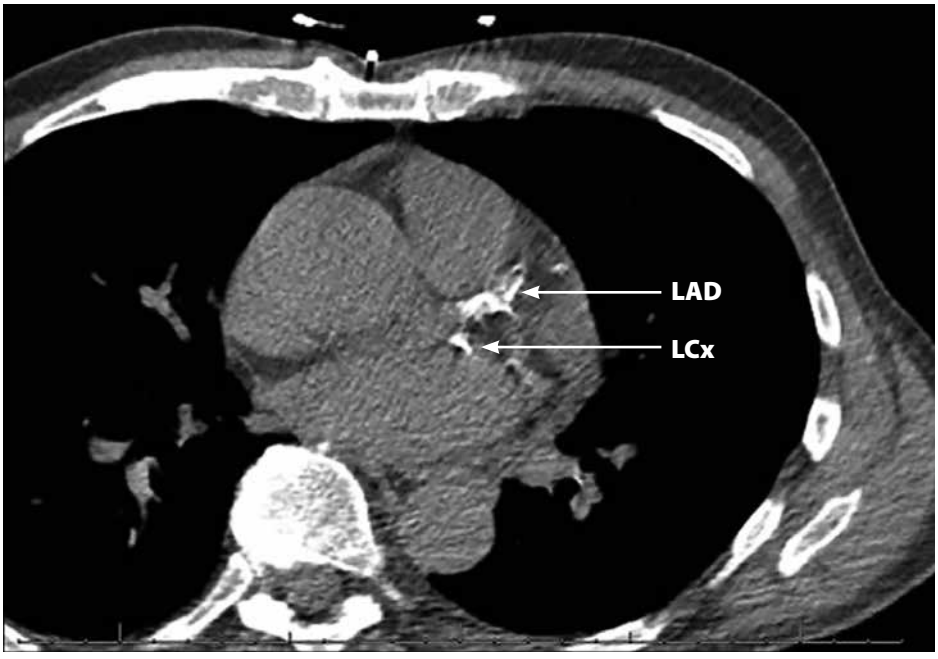

FIGURE. Sample coronary artery calcium scoring CT scan. A significant burden of calcified plaque can be seen in this patient with a high coronary artery calcium score, in both the left anterior descending (LAD) artery and the left circumflex (LCx) artery. The total calcium score was 944: left main coronary artery: 0, LAD artery: 643, LCx artery: 128, right coronary artery: 173.

TABLE. Coronary Artery Calcium Data and Reporting System (CAC-DRS) categories determined by Agatston score and visual assessment score.

CAC-DRS category	Agatston score	Visual assessment score	Risk of a coronary heart disease event
0	0	0	Very low
1	1–99	1	Mild
2	100–299	2	Moderate
3	≥ 300	3	Moderate to severe

Advantages and limitations

CACS is a superior tool for assessing cardiovascular risk compared with traditional risk factors and other markers, because it can help identify the patient group for therapeutic interventions, and it offers a highly personalized risk assessment. Additionally, it can enhance patient adherence to long-term treatment strategies, including dietary modifications, exercise regimens, and statin medications, which contributes to more effective and tailored health care.[21]

However, CACS has some limitations. It identifies only calcified plaque, not noncalcified (soft) plaque, and it does not

differentiate between stable and unstable plaque. The composition of plaque is crucial to understanding the true risk of cardiovascular events.[3] Additionally, it may have limited predictive value in specific populations, such as younger individuals and those with diabetes. In these groups, the absence of coronary calcium does not necessarily mean there is a low risk of cardiovascular events, in part due to the potential for noncalcified plaque to be present.[18] CACS also does not provide detailed information about plaque morphology or the degree of stenosis in coronary arteries.[22] This may lead to a lack of precision in assessing the severity and clinical significance of atherosclerotic cardiovascular disease. Last, while CACS has the potential to optimize risk stratification, the upfront cost of the procedure and subsequent follow-up testing may be a concern. The overall cost-effectiveness of integrating CACS into routine cardiovascular risk assessment needs careful consideration.[3]

Furthermore, CACS does not replace CT coronary angiography, especially in patients with concerning symptoms of coronary heart disease. CT coronary angiography performed noninvasively by administration of intravenous contrast provides direct visualization of the coronary artery lumen and is capable of detecting both calcified and noncalcified plaque. It assesses the anatomical severity of stenosis and is commonly used in symptomatic patients and those with abnormal exercise stress test results. Moreover, invasive coronary angiography allows for immediate therapeutic intervention, such as percutaneous coronary intervention or stenting, when necessary. Although CT coronary angiography provides greater anatomic detail and functional assessment, it is associated with higher radiation exposure and procedural risks compared with CACS. Therefore, while CACS is suitable for primary prevention and risk stratification, CT coronary angiography remains the gold standard for diagnosing and managing obstructive coronary heart disease in symptomatic patients and those with high pretest probability.[16,23]

Despite these limitations, CACS is a useful tool for assessing atherosclerotic cardiovascular disease risk, particularly in certain populations. However, health care professionals must be aware of these limitations and use CACS in conjunction with other clinical information for a more comprehensive risk evaluation.

The Multi-Ethnic Study of Atherosclerosis indicated that a CACS result of zero is the most significant negative risk marker among various clinical and imaging tests for cardiovascular risk.

The power of zero

The Multi-Ethnic Study of Atherosclerosis indicated that a CACS result of zero is the most significant negative risk marker among various clinical and imaging tests for cardiovascular risk. Low-risk patients with a CACS result of zero had a very low probability of developing coronary heart disease and of other cardiovascular disease events over a 10-year follow-up period.[24] The score significantly reduced the posttest risk assessment compared with other risk indicators, such as high-sensitivity C-reactive protein and carotid intima-media thickness. Furthermore, the absence of coronary artery calcification, indicated by a CACS result of zero, led to the most accurate significant downward adjustment of cardiovascular risk assessment. Thus, individuals initially assessed as having moderate or high risk based on traditional factors could have their risk downgraded after a CACS result of zero and thus potentially avoid unnecessary treatments such as statin therapy.[24]

Canadian Cardiovascular Society guidelines

In Canada, CACS is used selectively rather than for routine screening. The Canadian Cardiovascular Society's 2021 guidelines recommend CACS scanning for individuals age 40 and older who are at intermediate risk (10.0% to 19.9% based on risk scores such as the Framingham Risk Score) and for whom treatment decisions are uncertain. In these individuals, CACS can help refine cardiovascular risk and guide decisions regarding statin therapy. Specifically, the presence of a CACS result greater than zero can prompt the use of more aggressive prevention strategies, such as statin therapy, in those who may not have otherwise been recommended for treatment.[6]

Conclusions

CACS is a valuable tool for refining cardiovascular risk assessment, particularly in intermediate-risk individuals. The integration of novel biomarkers alongside CACS may further enhance early detection and personalized prevention strategies and thus ultimately reduce the burden of atherosclerotic cardiovascular disease. ■

Competing interests
None declared.

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Barriers to liver transplant preclinic access in British Columbia

Persistent regional disparities in access to liver transplantation highlights the need for localized and contextualized solutions to achieve timely and equitable care across the province.

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ABSTRACT

Background: Vancouver General Hospital, the sole provider of adult liver transplants in British Columbia, faces increasing numbers of referrals. We examined potential areas for efficiency gain in its preclinic evaluation process.

Methods: This single-centre study included interviews with internal and external health providers and a retrospective analysis of all 112 liver transplants performed in 2023. Wait times were compared between outpatients and inpatients and between Vancouver Coastal Health and the other regional health authorities in BC: Fraser Health, Interior Health, Northern Health, and Island Health.

Results: In 2023, median wait times from referral to first consult were 87 days for outpatients (highest in the Interior Health Authority: 156 days) and 1 day for inpatients. Median evaluation times were 143 days for outpatients and 8 days for inpatients. Median referral to transplant times were 320 days for outpatients and 32 days for inpatients. Median referral to transplant times for outpatients were shortest in Vancouver Coastal Health and Fraser Health and longest in Interior Health, followed by Northern Health and Island Health. Challenges to activation in the preclinic were attributed to the referral process, staffing, and resource allocation.

Conclusions: To meet increasing demand for adult liver transplants and improve efficiency, the preclinic requires additional clinic space, an online referral system, and better communication among health authorities.

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Background

Liver transplantation remains the leading treatment for chronic liver failure; it extends survival and improves quality of life. Since 1989, the British Columbia Liver Transplant Program at Vancouver General Hospital (VGH) has been the province's sole provider of adult liver transplants.[1] In 2023, the program performed 112 transplants, meeting increasing demand across BC's five regional health authorities: Vancouver Coastal Health, Fraser Health, Interior Health, Northern Health, and Island Health.[2]

Transplant evaluation begins with a referral from the patient's local health authority—typically submitted by an internist, hepatologist, or surgeon—and must include the necessary documents, scans, and tests. Referrals are then triaged based on urgency and are followed by interdisciplinary assessment at the VGH preclinic. Research on systemic barriers to liver transplantation has shown that longer wait times correlate with higher wait-list mortality and reduced access, particularly for patients in remote and resource-limited areas.[3-5] Programs in other regions have adopted day-case assessments and telehealth solutions to improve pretransplant processes, which have reduced costs and delays while maintaining patient satisfaction.[6,7] Additionally, the accelerated adoption of telehealth during the COVID-19 pandemic highlighted its potential to enhance health care delivery, although

barriers such as limited technology access and low health literacy continue to impede equitable access.[8] These studies have demonstrated the importance of evaluating and streamlining pretransplant workflows to ensure timely and equitable care.

No studies have formally assessed the efficiency of liver transplant preclinic assessment, wait times for each component, or barriers at each stage. This study builds on previous research by systematically analyzing wait times, identifying region-specific barriers, and gathering qualitative insights from transplant team members and referring physicians across BC. By examining the preclinic workflow in this context, we aimed to provide actionable recommendations to improve efficiency, reduce delays, and enhance equitable access to liver transplantation in the province.

Methods

We used a mixed-methods approach that included interviews with internal and external health care providers and retrospective data collection. To be listed for transplant, referred patients typically have five consultations with a team that includes hepatology, hepatobiliary surgery, anesthesia, social work, and nutrition. Consultations with cardiology, dentistry, pharmacy, psychology, and addictions specialists are conducted in select cases. We interviewed all individuals involved in the assessment process, including a referring hepatologist from each health authority to gain provincial insight. Internal interviews explored staffing, workflows, service volumes, challenges, efficiency improvements, and departmental goals. External interviews with referring physicians similarly addressed referral completion, preclinic efficiency, and local and provincial improvement suggestions.

Following institutional approval from the University of British Columbia, we obtained a list of all 2023 liver transplant recipients. We selected 2023 because it was the most recent complete year of liver transplants. Notably, there were a historically high number of transplants in 2023.[2] Nontransplanted patients, including those declined or still under evaluation, were excluded.

Outpatients completed individual assessments without hospitalization, while inpatients underwent their entire workup during hospitalization, including those later discharged to home. Wait times were measured from clinic referral to consultation, except for specialist referrals, which were counted from the referral date. For inpatients transferred from other institutions, the referral date is usually the day the patient arrived at VGH.

This study builds on previous research by systematically analyzing wait times, identifying region-specific barriers, and gathering qualitative insights from transplant team members and referring physicians across BC.

Data collection was conducted at VGH using the Vancouver Coastal Health CST Cerner system for patient records. Data analysis was conducted in Excel, with medians and interquartile ranges (IQRs) calculated for all variables except age, for which means and standard deviations (SDs) were used. A permutation test for differences in medians was performed using Python to compare wait times between Vancouver Coastal Health and other regional health authorities, because it accounts for small sample sizes, unequal group distributions, and nonparametric data.

Results

Transplant volume and demographics

In 2023, 112 liver transplants were performed across all health authorities in BC; they included 109 initial transplants and 3 retransplantations that occurred within the same year. A patient from Yukon was excluded from the analysis, which resulted in 108 initial transplant recipients and 111 workups analyzed.

For outpatients at referral, the mean age was 57 years (SD: 11), the median MELD-Na score was 17 (IQR: 13,21), and the median Child-Pugh score was 8 (IQR: 6,10) **[Table 1]**. For inpatients at referral, the mean age was 51 years (SD: 13), the median MELD-Na score was 27 (IQR: 23,37), and the median Child-Pugh score was 11 (IQR: 10,12) **[Table 1]**. These findings suggest that inpatients had more advanced liver disease severity at the time of referral compared with outpatients, reflecting a population with higher acuity requiring hospitalization.

Wait times by patient type

Sixty-four percent of patients were assessed as outpatients. Across all health authorities, the median wait time for outpatients from referral to first consult was 87 days (IQR: 52,131), compared with 1 day (IQR: 0,44) for inpatients **[Table 1]**. The median time to complete assessment for activation was 143 days (IQR: 80,269) for outpatients and 8 days (IQR: 5,13) for inpatients **[Table 1]**. Overall, outpatients waited a median of 320 days (IQR: 246,509) to receive a liver transplant, whereas inpatients waited a median of 32 days (IQR: 13,77) **[Table 1]**.

Regional disparities in overall wait times

Median wait times for outpatients from referral to transplant were similar in Vancouver Coastal Health (279 days [IQR: 160,320]) and Fraser Health (289 days [IQR: 230,572]) and were the lowest of the regional health authorities **[Table 1]**. The longest outpatient wait time from referral to transplant occurred in Interior Health (442 days [IQR: 306,572]), followed by Northern Health (426 days [IQR: 380,1189]) and Island Health (424 days [IQR: 320,561]) **[Table 1]**. Pairwise comparisons against Vancouver Coastal Health showed significantly longer median wait times in Interior Health and Island Health ($P = .022$ and $P = .018$, respectively) in receiving a liver transplant.

These findings demonstrate notable regional disparities, with median wait times in Interior Health and Island Health approximately 5 months longer than in Vancouver Coastal Health. The absence of statistical significance in Northern Health may be partially attributable to the small sample size, which limits the power to detect differences despite the observed delays.

Regional disparities in stages of wait times

For outpatient referral to first consult, median wait times were significantly longer in Interior Health compared with Vancouver Coastal Health ($P = .026$), with a difference of 82 days; all other comparisons between Vancouver Coastal Health and Fraser Health, Northern Health, and Island Health were not statistically different ($P > .05$). For outpatient first consult to activation, Interior Health and Island Health had longer wait times than Vancouver Coastal Health ($P = .043$ and $P = .030$, respectively). Similarly, in the outpatient activation to transplant stage, Island Health and Northern Health had longer wait times than Vancouver Coastal Health ($P = .021$ and $P = .048$, respectively). In contrast, for inpatients, there were no statistically significant differences across health authorities at any stage of the transplant process. **Figure S1** (available at bcmj.org) shows the key periods of assessment and associated wait times, by health authority.

Figure 1 shows that most patients saw six or seven providers during their workup prior to activation, with consultations involving six providers being the most common overall. This indicates that additional specialist referrals were frequently required beyond the standard five consultations. For outpatients, notably long

TABLE 1. Preclinic wait times (days) for patients who received liver transplants at Vancouver General Hospital in 2023.

Outpatients	Health authority					
	All health authorities	Vancouver Coastal	Fraser	Interior	Northern	Island
Number of transplants	71	21	22	12	6	10
Mean age, years (SD)	57 (11)	60 (10)	58 (10)	55 (11)	52 (15)	53 (12)
Median MELD-Na score at referral (IQR)	17 (13,21)	16 (9,20)	17 (13,21)	18 (13,21)	20 (15,24)	17 (14,20)
Median MELD-Na score at transplant (IQR)	17 (12,23)	13 (9,22)	16 (12,21)	17 (12,23)	22 (19,27)	21 (14,23)
Median Child-Pugh score at referral (IQR)	8 (6,10)	8 (5,10)	7 (5,8)	8 (6,10)	9 (8,10)	8 (7,9)
Median Child-Pugh score at transplant (IQR)	8 (6,10)	8 (6,11)	8 (6,9)	8 (6,10)	10 (8,10)	8 (5,9)
Male, number (%)	48 (67.6)	18 (86.0)	13 (59.0)	6 (50.0)	5 (83.0)	6 (60.0)
Wait time stages, median days (IQR)						
Referral to first consult	87 (52,131)	74 (31,125)	88 (57,120)	156 (80,203)	116 (95,157)	66 (42,80)
First consult to activation	143 (80,269)	122 (80,143)	146 (68,358)	227 (127,254)	227 (187,924)	265 (113,368)
Activation to transplant	56 (22,121)	28 (16,63)	55 (15,107)	54 (30,89)	100 (40,109)	130 (52,171)
Referral to activation	260 (189,399)	224 (125,264)	230 (195,402)	364 (248,449)	330 (266,1087)	306 (194,390)
Referral to transplant	320 (246,509)	279 (160,320)	289 (230,572)	442 (306,572)	426 (380,1189)	424 (320,561)
Wait time by provider, median days (IQR)						
Referral to surgery	88 (51,131)	75 (28,130)	88 (57,121)	156 (80,261)	116 (95,157)	66 (45,80)
Referral to hepatology	88 (56,130)	74 (31,125)	88 (57,120)	156 (80,203)	116 (95,157)	77 (55,96)
Referral to social work	158 (120,224)	143 (106,198)	182 (138,194)	224 (136,266)	224 (174,990)	148 (128,163)
Referral to anesthesiology	138 (79,234)	97 (66,170)	126 (106,178)	228 (149,346)	204 (151,794)	86 (62,136)
Referral to nutrition	152 (102,199)	130 (74,182)	171 (109,213)	162 (126,214)	215 (147,533)	149 (111,154)
Referral to cardiology consult	53 (32,62)	52 (50,53)	78*	6*	40 (26,54)	57*
Referral to dentistry	156 (96,218)	160 (103,170)	140 (107,188)	382 (301,441)	277*	94 (91,133)
Referral to pharmacy	196 (134,275)	184 (97,258)	170 (126,584)	452 (323,580)	233*	256 (202,310)
Referral to psychology	166 (103,320)	164 (51,246)	166 (78,288)	374 (312,398)	156 (148,158)	177 (138,264)
Referral to liver tumor rounds	180 (119,201)	182 (126,251)	156 (110,246)	182*	no data	98 (56,141)

* IQR not available; only one data value reported.

Table continued on page 291

specialist referrals, in increasing order, were dentistry, social work, psychology, and pharmacy, suggesting that pharmacy consultations may be a significant source of delay for those who require them during their workup [Table 1]. Similarly, for inpatients, the order of increasing wait time was social work, pharmacy, psychology, and dentistry, suggesting that dentistry and psychology consultations may also be important contributors to inpatient delays [Table 1]. This pattern suggests that specialist consultations may be a key source of variability in workup duration, and that both regional disparities

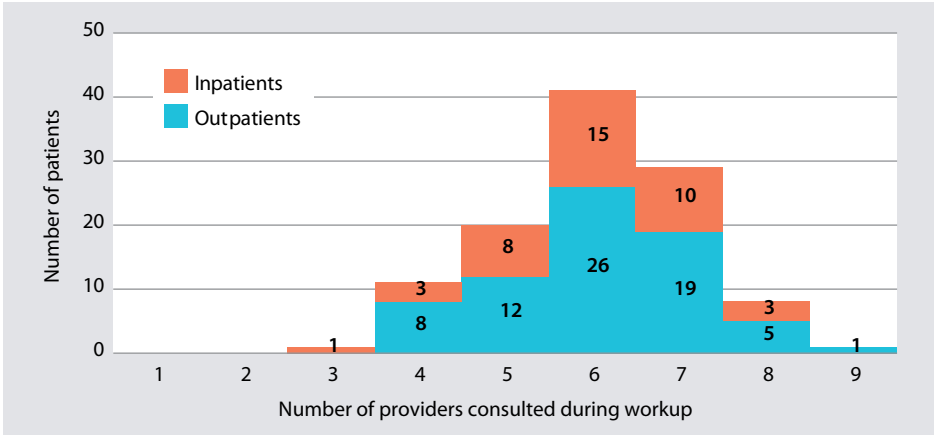

FIGURE 1. Frequency of preclinic provider consultations, by patient type.

TABLE 1 *(continued from page 290)*. **Preclinic wait times (days) for patients who received liver transplants at Vancouver General Hospital in 2023.**

Inpatients	**Health authority**					
	All health authorities	**Vancouver Coastal**	**Fraser**	**Interior**	**Northern**	**Island**
Number of transplants	40	10	8	12	3	7
Mean age, years (SD)	51 (13)	54 (15)	47 (14)	51 (13)	55 (20)	55 (9)
Median MELD-Na score at referral (IQR)	27 (23,37)	29 (23,39)	28 (23,37)	35 (24,40)	27 (25,32)	25 (23,27)
Median MELD-Na score at transplant (IQR)	28 (24,40)	35 (27,40)	28 (25,39)	37 (30,40)	20 (18,24)	25 (23,27)
Median Child-Pugh score at referral (IQR)	11 (10,12)	11 (10,12)	10 (9,11)	12 (11,13)	10 (10,12)	10 (10,11)
Median Child-Pugh score at transplant (IQR)	12 (10,13)	13 (12,13)	11 (11,13)	13 (10,13)	10 (10,12)	9 (9,12)
Male, number (%)	20 (50%)	6 (60%)	4 (50%)	6 (50%)	1 (33%)	3 (43%)
Wait time stages, median days (IQR)						
Referral to first consult	1 (0,44)	2 (0,80)	< 1 (0,17)	< 1 (0,1)	< 1 (0,28)	24 (10,59)
First consult to activation	8 (5,13)	8 (5,12)	8 (8,14)	6 (4,10)	13 (11,15)	11 (4,14)
Activation to transplant	11 (6,22)	8 (2,27)	8 (5,12)	15 (6,25)	19 (15,46)	9 (8,28)
Referral to activation	13 (7,62)	10 (7,112)	20 (8,37)	7 (6,13)	17 (15,41)	51 (27,72)
Referral to transplant	32 (13,77)	21 (11,127)	26 (16,48)	20 (12,62)	32 (30,84)	69 (50,83)
Wait time by provider, median days (IQR)						
Referral to surgery	2 (0,40)	15 (1,102)	1 (1,18)	< 1 (0,2)	4 (3,30)	25 (12,59)
Referral to hepatology	1 (0,36)	17 (2,102)	1 (0,18)	< 1 (0,1)	< 1 (0,28)	24 (10,60)
Referral to social work	6 (2,54)	6 (4,109)	6 (3,20)	3 (1,5)	7 (4,33)	38 (22,68)
Referral to anesthesiology	4 (2,51)	10 (4,110)	2 (1,20)	2 (1,3)	6 (4,32)	26 (12,63)
Referral to nutrition	5 (2,54)	6 (3,103)	2 (2,18)	3 (2,5)	7 (6,32)	38 (8,68)
Referral to cardiology consult	3 (3,23)	3*	13 (2,34)	3 (2,4)	no data	no data
Referral to dentistry	48 (26,90)	no data	105 (70,140)	2 (2,2)	62*	no data
Referral to pharmacy	6 (2,52)	93 (78,108)	4 (1,18)	4 (3,10)	33 (18,48)	18 (10,33)
Referral to psychology	11 (6,41)	120 (63,122)	8 (5,12)	6 (4,7)	11*	34 (18,56)
Referral to liver tumor rounds	23 (16,30)	37*	no data	9*	no data	no data

* IQR not available; only one data value reported.

and the complexity of coordinating multiple referrals may substantially lengthen the transplant evaluation process.

Internal interviews

Table 2 summarizes key barriers and proposed solutions identified by transplant team members, including nurse coordinators, program assistants, hepatobiliary surgeons, hepatologists, social workers, anesthesiologists, and dietitians. Key barriers included incomplete referral packages due to missing or delayed imaging, high administrative workload, patients arriving unprepared for consultations, delays in receiving signed forms, difficulty accessing prior test results, and limited clinic capacity. Proposed solutions included developing an online referral form with mandatory fields, hiring additional staff, creating educational resources to improve patient preparedness,

TABLE 2. Preclinic staff–identified barriers and suggested solutions.

Person/role	Problems identified	Possible solutions	Additional comments
Nurse coordinators	• Incomplete referral packages and missing imaging delay initial consults. • Increased workload and coordination efforts are causing delays.	• Create an online referral form with mandatory fields, including a test status label (e.g., "Ordered"), hosted on BC Transplant's website. • Hire an additional coordinator to support patient education and manage administrative demands.	• Referring physicians must order all tests locally, because the Liver Transplant Program cannot. Additional staff will be needed to handle increased administrative and patient education demands.
Program assistants	• Reminder phone calls are time-consuming.	• Hire an additional program assistant to manage scheduling and phone calls, perhaps across the entire transplant department, creating a full-time-equivalent role.	• The assistants do most of the nonmedical administrative work of the nurse coordinators.
Hepatobiliary surgeons/ hepatologists	• Missed dual assessments and delays due to scheduling conflicts. • Incomplete referrals for advanced hepatocellular carcinoma (HCC) patients can delay evaluation and jeopardize candidacy. • Imaging is often unavailable or is inaccessible at the time of consult. • Patients, particularly those with encephalopathy, often arrive unprepared, with incomplete forms.	• Improve communication and possibly consult patients together. • Create mandatory indication-specific fields (e.g., for HCC) within an online referral form. • Grant the Liver Transplant Program provincewide image-/lab-ordering privileges. • Develop online educational videos to support patient preparation, allowing them to watch at their own pace.	• Surgeons' and hepatologists' capacity to follow up with patients preoperatively is limited. There is interest in developing a re-referral system to streamline this process. • Automated text reminders were proposed to improve appointment preparedness.
Social workers	• Delays in receiving signed social support and medical adherence agreement forms from patients. • Patients often mistakenly believe they will be listed for transplant after the initial social work consultation. • Balancing pre-assessments with lifelong postoperative follow-ups.	• Include all key forms and resources upfront in the transplant package, allowing more time for completion. • Clarify the evaluation process and requirements for activation during the initial hepatology or surgical consult. • Hire an additional program assistant to support outpatient social work operations.	• Most patients have one social work consultation, with occasional follow-ups for financial or accommodation support. Inpatient assessments take longer than outpatient assessments. • The social workers highlighted the need for more patient education earlier in the evaluation process. This was previously done by the nurse coordinators, but they no longer have the time or resources.
Anesthesiologists	• Significant time is spent searching for missing charts, imaging, and cardiac data.	• Introduce a tagging system to CST Cerner with a "Liver transplant evaluation" tag to streamline file organization.	• Limiting evaluations to key specialists was proposed to improve efficiency. If a patient is an unlikely candidate, the hepatologist could refer them to the appropriate provider for a quicker final decision.
Dietitians	• Severely understaffed and essentially no clinic space, which is required for physical tests. • Severely backlogged with reports. • Patients get confused while waiting for multiple initial consult appointments on the same day.	• Implement additional dietitian and clinic prioritization following the first hepatology consult. • Hire an additional dietitian. • Install a monitor in the waiting area to display wait times, implement automated text reminders, and hire a support staff member to guide patients to appointments.	• Consultations after social work sessions are often difficult due to the emotional impact on patients. Limited clinic room availability in the afternoons creates scheduling conflicts, and frequent no-shows further complicates rescheduling efforts for the dietitians.

providing the key forms earlier in the process, granting the transplant program provincewide image- and lab-ordering privileges, and expanding clinic space.

The referral package consists of a referral form and all necessary documentation describing the patient's history and the indications for liver transplant assessment. This includes information on comorbidities, cardiac risk factors, and reports on recent blood work and imaging. To be assessed at VGH, the package must be complete, with all testing performed within the local health authority. **Table 3** outlines the main components of the referral package and highlights items that are often incomplete or missing.

External interviews

All hepatologists identified delays and inefficiencies in VGH's transplant referral process as major challenges, although long wait times were also shaped by region-specific factors.

TABLE 3. Referral package sections and common incomplete or missing items.

Section	Common incomplete or missing items
Indication for liver transplant assessment: Cirrhosis, liver cancer, other	No major issues reported.
In the context of: Hepatitis C virus (HCV), hepatitis B virus, nonalcoholic steatohepatitis, primary sclerosing cholangitis, primary biliary cholangitis, autoimmune hepatitis, alcohol and abstinence demonstration, other	No major issues reported.
Complicated by: Ascites, controlled by diuretics, regular paracentesis, spontaneous bacterial peritonitis, variceal bleed, encephalopathy, dates of last episodes	No major issues reported.
Cardiac risk factors: Hypertension, diabetes, hyperlipidemia, personal and family history of coronary artery disease, smoking history, alcohol consumption history, nontherapeutic drug history, counseling history	Often incomplete.
Mandatory reports: Consult notes with medication list and allergies, recent blood work (complete blood count, international normalized ratio/partial thromboplastin time), electrolytes, urea, creatinine, liver function tests, albumin For hepatocellular carcinoma including tumor markers: alpha-fetoprotein (carcinoembryonic antigen, cancer antigen 19-9), fecal immunochemical test (for patients over 50 years of age) Abdominal imaging within the last 2–3 months (contrast CT or MRI, ultrasound if low glomerular filtration rate, chest X-ray, electrocardiogram (ECG), transthoracic echocardiogram (ECHO [TTE]), myocardial perfusion imaging (MIBI; for patients with diabetes or over 60 years of age), chest CT (for long-term ex-smokers or patients who have recently quit), gastroscopy in the last year if portal hypertension history	Often missing: - Abdominal imaging within the last 2–3 months. - ECG. - ECHO (TTE). - MIBI. - Chest CT (smoker/ex-smoker). - Mammogram and Pap test where applicable.
Condition-specific reports: HCV genotype report, dynamic phase imaging for hepatocellular carcinoma, HIV viral load, cluster of differentiation 4 count, neurology consult notes for familial amyloid polyneuropathy; if available, colonoscopy reports, liver biopsy report, all abdominal imaging from the last 2 years	No major issues reported.

In Fraser Health, improved communication with VGH has helped, but delays have persisted due to incomplete referral packages and restrictive cardiac testing policies, such as requiring cardiologist approval for myocardial perfusion imaging scans. Proposed solutions included clearer transplant status recognition and streamlined processes to improve patient flow.

In Interior Health, first consult wait times were the longest (up to 156 days) due to limited services in smaller communities. The local hepatologist emphasized that addressing this requires not only expanding VGH's capacity but also adapting referral processes for patients with incomplete testing.

In Northern Health, geographic distances and socioeconomic challenges, especially for remote and First Nations communities, contributed significantly to delays. The hepatologist suggested tailoring referral requirements to each health authority's unique challenges, with solutions such as establishing flexible processes, expanding local testing, and providing transportation support.

In Island Health, delays in cardiac testing and geographic isolation sometimes led to avoidable hospitalization. A triage system and rapid access clinic in Victoria have reduced hospitalizations and improved outcomes, but further refinements are needed.

Collectively, hepatologists stressed the need to expand VGH's capacity, adopt more flexible referral processes, and address inefficiencies within each health authority to reduce wait times and meet growing transplant demands.

Discussion

The VGH liver transplant preclinic serves all of BC and has doubled the number of transplants performed over the last 12 years. A key driver of this success was increasing the clinic's weekly capacity for new consults. This was achieved by mandating complete referral packages before submission, which allowed the identification of patients with contraindications to transplant at the time of triage and minimized the number

of visits per patient before a decision for activation could be reached. By minimizing follow-ups and addressing incomplete referrals, the clinic significantly enhanced both efficiency and consult volume.

However, challenges have persisted, particularly in managing referral delays caused by incomplete submissions and systemic constraints. Many studies have highlighted health care disparities and disparities in access to liver transplantation related mostly to race and ethnicity,[9-13] but few have specifically examined the referral and evaluation stages.[14] Those that have focused on the referral stage identified barriers such as poor adherence to referral guidelines, provider biases, administrative delays, and poor coordination.[14,15] While our study did not indicate poor adherence to referral guidelines, it did identify administrative inefficiencies and poor coordination. Geographic and regional disparities in wait times were also evident. Similar to Madabhushi and colleagues, who highlighted how geographic isolation and limited specialist access hindered transplant access in rural areas,[16] we observed similar trends and increased wait times in underserved regions of BC.

Our findings demonstrated that outpatients experienced substantially longer wait times at each stage of the evaluation process compared with inpatients, with regional disparities contributing to median differences of up to 5 months. The need for multiple specialist consultations, particularly pharmacy, dentistry, and psychology referrals, also emerged as a possible factor prolonging workup durations.

Local preclinic challenges

Internally, incomplete referral packages and outdated fax systems, combined with difficulty tracking the status of required laboratory and imaging studies, continued to delay the scheduling of first consultations. Nurse coordinators often had to follow up to confirm whether essential tests were complete, adding to their administrative burden. Once patients were in clinic, additional challenges could arise during the evaluation process. They often stemmed from poor health literacy, inadequate social support, and geographic isolation.[17] Staffing shortages, particularly among social workers and dietitians, further exacerbated these issues by limiting the clinic's ability to handle increasing patient volumes and provide comprehensive education. Insufficient clinic space also restricted patient flow. As a provincial service, the program would benefit from provincewide ordering privileges for labs and imaging, and the development of an online referral system that resets requirements by indication and can flexibly accommodate the unique challenges of each health authority.

Persistent regional disparities, driven by imaging delays, geographic isolation, and consultation bottlenecks, highlight the need for localized and contextualized solutions.

Health authority–specific challenges

Geographic isolation in Northern Health and Island Health and inconsistent access to testing facilities in smaller communities, such as those in Interior Health, compounded delays. Socioeconomic barriers, particularly in remote and First Nations communities, complicated coordination efforts, which often required long-distance travel with limited support. McCormick and colleagues similarly noted that geographic proximity and financial barriers significantly affected access to liver transplantation, even within systems that offered universal health care.[18] Addressing these regional disparities necessitates expanding localized testing infrastructure—especially for cardiac and imaging services—and introducing transportation support for patients in underserved areas. Barritt and colleagues found that the number of gastroenterologists in a rural-referred patient's health authority influenced transplant likelihood; that likelihood increased by 12% with each additional gastroenterologist per 100 000 population.[19]

Proposed solutions

To address the challenges identified in our study, we propose several solutions. Internally, increasing the number of hepatologists, expanding clinic space, and enhancing technological infrastructure are critical to reduce bottlenecks in first consults. Implementing an online referral system with mandatory fields tailored to specific indications could minimize incomplete submissions, although care must be taken to avoid overburdening referring physicians. Centralized tagging in CST Cerner for "Liver transplant" files could streamline workflows, and online educational videos could support patient education, particularly for those with encephalopathy. Investments in localized testing and transportation programs are also needed to reduce regional inequities. Addressing intraprovincial disparities will require coordinated efforts across all health authorities.

Study limitations

Our study is limited by the inherent challenges of retrospective chart reviews, including incomplete or missing records. Additionally, only patients who received liver transplants in 2023 were included; those who were referred but did not receive transplants that year were excluded. We interviewed only a small sample of referring physicians, and their answers may not reflect the opinions of other physicians. However, we included representation from each health authority, which provided a provincial perspective. Despite these limitations, this study provides valuable metrics on the VGH liver transplant preclinic efficiency, integrates insights from referring physicians and allied health teams, and highlights wait times experienced by liver transplant recipients in 2023.

Conclusions

Patients experience major barriers to accessing liver transplantation in BC. Persistent

regional disparities, driven by imaging delays, geographic isolation, and consultation bottlenecks, highlight the need for localized and contextualized solutions. Additionally, coordinated reforms to streamline the preclinic process are essential to advancing timely and equitable care across the province. Future research should evaluate the impact of these solutions and explore additional strategies to improve patient outcomes. ■

Competing interests

None declared.

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Unpacking excess mortality in BC

In April 2020, the BC Centre for Disease Control (BCCDC) and the Office of the Provincial Health Officer initiated systematic surveillance of the societal and unintended impacts of the COVID-19 pandemic. Excess mortality was one of the priority metrics of this initiative. Excess mortality measures the number of deaths that exceed the statistically expected count during a given period and, in turn, contextualizes recent trends in deaths relative to historical data.[1-3]

Unlike observed mortality, which captures deaths officially attributed to specific causes, such as COVID-19, excess mortality encompasses the magnitude of shifts in mortality broadly, including deaths indirectly related to COVID-19,[4] in a timely way. However, estimating excess mortality presents methodological challenges, as no single standardized methodology exists.[5] These complexities are compounded by concurrent public health emergencies in British Columbia along with COVID-19, including the ongoing unregulated drug poisoning crisis (a leading cause of death among people 19–59 years of age)[6] and the extreme heat event of June 2021, both of which contributed significantly to increased rates of mortality.[7]

A fundamental component of excess mortality estimation is establishing a counterfactual baseline: an estimate of expected deaths under normal circumstances. This requires modeling historical mortality patterns and projecting them into the future based on various assumptions. Many methods can achieve this, but no single approach has gained universal acceptance. Each method involves trade-offs, reflecting differences in complexity, assumptions, and applicability to different contexts.

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To provide a robust estimation of excess mortality in British Columbia from 2020 to 2023, we used two methods: a seasonal auto-regressive moving-average (SARIMA) model and a quasi-Poisson regression-based method adapted from the UK Office for National Statistics.[8]

Both methods produced comparable estimates of expected and excess mortality. However, the quasi-Poisson regression model's ability to easily summarize results by age, sex, and geography makes it a more immediately practical tool for monitoring and reporting.

Estimating excess mortality presents methodological challenges, as no single standardized methodology exists.

Out of approximately 169 000 total deaths in BC from 2020 to 2023, we estimate that there were 7270 (95% CI, 1600 to 12 900) excess deaths: 1200 (95% CI, −200 to 2500) in 2020, 3200 (95% CI, 1800 to 4700) in 2021, 2900 (95% CI, 1500 to 4300) in 2022, and −30 (95% CI, −1500 to 1400) in 2023. The imprecision of the estimates is directly related to the uncertainty of estimating expected deaths both during and after a pandemic, with a simultaneously changing and aging population and other co-occurring public health emergencies. Wide confidence intervals for calculations of excess mortality were also seen in the UK using a similar method.[8] These results suggest that we do not have strong evidence for excess mortality outside of the peak pandemic years (2021 and 2022).

Stratified analyses revealed sex-based disparities in excess mortality estimates during the first 4 years of the pandemic. Males generally experienced higher levels of excess mortality than females, with differences most pronounced during periods of high COVID-19 community transmission. These disparities also varied by age group: minimal excess mortality was observed in younger age groups (< 40 years of age) for both sexes, while excess deaths among those 40–60 years of age were concentrated in males, largely reflecting the concurrent unregulated drug poisoning crisis.[9] Among those 60 years of age and older, differences between the sexes in excess mortality were more modest but still evident.

Most of the excess deaths occurred in community settings, compared with acute or long-term/assisted care facilities, based on Vital Statistics data. In fact, mortality in acute care settings was below expected levels at the outset of the pandemic, aligning more closely with historical baselines beginning in mid-2021 across all facility types.

Excess mortality surveillance offers a critical lens into the broader impacts of public health crises, capturing both direct effects, such as COVID-19 deaths, and indirect consequences, including those linked to health system disruptions, social isolation, and environmental disasters. Based on a comparative evaluation of different modeling approaches, we recommend the quasi-Poisson regression approach as the most appropriate method for estimating excess mortality in BC, given its adaptability to stratified analyses. While this approach currently offers the best balance of accuracy and applicability, ongoing methodological refinement remains a priority as the province continues to strengthen its public health response capacity by embedding excess mortality monitoring into routine surveillance. ■

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How much protein do I need, Doc?

What every physician should know about malnutrition in seniors.

The question of how much protein is optimal in an average diet comes up often in clinical practice, especially as more evidence links nutrition to frailty, sarcopenia,[1] and overall health in older adults. Malnutrition is a common yet often overlooked issue in seniors, and the following recommendations set out what every physician should know about this issue.

Screen for malnutrition risk[2] using recommended validated tools (e.g., SCREEN-14, Mini Nutritional Assessment – Short-Form).

Recognize that protein requirements increase with age. While the recommended dietary allowance for protein is 0.8 g/kg/day, most seniors require 1–1.2 g/kg/day due to poorer absorption and other medical conditions. More recent studies[3,4] recommend up to 1.6–1.8 g/kg/day. This needs to be individualized, especially in cases of renal disease to balance kidney function without protein overloading.

Identify barriers to adequate intake, including decreased appetite, mobility, and social activity; poorer dentition; more effort needed to prepare meals; onset of taste changes in dementia; and medication side effects. Any significant weight changes (more than 5% over 6–12 months) must be investigated to rule out other causes (e.g., cancer, sarcopenia). Weight loss can portend increased mortality.[5-7] Hence, weight change may be a better indicator for estimating disease risk in seniors than body mass index (BMI).[7]

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Interpret BMI with context.[7] In Canada, the normal-weight or low-risk BMI range may be higher and wider for elderly people (e.g., 22–29 kg/m^2) than for younger adults (18.5–24.9 kg/m^2).[6] Higher BMI allows more reserve in case of illness, but some older adults may have difficulty maintaining weight (e.g., from sarcopenia) or losing weight (e.g., sarcopenic obesity).

Recognize food insecurity,[8] which is exacerbated by fixed incomes.

Physicians need to be aware of and proactively screen for malnutrition risk in seniors, using BMI alongside weight trends. Protein requirement depends on fitness and activity levels, medical comorbidities, weight trends, and other factors. Stage of life (e.g., an active community-dwelling 70-year-old versus a long-term-care-bed-bound 85-year-old) and goals of care will shape dietary plans. Dietitians are essential partners in this work, but physicians

Continued on page 300

BOX. Additional resources on older adult nutrition.

For health care providers

- **Screening tools:**
  - Explanations of nutrition screening: *Older Adult Nutrition Screening* (https://olderadultnutritionscreening.com).
  - Nutrition screening tools for community-dwelling older adults (https://nutritioncareincanada.ca/sites/default/uploads/files/Pathways/Guide_to_Nutrition_Screening%20Tools%20for_Community-Dwelling_Older%20.pdf).
  - Malnutrition screening by the Canadian Malnutrition Task Force (CMTF) (https://nutritioncareincanada.ca/sites/default/uploads/files/CMAW2024-ENG/PrimaryCare_ENG.pdf).
  - CMTF Malnutrition Toolkit (https://nutritioncareincanada.ca/resource-library/primary-community-care/malnutrition-toolkit).
- **Nutrition care plans:**
  - Alberta Health Services, *Nutrition Guideline Seniors Health Overview (65 Years and Older)* (www.albertahealthservices.ca/assets/info/nutrition/if-nfs-ng-seniors-health-overview.pdf).
  - CMTF, *Basic Nutrition Care Plan: For Healthcare Providers* (https://nutritioncareincanada.ca/sites/default/uploads/files/Pathways/Basic%20Nutrition%20Care%20Plan%20for%20Healthcare%20Providers_V10.pdf).

For patients

- Explanations of nutrition screening: *Older Adult Nutrition Screening* (https://olderadultnutritionscreening.com/resources-for-older-adults/).
- HealthLinkBC: Dietitian services providing free, up-to-date, evidence-based nutrition advice and counseling with more than 100 consumer nutrition-based brochures and 22 nutrition topics (www.healthlinkbc.ca/search?kw=dietitian).

Considerations when gradual-onset musculoskeletal conditions may be work related

Consider this scenario: A 41-year-old patient comes to your primary care clinic reporting onset of dominant-arm elbow pain while performing their regular work activities (scanning and bagging items at a grocery store), with no linkage to a specific activity or incident. The patient states they have not had prior injuries or problems with the elbow.

Your physical examination is notable for tenderness over the anterior and lateral aspects of the elbow, as well as joint pain with flexion/extension. You are unsure of the diagnosis. You request an X-ray and advise the patient to limit activities that provoke symptoms pending follow-up. Ten days later, the patient presents with ongoing pain over the outside of the elbow. The X-ray shows mild degenerative changes in the lateral compartment. Your physical examination is notable for tenderness over the anterolateral compartment and the lateral epicondylar region.

Given that there is no specific incident, you may be wondering if the patient's symptoms are related to work and how WorkSafeBC approaches this scenario.

WorkSafeBC may consider claims not tied to a specific workplace incident

WorkSafeBC does not require a single, identifiable incident for a claim to be considered, but it does require evidence that work activities contributed to the worker's condition. A claim may be accepted even when an injury results from work activities the worker is accustomed to and has previously performed without injury.

Once a worker files a claim for such a condition, WorkSafeBC gathers information about their work activities and work environment to determine if these are related to the injury. The primary care physician assists by submitting medical information using Form 8 (Physician's First Report) and Form 11 (Physician's Progress Report).

WorkSafeBC may consider work to be related to a worker's condition in the absence of a specific incident under one of two categories: gradual-onset injury or activity-related soft tissue disorder. Gradual-onset injuries are musculoskeletal injuries arising from overexertion during usual work. Activity-related soft tissue disorder is a WorkSafeBC term that refers to a group of specific soft tissue disorders that affect muscles, tendons, and other soft tissues—for example, carpal, cubital, and radial tunnel syndromes; epicondylitis; and shoulder and hand/wrist tendonitis.[1]

The biomechanics involved in these conditions is often complex; therefore, WorkSafeBC will look at your patient's specific job duties and work environment—particularly those impacting the affected area(s)—within the context of their medical history. This is why it is helpful for primary care physicians to provide information about the onset and course of symptoms, work activities, and non-occupational activities that may be contributory.

Key information

A clear diagnosis assists WorkSafeBC in managing your patient's claim. Nondiagnostic or nonspecific terms such as "elbow pain" or "arm tendonitis" may not provide sufficient information to support the WorkSafeBC claims team.

Returning to the 41-year-old patient, a clear, precise diagnosis, such as symptomatic lateral compartment osteoarthritis, distal biceps tendonitis, or lateral epicondylitis, supported by a detailed history (including occupational history, relevant medical history, and relevant prior injuries), as well as physical examination findings, help WorkSafeBC focus on how the worker's work activities and environment may impact specific muscles, tendons, and nerves.

Medical management

Medical management of gradual-onset musculoskeletal conditions typically involves active treatment such as strengthening and stretching, often guided by community health care providers, as well as analgesia, which can be more effective than prolonged rest, immobilization, or exclusively passive modalities.

If recovery is not as expected, you can request a discussion with a medical advisor at WorkSafeBC on the Form 8/11 or via the RACE app (www.raceconnect.ca/get-raceapp).

Your patient's journey

You started by recommending limited use of the elbow; however, your patient remained symptomatic. At follow-up, you clarified the diagnosis and recommended community-based musculoskeletal therapies, including strengthening and conditioning, workplace ergonomic supports, and additional work activity modifications.

Your patient continued to work, because their employer was able to accommodate

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WORKSAFEBC

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the temporary modifications. Four weeks later, your patient successfully returned to regular work duties and regained full function. They maintained their physical fitness and resilience to future injury with ongoing self-directed exercise and regular activity. ■

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COHP

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should have a foundational understanding of seniors' nutrition. Early recognition can prevent decline and improve quality of life. See the **Box** for additional resources on older adult nutrition, and increase your nutritional knowledge following National Seniors Day (1 October). ■

—Eileen M. Wong, MD, CCFP, FCFP
Council on Health Promotion Member

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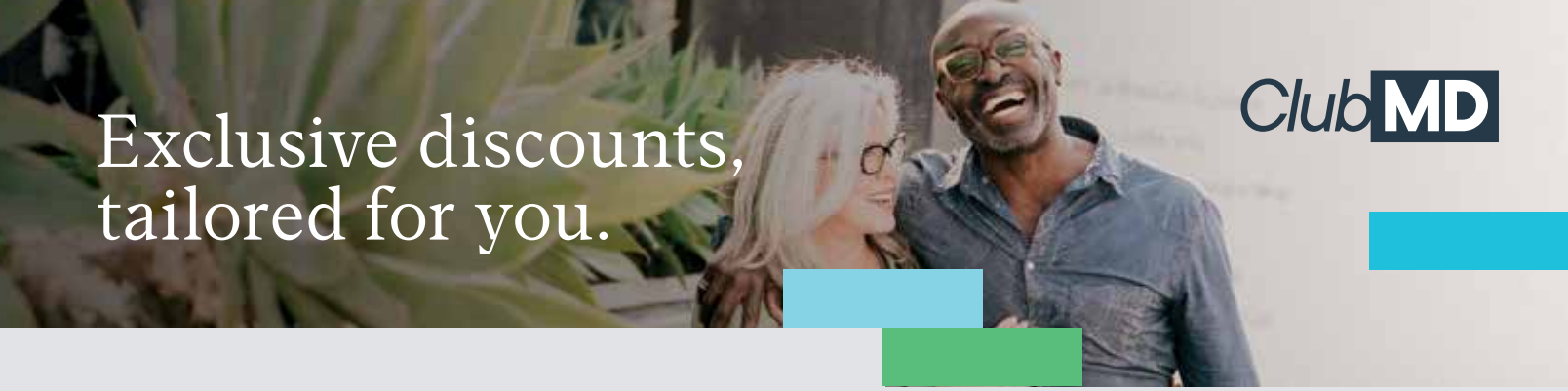

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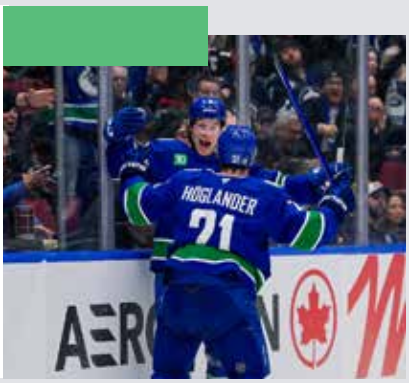

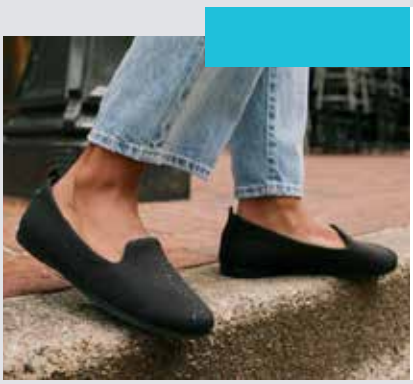

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