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BCMJ
A Doctors of BC Publication

RSV immunization in pregnancy and infancy

PLUS: BC immunization program update

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The 2021 heat dome and recurring wildfire seasons have caused hundreds of deaths, worsened chronic disease outcomes, and disrupted health system operations. The COHP article "Climate resilience 101: Preparing for a changing climate" begins on page 367.

Mission: The *BCMJ* is a general medical journal that shares knowledge while building connections among BC physicians.

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ON THE COVER
Nirsevimab (Beyfortus) provides temporary passive immunity against RSV while the child's immune system matures and can be given with any other routine childhood vaccines. Article begins on page 348.

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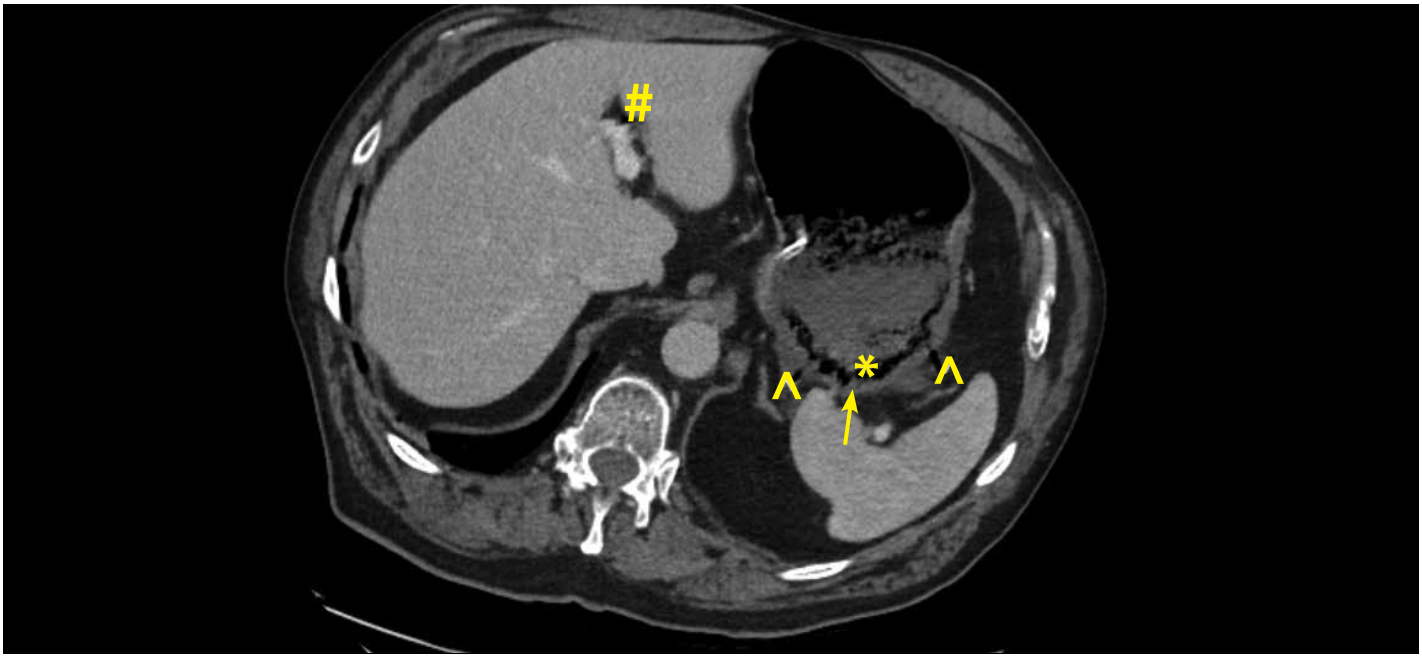

Figure 1 from the article "Successful nonoperative management of gastric ischemia and portal venous gas secondary to* Sarcina ventriculi *infection." Initial CT scan on postadmission day 1 showing the presence of intramural gas (denoted by *), portal venous gas (denoted by #), hypoenhancing posterior stomach body (denoted by yellow arrow), and gas in vasculature of stomach (denoted by ^). Article begins on page 354.

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We humbly acknowledge the traditional territories of First Nations within British Columbia and that our offices are situated on the unceded territories of the xʷməθkʷəy̓əm (Musqueam), Sḵwx̱wú7mesh (Squamish), and səlilwətaɬ (Tsleil-Waututh) Nations. For Doctors of BC, acknowledging the traditional territories is an expression of cultural humility that involves recognizing our commitment to support the provision of culturally safe care to Indigenous Peoples in BC.

Merry or scary? Managing sugar without spoiling the holidays

Happy holidays! December is upon us, and with it come the familiar, tempting smells of cinnamon, hot chocolate, and fresh cookies. Holiday lunches and office parties are full of tasty foods, abundant sweets, and celebratory cocktails. Physicians' offices brim with festive tokens of appreciation: boxed chocolates, gift baskets, and holiday baking. The air, both figuratively and literally, seems sweeter in December.

But as physicians, we know that sugar in our society has become more than an occasional indulgence. A 2023 study in the *British Medical Journal* found significant harmful associations between excess dietary sugar consumption and 18 endocrine/metabolic outcomes, 10 cardiovascular outcomes, 7 cancer outcomes, and 10 other negative outcomes spanning neuropsychiatric, dental, hepatic, osteal, and allergic conditions.[1] Each 250 mL/day increment of sugar-sweetened beverage consumption was associated with a 17% higher risk of coronary heart disease and a 4% higher risk of all-cause mortality.[1]

Sugar-sweetened beverages are the largest source of added sugars worldwide,[1] and childhood obesity has been independently associated with their consumption.[2] These drinks have become so prevalent in our daily lives that avoiding them is nearly impossible—especially during the holidays.

Sugars also come in many different forms and with many different names, which can make it confusing to know what we are consuming and which options are more or less healthy.

Added sugars are those that are added during manufacturing or processing or at the table to change a food's composition and make it more appealing.[3] Common examples include table sugar, brown sugar, corn syrup, high-fructose corn syrup, glucose, dextrose, agave syrup, maltose, and fruit juice concentrates. High amounts of added sugars are typical in products like sports drinks, soda, candy, sweetened cereals, condiments (e.g., ketchup, salad dressing, BBQ sauce), ice cream, and baked goods. Added sugars are usually absorbed rapidly and provide calories without nutrients. Honey and maple syrup can also be added sugars, although they may also have health benefits through antioxidants, vitamins, minerals, and antimicrobial properties.[4]

Rather than villainizing all forms of sugar, educating patients on achieving balance can be more sustainable and empowering.

Natural sugars are those in whole, unprocessed foods like whole fruits, vegetables, and dairy. These naturally occurring sugars, like fructose, glucose, and lactose, are delivered along with fibre, water, vitamins, and minerals, which slow absorption, promote satiety, and dampen blood-glucose spikes.[5]

Free sugars are what the World Health Organization (WHO) defines as all of the added sugars plus whatever natural sugars are present in honey, syrups, and fruit juices.[3] In its most recent guideline (2015), the WHO recommends that children and adults keep free sugar consumption to less than 10% of their total energy intake, ideally under 5%.[6]

One useful tool for reducing excess sugar is understanding how to read food labels. In Canada, the nutrition facts table on packaged foods lists "sugars" (total sugars), along with a daily percentage value: 5% or less is "a little" and 15% or more is considered "a lot," based on 100 g of sugar per day, or 20% of a 2000-calorie diet.[7] Notably, Canada does not require labels to distinguish between naturally occurring and added sugars. For example, a cup of plain yogurt contains lactose (a natural sugar) but no added sugars, so consumers must check the ingredient list to determine the type of sugar present. Natural sources of sugar, such as those from fruits, vegetables, and dairy, are a recommended part of a balanced diet.

If you're interested in cutting down on sugar, consider these strategies:[3,8,9]

- Reduce gradually, even by half a teaspoon each week, to retrain your taste buds.
- 4 g of sugar = 1 teaspoon.
- Assume that sugars in foods with little or no dairy or fruit are all free sugars.
- Replace sugar-sweetened beverages with water or unsweetened tea.
- When baking, halve the sugar in recipes or substitute with unsweetened applesauce or bananas.
- Use natural alternatives like fruit, cinnamon, or coconut to sweeten foods.
- Low-calorie sweeteners can serve as a short-term bridge to reduce sugar intake.
- For those who drink alcohol, distilled spirits (e.g., vodka, gin, rum) are usually sugar-free, and "dry" wines contain less than 1 to 2 g of sugar per 5 oz serving.[10] Cocktails with juice, cola mixers, eggnog, and creamy liqueurs have 5 to 10 times that amount of sugar. Most regular beers (e.g., lager, ale, pilsner) and "light" beers have very little sugar (0 to 2 g per serving), while darker beers have comparatively more sugar.[11] In general, try drinking water between alcoholic drinks to stay hydrated and reduce overall sugar intake.

Continued on page 342

Midweek munch and muse

Being a member of the *BCMJ* Editorial Board for the last 17+ years has taught me a few things about communication. I believe the main aim of the journal is to communicate knowledge, thoughts, and ideas that are relevant to BC physicians. In doing so, the journal builds connections between us. Good communication is the cornerstone of strong and healthy relationships.

My partner is an aunty to two lovely nieces. By extension, they call me "Uncley." Their parents have started a wonderful tradition in their family called the midweek munch and muse. The goal of this tradition is to strengthen the bonds within the family. It also enhances their children's comfort with talking to adults. Every Wednesday, the six of us (mom, dad, daughters, aunty, and uncley) get together after dinner and spend an hour or more talking. In rotating fashion, one member of the group will put together a selection of questions and some refreshment for the evening. Going in turn, we each draw a question that we have to answer for the group, while everyone is munching on their gourmet treat, sourced by the week's leader. Even the kids, ages 8 and 11, have their turn creating the questions and curating the treats. These are some of the questions from recent weeks:

- When you think about the last few months, what are you most grateful for?
- What has been most important or meaningful to you lately?
- What's one thing you wish people asked you about more often?
- If you could spend more time on one thing in your life, what would it be?
- When you think about the future, what are you most hopeful for?
- What's been bringing you joy lately?
- What's something you are excited about right now?
- Is there anything in your life that you would like to change or improve this year?
- What's the silliest thing you did this week that made you laugh?
- If you could invent a new holiday, what would it be called, and how would we celebrate?
- If you could travel anywhere in the world (or outer space!), where would you go?
- If you could eat only one food for a whole week, what would you pick?
- What's something you're really proud of from this week?
- If you could talk to animals, what's the first question you'd ask?
- What's your favorite thing to do when you feel bored?
- If you could design your own playground, what would it look like?
- What's one thing you want to try or learn with our family this month?

The questions give multiple opportunities for everyone around the table to communicate with each other. It's one of the highlights of our week and is a fun way to engage with each other.

As my tenure on the Editorial Board draws to a close, I am musing about the great experience it has been. I was invited on to the Editorial Board by D1, when he became the editor (see *BCMJ* 2022;64:283). Seventeen and a half years later (it went by in a flash), it is time for me to step aside for another colleague to take my place. It has been a privilege to work with such gifted and genuinely nice people during this time. This is D2 signing off. ■

—David B. Chapman, MBChB

Continued from page 340

Sugar is an inseparable part of celebration, but it doesn't need to overshadow our health. As physicians, we can help families keep festive traditions joyful while offering practical, evidence-based guidance. Rather than villainizing all forms of sugar, educating patients on achieving balance can be more sustainable and empowering. Small, mindful changes around added sugar can protect well-being and model healthy habits for children, ensuring that holiday treats remain merry, not scary. ■

—Caitlin Dunne, MD, FRCSC

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Letters to the editor

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Re: Beyond Kelowna

The recent editorial by Dr Kristopher Kang [*BCMJ* 2025;67:234] highlighting the shortage of pediatricians—particularly in rural BC—is an example of a larger challenge facing all of medicine: the death of the generalist. From general obstetrics/gynecology (which is experiencing unprecedented shortages leading to unit closures) to family medicine, physicians who choose a wide scope of practice are rewarded with punishing call schedules, poor remuneration, and diminished respect from many patients and some colleagues.

Daily, patients ask for unnecessary referrals to consultant specialists because they do not trust that their family physician has the expertise to diagnose or treat their acne or migraines or heavy periods or menopausal symptoms or whatever other malady family medicine cares for. Not only does this lead to the forever-growing referral pile that keeps our colleagues up at night—worried about what serious, time-sensitive ailment is awaiting their assessment—but it also leads to significant emotional burnout from generalists. The idea that over 2 decades of longitudinal family practice, including hospital care, maternity care, and rural experience, is meaningless to many of my patients because I'm not a "specialist" is eroding my love of family medicine. I imagine many general pediatricians experience that same pressure from worried parents who would prefer a referral to a specialist because they don't trust that a generalist could know enough about everything. Add to that the breadth of knowledge that a rural pediatrician requires, and anyone can understand why rural pediatricians are few and far between.

In a field where no human brain can keep up with the volume of new information, we as a profession need to maintain respect and support for each other and recognize that the superpower of generalists is needed now more than ever before. This means acknowledging and countering the hidden curriculum within medical education that continues to glorify specialization and minimize the importance of generalism.

—Tahmeena Ali, MD, CCFP, FCFP
Surrey

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

I read with interest my colleague Dr Gerald Tevaarwerk's article on the ongoing pressures facing family physicians [*BCMJ* 2025;67:273-274]. I wanted to reply to his comment regarding consulting specialists, "for whom 'service' means managing one disorder." This does not reflect the scope of many specialist physicians or the pressures facing specialists who care for patients without primary care.

As a general internist, it is expected not only that I and my colleagues manage more than one issue, but also that we weigh in on almost *every* medical issue. I know that other medical specialists also feel pressured to follow patients for longer than we would if they had a primary care provider and to practise outside our scope for patients who do not have other access to care. This was well described by Drs Mason, Atwood, and Hodgins [*BCMJ* 2024;66:210-214].

I wonder if this may account for some of the increase in specialist visits Dr Tevaarwerk mentions; if so, that is another ripple of our system's failure rather than a sign of success for specialists. The ongoing crisis in our system is affecting family physicians and specialists in different ways, but specialists are certainly not spared from the growing challenges in physician working conditions in BC. I welcome any efforts to increase support for family physicians, as I see the lack of primary care showing up in my clinic, in the ED, and on the wards.

—Ben Schwartzentruber, MD
Victoria

An invitation to explore a Probus club near you

Dear friends and colleagues, those of you who are planning to retire or have recently retired may consider joining one of the Probus ("professional and business") clubs in the province. Typically, Probus clubs have regular monthly meetings to which guest speakers are invited to present on fascinating topics of interest to members. Additionally, there are a wide range of social activities. There are many members from the medical profession as well as other professions, academia, and business. Most clubs have individual websites where you can find details about their programs and activities. Many clubs also have policies allowing for guests who are interested in joining to be invited as potential future members. I have been a member of the Probus Club of Vancouver for 19 years, and I have found it to be an enjoyable, enriching experience.

—Hugh Chaun, MA, BM BCh
Vancouver

Reflection, gratitude, and hope

As my year as president of Doctors of BC concludes, I reflect with deep gratitude and humility. It has been the honor of a lifetime to represent physicians across this province—to be trusted to speak on behalf of colleagues who dedicate themselves daily to caring for others. Every meeting, media interview, and policy discussion carried the weight of that responsibility—the knowledge that I was representing more than 16 000 physicians who give so much of themselves each day. I am deeply thankful for the trust you placed in me and for the opportunity to share your stories and perspectives with decision-makers across the province.

Over the past year, I've had the opportunity to meet colleagues from all parts of British Columbia—family doctors and specialists, rural physicians and urban hospitalists, residents and medical students. Each encounter has reminded me of the deep commitment physicians have to the well-being of their patients and communities, even in the face of immense challenges.

I have been inspired by the resilience and compassion of our profession. The past year has not been easy for anyone in health care. The pressures on our system are real—workforce shortages, administrative burdens, rising demand, and the personal toll that burnout and moral distress can inflict. Yet time and again, I've seen colleagues step forward with creativity and courage—advocating for their patients, mentoring the next generation, and leading innovative solutions in clinics, hospitals, and health authorities. That perseverance has been both humbling and inspiring to witness.

This year has also deepened my appreciation for the vital role that Doctors of BC plays in supporting our profession. Our organization is more than just a negotiating body; it is a community that advocates for physicians in all aspects of their work and personal lives. From advocacy and policy development to wellness initiatives, peer support, and practice resources, Doctors of BC stands with physicians through every stage of their careers. Whether it's addressing systemic challenges through collaborative negotiations or offering confidential wellness support for colleagues in need, the association's work is rooted in a simple but powerful belief: when physicians are supported, patients and communities benefit.

Leadership occurs in exam rooms, operating rooms, and community halls.

I've seen firsthand how the association's staff and physician leaders embody this belief. I've observed their dedication during countless committee meetings, community visits, and stakeholder discussions—always focused on improving care, strengthening the profession, and ensuring that physicians' voices are heard. It has been a privilege to work alongside such talented and passionate individuals. I want to take this opportunity to sincerely thank all the staff and physician leaders who make such a significant difference in our health care ecosystem.

This year has also reaffirmed my belief in the importance of physician leadership—not just in formal roles, but also in all the ways we can influence care and culture on a daily basis. Leadership occurs in exam rooms, operating rooms, and community halls. It also happens when a doctor advocates for a patient who doesn't have a voice, when a colleague supports another through burnout, or when we come together to design a better way of delivering care. Physicians bring both clinical insight and deep empathy to these conversations, and that combination is indispensable in shaping a better health care system.

As I step back from this role, I carry immense gratitude—for the friendships formed, the lessons learned, and the opportunity to witness the incredible breadth of talent and compassion among BC's physicians. I also carry hope. Hope that we continue to build a health care system that values collaboration, wellness, and respect. Hope that we keep lifting each other up, even during difficult times. And hope that, together, we continue to lead with courage, empathy, and purpose.

Thank you for the honor of serving as your president. Thank you for the work you do every day, often unseen and unheralded, but always essential. Thank you for your trust, dedication, and compassionate service to your patients and the health care system. It has been an unforgettable year, and I will treasure the lessons and relationships from it with deep gratitude, always.

Together is our superpower! ■

—Charlene Lui, MD
Doctors of BC President

Debunking common myths in infectious diseases practice

Dispelling 10 common myths that percolate widely in infectious diseases practice.

Davie Wong, MD, FRCPC

The field of infectious diseases is fraught with ideas that drive our daily clinical decision making yet lack a credible scientific basis. We need rational and critical thinking to overcome these misconceptions to optimize patient outcomes.

Myth 1: Bactericidal antibiotics are better than bacteriostatic antibiotics

A commonly taught principle is that bactericidal antibiotics kill bacteria, while bacteriostatic agents inhibit the growth of bacteria. This implies that bactericidal antibiotics are more effective than their bacteriostatic counterparts and might lead clinicians to intuitively and preferentially choose bactericidal options. It is important to understand two definitions. The minimum inhibitory concentration (MIC) is the concentration of antibiotic needed to inhibit visible bacterial growth at 24 hours, while the minimum bactericidal concentration (MBC) is the concentration of antibiotic that reduces the bacterial inoculum by one-thousand-fold. A drug is considered bactericidal if the ratio of MBC to MIC is less than or equal to 4, while a ratio greater than 4 characterizes a bacteriostatic agent.[1] In other words, both bactericidal and bacteriostatic antibiotics kill bacteria, but bacteriostatic antibiotics require higher concentrations relative to their MIC to do so compared with bactericidal agents. Moreover, a drug that is bactericidal against one pathogen might be bacteriostatic against another. For example, linezolid is bacteriostatic against staphylococci but is bactericidal against streptococci.[2] A systematic review found no significant difference in efficacy between bactericidal and bacteriostatic antibiotics for treatment of skin and soft tissue infections, pneumonia, intra-abdominal infections, bacteremia, and typhoid fever.[1] In fact, several studies have demonstrated that linezolid (bacteriostatic) was superior to vancomycin (bactericidal) in treating staphylococcal infections.[1]

Myth 2: A positive response to antibiotics confirms the presence of an infection

An improvement in the patient's clinical status is often attributed to the effect of antibiotics, which implies an infection is being treated. While this may be true, it is important not to overlook concomitant therapies that might affect the clinical response, including anti-inflammatories, IV fluids, and supplemental oxygen.[3] Additionally, some antibiotics, such as azithromycin, possess immunomodulatory properties that can attenuate the immune reaction, leading to a positive response in a patient with a noninfectious inflammatory condition.[4] Conversely, a perceived lack of response to antibiotic does not necessarily indicate treatment failure. It is important to understand the natural course of the infection to determine when a clinical response is expected. For example, in the treatment of cellulitis, symptoms and signs of inflammation can initially worsen before they get better, and it can take up to 3 days to see any improvement.[5]

Myth 3: IV antibiotics are better than oral antibiotics

There is no evidence to suggest that IV administration of antibiotics is more effective than antibiotics taken orally. In fact, numerous RCTs have demonstrated the noninferiority of oral antibiotics compared with IV antibiotics for many types of infections, including infective endocarditis, osteoarticular infections, bacteremia, urinary tract infections, cellulitis, intra-abdominal infections, and pneumonia.[6] In some studies, oral therapy was *more* effective than IV treatment. IV antibiotics are often overused in situations where oral therapy is appropriate. For example, an audit of 100 outpatient IV prescriptions from the emergency department at a single hospital identified that 59% of IV treatments could have been avoided.[7] IV administration carries many disadvantages, including IV-line complications, increased staff workload, reduced patient convenience and mobility, increased costs, delayed hospital discharge, and a higher carbon footprint.[6] Oral therapy should be used if there is a safe and effective oral option, there is no concern regarding ingestion or absorption of oral medications, clinical stability has been achieved, there is no source control problem that requires intervention, and there is no psychosocial reason to prefer IV therapy.

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Reserve IV therapy for critically ill patients and situations where oral administration is not feasible or is not supported by evidence.[6]

Myth 4: Longer courses of antibiotics are better than shorter courses

Many RCTs have shown that shorter courses of antibiotic are just as effective as longer courses for common infections.[8] To illustrate a few examples, a recent RCT demonstrated that 3 days is noninferior to 8 days for the treatment of community-acquired pneumonia in adult inpatients who have reached clinical stability,[9] a 2025 systematic review and meta-analysis of 4 RCTs showed that 7 days of antibiotic is just as effective as 14 days for uncomplicated gram-negative bacteremia,[10] and another RCT of adult males with afebrile urinary tract infections concluded that 7 days of treatment is no worse than 14 days.[11] It was previously thought that longer courses of treatment were needed to reduce the emergence of antibiotic resistance and prevent infection relapse. In fact, the longer that microbes are exposed to antibiotics, the greater the selective pressure is for drug resistance. Some advantages of shorter treatment durations are decreased drug resistance and side effects, lower costs, reduced environmental impact, and diminished risk of *Clostridioides difficile* colitis.[8] Local guidelines, such as those from the Fraser Health Authority, already promote shorter durations over longer durations for infections such as pneumonia, cellulitis, and urinary tract infections.[12]

Myth 5: Fever demands immediate initiation of antibiotics

A febrile patient presenting to the emergency department or a hospitalized patient who develops a fever will generally receive a workup for an infection. It is common for empiric antibiotics to be started before an infectious diagnosis is confirmed.[13] Fever is not specific for a bacterial infection and can be caused by viral infections, thromboembolic disease, autoimmune conditions, and medications.[3] Initiating antibiotics prematurely can be harmful when there is no actual infection or by delaying the diagnosis of a true infection. It is reasonable to withhold antibiotics in an otherwise stable patient with fever while working through the diagnostic process. Likewise, a patient who remains febrile or develops a new fever while receiving antibiotic therapy for a suspected or confirmed infection does not automatically require an escalation of antimicrobial treatment. A careful assessment should be made considering the natural history of the illness, searching for a potential source control problem, and evaluating for noninfectious causes of fever. On the other hand, in an unstable or septic patient, prompt initiation of appropriate antibiotics is critical and must not be deferred until further investigations are obtained.[3,13]

Myth 6: Broad-spectrum antibiotics are better than narrow-spectrum antibiotics

While broad-spectrum antibiotics cover a wide range of bacteria, they are not intrinsically more effective or safer than narrow-spectrum antibiotics. Broad-spectrum agents are recommended for the treatment of sepsis, multi-drug-resistant pathogens, and polymicrobial infections, but they can increase the risk of adverse effects if used inappropriately.[14] In methicillin-sensitive *Staphylococcus aureus* bacteremia, for example, the use of narrow-spectrum antibiotics such as cloxacillin is associated with lower mortality compared with the use of broad-spectrum beta-lactams.[15] The inappropriate use of broad-spectrum antimicrobials can severely deplete the patient's natural protective microbiome, increase the risk of acquiring *C. difficile* colitis, and promote the development of multi-drug-resistant pathogens.[16] The efficacy of a drug depends not only on how many bacteria it can kill, but also on its ability to penetrate the site of infection, barrier to resistance, and potency.[3] Rational prescribing involves selecting the narrowest agent with a good safety profile to target the most likely pathogen(s) implicated in the infection.

Myth 7: Antibiotics are always the most important treatment for infections

Undoubtedly, antibiotics have dramatically reduced mortality for common infections. Antibacterials alone are usually curative for simple infections like cellulitis, pneumonia, and pyelonephritis. However, for more complex diseases, such as diabetic foot infections, a multiprong approach is required involving antibiotics, wound care, glycemic optimization, offloading, and vascular assessment.[17] Rarely is pharmacologic therapy alone sufficient to fully cure the problem. Aggressive antibiotic therapy is not a proper substitute for other more important interventions, such as surgical debridement of chronic osteomyelitis or drainage of an abscess. Most antibiotics do not work against bacteria in biofilms of chronic infections and have limited penetration and activity in the hostile environment of abscesses.[3]

Myth 8: Antibiotics are harmless

Telephone interviews with adult patients and parents revealed that antibiotic benefits are often overestimated and harms are often minimized, highlighting a tendency to prioritize instant gratification.[18] Antibiotics can cause many side effects, such as gastrointestinal upset, acute kidney injury, cytopenia, and hepatitis.[19] Excess use drives antibiotic resistance on individual and population levels. Inappropriate prescriptions also increase costs and pollute the environment. An underrecognized and unmeasurable effect is the negative impact of antibiotic use on the human microbiome, which serves an important role in metabolism, immunity, gut health, and psychological well-being.[20] Antibiotic use is associated with an increased risk of colon cancer, atopic diseases, and metabolic disorders.[20,21]

Myth 9: A penicillin allergy is a low priority

Penicillin allergy is the most commonly reported drug allergy, with up to 10% of the population carrying this label. However, 90% of these patients are judged not to have a true penicillin allergy after

careful assessment and/or allergy testing.[22] In patients who have a confirmed immediate IgE-mediated (type 1) hypersensitivity reaction to penicillin, 80% of them outgrow it after 10 years of avoidance.[23] It is common for penicillin-allergic patients to receive antibiotics that are broader spectrum, less effective, more expensive, and more toxic.[22] Consequently, these patients are at higher risk of worse outcomes. A patient with a penicillin allergy label who has an infection for which beta-lactam antibiotics are the drug of choice should have their allergy status reviewed. Penicillin allergy delabeling is an important initiative of antimicrobial stewardship. Various tool kits and algorithms have been deployed to successfully delabel patients by obtaining a thorough allergy history, performing a direct oral challenge, or referring to an allergist for skin testing followed by oral challenge.[24]

Myth 10: A positive microbiological test confirms the presence of an infection

The diagnosis of infections is often complex, requiring clinical, biochemical, microbiological, and/or radiographic information. Microbiological testing is critical for identifying the causative pathogen but suffers from limitations. The most common tests are microscopy, culture, serology, nucleic acid amplification (NAAT), and histopathology.[25] A common misconception is that a positive test confirms the presence of an infection. For example, clinicians often misinterpret a positive urine culture as evidence of a urinary tract infection in the absence of relevant symptoms.[26] From a microbiological perspective, an infection occurs when a microorganism invades, destroys, and multiplies in host cells. The absolute method to diagnose an infection is a tissue biopsy for histopathology. However, the vast majority of infections are diagnosed without such an invasive procedure, as that would be impractical and resource intensive. The current diagnostic tools inform us if a pathogen or its components are present at a specific body site. Microscopy can reveal the presence of microbes in body fluids and tissues but cannot differentiate living from dead organisms. Microbial cultures can identify the presence of viable organisms in sterile and nonsterile sites but cannot prove infection. Serology detects antibodies against microbial antigens, but it might not be able to accurately distinguish between active and resolved infection. NAAT looks for microbial DNA but is unable to determine the viability of the organism.[25] These tests are merely pieces of the diagnostic puzzle that must be interpreted in the right clinical context. They alone cannot diagnose an infection—it is the clinician who does.

Conclusions

Myths are common drivers of decision making in the diagnosis and management of infections. They prevail because outdated information is left unchallenged or a concept that intuitively makes sense but is factually incorrect is perpetuated by many over the course of time. As new evidence emerges, it is incumbent upon clinicians to question and update the status quo to advance medicine for the betterment of our patients. ■

Competing interests

None declared.

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RSV immunization in pregnancy and infancy

A combined program of universal RSVpreF (Abrysvo) vaccination for pregnant individuals and nirsevimab (Beyfortus) for at-risk infants would substantially curtail respiratory syncytial virus disease burden in BC with the lowest budget impact.

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ABSTRACT: Respiratory syncytial virus (RSV) is the leading cause of acute respiratory illness in infants, with the highest incidence in the first months of life. In BC, two prevention strategies are available: the adult RSVpreF (Abrysvo) vaccine and the infant monoclonal antibody nirsevimab (Beyfortus). RSVpreF is recommended in BC, but it is not publicly funded. When administered between 32 and 36^{+6} weeks of gestation (at least 14 days before delivery) to pregnant individuals whose due date falls during or just before the RSV season, the vaccine protects newborns during their highest-risk first 6 months of life. Nirsevimab (Beyfortus) is publicly funded for high- and moderate-risk infants and provides direct protection for an entire RSV season when given once before or during the season. In the future, a universal program combining RSVpreF (Abrysvo) with targeted nirsevimab (Beyfortus) for higher-risk infants could markedly reduce RSV burden across BC, maximizing health benefits with the lowest overall budget impact.

Background

Respiratory syncytial virus (RSV) is a common seasonal virus and the leading cause of respiratory infections in infants. In British Columbia, RSV cases fall below detection in the summer, increase by late October to early November, and peak from December or January until the end of March.[1] In northern BC, RSV activity is often delayed, peaking in February. Virtually all children are infected by 2 years of age. The risk of severe RSV disease peaks within 3 months of birth.[2] Although most infants recover within a few days, approximately 1% develop bronchiolitis or pneumonia requiring hospitalization.[2]

RSV immunization options

In May 2024, the National Advisory Committee on Immunization recommended that provinces move toward universal infant RSV immunization, prioritizing those at highest risk.[3] Two new passive RSV immunization strategies have become available:

RSVpreF (Abrysvo) is an adult vaccine approved in pregnancy between 32 and 36^{+6} weeks of gestation.[4-6] It is a recombinant vaccine that stimulates natural antibodies against the RSV fusion protein, which is critical for virus infectivity. The antibodies produced by the pregnant person are then transferred to the fetus via the placenta,

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Key points

- Nirsevimab (Beyfortus) is a long-acting monoclonal antibody that provides passive protection against respiratory syncytial virus (RSV) with a single intramuscular dose per season; it is available in BC from 1 September to 31 March.
- In BC, nirsevimab (Beyfortus) is publicly funded for defined infant populations at increased risk of severe RSV disease, according to provincial eligibility criteria.
- Eligible infants are identified in hospital perinatal units or by public health teams in community settings. Clinicians should verify eligibility and refer through their health authority pathways.
- RSVpreF (Abrysvo) is an adult vaccine approved in pregnancy between 32 and 36^{+6} weeks of gestation to boost RSV antibody levels at birth and protect infants against severe RSV infections.
- Both immunization products may be available for purchase out-of-pocket or using extended health coverage, with RSVpreF (Abrysvo) priced at approximately $300 and nirsevimab (Beyfortus) at $750.

which boosts RSV antibody levels at birth and protects infants against severe RSV infections. RSVpreF (Abrysvo) is 57% to 79% effective in reducing RSV hospitalization in infants up to 6 months after birth, when the risk of severe disease is highest.[7-10] Infants born very preterm or with specific chronic conditions involving their heart, lungs, or immune system remain at high risk for longer and require additional protection with nirsevimab (Beyfortus).[2]

Nirsevimab (Beyfortus) is a cell line–produced long-acting human monoclonal antibody that neutralizes RSV by binding to its RSV fusion protein, which prevents virus entry into host cells.[11,12] It is administered directly to the infant and provides protection for at least 6 months from the time of administration.[13] It is not a vaccine and does not induce long-term immunity in the infant. However, in randomized trials and real-world studies, nirsevimab (Beyfortus) reduced medically attended RSV lower respiratory tract illness, RSV hospitalizations, and ICU admissions in first-season infants by approximately 75% to 83%.[14] Nirsevimab (Beyfortus) efficacy against RSV hospitalization remains high for at least 180 days.[15]

Both interventions are available in BC for the 2025–2026 fall/winter season. RSVpreF (Abrysvo) is not publicly funded, but patients may obtain coverage through their private or extended health insurance or the First Nations Health Authority's Health Benefits Program. The vaccine is also available for $250 to $300, including immunization fees, at local pharmacies. Many community pharmacies carry RSVpreF (Abrysvo).

A publicly funded supply of nirsevimab (Beyfortus) is available for children who meet specific criteria (see "Eligibility criteria," below). Nirsevimab (Beyfortus) is also available on a private-pay basis (approximately $905 per dose) for children who do not meet the BC RSV program's eligibility criteria. Private administration requires a prescription and is available only in outpatient settings.

The **Figure** presents a general algorithm for deciding when RSVpreF (Abrysvo) or nirsevimab (Beyfortus) should be administered. RSVpreF (Abrysvo) is recommended for pregnant individuals from August to March to ensure that the infant is protected during the peak of seasonal RSV activity. Some patients may still choose to

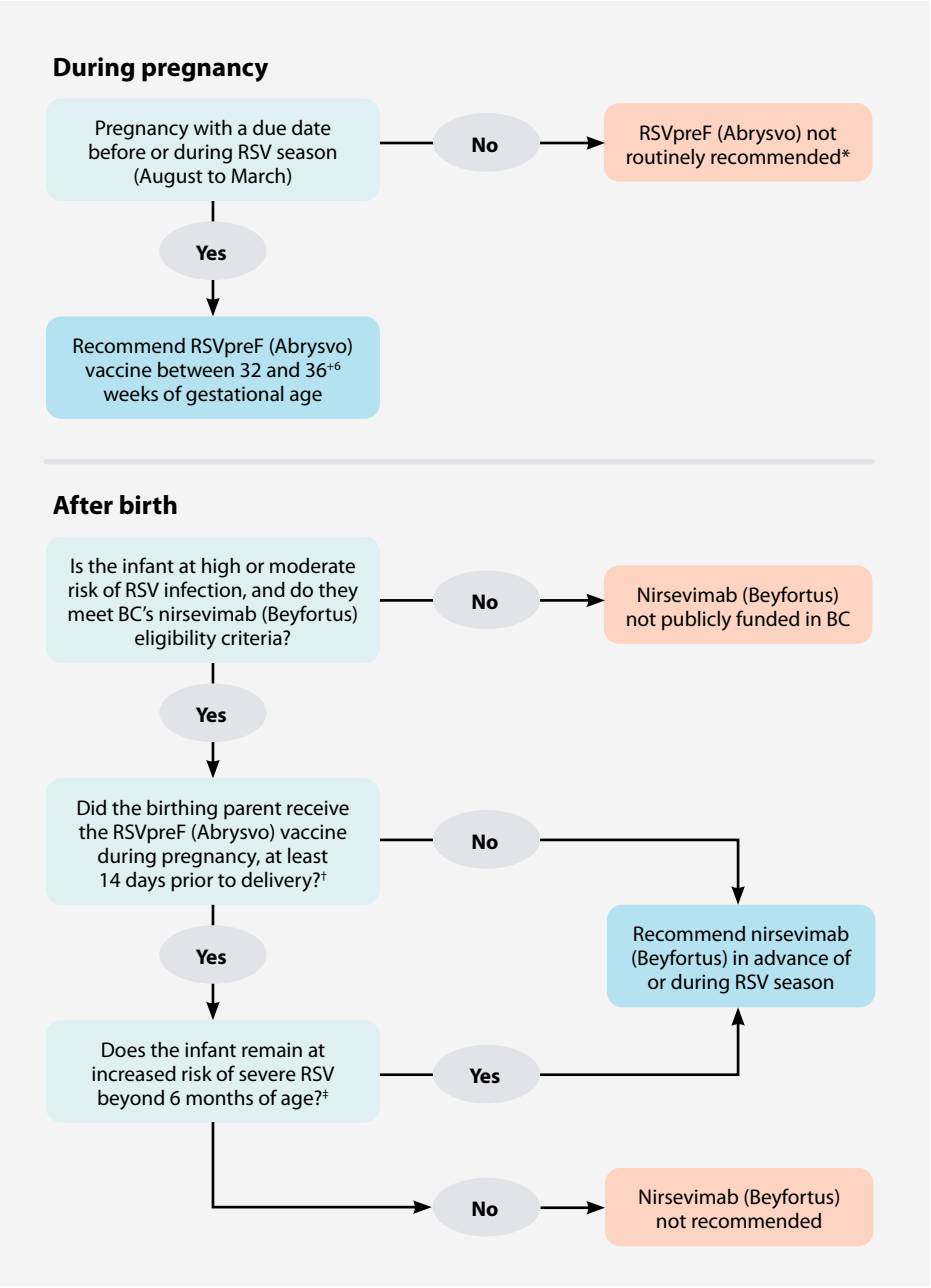

FIGURE. Algorithm for decision making about RSVpreF (Abrysvo) use in pregnancy versus direct nirsevimab (Beyfortus) immunization of infants.

*Some patients may still choose to get vaccinated themselves with RSVpreF (Abrysvo) outside this period.

† Because some infants who are eligible for nirsevimab (Beyfortus) may be born to vaccinated individuals, those whose birthing parent received the RSVpreF (Abrysvo) vaccine more than 14 days before delivery are considered protected and do not require nirsevimab (Beyfortus) in their first RSV season unless they remain at high risk of severe RSV disease beyond 6 months of age (up to 2 years of age, as defined in BC's eligibility criteria).

‡ Children who remain at increased risk for severe RSV disease beyond 6 months of age may also receive nirsevimab (Beyfortus) during their first RSV season, regardless of whether their birthing parent received RSVpreF (Abrysvo) during pregnancy, if they are expected to turn 6 months old before the end of the RSV season.

get vaccinated with RSVpreF (Abrysvo) outside this period. However, the benefit of RSVpreF (Abrysvo) in the infant beyond 6 months of age is uncertain.

Dual immunization with both products is considered unnecessary for most infants (with exceptions detailed below in "Eligibility criteria"). Providers may consider deferring RSVpreF (Abrysvo) vaccination in select pregnancies where the fetus is affected by a condition that would make the newborn eligible for nirsevimab (Beyfortus) at birth, regardless of maternal vaccination. For example, if the fetus is known to have a trisomy, parents may choose to defer RSVpreF (Abrysvo), as the infant would automatically qualify for nirsevimab (Beyfortus). The combined benefit of both interventions in such cases remains uncertain.

Nirsevimab (Beyfortus)

Efficacy

Nirsevimab (Beyfortus) was first described in 2016.[11] Compared with palivizumab (Synagis), the monoclonal antibody for high-risk infants that was available in BC before fall 2025 and required monthly administration, nirsevimab (Beyfortus) offers two critical improvements: it is 50 times more neutralizing in vitro[11] (about 10 times more neutralizing in vivo[16]), and has a longer half-life in serum (approximately 70 days in infants vs approximately 20–30 days for palivizumab [Synagis]); thus, protection from a single dose of nirsevimab (Beyfortus) lasts for an entire RSV season in BC.[17]

Four RCTs that included more than 12 000 infants demonstrated the safety and efficacy of nirsevimab (Beyfortus) against RSV when administered at the beginning of or during the RSV season (for infants born in season).[17-19] A pooled analysis of the initial three RCTs (Phase 2b, MEDLEY and MELODY trials) indicated that medically attended RSV lower respiratory tract infections and RSV-related hospital admissions were reduced by more than 75%, and severe RSV infection in healthy-term and late-preterm infants was reduced by 86%.[20] Nirsevimab (Beyfortus) recipients also showed a 40% reduction in hospital admissions for any-cause respiratory illness and a 23% reduction in antibiotic prescriptions.[20] Among infants with chronic lung disease, congenital heart disease, or extreme preterm birth, nirsevimab (Beyfortus) serum levels over the first 150 days were similar to those found in the pooled data, indicating a potential extrapolated efficacy to those subpopulations.

Pregnant individuals are recommended to receive the RSVpreF (Abrysvo) vaccine between 32 and 36^{+6} weeks of gestation, prior to the RSV season, to help protect their infants from severe RSV disease, especially if their baby will still be young during the peak RSV activity months.

During the 2023–2024 RSV season, France, Spain, Luxembourg, and the US implemented universal immunization programs with nirsevimab (Beyfortus) for all infants. Spain achieved very high coverage (approximately 90% to 95%).[21] In contrast, the US faced supply limitations that forced prioritization of high-risk groups as the season progressed.[22] Based on real-world settings, nirsevimab (Beyfortus) resulted in an approximately 80% to 85% reduction in RSV hospitalizations, consistent with clinical trials.[14,23] Considering overall coverage, Catalonia, Spain, achieved approximately 44% to 55% less ED visits for bronchiolitis and approximately 48% to 88% less RSV hospitalizations among infants under 6 months of age.[24] Using our recently published methodology,[2] we estimate that in BC, nirsevimab (Beyfortus) could avert approximately 250 to 300 RSV hospitalizations if all infants were covered under the National Advisory Committee on Immunization's current recommendations, assuming 80% effectiveness and 90% coverage.[25] For context, approximately 10 000 pediatric hospitalizations of any cause occur each RSV season across the province [unpublished data].

Canadian studies have shown that RSV is associated with substantial pediatric hospital costs.[25-27] Seasonal RSV vaccination for all pregnant individuals, with nirsevimab (Beyfortus) specifically for high- and moderate-risk infants, may be cost-effective compared with a high-risk palivizumab (Synagis) program, whereas a universal nirsevimab (Beyfortus) program for all infants in BC is not cost-effective (at least not without major product cost reductions).[25] A combined program of universal RSVpreF (Abrysvo) vaccination and nirsevimab (Beyfortus) for high- and moderate-risk infants would substantially curtail RSV disease burden in BC, while having the lowest overall budget impact.

Eligibility criteria[28]

Pregnant individuals are recommended to receive the RSVpreF (Abrysvo) vaccine between 32 and 36^{+6} weeks of gestation, prior to the RSV season, to help protect their infants from severe RSV disease, especially if their baby will still be young (e.g., under 3 months of age) during the peak RSV activity months (December to March).

Infants can receive nirsevimab (Beyfortus) via the publicly funded BC RSV program supply if they meet *any* of the following criteria *and* their birthing parent did not receive RSVpreF (Abrysvo):

- Prematurity: Infants born at less than 35 weeks of gestation (i.e., up to 34$^{6/7}$ weeks of gestation).
- Infants with chronic medical conditions involving the heart, lungs, gastrointestinal tract, or nervous system; with severe immunological compromise; or with underlying genetic or metabolic disorders.
- Infants under 6 months of age who live in remote communities, isolated Indigenous communities, or congregate settings such as supportive housing.

Most of these infants do not need nirsevimab (Beyfortus) if RSVpreF (Abrysvo) was given to their birthing parent during pregnancy, unless the baby was born less than 14 days after maternal vaccination (a shorter period between RSVpreF [Abrysvo] vaccination during pregnancy and delivery reduces transplacental antibody transfer).

However, children who remain at high risk of severe RSV disease beyond 6 months of age may receive nirsevimab (Beyfortus) during their first RSV season, regardless of whether their birthing parent received RSVpreF (Abrysvo) during pregnancy, if they are expected to turn 6 months old before the end of the RSV season.

Children with the following conditions remain at increased risk for severe RSV disease beyond 6 months of age and should receive nirsevimab (Beyfortus) during their second RSV season (up to 2 years of age):

- Chronic lung disease requiring ongoing assisted ventilation or oxygen therapy.
- Hemodynamically significant congenital cardiac disease or cardiomyopathy.
- Severe or profound combined immunodeficiencies.
- Severe congenital airway anomalies that impair clearing of respiratory secretions.
- Neuromuscular disease that impairs clearing of respiratory secretions.
- Cystic fibrosis with respiratory involvement and/or growth delay.
- Down syndrome (and other trisomies).
- Preterm infants born at less than 28 weeks of gestation (born after 31 March 2024).

"Children in their second season" generally refers to those of chronological age from 8 months to less than 24 months who have already passed through one period of RSV circulation. However, children who remained hospitalized from birth throughout their first RSV circulation period (e.g., a very premature baby born in January but hospitalized since birth and discharged from the neonatal intensive care unit only in August) are considered to be in their first season upon community discharge, regardless of chronological age.

Ineligibility

Nirsevimab (Beyfortus) provides temporary passive immunity against RSV while the child's immune system matures. It is not indicated for children 2 years of age or older, as the protection it provides is likely significantly reduced and dosing has not been established over 17 kg. Its administration should be postponed in infants with a moderate or severe acute illness. A mild febrile illness or respiratory infection is not usually a reason to defer immunization. Previous RSV infection is not a contraindication, and eligible infants may still receive nirsevimab (Beyfortus) even after recovering from RSV. It should be used with caution in children with bleeding disorders.

Nirsevimab (Beyfortus) provides temporary passive immunity against RSV while the child's immune system matures. It is not indicated for children 2 years of age or older, as the protection it provides is likely significantly reduced and dosing has not been established over 17 kg.

Dosage schedule

In BC, nirsevimab (Beyfortus) is offered from 1 September to 31 March. Infants born before the start of the RSV season should receive their dose in September or October, whereas infants born during the season should get it promptly after birth. Nirsevimab (Beyfortus) is available in 50 mg (0.5 mL) and 100 mg (1 mL) prefilled syringes. Dosage follows a weight-based regimen:

- 50 mg (0.5 mL) if the infant weighs 1.6 kg to less than 5.0 kg.
- 100 mg (1 mL) if the infant weighs 5.0 kg or more.

In BC, reimmunization for a second season is recommended for children up to 2 years of age who have specific conditions (see "Eligibility criteria," above). These children should receive 200 mg, given as two 100 mg (1 mL) nirsevimab (Beyfortus) injections if they weigh more than 10 kg at the time of dosing.

Infants need only one dose per RSV season, except for children who undergo cardiopulmonary bypass surgery; they should receive a subsequent dose before discharge after the surgery.

Nirsevimab (Beyfortus) can be given with any other routine childhood vaccines. Monoclonal antibodies do not blunt vaccine responses.

All nirsevimab (Beyfortus) doses should be immediately entered in the child's immunization record after they have been administered. Doses entered in the provincial immunization registry can be viewed in CareConnect, BC's electronic health record, and by the family using Health Gateway.

Side effects, safety precautions, and contraindications

The adult RSVpreF (Abrysvo) vaccine is contraindicated in individuals with a history of anaphylaxis from the vaccine or any components of the vaccine. Expected side effects include local injection-site reactions, such as pain (41%), redness (7%), and swelling (6%), as well as systemic symptoms, such as myalgias (27%) and fever (3%). It is important to note that only the RSVpreF (Abrysvo) vaccine is indicated in pregnancy; at the time of writing this article, no other RSV vaccines had been approved to be used in pregnancy.

An active vaccine is not yet available for RSV prevention in children. Clinicians should also be aware that RSVpreF (Abrysvo) is indicated *only in adults* and should *not* be administered directly to an infant, as it may even produce a deleterious immune response.

Nirsevimab (Beyfortus) is safe for infants. No excess adverse events have been detected in trials that have included more than 12 000 infants.[29] Since its licensure, 500 000 to 2 million infants have received at least one dose, with no major safety concerns.

Based on the product monograph, common reactions include local injection site reactions in 1% of infants and fever and rash in 1% or less of cases.[30] In a Canadian post-licensure safety analysis where parents were asked to report health events within 7 days after nirsevimab (Beyfortus) administration, the main side effect was self-resolving local injection site reactions in approximately 5% of the infants,[31] which, in our clinical experience, resolve quickly. To our knowledge, no cases of anaphylaxis have been reported.

Nirsevimab (Beyfortus) does not appear to delay the risk period for RSV-related hospitalizations in subsequent seasons.[32] Nirsevimab (Beyfortus) is contraindicated in infants with a history of severe allergic reaction to or anaphylaxis from its components (e.g., polysorbate 80) or other humanized monoclonal antibodies.[30]

Referrals and contacts

Infants in BC must meet the BC RSV program's eligibility criteria to receive publicly funded doses of nirsevimab (Beyfortus). For the 2025–2026 fall/winter season, most eligible infants will likely be identified by hospital programs or public health units. If you think a child may be eligible, please contact your local health authority or public health liaison to coordinate referral and dosing. Email the BC Infant RSV Immunoprophylaxis Program at RSV@cw.bc.ca for any adverse event reporting, cold chain events, or other general inquiries beyond the help and support your health authority can provide.

RSV vaccination in pregnancy

Approximately 10% of infants born in BC are expected to meet the eligibility criteria for nirsevimab (Beyfortus); the remainder rely on the RSVpreF (Abrysvo) vaccine in pregnancy for protection. RSVpreF (Abrysvo) vaccination is recommended for all pregnant individuals unless their infant is expected to qualify for nirsevimab (Beyfortus). The vaccine is available by prescription at many community pharmacies; the BC Pharmacy Association has developed an online map that shows locations that stock it.[33] At present, there is no public funding for the RSVpreF (Abrysvo) vaccine during pregnancy. However, Indigenous individuals covered under the First Nations Health Authority's Health Benefits Program are eligible to receive the vaccine at no cost, which helps mitigate inequities in access. Additionally, some third-party insurance plans may provide partial coverage.

Other relevant links and references

More information can be found on the BC Centre for Disease Control website, including a detailed Q&A document for BC health care providers.[34] Supporting materials related to RSVpreF (Abrysvo) vaccination in pregnancy and nirsevimab (Beyfortus) immunization in BC are provided on Perinatal Services BC's Perinatal and Newborn Health Hub.[35] ■

Competing interests

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Successful nonoperative management of gastric ischemia and portal venous gas secondary to *Sarcina ventriculi* infection

Initial conservative management of *Sarcina ventriculi* in hemodynamically stable patients, even those with gastric ischemia and necrosis, can be considered in the absence of perforation.

Sukhdeep Jatana, MDCM, Graeme Hintz, MD, FRCSC, MEd

ABSTRACT: Gastric ischemia secondary to infection by *Sarcina ventriculi* is rare and has been reported in a limited number of case studies. We describe the case of a patient who presented after a low-velocity motor vehicle accident with no symptoms. During his workup, a CT scan incidentally found the patient had portal venous gas and a focus of gastric wall ischemia, despite being asymptomatic. He underwent an esophagogastroduodenoscopy, which showed patchy necrosis but no perforation. He was managed conservatively with antibiotics and bowel rest. Biopsy showed the presence of *S. ventriculi*. A repeat CT scan with oral contrast and an esophagogastroduodenoscopy did not show any leak, and the patient was progressed to a full diet and discharged with oral antibiotics. This case showed that initial conservative management of *S. ventriculi* in hemodynamically stable patients, even in patients with gastric ischemia and necrosis, can be considered in the absence of perforation.

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Sarcina ventriculi is a gram-positive anaerobic bacterium with a characteristic tetrad morphology.[1,2] It is technically part of the *Clostridium* genus and is therefore occasionally referred to as *Clostridium ventriculi*.[3] Case reports of the presence of *S. ventriculi* in the stomach often describe resultant symptoms of delayed gastric emptying, with cases of perforation also noted.[1] We describe the case of a patient who had gastric wall necrosis, extensive air in the portal vein system, and a biopsy that showed the presence of *S. ventriculi*.

Case data

A 71-year-old male presented to a peripheral centre with chest pain and shortness of breath after a low-velocity motor vehicle accident. His medical history was significant for previous myocardial infarction with stents in situ, hypertension, dyslipidemia, gastroesophageal reflux disease, and chronic obstructive pulmonary disease. He had an 80-pack-year smoking history and was otherwise functionally independent. Cardiac workup was negative, and he was presumed to have a chronic obstructive pulmonary disease exacerbation. A CT scan of the abdomen was performed **[Figure 1]** in the context of the recent motor vehicle accident and new chest pain. Incidentally, the CT showed hypoenhancement of the posterior gastric wall with intramural air, gas extending along the right and left gastroepiploic veins, and portal venous gas. There was adjacent inflammation without any significant free fluid.

The patient was hemodynamically stable and minimally symptomatic. Prior to transfer to our centre, the patient had a nasogastric tube inserted and was started on broad-spectrum antibiotics and a proton pump inhibitor. He remained well during transfer and had minimal tenderness on abdominal examination. Laboratory investigations revealed a normal white blood cell count and mildly elevated C-reactive protein (21 mg/L). On arrival, the general surgery team saw the patient. He was alert, appeared well, and had a benign abdominal exam without tenderness. Given his clinical stability, he was taken for an esophagogastroduodenoscopy, which showed a 5 cm area of ulceration and necrosis with surrounding inflammatory changes, with no clear evidence of full thickness perforation **[Figure 2]**. Biopsies were taken.

Given the patient's ongoing hemodynamic stability, benign examination, and no clear evidence of perforation on either CT or esophagogastroduodenoscopy, he continued to be managed nonoperatively. He was taken for a repeat esophagogastroduodenoscopy the following day, which showed the lesion was similar in size and mucosa

seemed to be slightly less necrotic. A CT scan with oral contrast was done 2 days later, which again did not show evidence of frank perforation. Peri-gastric inflammation had also decreased, and there was no longer presence of gas in the gastroepiploic or portal veins.

The patient was then progressed to a full diet, which he tolerated. At that time, pathology returned, showing the presence of luminal *S. ventriculi*. Additionally, biopsies showed chronic active gastritis with erosion and ulceration; no dysplasia, metaplasia, or malignancy; and equivocal results for *Helicobacter pylori* immunostaining. The infectious diseases service was consulted, and due to the possibility of gastric necrosis secondary to *S. ventriculi*, the patient was treated empirically with ciprofloxacin 500 mg twice daily and metronidazole 500 mg twice daily for 10 days.

Follow-up with the patient as an outpatient was conducted several weeks later. He remained well. An outpatient esophagogastroduodenoscopy was arranged and was normal, and repeat biopsies of the gastric body failed to demonstrate the ongoing presence of *S. ventriculi.*

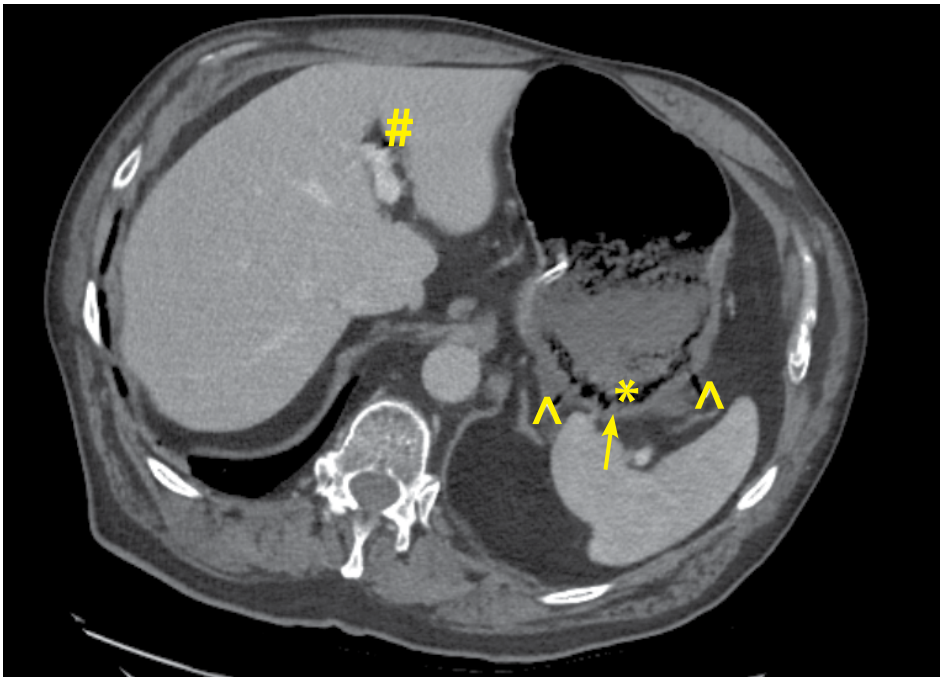

FIGURE 1. Initial CT scan on postadmission day 1 showing the presence of intramural gas (denoted by *), portal venous gas (denoted by #), hypoenhancing posterior stomach body (denoted by arrow), and gas in vasculature of stomach (denoted by ^). Despite the notable findings on CT scan, the patient demonstrated hemodynamic instability and minimal symptoms.

Discussion

S. ventriculi is normally found as spores in soil, water, and air,[4] and it causes similar gastrointestinal presentations in veterinary medicine as in humans.[5] It may exert its pathologic effects via the accumulation of acetaldehyde from its metabolism.[6] This bacterium has been seen in patients with and without prior gastric surgery, and presentations have ranged from duodenal mass to gastroparesis to perforation.[1] It has also been seen in specimens associated with malignancy, including gastric adenocarcinoma.[1] It is unclear what determines the various degrees of symptomatology associated with infection.

We observed a case associated with a localized area of gastric necrosis with intramural air and gastroepiploic and portal vein gas. While we were not able to definitively rule out an additional or alternative cause, similar case reports seem to support that the pathogen may have played a contributory role.[7] Given that the stomach is a well-perfused organ, ischemia is rare and is usually due to vascular causes, systemic hypoperfusion, or mechanical obstruction.[8] Differential diagnosis for this patient's localized gastric ischemia included a focal vascular event, especially in the context of the patient's smoking history and medical comorbidities. Although we did not have a CT with arterial contrast, there were no obvious calcifications of the blood supply, and the patient did not describe a history consistent with chronic mesenteric ischemia, so we thought this was less likely. The ischemia could also have been due to trauma from the motor vehicle accident,

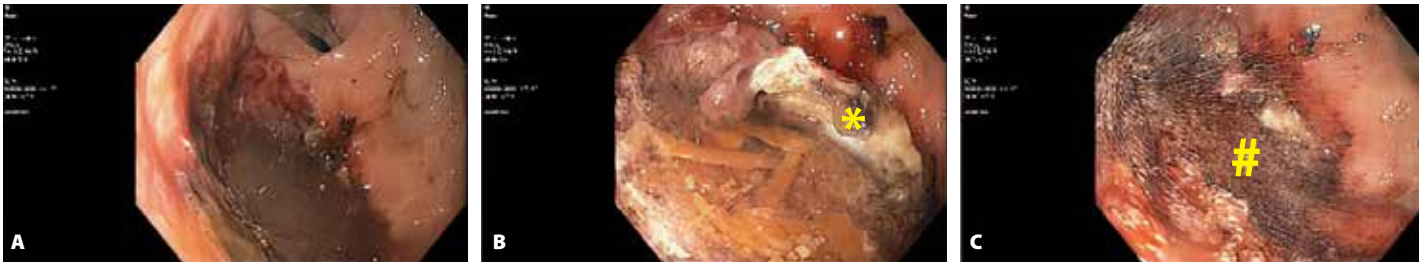

FIGURE 2. Initial esophagogastroduodenoscopy on postadmission day 1 showing the area of focal necrosis and ulceration (denoted by # in Panel C). Notable fibrin deposition (denoted by * in Panel B) was also seen. This was improved by the time of repeat esophagogastroduodenoscopy.

but the accident lacked sufficient force to cause injuries to any adjacent structures (e.g., rib fractures, splenic injury). Given the lack of another rationale for the gastric ischemia, the bacterium was thought to be the culprit rather than an incidental finding. While not all patients with gastric ischemia require operative management, such findings should prompt monitoring, additional workup and consideration of endoscopy, and follow-up to ensure resolution. Operative indications can include gastric volvulus failing endoscopic management and gastric or mesenteric ischemia causing hemodynamic instability. Thus, cases of gastric ischemia should be assessed on a case-by-case basis.[8] The patient in this case study did not have a definitive reason for operative intervention; thus, we pursued conservative management, and there was complete resolution of the patient's endoscopic, pathologic, and radiographic findings with antimicrobial therapy.

This case is unique and highlights that certain patients with active *S. ventriculi* infection without pneumoperitoneum or hemodynamic instability could be nonoperative candidates. Although the literature suggests that those with perforation associated with *S. ventriculi* gastric infection have a poor prognosis,[9] it is mixed for those without frank perforation. In one case report, an 86-year-old female with nonperitonitic pain, elevated lactate, and leukocytosis was taken for an exploratory laparotomy, and imaging showed extensive portal vein gas and gastric emphysema.[10] There was no frank perforation, and no resection was performed at the time of operation; intraoperative endoscopy revealed necrotic gastritis. Postoperatively, the patient was managed with antibiotics, and repeat imaging within 24 hours showed significant improvement of imaging findings; thus, there may be a role for nonoperative management. This is further supported by a case report of a 3-year-old patient who presented with hematemesis and leukocytosis, and X-rays showed massive gastric dilation with intramural air.[11] The patient was managed with endoscopic decompression and antimicrobial treatment, and there was significant improvement of endoscopic findings on repeat esophagogastroduodenoscopy. Because *S. ventriculi* can persist despite antimicrobial treatment, even up to 4 weeks after treatment,[12] repeat esophagogastroduodenoscopy should be considered to ensure clearance. Conversely, there was a report of an 86-year-old patient who presented with diffuse nonperitonitic pain, and investigations showed elevated lactate, extensive portal vein gas, and gastric emphysema; the patient died during resuscitation, prior to any operative management.[13] Notably, the diagnosis of *S. ventriculi* infection may not be readily available at the time of initial management or during the early resuscitation period.

This case report includes details on imaging, the extent of infection, and our management of the case, which may be of use to clinicians in similar scenarios. However, our results cannot be generalized, because this is a case study that lacks comparisons to other patients. Many reports lack a control group; hence, it is difficult to identify the optimal management for patients with *S. ventriculi*, because their presentation and prognosis can vary significantly.

Nonetheless, this case report suggests that patients with *S. ventriculi* infection should be managed on a case-by-case basis, ideally in a setting with access to overnight surgical and endoscopic capabilities. Close follow-up of biopsy results, with documented clearance of *S. ventriculi* infection, is warranted to avoid progression to perforation.

Summary

S. ventriculi can present in both outpatient and inpatient settings, and presentations associated with radiographic or endoscopic findings of ischemia should warrant close observation and treatment. Patients without gastric perforation or hemodynamic instability can be trialed for nonoperative management on a case-by-case basis with monitoring. Posttreatment investigations should be performed to ensure bacterial clearance. ■

Competing interests

None declared.

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Overdose and British Columbia's hospital system: Have we miscounted?

A growing gap between paramedic and hospital overdose data in BC reveals that thousands of overdose cases go unclassified or unrecorded in emergency departments each year, obscuring the true impact of the toxic drug crisis and undermining effective public health response.

Eris Nyx, BA, Jeremy Kalicum, MPH, Thomas Kerr, PhD

As the overdose crisis in North America continues unabated, data specific to overdose presentations in hospital remain critical to ongoing monitoring efforts and the evaluation and implementation of public policy. For example, a recent study in *JAMA* by Nguyen and colleagues, with the stated goal of assessing "the association of British Columbia's adoption of the safer supply policy and subsequent decriminalization of drug possession with opioid overdose hospitalizations and deaths," examined opioid-related hospitalizations using Canadian government counts of opioid overdose hospitalizations triaged with *International Statistical Classification of Diseases and Related Health Problems 10th Revision* (ICD-10-CA) codes T40.0–T40.4 and T40.6.[1] Although on the surface, such an examination would appear intrinsically robust, the true impact of drug-related overdoses on hospitals has likely been underreported due to gaps in surveillance and incomplete case classification within emergency departments. In fact, data from several sources indicate that many overdose cases are not fully classified during triage or may remain undocumented if patients leave against medical advice before triage. Such a surveillance gap would obscure the full scale of the overdose crisis and hamper the development of effective public health policy aimed at relieving strain on BC's health care system. Bridging this gap will require better integration between paramedic services and hospital triage systems to ensure that overdose cases are accurately identified, categorized, and managed.

This surveillance discrepancy is evident when examining the following data sources:

- Canada's opioid- and stimulant-related harms dashboard. This source tracks annual opioid poisoning–related emergency department visits by province, categorizing opioid-related emergencies under ICD-10-CA codes T40.0–T40.4 and T40.6,[2] with stimulant-related poisonings under codes T40.5 and T43.[2]
- The BC Centre for Disease Control (BCCDC) unregulated drug poisoning dashboard paramedic-attended overdose events. This database includes counts of "opioid overdose events" based on specific paramedic impression codes, as well as 9-1-1 dispatch codes.[3]
- The 2019 BCCDC knowledge update on declining rates of hospitalizations. This report examined overdose events attended by the BC Emergency Health Services from 1 January 2010 to 31 May 2019 where transportation to the hospital was required and the disposition record indicated received or declined.[4]

First, if we scrutinize the BCCDC's 2019 knowledge update, we see a recorded 13 284 opioid overdoses *requiring* transport to hospital in 2018, 2 years after BC's overdose emergency was declared.[4] The same document notes that while 8811 (66%) of these individuals were transported to hospital, 4573 (34%) were not.[4] During the same period, the Government of Canada reported 3512 opioid poisoning–related emergency department visits in BC, according to its opioid- and stimulant-related harms dashboard.[5] If the BCCDC data are accurate, the 3512 people counted by the Government of Canada represent only 40% of the 8811 people who should have arrived at the emergency department by ambulance because they overdosed. To rephrase, this discrepancy suggests that 5299 individuals who were taken to the emergency department to be treated for opioid overdose were transported to the emergency department but were not triaged with an opioid overdose code (i.e., ICD-10-CA

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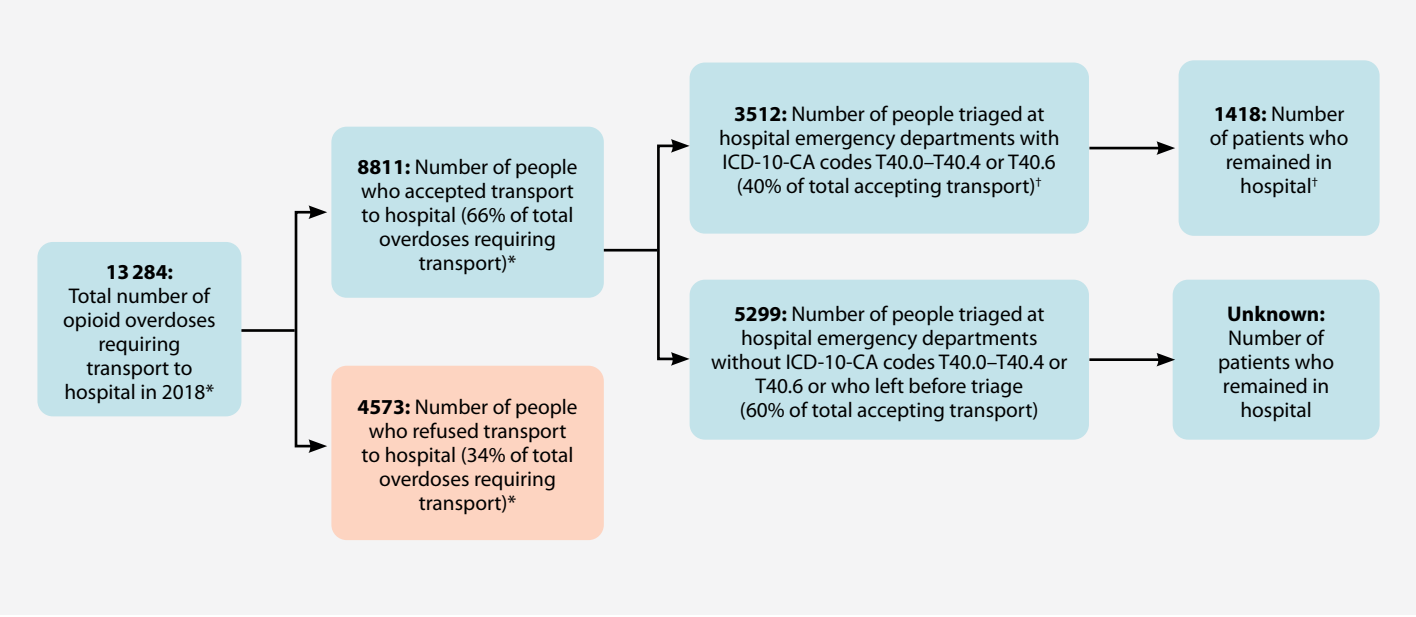

FIGURE. Number of visits to the emergency department for opioid overdoses in 2018.

* Data from BC Centre for Disease Control knowledge update; † data from Government of Canada opioid- and stimulant-related harms dashboard.

codes T40.0–T40.4 or T40.6) or left the hospital before triage **[Figure]**.

As this example illustrates, the lack of classification at emergency department triage and unclear surveillance around premature hospital discharge complicates the accurate surveillance of overdose cases. From the example, we can also see that a known 60% of transported overdose cases were not counted under an overdose ICD-10-CA code at triage, or people left against medical advice before they could receive a code. This means that only one-quarter of the total opioid overdoses requiring transport to hospital agreed to the transport, arrived, and were triaged at the emergency department with the correct ICD-10-CA code. Such a gap would distort surveillance data and obscure the full impact of the overdose crisis on the hospital system.

Lack of provincial-level data

A key limitation of this analysis is the absence of recent provincial-level data linking overdose-related hospitalizations with paramedic transport. At present, the most recent publicly available data set containing linked and verifiable figures across BC Emergency Health Services and hospital systems dates to 2019. The reasons behind this lack of updated data remain unclear. This surveillance gap significantly hampers efforts to track emerging trends; evaluate the real-time impact of public health interventions such as safer supply and drug decriminalization; and make informed decisions regarding hospital system preparedness, resource allocation, and emergency response planning. Without timely, integrated data, the true burden of the toxic drug crisis on BC's health care infrastructure remains obscured.

Emergency department coding practices

Beyond the absence of updated data, further discrepancies in overdose-related hospitalization figures may arise from clinical coding practices within emergency departments. Physicians frequently assign diagnostic codes based on a patient's immediate clinical presentation or the condition currently being treated, rather than the underlying cause. For instance, a patient who overdosed might receive a diagnostic code for respiratory failure or cardiac arrest rather than an opioid-poisoning code. Such symptom-based coding can effectively hide overdose cases within hospital records, further contributing to systemic undercounting. While this approach aligns with standard clinical workflows, it underscores the urgent need for dual or bundled coding protocols that capture both presenting symptoms and the underlying overdose etiology to improve surveillance accuracy.

The failure to accurately capture overdose cases within hospital data has significant consequences. It diminishes the health care system's ability to quantify demand, plan adequate staffing and emergency response capacity, and evaluate the effectiveness of critical interventions such as safer supply programs or expanded harm reduction services. When overdose cases are misclassified or omitted, public health strategies risk being underfunded, misdirected, or based on incomplete evidence. Addressing these issues through better integration of paramedic and hospital data systems, routine implementation of dual-coding practices, and mandated tracking of suspected overdose presentations should be understood not merely as a technical improvement but as an ethical imperative amid a public health emergency.

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Failing health care delivery in Canada is the result of an outdated operating model

A comparison of the performance of Canada's publicly funded health care model with that of the Netherlands shows that the Netherlands provides double the benefits for approximately the same costs per capita. A root-cause failure analysis was conducted to determine the cause of the discrepancy.

Gerald Tevaarwerk, MD, FRCPC

Canada's publicly funded health care system is failing. No credible cause has been found, which is crucial to finding a workable solution. In the search for answers to the proximal causes of too few physicians, nurses, hospital beds, and diagnostic and treatment facilities, a root-cause failure analysis was used to compare Canada with a country that has a perennially high-performing system.[1] From four advanced countries with leading publicly funded health care rankings—Switzerland, Denmark, Norway, and the Netherlands—the Netherlands was chosen because its per-capita annual health care expenditure most closely resembles Canada's.[2-4]

Canada and the Netherlands are affluent countries with advanced market economies and a strong social orientation, often referred to as welfare capitalism.[5] Canada is approximately 240 times the size of the Netherlands, with a population of 41.5 million.[2-4] The population of the Netherlands is 18.3 million. In 2024, Canada's per-capita GDP was $67 853 (all dollar values are in Canadian dollars unless otherwise specified). The Netherlands' was 39% higher, at $94 500.[6] Personal income taxes in the two countries are similar, but the Netherlands has a value-added sales tax of 21% as well as a wealth tax, reducing median disposable household income in 2021 to $45 000, $3750 less than in Canada, which has no wealth tax and combined federal and provincial sales taxes up to 15%.[6,7] Both countries have had publicly funded health care for more than 60 years. Although there are similarities, they differ fundamentally in how they are funded and who operates the programs. For both, the central (federal) parliament decides the benefits package and is responsible for enforcing the standards of care. The proportions of the population that are 65 years and older and 80 years and older are similar in the two countries.[8,9]

In Canada, the Medical Care Act[10] of 1966 introduced publicly funded health care, based on Britain's model of financing through taxation combined with public ownership of hospitals and operation by government.[10,11] Unlike Britain, which uses salaries to pay its physicians, Canada continued to use fee-for-service remuneration.[10,12] It also differs from both Britain and the Netherlands in that it uses a separate program for each province and territory, rather than a single program for the entire country.[10,12]

In the Netherlands, publicly funded health care was introduced during the Second World War, based on the German model.[13] Although the country is made up of 12 provinces, it has one national health insurance plan, with a uniform benefits package delivered by the private insurance sector using a not-for-profit public contract model.[11,13] Health insurance is compulsory for all permanent residents. Insurers must take all applicants regardless of health status and guarantee finding a family physician if necessary. Patients are free to choose their insurer, primary care practitioner, and hospital. Premiums are the same for all insurers and are set by the central government in consultation with the insurance companies. Insurers compete on premiums, service, quality of care offered, and profits from supplementary insurance. Premiums are collected monthly using the pay system or private billing. There are no user charges. The federal government pays the premiums for children and adolescents up to the age of 18 and subsidizes the premiums for low-income citizens. The collected premiums are deposited in sickness funds controlled by not-for-profit nongovernment public agencies.[13] Insurers contract with the family physician section and the

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various consulting specialists' sections and hospitals, or they may provide care directly using their own facilities and staff. Family physician billings, referred to as "functions of care," are standardized among insurers and are paid from the sickness funds, as are the hospitals and consulting specialists.[13]

Developments that led to the need for changes

In the last quarter of the 20th century, the publicly funded health care systems in both Canada and the Netherlands began to experience inadequate access to health care and rising costs that threatened sustainability. In response, the two countries took very different approaches to attempt to make corrections. Canada's system had initially been successful and popular with the public; however, it soon outspent its allocated funding, which the federal government responded to by introducing Established Programs Financing in 1977, reducing federal funding of provinces' and territories' health care costs from 50% to 24%.[14] The provincial and territorial governments responded by decreasing their fee-for-service annual increases to half the rate of general inflation.[15] Extra billing was permitted, but when it increased from $2 million to $200 million between 1979 and 1983, the federal government responded with the Canada Health Act of 1984.[10] It reaffirmed the four original principles of the Medical Care Act (public administration, comprehensiveness, universality, and portability); slightly modified the first principle to "administration on a nonprofit basis by a public authority"; and added a fifth principle, "must provide . . . reasonable access to those services." Extra billing was not made illegal, but provinces and territories were deducted an amount equal to the extra amount billed, effectively stopping it. To further reduce expenditures on health care, Canada reduced its homegrown supply of physicians in the 1990s by decreasing medical school admission numbers, based on the correlation between the size of the physician work force and health care expenditures.[16] It retained its 21 medical services plans, 13 operated by provincial or territorial governments and 8 operated directly by the federal government for various segments of the population, such as the Canadian Armed Forces, the RCMP, First Nations, and federal prisons. There is also a separate plan for federal members of parliament and their families.[12] The changes resulted in a gradual decrease in access to health care, combined with rising costs well beyond general inflation. The relationship between the medical profession and government became increasingly more problematic, and at times threatening to physicians.[17] Since then, there has been a marked decrease in the comprehensiveness of family practice and a high rate of family physicians leaving it.[18]

Compared with peer countries with publicly funded health care, the Netherlands scores very high, much higher than Canada, while spending just 6% more per capita.

The Netherlands experienced a gradual deterioration in the provision of health care services and unsustainable rising costs starting in the 1970s.[13] By the end of the last century, "the universal health care system was failing, operating under top-down cost-containment policies, such as regulation of doctors' fees and hospital budgets, that were widely criticized for lacking incentives for efficiency and innovation."[19] After several years of study, this led to the Health Insurance Act of 2006, which, on the advice of Stanford economist Alain Enthoven, shied away from the command-and-control top-down approach adopted in Canada. Instead, it focused on introducing market forces of "incentives for efficiency and innovations."[19] Key to improving efficiency was to make family physicians the gatekeepers of health care costs by making them the only mechanism for patients to enter the system, except in true emergencies such as automobile accidents. A frugal approach to referring patients to consulting specialist care was incentivized by making the family physician section's total remuneration inversely proportional to its use of specialty care. The cooperation of patients was cultivated by splitting the health insurance premium into two components, the basic benefits package and the deductible (*eigen risico*, or "own risk").[20] The basic benefits package covers primary and hospital care, while the deductible, at slightly more than €1 per day, is used for the first €385 of consulting specialist care in a year, after which the basic benefits package pays for any continuing need for specialty care. The disincentive effect on patients has also recently begun to be used for patients requesting blood tests that are considered unnecessary by a family physician. A further difference in the attempt to improve access and sustainability was the recognition by the Netherlands' planners of the need for a culture based on a common vision that acknowledges the central role of physicians in health care, including the efficient use of resources.[19] It recognizes the importance of adequately remunerated time opportunity and the necessary means to motivate high performance by physicians.[21] In that respect, the Netherlands started with two advantages over Canada: a lower cost to become a physician and an equal relationship with the operators of the public contract health care system, as opposed to the top-down command-and-control system in Canada, along with its adversarial relationship.

Performance comparison between the current health care systems of Canada and the Netherlands

An evaluation of the performance of the publicly funded health care systems of Canada and the Netherlands, after changes to improve access and ensure sustainability, must take into account that the Netherlands is a much smaller country, with the population residing within 15 minutes of their family physician's practice by car, and no more than half an hour from a hospital and

consulting specialist care. The ubiquitous, highly integrated public transport system is also a major advantage for both patients and medical school students, all of whom live within 1 hour of a medical school via public transportation, on which they can travel for free on a student pass. In addition, financial support is readily available for those who need it. These fortuitous conditions were made possible by the discovery of a large natural gas field in the north of the country in 1959, which is now closed.[22] The multiparty elected politicians of the day agreed to use the proceeds to build a capitalist welfare state, focusing on education and training for the future workforce for a planned, modern, technologically sophisticated economy. The Netherlands recognized the importance of the social determinants of health, ensuring adequate future opportunities and support for people with lower incomes, including generous pensions. The long-term effect is that the Netherlands has one of the highest median household incomes in Europe, largely due to its secondary manufacturing and service industries. Its use of a substantial one-time natural resource for the benefit of the country created great social solidarity, including for its publicly funded health care system and its caregivers.[23] **Table 1** shows expenditures on the various components of publicly funded health care, published by the Organisation for Economic Co-operation and Development.[2] Included are Switzerland, as the best-performing country, and Britain, as the only other developed country with health care services delivered by the government.

Per-capita expenditure in the Netherlands was 6% more than in Canada and 23% more than in Britain, but 20% less than in Switzerland. Britain spent 15% less than Canada. For overall performance, the Netherlands placed second out of the top 10 leading performers, while Canada ranked 10th, just ahead of Britain.[2] The relatively low hospital expenditures in the Netherlands are the result of its extensive long-term care and home-care programs **[Table 1]**. At 26%, it spends nearly double Canada's 15% on long-term care, which allows people to stay in their homes longer, saving expensive hospital care. According to the 2021 World Index of Healthcare Innovation, whose rankings correlate closely with overall performance,[24] Canada ranked 23rd, while the Netherlands ranked second.

The physician workforce is a major determinant of the performance of health care systems. **Table 2** shows how they compare in Canada and the Netherlands following changes that were made to improve access and sustainability. There are many more physicians in the Netherlands, and nearly all are homegrown, having benefited from a shorter and less personally expensive medical school education. Of the 39% more practising physicians, only 23.6% are family physicians, compared with 47.4% in Canada. Nevertheless, family physicians are the dominant physician factor in the delivery of health care services in the Netherlands in their role as gatekeepers to maintain sustainability. The supply of

TABLE 1. Indicators in four peer countries with publicly funded health care in 2021.

Country	Per-capita* health care costs (Can$)	Health care costs share of GDP	Avoidable mortality† (per 100 000 population)	Practising physicians (per 1 000 population)	Primary care physicians (%)	Nurses (per 1 000 population)	Capital costs (%)	Hospital care costs (%)	Outpatient care costs (%)	Home and long-term care costs (%)
Switzerland	$10 061	11.3%	125	4.4	27	18.4	12.2	25	34	19
The Netherlands	$8 411	10.2%	153	3.9	24	11.4	8.8	24	29	26
Canada	$7 899	11.2%	176	2.8	48	10.3	5.6	22	32	15
Britain	$6 866	11.4%	189	3.2	27	8.7	3.2	29	31	19

* Purchasing parity; † age standardized.

TABLE 2. Comparison of the physician workforces in Canada and the Netherlands in 2021.

Country	Practising physicians (per 1 000)	Family physicians (%)	Foreign-trained physicians (%)	Medical graduates (per 100 000 population)	Medical school fees per year (Can$)	Self-employed family physicians (%)	Ratio of family physician remuneration to median wage	Ratio of specialist physician remuneration to median wage	Hospital physicians (per 1 000 population)
Canada	2.8	47.4	24	7.5	$6 000 to $30 000	70	2.7	4.2	0.99
The Netherlands	3.9	23.6	3.6	15.5	$3 000 to $6 000	85	2.5	3.3	1.37

physicians is provided almost entirely by graduates from the Netherlands, at more than double the annual rate of Canada.[8,9] Foreign-trained physicians, at 3.6%, are one-seventh of those in Canada. Qualification for medical school is simpler, with no requirement for a premedical university education to qualify for the 6-year medical school curriculum. Fees are significantly lower than in Canada, ranging from $3000 to $6000 per year. Specialization for family medicine and the many secondary and tertiary specialties are similar in the two countries. Physician incomes, expressed as ratios to median income, are quite similar for family physicians. However, the incomes of Canadian consulting specialists exceed those of their family physician colleagues by 55%, more than their Dutch consulting specialist peers, who have 30% higher incomes.[8,9]

The average number of annual in-person doctor consultations is 4.7 in Canada and nearly double that in the Netherlands, at 8.6. The benefits package in Canada is for "medically necessary services" provided by physicians and hospitals. It is not universally comprehensive, excluding prescription medications and comprehensive eye, hearing, dental, and psychological care **[Table 3]**.[8,12] In the Netherlands, these are included, with full dental care and physiotherapy for children and adolescents up to age 18, and health insurance premiums are paid by the federal government until age 18.[9,13] For young adults pursuing higher education, there are special health subsidies to pay for compulsory health insurance during their education, depending on the individual's income. **Table 3** demonstrates some of the differences in the benefits packages.

The promptness with which benefits are delivered also varies. Unlike the difficulty in accessing primary care in Canada,[28] in the Netherlands, it is available immediately: 24 hours a day, 7 days a week, 52 weeks a year for urgent care and same-day appointments if deemed necessary by the patient. It is facilitated by the relatively large capitation payment of the blended remuneration formula, freedom for a patient to switch family physicians anytime, and ready availability of family physicians taking new patients. It also makes it attractive for family physicians to locate their practice where there is a need. Access to specialty care is via the family physician and is immediate if needed. **Table 4** shows the wait times for specialty care. There are many places to have tests and investigations done, including hospitals. All payments are provided by the patient's insurer.[13]

Delivery of primary care

In Canada, primary care is provided by family physicians operating private practices and nurse practitioners salaried by governments.[6,7] Physicians are remunerated in various forms, mostly fee-for-service, but often with some form of rostering payment and/or subsidies. Most provincial and territorial payment modalities do not support multidisciplinary teams. Except in rural areas, 24/7 in-person primary care coverage is minimal or nonexistent and has become expected to be made available by government-operated hospital emergency departments, as in Britain.[29] Hospitalists for inpatient care are recruited from the family physician pool.

Primary medical care in the Netherlands plays a dominant role in both providing health care and containing costs. It is provided by family physicians who own and operate primary care practices composed of multidisciplinary teams of nurses,

TABLE 3. Comparison of benefits packages in Canada and the Netherlands in 2024.

Country	Government pays health insurance until age 18	Government pays dental care and physiotherapy until age 18	Annual in-person visits per patient	Out-of-hours in-person primary care access	Dental care	Comprehensive hearing care	Comprehensive eye care	Comprehensive maternity care	Comprehensive mental health care	Comprehensive outpatient prescriptions
Canada	No	No	4.7	No	No	No	No	Yes	No	No
The Netherlands	Yes	Yes	8.6	Yes	Basic	Yes	Yes	Yes	Yes	Yes

TABLE 4. Comparison of wait times in Canada and the Netherlands in 2024.

Country	Median wait times (weeks)		Median total wait times for specialty care and imaging procedures† (weeks)						
	Family physician to consulting specialist consultation	Consultation to treatment	Hip or knee replacement	Cataract treatment	Oncology treatment	Ultrasound	CT	MRI	PET
Canada	15	15	57	35	4.6	5.2	8.1	16	N/A‡
The Netherlands	4*	7*	8.5	7	1.5	2	<1	<1	<1

* Maximum wait time tolerated by the insurer; † at nearest location; ‡ information not available.

"practice supporters" (physician assistants with specialty-training enhancement in various system disorders, designated by a specialty-specific notation, *-sp*), dietitians, midwives, and psychologists. Family physician practices average 5.4 practice supporters, of which 1.8 are specialized in mental health.[8,9] The family physician owner–operator of the practice is the most responsible physician for all patients attending the practice, is responsible for all billings, and pays all expenses, including salaries. Remuneration consists of a blend of mostly annual capitation payments to encourage large panels of patients, with modest visit and special disorders fees. Family physician–owners may employ other physicians to assume the most-responsible-physician function in their absence. Patients are automatically registered on their first visit and may change family physicians at any time. Access to medical care is via family physicians only, except in emergencies such as motor vehicle accidents, making family physicians the gatekeepers of the health care system by controlling access to more expensive specialty care.[9,13] Appointments with family physicians average 15 minutes each and are limited to one disorder per visit. For special circumstances, an appointment may be booked for two disorders, doubling the appointment duration. Family physicians are required to provide comprehensive primary medical care, including 24/7/365 after-hours coverage through participation on a rotational basis providing in-person care from a regional primary care centre.[13] Patients requiring urgent primary care outside office hours must call the general emergency phone number to be directed to the centre. The average number of capitated patients per family physician is slightly more than 2200.[13] Obstetric care is initiated via a midwife or family physician, working closely with a consulting specialist obstetrician/gynecologist and a hospital. Family physicians no longer provide hospital care but refer patients to consulting specialists at the hospital of their or their patient's choice.

Delivery of specialty care

Specialty care is similarly provided in Canada and the Netherlands, but there are some important differences. Except in rural areas in the Netherlands, family physicians no longer provide hospital care but refer their patients to their consulting specialist or hospital of choice. In both countries, remuneration may be with section-specific negotiated fees-for-service, but in the Netherlands, consulting specialists may be employed by a hospital and receive a salary.[13] Unlike in Canada, where hospitals are owned and operated by the provincial and territorial governments using global budgeting, in the Netherlands, they are owned and operated by not-for-profit organizations, commonly the local municipality.[13] For inpatient services, hospitals and physicians are paid using diagnostic treatment combinations. Hospitals and insurers are allowed to negotiate prices freely and contract selectively for approximately 7000 of the 35 000 diagnostic treatment combinations.[9,13]

Inpatient facilities and their operation differ considerably between the two countries.[8,9] Canada has 2.6 hospital beds per 1000 population, while the Netherlands has 3. Average length of stay in hospital is 7.8 days in Canada but 5.2 days in the Netherlands. The hospital physician workforce per 1000 population consists of 0.99 physicians in Canada, but 1.37 in the Netherlands. Hospitalists recruited from family physicians are widely employed in Canadian hospitals to provide inpatient care. In the Netherlands, inpatient care is provided by medical graduates training to become consulting specialists under the supervision of trained consulting specialists. Inpatient 24-hour hospital coverage is the responsibility of each specialty section. Unlike in Canada, the use of CT, MRI, and PET examinations in the Netherlands is reserved for consulting specialists. There is little difference in the frequency of use of CT and MRI exams between the two countries, but PET exams are more common in the Netherlands. Medical insurance companies encourage competition among hospitals and groups of consulting specialists for common elective procedures, including surgeries. **Table 4** shows the much shorter wait times for specialty consultations and procedures in the Netherlands, including for sophisticated imaging procedures.[9]

Conclusions

Canadians are concerned about the lack of timely access to primary and specialty care. In the Netherlands, physicians and patients alike are relatively content with their highly integrated universal health care system. From a global perspective, compared with peer countries with publicly funded health care, the Netherlands scores very high, much higher than Canada, while spending just 6% more per capita **[Table 1]**. Although Switzerland slightly outperforms the Netherlands, it does so by spending 20% more per capita. From the patient's perspective, the benefits package in the Netherlands is markedly superior to that in Canada **[Table 3]**, as are wait times for specialized care **[Table 4]**. The premise is that Canada's system of publicly funded health care is failing because of its top-down command-and-control delivery model. The Netherlands' public contract model, operated by insurance companies, outperforms Canada's in every respect. The breadth of its superior performance suggests that the problem in Canada's performance is the result of a pervasive defect negatively affecting the system in many ways, making piecemeal corrections in individual components ineffective for the system at large. Rather, there should be an examination of what has worked elsewhere. Most importantly, consideration should be given to whether the command-and-control delivery model of health care is likely to deliver quality care to the whole population in the most efficient manner. There are only two rich countries with modern economies, Canada and Britain, that continue to use it. Although Britain can claim inadequate expenditures, Canada spends as much as its highly successful peers. It is high time that the federal government reviewed its unanimous 1984

decision of adopting the currently operating version of publicly funded health care. At the time, it was not well known that the disastrous economies of the communist countries of Eastern Europe and China used that model to operate their economies.[5,30] Once those countries recognized the problems and introduced market forces, their economies began to flourish. Unfortunately, Canada and Britain continue to use the top-down command-and-control systems, reducing physicians to foot soldiers. It commands a too-small army to battle disease, distress, and disorders without sufficient time opportunity, adequate means, or a morale-building cooperative relationship.

When timely access to medical services began to fail and rising costs became unsustainable, Canada and the Netherlands reacted quite differently. Canada responded with a decrease in physician remuneration combined with maintaining a low physician-to-patient ratio and continued its top-down command-and-control government-operated model. The Netherlands responded with a culture of a common vision of quality and efficiency, using market mechanisms to promote entrepreneurship and competition. By actively engaging physicians to improve efficiency by responding to deficiencies and scarcities of essential needs, they have succeeded in changing the Netherlands' health care system from its unsustainable state at the start of the century to a well-performing efficient system, producing superior benefits. Primary and specialty care functions are more clearly defined than in Canada, with the Netherlands being an effective gatekeeper. On a positive note, the sorry situation Canada finds itself in may be yet another opportunity for nation building by introducing one uniform comprehensive health care insurance model for all Canadians. ■

Competing interests
None declared.

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BC immunization program update

There have been significant changes and expansions to several publicly funded immunization programs in British Columbia, including changes to the human papillomavirus (HPV), pneumococcal, avian influenza, and infant respiratory syncytial virus (RSV) programs that enable more people to access publicly funded immunizations. Detailed information about these changes can be found in the *BC Immunization Manual*.[1]

HPV vaccination program

HPV vaccines (Gardasil 9 is used in Canada) are highly protective against many cancers (cervical, vaginal, vulvar, anal, and head and neck) and genital warts. As of 31 July 2025, eligibility for HPV vaccination was expanded **[Box 1]**, including coverage for everyone up to 26 years of age (increased from 19), high-risk populations up to 45 years of age (increased from 26), and people receiving postcolposcopy treatment.

There has also been a change to the dosing schedule **[Table]**, as several clinical trials have demonstrated that even one dose of HPV vaccine for those under 21 years of age can provide long-lasting protection against HPV and associated cancers.[2]

Increased eligibility and changes to the dosing schedule will enable many more people in the province to be fully protected against HPV. Further information on HPV vaccination is available in the BCCDC HPV Q&A for immunization providers.[3]

Pneumococcal vaccine program

Pneumococcal vaccines prevent disease caused by *Streptococcus pneumoniae*, which can cause invasive (e.g., meningitis, bacteremia) and noninvasive (e.g., pneumonia, otitis media, sinusitis) pneumococcal disease, particularly in very young children, older adults, people with chronic medical conditions, and those with weakened immune systems. In BC, two types of immunizations have historically been used to protect against pneumococcal disease: a polysaccharide vaccine (PPV23) that was generally offered to adults and a conjugate vaccine (PCV13) that was part of the routine childhood vaccination program.

As of July 2025, BC replaced PCV13 and PPV23 with a single PCV20 product (Prevnar 20) for both children and adults. PCV20 is a superior vaccine due to its broad serotype coverage and increased effectiveness compared with polysaccharide vaccines.

For children 2 months to less than 5 years of age who are starting or completing a primary pneumococcal vaccination series, PCV20 replaces PCV13. Individuals 2 months of age or older at increased risk of invasive pneumococcal disease (e.g., chronic medical conditions, certain social/behavioral risk factors such as substance use disorder) and healthy adults over the age of 65 are now eligible for PCV20 rather than PPV23.

Of note, adults who have previously received PPV23 are generally not eligible for publicly funded PCV20 but can purchase the vaccine privately. Further information on pneumococcal vaccination is available in the BCCDC PCV20 Q&A for immunization providers.[4]

Human avian influenza vaccine program

For the first time, human avian influenza vaccine (Arepanrix) is available in Canada. While BC did have Canada's first case of human avian influenza in the fall of 2024, overall risk of human avian influenza infection is extremely low for most people. Therefore, this vaccine (given as a two-dose series, 3 weeks apart) is being offered only

BOX 1. BC's HPV immunization program eligibility.

- All individuals up to 26 years of age (inclusive).
- Individuals living with HIV who are between 27 and 45 years of age (inclusive).
- Individuals between 27 and 45 years of age (inclusive) who self-identify as belonging to the gay, bisexual, and/or men who have sex with men communities (including those who are not yet sexually active and/or are questioning their sexual orientation).
- Individuals who have received postcolposcopy treatment for cervical dysplasia on or after 31 July 2025.

TABLE. Changes to BC's HPV immunization program schedule.

	Prior to 31 July 2025	On or after 31 July 2025
Immunocompetent individuals	• 9–14 years of age (inclusive): 2 doses separated by at least 6 months. • Individuals 15 years of age or older: 3 doses given at 0, 2, and 6 months.	• 9–20 years of age (inclusive): 1 dose. • 21–45 years of age (inclusive): 2 doses given at 0 and 6 months.
Immunocompromised individuals	• Those who are immunocompromised will continue to require a 3-dose series.	
Postcolposcopy treatment for cervical dysplasia	N/A	• 3 doses given at 0, 2, and 6 months.

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to people who may have repeated and prolonged exposure to avian influenza **[Box 2]**. Further information on avian influenza vaccination is available in the BCCDC avian influenza Q&A for immunization providers.[5]

BOX 2. BC's human avian influenza vaccine eligibility.

- Lab workers who routinely handle samples that are known or likely to contain live or culture avian influenza virus.
- Veterinary staff performing necropsies on potentially infected animals.
- People working in diagnostic laboratories in contact with a large volume of potentially infected carcasses.
- People who repeatedly contribute to the management of infected animals, including animal destruction and disposal or building cleaning and disinfection.
- People working in close contact with wild birds or in and around waterfowl habitats (e.g., wildlife/animal control officers, wildlife rehabilitation workers, wildlife researchers, hunters and trappers, people working on environmental impact assessments and surveys, people working with waterborne pathogens).

Infant RSV immunoprophylaxis program

RSV is a very common infection among infants and young children, with approximately 1% of infants in BC requiring hospitalization due to RSV infection in their first year of life.[6] In BC, there are two products available to protect infants against RSV, which both offer robust protection (70%–80%) against RSV hospitalization:

- Nirsevimab (Beyfortus): A monoclonal antibody administered to the infant after birth.
- RSVpreF (Abrysvo): A maternal vaccine administered during pregnancy between 32 and 36 weeks of gestation that provides protection via passive antibody transfer.

This fall, there is an expansion of BC's publicly funded nirsevimab program, which will cover infants at moderate to high risk of severe RSV infection (approximately 10% of total births). Specific eligibility for the publicly funded program is available in the 2025–2026 provincial infant RSV program eligibility criteria[7] and includes:

- Infants born prematurely (i.e., before 35 weeks of gestational age).
- Infants with specific chronic medical conditions.
- Infants living in remote communities, isolated Indigenous communities, or congregate settings.

Most infants will be eligible for nirsevimab only as they enter their first RSV season. A smaller subset of children with certain health conditions will be eligible in their second RSV season if they are under 2 years of age.

RSVpreF is not publicly funded in BC; however, the First Nations Health Authority Health Benefits Program will cover it[8] for the 2025–2026 RSV season for eligible pregnant people. Both nirsevimab and RSVpreF will be available for private purchase this year and may be covered by private insurance plans. Infants whose birthing parent received RSVpreF at least 14 days before delivery generally do not need nirsevimab unless they have specific health conditions (e.g., bronchopulmonary dysplasia, significant congenital cardiac disease).

Further information on nirsevimab, RSVpreF, and the RSV immunoprophylaxis program is available in the BCCDC infant RSV Q&A for immunization providers.[6] ■

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Climate resilience 101: Preparing for a changing climate

Climate change and associated climate events are now a fact of life. It is predicted that these events and their related health impacts will intensify over the coming years. In British Columbia, events such as the 2021 heat dome and recurring wildfire seasons have caused hundreds of deaths, worsened chronic disease outcomes, and disrupted health system operations.[1] However, there are many opportunities to prepare for these changes to minimize the associated health harms.

Climate resilience in health systems refers to our ability to withstand climate events while maintaining care and recovering quickly from disruptions. Because of the intimate connection between climate and health, those working in the health system play a critical role in strengthening our systems and communities for the changes to come.

Recognizing climate risks enables more focused, long-term infrastructure and operations planning. In practice, climate projections are now incorporated into building design and maintenance to better align with expected future conditions. To support continuity of care during climate emergencies, measures such as reliable backup power, improved ventilation, and diversified supply chains have proven effective in enhancing facility preparedness. Looking ahead, every facility should undertake a climate change vulnerability and risk assessment and consider climate resilience in all facility-level decisions. Together, these efforts position the health system to better anticipate, absorb, and recover from future climate impacts.

Building resilience isn't limited to infrastructure. It also involves helping patients strengthen their ability to cope with climate-related health challenges. Individual health care providers play an important role in protecting the health and enhancing the resilience of their patients. Certain populations are more vulnerable to the health effects of climate events, including those who are required to work outside and those with impaired mobility, limited social connections, and precarious housing or income. Medical issues such as respiratory illness, mental health problems, and certain medications can also put people at increased risk. For example, providers must monitor patients who are taking strong anticholinergics, nonselective beta blockers, or anti–Parkinson disease agents, as these patients can have impaired thermoregulation and are particularly vulnerable to heat stress.[2] Providers must also recognize that patients with respiratory, cardiac, or other conditions need particular attention during wildfire season, and primary care providers should identify and provide anticipatory guidance and information about understanding the importance of monitoring the air quality index and installing even simple air filters for their homes.

Physicians should ensure patients have adequate medication in case of evacuation. Patients living in flood-prone areas should be provided with information about chemical/microbial hazards, wounds, and drinking-water safety after flooding events.

Although we must continue to work toward reducing our collective impact on the climate, for the foreseeable future, we need to prepare ourselves and our patients to be as climate resilient as possible. ■

—Ilona Hale, MD, FCFP
Council on Health Promotion Member

—Jennifer Phillips, CCFP
Council on Health Promotion Member

—Mehrnaz Makuei, PhD, EIT
Climate Resilience Coordinator, Interior Health Authority

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Resources for climate resilience

For health system leaders: Reports that describe opportunities to make health care and infrastructure safer and more resilient:

- *Climate Change and Health in British Columbia: From Risk to Resilience* (https://nrs.objectstore.gov.bc.ca/xedyjn/Projects/2023/ClimateReadyBC/page_health_r2r/Final.pdf).
- *Climate Resilience Guidelines for BC Health Facility Planning & Design* (https://bcgreencare.ca/resource/hf-climate-resilience-guidelines/).

For patients and providers:

- The BC Centre for Disease Control offers an excellent collection of patient and provider resources, including one-page talking points for extreme heat, wildfire, and flooding (www.bccdc.ca/health-info/prevention-public-health/climate-change-health).

This article is the opinion of the authors and not necessarily the Council on Health Promotion or Doctors of BC. This article has not been peer reviewed by the BCMJ *Editorial Board.*

Imaging for injured-worker patients with knee pain: An interview with Dr Kostas Panagiotopoulos

Dr Kostas Panagiotopoulos is an orthopaedic surgeon specializing in hip and knee reconstruction, sport medicine, and complex trauma, who sees many patients with work-related injuries, including at the WorkSafeBC Visiting Specialist Clinic. In this interview, Dr Panagiotopoulos explains why it is best practice to let patient history and physical-exam results guide the diagnosis and management of knee pain in these patients and to refer to orthopaedics before ordering an MRI scan.

What knee imaging is necessary before a referral to orthopaedics?
Specialists seeing referrals from primary care typically require a minimum of standing knee X-rays. We don't typically require advanced imaging for a referral.

In terms of advanced imaging, how do you choose between ultrasound, CT, and MRI?
Knee ultrasound is almost never needed. In the elective world, one could consider it for reviewing cysts; however, ultrasound of Baker cysts is not useful, as it will not change treatment. For acute trauma, ultrasound may be useful if one is unsure of tendon rupture (e.g., patellar or quadriceps tendon rupture), but that is more typically a clinical diagnosis.

CT is useful in the setting of acute trauma to look at fractures in more detail for surgical decision making or planning. Electively, we rarely need a CT scan.

When considering an MRI scan, a clinician needs to decide whether the anticipated findings will change management. They need to consider the duration of symptoms, age of the patient, mechanism of injury, and findings on physical examination. Will surgical management be considered?

Where physical examination points to internal derangement of the knee that is amenable to surgical treatment, MRI can be useful if it changes management. In cases of acute pathology (e.g., major trauma with a large amount of swelling leading one to consider ligament tears that may warrant surgical intervention, truly locked knee), I'll more urgently request an MRI scan.

For conditions that are not immediately acute or that have a clinical diagnosis that can be treated with nonsurgical methods, like patellofemoral pain, MRI is generally unhelpful.

It's most important to use the clinical area of pain to develop a working diagnosis, since imaging findings on MRI may not be clinically important or relevant. For example, you might find a meniscus tear on MRI, but if the knee pain is not coming from the joint line (indicating meniscal pathology), then the pathology seen on the MRI scan may not be clinically meaningful.

I use MRI when I am thinking about surgery as a treatment option rather than using it for diagnostic purposes. If the scan will change management, then it's a more useful test.

Are there common misconceptions about when MRI is needed? Is it over-ordered?
MRI scans are often over-ordered. One reason for this is virtual care appointments, where there is an inability to examine exactly where the pain is coming from, so MRI is ordered. In addition, many primary care providers believe MRI is a prerequisite for referral. In orthopaedics, that is not true. We even tell our catchment area of local

A note to primary care physicians and nurse practitioners from WorkSafeBC

Thank you for seeing workers in person for physical examination of musculoskeletal complaints. Your clinical note is the most important documentation on forms.

If you're considering an MRI scan, please review WorkSafeBC's appropriateness criteria on Form 83D56, available at www.worksafebc.com/form-83D56. If the criteria are not met, we recommend referring your patient for further clinical examination.

You can refer directly to a sport medicine physician or a specialist in the community for the accepted area of injury without prior authorization from WorkSafeBC. Pathways BC filters may help you find specialists who will expedite referrals for WorkSafeBC patients.

Alternatively, you can contact WorkSafeBC and request consideration of a referral to a WorkSafeBC-contracted program physician or WorkSafeBC's Visiting Specialist Clinic. Contact WorkSafeBC by checking the applicable box on Form 8/11, leaving a voicemail at 1 855 587-7399, or placing a request via the RACEapp+.

Find your patient's claim status at https://pvc.online.worksafebc.com.

This article is the opinion of WorkSafeBC and has not been peer reviewed by the BCMJ *Editorial Board.*

primary care physicians, "Please send the patient without an MRI. Let us see if they need an MRI scan."

What are the harms in ordering an unnecessary MRI scan, apart from costs?
Apart from taking away a slot from someone who might need the scan more urgently, MRI-reported findings can create a lot of anxiety since there is so much documented that is not clinically meaningful for your patient's care. Patients will often read an imaging report line by line and wonder if the constellation of imaging findings explains their problem. While that can be the case, more frequently it is not.

How do you prepare patients for what they might read on the imaging report?
I try to foreshadow what they will see on the report, so they are not surprised. I tell them specifically what I am looking for (e.g., ligament tear) and that other findings are expected age-related changes that are not necessarily clinically relevant. When I see them afterward, I explain the findings and go through the report in more detail, but I always give them a heads-up before the scan is completed.

What is your bottom-line message to physicians who refer patients to orthopaedics?
You generally do not need MRI to refer to a specialist in orthopaedics, specifically for knees, as well as hips. It's rarely useful in changing clinical management. You can refer to orthopaedics when in doubt, and the surgeon can triage the referral and then decide whether further imaging is necessary. If you look hard enough with higher-level imaging, particularly in patients over 50 years of age, you are going to frequently find pathology, and the MRI findings may not change patient treatment. It is better if the orthopaedic surgeon assesses the patient in person first and then decides when MRI can help with diagnosis or treatment. ■

—Celina Dunn, MD, CCFP, FCFP
Manager, Medical Services, WorkSafeBC

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The low rates of accurate classification of overdose patients expose significant deficiencies in how overdose data are captured and, more broadly, handled in the health care system's response to the toxic drug crisis. To mitigate these challenges, it is imperative to enhance data collection and refine classification systems, thus facilitating a meaningful response to this ongoing crisis. ■

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Competing interests

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Obituaries

We welcome original tributes of less than 700 words; we may edit them for clarity and length. Email obituaries to journal@doctorsofbc.ca. Include birth and death dates, full name and name deceased was best known by, key hospital and professional affiliations, relevant biographical data, and a high-resolution head-and-shoulders photo.

Dr Geddes Frank Owen Tyers

1935–2025

It is with profound sadness that we announce the passing of Dr G. Frank O. Tyers, a pioneering heart surgeon and inventor. Dr Tyers is credited with saving the lives and improving the well-being of countless patients worldwide. Over a career that spanned 6 decades, Dr Tyers made outstanding innovations in cardiac surgery. He is internationally recognized for groundbreaking work in myocardial protection, setting the worldwide standard for cardiac operations. He was an active inventor and developer in cardiac pacemaker design and functionality, introducing programmable technology, hermetically sealed batteries, and advanced telemetry systems. He also started and directed the only nationally and internationally recognized lead extraction program in Canada, and in 1996, 2 years before US approval, he introduced the use of an excimer laser for this procedure. He was also a leader in quality-of-care appraisal, which prompted the formation of the BC cardiac registry. Dr Tyers became a mentor to generations of surgeons and was a respected voice on national and international advisory boards.

Frank was also a devoted family man. He and Phyllis, the love of his life, celebrated their 65th wedding anniversary earlier this year. Frank was a dedicated father to their sons, Randall and Owen. He is also survived by his sister, Catherine, and brother, Dennis. His humility, integrity, and love for his family, friends, and community will never be forgotten. Frank's legacy is etched not only into the field of cardiac surgery but also into the lives of everyone privileged to have known him.

Frank was a man of tireless energy. Beyond medicine, he delighted in skiing adventures with family, warm afternoons in the garden, and long hikes. He took great joy in the companionship of the family's Cairn terriers, Calee and then Tavis. Frank took every opportunity to travel the world to teach and then return home to nurture the vegetable garden with the same care he gave to everything.

Frank was born in Giroux, Manitoba, in 1935 and raised in Kaslo, BC. While there, he became an accomplished clarinetist. After graduating in 1963 from the UBC Faculty of Medicine, he proceeded to Philadelphia for 5 years of surgical training and research at the University of Pennsylvania, followed by an additional 2 years of training in cardiovascular and thoracic surgery at the University of Toronto. His first position was at the recently established Pennsylvania State University Hershey Medical Center before becoming the head of thoracic surgery at the University of Texas Medical Branch at Galveston. Choosing a path that prioritized patients and allowed him to contribute in Canada, in 1979, he returned to Vancouver to head cardiovascular and thoracic surgery at Vancouver General Hospital and UBC. He continued consulting and following pacemaker patients until March 2022. Throughout, Frank credited the support of Phyllis for his successful career and the opportunity to dedicate his professional life to his love of medicine and his devotion to patients.

Frank's passing marks the end of a remarkable chapter, but his story continues with his family, his medical innovations, the people he mentored, and the countless hearts still beating today because of his vision. In lieu of flowers, please donate to the Nature Conservancy of Canada.

—Owen Frank Tyers, PhD
Delta

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