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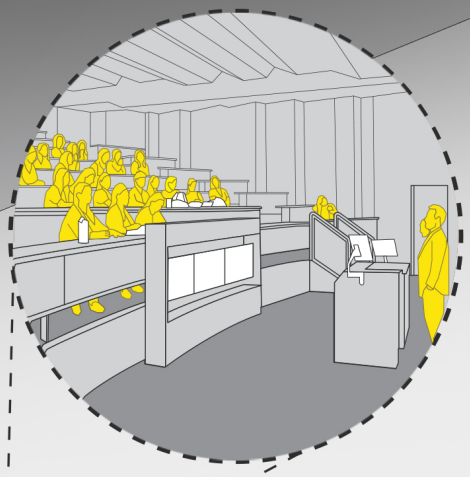

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Building bridges between provinces: The Conference of Atlantic Medical Students

Josh McKenna

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Editor's Message

Across the Causeway: Dalhousie Medicine expands to three

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On January 27, 2023, Dalhousie Medical School announced the addition of its third medical campus—the Cape Breton Medical Campus or "CBMC".[1] Based in Sydney, the CBMC will welcome its first cohort of 30 students in August 2025, emphasizing training in family medicine and rural health care.[2] It will join the existing Dalhousie Medicine Nova Scotia (DMNS) and Dalhousie Medicine New Brunswick (DMNB) campuses, building on more than 150 years of medical education at Dalhousie.

The launch of the CBMC reflects a broader movement to address physician shortages in Canada, particularly in rural and underserved areas. In 2014, the College of Family Physicians of Canada and the Society of Rural Physicians of Canada published the Rural Road Map for Action, a framework outlining four key directions and several guiding statements towards improving the health of rural Canadians.[3] The CBMC addresses several aspects of the framework directly, such as: (1) incorporating affinity and suitability for rural practice into admissions criteria, (2) supporting the successful recruitment of Indigenous and rural students to medical school, (3) providing high-quality rural clinical and educational experiences to medical students, and (4) fostering government and university partnerships with rural physicians, rural communities, and regional health authorities.[3]

The concept of distributed medical education in Canada is not new. Several medical schools have adopted variations of distributed models, from hub-and-spoke systems with regional centres (e.g., Dalhousie, McMaster, Toronto, UBC, Western) to centrally operated programs with smaller affiliated teaching sites (e.g., Calgary, Memorial, Ottawa, Queen's).[4] Many schools also offer longitudinal integrated clerkships, where senior medical students complete their entire clerkship year in one peripheral community as opposed to traditional block-based rotations.[4] The Northern Ontario School of Medicine (NOSM), which opened in 2005, was the first Canadian medical school with a clear social accountability mandate.[5] NOSM primarily accepts applicants from Northern Ontario and other rural areas, as well as Indigenous and Francophone applicants.[6] NOSM is structured as a geographically distributed, collaborative network as opposed to a centralized hierarchy, referring to the "entire geography of Northern Ontario" as its campus.[5] This approach has led to increased recruitment to family medicine and physician retention in the area; among the first ten years of NOSM graduates, 77% became family physicians and 54% were practicing in Northern Ontario.[7]

As medical schools increase their capacity and add new sites, maintaining meaningful opportunities for in-person collaboration is essential. While virtual learning has become an indispensable tool in recent years, it cannot fully replace the benefits of face-to-face engagement.[8] This issue's feature article, "Building bridges between provinces: The Conference of Atlantic Medical Students", thoughtfully reflects on a student-led intercampus initiative and highlights the spirit of connection that has become synonymous with the Dalhousie medical student experience. The cover art, a striking architectural rendering of the Sir Charles Tupper Medical Building by DMJ Layout Editor Josh McKenna, reinforces this theme by inviting you to imagine the inner workings of our medical school.

The expansion of Dalhousie Medical School to three campuses is a significant development in the school's 157-year history, ushering in an exciting new chapter for healthcare delivery and medical education in the Maritimes. Fittingly, this issue of the Dalhousie Medical Journal debuts a new visual identity—a clean, modern design that we hope will bring a renewed energy to these pages. We look forward to featuring the voices of our CBMC colleagues in future issues of the Dalhousie Medical Journal.

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Review

New directions for the treatment of tendinopathies

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Tendinopathies are among the leading causes of Nova Scotia's high rate of disability and the incidence of tendinopathy is increasing in developed nations with aging populations. The considerable impact of tendinopathies may stem from a shortfall of effective treatments. Presently, even the most successful medical interventions cannot fully restore the properties of damaged tendons. This gap signals a need for novel treatments with the potential to improve tissue regeneration. Increased research into treatments involving (i) transcutaneous nitric oxide, (ii) sclerotherapy, (iii) extracorporeal shock wave therapy, (iv) the administration of growth factors, (v) stem cell therapy, and (vi) biomaterials could help reduce individual suffering, strengthen Nova Scotia's workforce, and decrease the portion of the population relying on limited provincial disability payouts and stipends for disabled persons.

Disability in Nova Scotia

Nova Scotia has the highest percentage of individuals living with disabilities of any province or territory in Canada.[1] In fact, over 30% of Nova Scotians aged 15 years or older lived with at least one disability in 2017 (nearly 250,000 people).[2] This considerable incidence of disability continues to be of detriment to both afflicted Nova Scotians and the province's economy.[3-5] Despite this alarming statistic, there are minimal accommodations for individuals with disabilities in Nova Scotia.[6-7] The province spent $542 per capita on provincial 'Sickness & Disability' funding in 2017.[8] In comparison, Saskatchewan, with a disability rate nearly 25% lower than that of Nova Scotia, spent $1379.[8] This disparity is also reflected in stipends for persons with disabilities; annual disability support in Nova Scotia was $10,264 in 2017 – $2,727 lower than the national average of $12,991.[9] In Ontario, this support was $14,682 and in Alberta it was $19,705.[9] Taken together, Nova Scotia's high incidence of disability and limited available financial support for persons with disabilities stress the importance of adopting novel medical interventions for the treatment of commonly disabling injuries and diseases.

Musculoskeletal Injuries and Tendinopathies

Musculoskeletal injuries have been among the leading causes of Nova Scotia's high rate of disability.[5, 10, 11] The 2017 census revealed that 10.1% of Canadian adults (2.3 million people) had experienced a repetitive strain injury serious enough to limit daily function that year.[12] Moreover, repetitive strain injuries originating from labour-intensive work continue to be the single greatest contributor of working-age disabilities in Canada.[5, 10, 11] In Nova Scotia, repetitive strain injuries and other musculoskeletal injuries accounted for 63% of all lost time claims in 2018.[3, 5, 13] These claims resulted in a mean time off work of 178 days with inability to work occasionally being indefinite in certain labour-intensive professions.[5, 14] As a result, musculoskeletal disorders increase workers' compensation payouts, amplify unrealized economic production, and bring additional costs associated with worker overtime, replacement, and training.[5,13,15–17] Altogether, cost to the Nova Scotian economy is estimated to be at least $100 million annually.[13] In reality, European data suggest the true cost might be ten-fold that amount.[18]

Among the most common repetitive strain injuries are 'tendinopathies'; defined as tendon-related disorders resulting in pain or impaired function.[19,20] Tendinopathies afflict a quarter of adults and comprise half of all musculoskeletal injuries.[3,18,21,22] They are most common in active individuals with high-level runners at over 50% risk of developing pathology to their Achilles tendons during their careers.[16,19,23] Tendon pathology also gives rise to both pain-related and mobility disabilities which are the first (19.8%) and third (13.3%) most common disability types in Nova Scotia, respectively.[1,19,20] This appreciable impact may result from a shortfall of effective treatments for tendinopathy.[24] At present, even the most successful medical interventions cannot fully restore the mechanical properties of damaged tendons.[25]

The lack of good therapeutic options for regaining tendon function has been made more glaring by the increasing incidence of tendinopathy in developed nations with aging

populations.[7,18–20,26] This increasing incidence also extends to Canadian youth – with adolescent basketball players at 23.3% risk of developing patellar or Achilles tendinopathy each playing season.[27] Thus, the time has come to consider novel treatments with the potential to improve the morbidity associated with tendinopathy.

Common Treatments for Tendinopathy

The treatment of tendinopathy has traditionally involved (i) physical therapy, (ii) injection of corticosteroids or non-steroidal anti-inflammatory drugs (NSAIDs), and (iii) surgery.[28–31] However, these interventions often result in suboptimal patient outcomes. First, physical therapy with an emphasis on eccentric exercise (involving the lengthening of the affected tendon) has long been considered one of the most effective treatments for tendinopathy;[28,32] but its success relies heavily on patient motivation and thus may be less successful in patients without a substantial athletic history.[31,33] There is also little evidence that corticosteroid injection or NSAIDs administration assist in mediating chronic tendinopathy.[29,30,34,35] In fact, prolonged corticosteroid injection has been associated with tendon atrophy and even spontaneous tendon rupture.[36,37] Finally, reviews of surgical interventions cite that over 30% of patients continue to experience unsatisfactory function in the years following reparative tendon debridement;[38–40] though this figure appears to be improving.[34,41] These existing treatment gaps reinforce the need to explore new means of restoring tendon function.

Future Directions of Tendinopathy Treatment

Transcutaneous nitric oxide

A treatment that has gained momentum in recent years is the transcutaneous release of nitric oxide from glyceryl trinitrate patches which has traditionally been used in the treatment of heart disease.[42,43] Nitric oxide is naturally produced in the event of tendon injury via the upregulation of the nitric oxide synthase family of enzymes.[44,45] An increased nitric oxide level can lead to: (i) increased apoptosis of inflammatory cells, (ii) enhanced angiogenesis and vasodilation, and (iii) amplified tenocyte and collagen proliferation.[29,42,44–47] In this way, increasing local nitric oxide concentration upon tendon injury could play a role in both pain reduction and tendon healing[31,35] – a theory reinforced by multiple studies.[48,49] Indeed, patients suffering from Achilles tendinopathy treated with glyceryl trinitrate patches exhibit greater improvements in tendon power, function, and associated pain than controls.[49] Moreover, 79% of treated patients became asymptomatic at six months compared to 49% of the control group.[49] However, promising results such as these remain contested by skepticism arising from the results of studies showing little or no benefit of glyceryl trinitrate patches over other standard nonoperative treatments.[50,51] Because of this, the widespread adoption of transcutaneous nitric oxide in tendinopathy awaits further clinical assessment.

Sclerotherapy

Another promising intervention is sclerotherapy via polidocanol injection.[52,53] Pathologic regions of tendon tend to exhibit increased vascularization (or proliferations of small blood vessels).[35] Sclerotherapy seeks to decrease tendinopathic pain by obliterating innervation associated with neovascularization.[30,31,35] In addition, sclerosing agents also induce inflammatory responses and thus assist in proliferating tenocytes (tendon fibroblasts) and increasing collagen synthesis.[30,35,53] Two reviews recently supported the use of sclerotherapy in treating chronic Achilles and patellar tendinopathies.[52,53] However, both reviews called for increased research with larger volume studies.[52,53] Moreover, uncertainties persist regarding the potential correlation between the manipulation of neovascularization and the perception of pain.[54,55] Therefore, the rationale behind sclerotherapy hinges on the need for an increased understanding of basic science and subsequent clinical research.

Extracorporeal shock wave therapy

Extracorporeal shock wave therapy (ESWT) was originally developed for the treatment of kidney stones by outputting a series of shock waves with peak pressures approximately 1,000 times that of ultrasound waves.[35,56,57] While tendon function and pain have been found to improve following ESWT treatment[58–60] (though controversy regarding its effectiveness exists[61]), both the mechanism of action and ideal method of application of ESWT remain unclear.[28,35,62] Some suggest that ESWT may be beneficial in its mimicry of mechanical stimulation;[28,60] here, ESWT might assist in promoting the catabolic processes associated with the removal of damaged tendon.[63,64] Alternatively, ESWT has also been proposed to: (i) induce tenocyte proliferation, (ii) degenerate nerve fibers, and (iii) increase the expression of lubricin (a protein that assists in tendon gliding) alongside several growth factors such as transforming growth factor beta-1 (TGF-β1) and insulin growth factor-1 (IGF-1).[63,65–69] While these possibilities are exciting, it remains doubtful that ESWT acts by all of these mechanisms. Thus, further investigation into the precise physiological changes induced by ESWT is necessary to clarify its role with respect to tendinopathy treatment.[28,30,62]

The introduction of growth factors

The alleged upregulation of growth factors like TGF-β1 and IGF-1 in ESWT touches on another prospective area of treatment: the deployment of growth factors through injection of platelet-rich plasma (PRP) or autologous blood (read: growth factor therapy).[35,70] Several studies have suggested that exposing pathologic tendon to exogenous growth factors could aid in tendon healing and the monocytes present in PRP or autologous blood offer a means of such exposure.[30,40,70–72] Tendon injury causes an innate upregulation of growth factors with distinct functions, including IGF-1, TGF-β1, and 'vascular endothelial growth factor' (VEGF).[62,73] IGF-1 may promote extracellular reconstruction by stimulating the production and migration of tenocytes,[74,75] TGF-β1 may play a role in collagen production and the regulation of tendon

proteinases,[76,77] and VEGF supports vascular ingrowth to the area of injury for further delivery of additional growth factors.[78] It seems intuitive, then, that supplying the affected tendon with more of these naturally upregulated factors would aid in healing and, promisingly, this has largely been found to be the case.[79,80] However, the efficacy of providing damaged tendon with PRP or autologous blood has been controversial – stemming foremost from a fundamental lack of knowledge of the spatial and temporal roles of individual growth factors in the process of tendon healing.[81,82] Given the high degree of interaction that occurs between growth factors throughout tendon repair, more effective use of growth factor therapy will ultimately involve administering a 'cocktail' of growth factors deployed at strategic time points of healing.[31,62,83] Until advances in basic science allow for this, simply delivering large quantities of several growth factors may only serve to overload a pathologic tendon and interfere with natural healing processes.[70,82]

Stem cell therapy

Another therapy with promise in mediating tendinopathy is the transplantation of bone marrow-derived or adipose-derived stem cells (BMSCs and ASCs, respectively).[84,85] The injection of stem cells into damaged tendon has been proposed to aid in healing by two mechanisms: (i) by increasing the cumulative secretion of growth factors and cytokines that aid in local regenerative and inflammatory responses, and (ii) by increasing the local cell population via the transformation of stem cells themselves into tenocytes.[86–88] However, the true assistance afforded by stem cell injection remains unclear.[28] A considerable number of animal studies have supported the use of stem cells in the treatment of tendinopathy.[89–91] An example of one such study is the rapid infilling of tendon defects seen following the harvest, in vitro expansion, and implantation of BMSCs into damaged horse superficial digital flexor tendon (a proxy for the Achilles).[92] This has also been echoed in early clinical trials: patients with Achilles tendinopathy have been documented to exhibit faster healing when treated with ASCs than PRP.[93] Based on these findings, stem cell therapy may represent a future line of treatment for tendinopathy.[35] However, trials of stem cell therapy in other organs have resulted in severe side effects such as renal failure, blindness, and glioma.[94–96] Therefore, further research into the plausible dangers of relocating autologous stem cells, as well as a better understanding of their mechanism of action, is needed before they can be safely used in tendons.

Implantation of biomaterials

A final emerging area of tendinopathy treatment is the injection or surgical insertion of manufactured biomaterials into sites of tendon injury.[97,98] Compared to autografts and allografts that have long been deployed in reparative tendon surgery, biomaterials laden with growth factors, stem cells, or gene regulators are promising alternatives with the potential for superior efficacy.[31,99–101] The least intrusive of these are injectable materials like hydrogels (water-based 3D polymeric systems) and microspheres (particles with modified surfaces).[97,102] More invasive options include surgically-introduced scaffolds produced using (i) decellularized tendon, (ii) electrospinning, (iii) 3D printing, or (iv) melt electro-writing.[103–106] Natural polymers (such as collagen or silk), synthetic polymers (poly(lactic-co-glycolic) acid polycaprolactone), and biological scaffolds like extracellular matrix materials have all been proposed as candidates for tendon scaffolding.[103] However, the strengths and weaknesses of some of these materials relative to others – like the remarkable mechanical properties but inferior biological activity of synthetic polymers relative to their natural and biological counterparts[99,104,107,108] – have made it challenging to optimize biomaterial interventions. In light of this, recent research has attempted to use various biomaterials in combination.[98] For example, polycaprolactone fibers were used in conjunction with silk fibroin yarns to deploy the strength of the former and tendon-crimp-like structure of the latter.[109] Other research leveraged the combination of the mechanical strength of collagen fibers with the biocompatibility of hydrogels (as in "fiber-reinforced hydrogels").[98,110] Thus, exploring ways to produce a biomaterial well-suited for a particular tendinopathy by adding other biomaterials is a key focus for future research.

Conclusion

Tendinopathies represent an increasing concern for their anticipated role in further elevating Nova Scotia's already high incidence of disability. Promising means of tendinopathy treatment, including transcutaneous nitric oxide, ESWT, and stem cell therapy, will all require substantial research effort before they can be used clinically. Improved treatment of tendinopathy may help reduce individual suffering, strengthen Nova Scotia's workforce, and decrease the portion of the population relying on limited disability benefits.

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Case Report

Nutritional rickets and severe hypocalcemia in two Canadian newcomers

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Nutritional rickets and hypocalcemia are serious but preventable medical conditions with important and potentially long-lasting health implications. Despite well-established recommendations around dietary modification and nutritional supplementation, these diseases remain disproportionately higher among Canadian newcomers. We describe two cases of nutritional rickets and hypocalcemia in adolescent newcomers from East Africa. Both children attended a primary care clinic on arrival to Canada, but neither child was taking appropriate supplementation at the time of diagnosis. Once diagnosed, both patients responded to supplementation but, due to the severity and chronicity of their nutritional deficiencies, required additional medical testing and intervention to achieve adequate management. This case report emphasizes Canadian newcomers as an at-risk group for nutritional rickets and hypocalcemia, and underlines an urgent need for improved awareness, dietary counselling, supplementation, and access to reliable long-term prescription coverage upon arrival to Canada.

Case Presentation

In our first case, a previously healthy 14-year-old girl was referred to the orthopedic clinic with a two-year history of progressive knock knees, leg pain, and abnormal gait. She moved from East Africa two years before symptom onset, was otherwise asymptomatic, had no history of trauma or fractures, and had no known family history of metabolic bone disease or endocrinopathy. Physical examination found bilateral severe genu valgus deformity and a circumduction gait. Initial bloodwork identified severe hypocalcemia, low 25 hydroxyvitamin D (25[OH]D), low phosphate, high parathyroid hormone (PTH), and high alkaline phosphatase (ALP). Plain radiographs showed markedly elevated femorotibial angles but no radiographic evidence of rickets.

In our second case, a previously healthy, asymptomatic, 12-year-old female presented to her local Canadian newcomer clinic for routine follow-up approximately 18 months after arriving from East Africa. She was incidentally found to have severe hypocalcemia, low 25[OH]D, normal phosphate, high PTH, and high ALP. Plain films did not show radiographic features of rickets; however, electrocardiography identified a prolonged QTc interval. In both cases, dietary history was significant for chronically low calcium and vitamin D intake.
Both patients had visited their local newcomer health clinic on arrival to Canada, but the first patient was never prescribed dietary supplementation, and the second patient stopped taking her recommended supplementation after her temporary medication coverage ended six months before presentation. Ultimately, both children were diagnosed with nutritional rickets and severe hypocalcemia. Although neither child had evidence of rickets on x-ray, we hypothesize that both children would have had some increased exposure to vitamin D after arrival in Canada through supplementation (case 2), albeit for a short period, and diet for both. This may have led to partial healing of the rickets and absence of radiographic findings at diagnosis.

After diagnosis, both patients were prescribed long-term daily calcium and vitamin D supplementation and received dietary education. Their healthcare teams also addressed any barriers to ongoing treatment adherence. Laboratory values gradually normalized, and both patients maintained appropriate calcium and vitamin D levels at their three-month follow-up appointment. Due to the severity and chronicity of her metabolic derangements, the first patient also underwent surgery on her lower limbs to correct her genu valgus deformity. The second patient was admitted to hospital for serial electrocardiograms to ensure resolution of her prolonged QTc without arrythmia.

Table 1 | Laboratory results pre and post supplementation.

		Case 1		Case 2	
Result	**Normal Range**	**Pre**	**Post**	**Pre**	**Post**
Total Calcium	2.1-2.7 mmol/L	1.84	2.35	1.38	2.34
Albumin	36-49 g/L	42.9	41	43	38.5
25[OH]D	49.9-200 nmol/L	14.5	134.9	11.1	61.5
Phosphate	1.3-1.8 mmol/L	1.18	1.46	1.72	1.74
PTH	2.3-9.3 pmol/L	55.9	5.1	41.3	7.6
ALP	70-230 u/L (case 1) 105-420 u/L (case 2)	432	176	489	196

Discussion

Nutritional rickets is a serious and progressive health condition caused by vitamin D deficiency that decreases bone mineralization within pediatric growth plates.[1] This results in softer and weaker bones with higher incidence of motor delays, lower limb deformities such as bowing and knock knees, fractures, and bone pain.[1-3] Additionally, vitamin D deficiency contributes to hypocalcemia which can manifest as seizures, tetany, cardiomyopathy, and/or prolonged QT intervals.[1-3]

Nutritional rickets and hypocalcemia are rare in Canada, but more common among Canadian newcomers.[4,5] Risk factors include genetic predisposition, dark skin pigmentation, northern latitude, sun avoidance, certain cultural clothing practices, low maternal vitamin D levels, breastfeeding without infant vitamin D supplementation, food insecurity, and chronically low or unfortified dairy intake.[3,4,6] Several of these risk factors are modifiable, and most cases of nutritional rickets and hypocalcemia are preventable through timely identification of at-risk individuals, appropriate dietary counselling, and daily nutritional supplementation.

These cases highlight a need for increased awareness of Canadian newcomers as an at-risk group. Once a patient is identified as high risk, current recommendations suggest long-term supplementation.[2,7] Specifically, a daily intake of 400 IU for those under 12 months of age, and 600 IU for those over 12 months of age, of vitamin D is adequate to prevent nutritional rickets in the majority of individuals. However, children with nutritional rickets should consume higher amounts of daily vitamin D (cholecalciferol 2000-6000 IU based on age) and ensure a minimum of 500 mg/day of calcium for at least three months, or until laboratory values normalize.[8]

These cases also underline two potential barriers to supplementation adherence within this demographic. First, there is a lack of access to reliable long-term prescription coverage on arrival to Canada. Second, nutritional supplements such as cholecalciferol and calcium often fall outside of insurance policy coverage guidelines and therefore represent a considerable out of pocket expense for patients.

We advocate for healthcare providers to recognize the increased risk of nutritional rickets and hypocalcemia among Canadian newcomers. The incorporation of dietary counselling and supplementation into routine care for these patients, and screening for potential barriers to long-term supplement adherence, will reduce rates of nutritional rickets and hypocalcemia among Canadian newcomers and thereby improve their long-term health outcomes.

Clinical Pearls

1. Nutritional rickets and hypocalcemia are rare in Canada, but more common among newcomers. These diagnoses can have serious health implications, and providers should consider them in all Canadian newcomers.
2. Most cases of nutritional rickets and hypocalcemia are preventable or treatable with appropriate dietary intake and/or supplementation. Providers should recognize Canadian newcomers as an at-risk group and encourage the current recommendations of long-term vitamin D prophylaxis in all at-risk individuals.
3. Many newcomers face significant barriers to long-term supplementation adherence. It is important to screen for these barriers and advocate when appropriate.

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Consent: Legal guardians provided written consent for the publication of this case report. Patients provided assent.

Case Report

Streptococcus gordonii: an emerging pathogen as a cause of infective endocarditis?

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Infective endocarditis (IE) is a serious illness that affects the endocardial surfaces of heart valves, the mural endocardium, and septal defects. It can cause severe complications, such as abscesses, aneurysms, heart failure, renal failure, and sepsis. Right-sided endocarditis is more prevalent in persons who inject drugs, accounting for 10% of all instances of IE. *Streptococcus gordonii* is a gram-positive bacterium that colonizes the oral mucosa, skin, and gastrointestinal tract. It is an opportunistic pathogen and a rare cause of IE. We describe a case of *S. gordonii* IE in a 47-year-old man who injected drugs and had a history of prior tricuspid valve IE treated with tricuspid valve replacement and mitral annuloplasty.

Introduction

Infective endocarditis (IE) is an uncommon but potentially fatal cardiac condition. Its incidence is 3-7.5 per 100,000 person-years, and its 5-year death rate is 45%, with an in-hospital mortality rate of up to 22%.[1] Individuals with IE often exhibit non-specific systemic symptoms such as chills, fever, tiredness, and night sweats.[2,3] A new murmur and positive blood cultures are often present. Despite advancements in early detection and treatment, IE is linked to substantial complications, such as cardiac abscess and aneurysm, heart failure, septic pulmonary emboli and infarction, lung abscess, and empyema.[2,3] These are particularly prevalent in those with high cardiac risk factors, such as prosthetic valves, recent operations, or coexisting illnesses such as intravenous (IV) drug usage, cancer, steroid use, and uncontrolled diabetes.[2,4]

Staphylococcus aureus, viridans group streptococci, and enterococci are the most common causes of IE, which usually affects the left side of the heart.[3] *S. aureus* is the most common causal bacterium in right-sided IE, which often occurs in persons who inject drugs.[3] While viridans group streptococci have a low virulence and are usually found in damaged and prosthetic valves, *S. aureus* has a high virulence and frequently infects normal/native valves.[4] An emerging bacterium of the sanguinis group of commensals, *Streptococcus gordonii*, typically inhabits the human skin, mouth, upper respiratory tract, and gastrointestinal system.[4,5] Certain components of *S. gordonii*'s cell wall function as virulence and attachment factors, causing vegetations and biofilms to develop.[4-6] Due to its prevalence in the oral cavity, it is most commonly linked to periodontal disease and dental caries.[1,5] Yet, it may also cause systemic infection, which can result in a number of illnesses, including hepatic abscesses, endocarditis, spondylitis, and empyema.[1,4,7]

Case Presentation

A 47-year-old man with chills, fever, and increased frequency of urination over the previous four days was brought into the emergency room. He denied having a cough, shortness of breath, palpitations, arthralgia, skin lesions, dysuria, or urethral discharge. Prior history included IE requiring tricuspid valve replacement and mitral valve annuloplasty, treated Hepatitis C virus infection, asthma, chronic obstructive pulmonary disease, and hypertension. Social history was notable for daily IV heroin use. He endorsed occasionally lubricating the needles with saliva before heroin injection and licking the injection site following injection.

Vital signs were as follows: temperature 39°C, blood pressure 158/66 mmHg, HR 70 bpm, RR 17 breaths per minute, and SpO2 98% on room air. Upon physical examination, a middle-aged man appeared acutely unwell without scleral icterus or conjunctival pallor. He had fair dentition on oral examination without visible oral lesions. The cardiovascular exam was unremarkable, without a murmur. Chest exam revealed clear breath sounds bilaterally. He had tender indurated right forearm phlebitis with visible needle marks at the sites of prior IV drug injection.

Laboratory investigation revealed leukocytosis of 10,230/mcL (4,800-10,800/mcL), normocytic anemia with Hgb 10.7 g/dL (14.0-18.0 g/dL), thrombocytopenia 100,000/mcL (150,000-450,000/mcL), serum lactate of 1.6 mmol/L (0.6-1.4 mmol/L), procalcitonin of 0.31 ng/mL (0.02-0.08 ng/mL), C-reactive protein of 89.7 mg/L (0.0-5.0 mg/L), and erythrocyte sedimentation rate of 32 mm/hr (0-15 mm/hr). HIV 1,2 Ag/Ab were non-reactive, and HIV-1 viral load was not detected. Urine toxicology was positive for opiates/methadone, while urinalysis was within normal limits.

Electrocardiogram showed normal sinus rhythm with non-specific T wave abnormalities in the anterolateral leads. A chest radiograph showed evidence of tricuspid valve replacement and blunting of bilateral costophrenic angles, with no focal consolidation. Bilateral upper extremity duplex ultrasound was negative for deep vein thrombosis.

After obtaining the first two sets of blood cultures, the patient was started on empirical vancomycin and piperacillin/tazobactam. A transthoracic echocardiogram showed normal ejection fraction but limited visualization of the heart valves. Forty-eight hours after starting antibiotics, two other sets of blood cultures were obtained. All four sets of blood cultures drawn grew *S. gordonii*, and based on sensitivities, antibiotics were switched to IV ceftriaxone and gentamicin. He underwent a transesophageal echocardiogram, which confirmed a bioprosthetic tricuspid valve with vegetation on the right atrial side measuring 1 cm x 0.4 cm. A chest CT scan was negative for any evidence of septic emboli or microinfarcts. The patient was discharged on six weeks of IV ceftriaxone and two weeks of gentamicin.

Follow Up

The patient completed six weeks of antibiotics and was also appropriately referred for addiction care. Discharge follow-ups were also scheduled with cardiology, primary care, and infectious disease. Twelve months after the completion of therapy, a wellness check-up phone call was conducted with the patient. The patient endorsed that he had not used any recreational drugs since his discharge from the hospital.

Discussion

IE is a rare systemic illness that affects the endocardial surfaces of natural and prosthetic heart valves, the mural endocardium, or septal defects. The clinical presentation may be insidious and develop acutely or subacutely.[1,2] The majority of patients have fever, chills, and night sweats for days to weeks, and around 25% have a new murmur or embolic phenomena.[2,3] Myocardial abscesses, valve insufficiency, and congestive heart failure are among the intracardiac sequelae.[2-4] IE is usually lethal without treatment. It has a mortality rate of up to 30%, even with optimal treatment.[1,2] Cardiovascular risk factors such as congenital, damaged, or prosthetic valves/devices, as well as comorbidities such as old age, malignancies, poor dentition, poorly controlled diabetes, chronic renal disease, steroid usage, and IV drug use, are examples of risk factors.[2]

Staphylococci, streptococci, and enterococci species account for more than 80% of all instances of IE worldwide.[5] While *S. aureus* is currently the most common cause of endocarditis, accounting for 26% of all cases,[2] there is a growing prevalence of streptococci-related infections due to an aging population and the increased use of prosthetic valves.[2,3] Poor dentition is a significant risk factor for streptococcal IE.[2] Our patient, in this case report, had a history of endocarditis with tricuspid valve replacement, putting him at high risk for additional episodes.

One-tenth of all cases of IE involve the right heart, with a substantial percentage occurring among persons who inject drugs.[3] Bacteria enter the systemic circulation by direct inoculation and common IV drug practices such as lubricating needle tips with saliva before use and licking the puncture wound site following injection. IE in persons who inject drugs typically affects the tricuspid valve.[2,3,8] This was in keeping with our patient's presentation because he was known to lick the needles or injection site, increasing the potential of systemic transmission.

Gram-positive *S. gordonii* is a member of the sanguinis group of bacteria known to colonize the skin, oral mucosa, and gastrointestinal tract.[4,5] They alkalinize and produce the protective biofilm in the oral cavity.[4] They are alpha-hemolytic, catalase-negative cocci in pairs and chains.[5] A key component of S. gordonii's pathogenicity is its cell wall. Cell wall proteins expressed by *S. gordonii* include Hs antigen (Hsa), collagen-binding domain protein (CbdA), gordonii surface protein B (GspB), and streptococcal surface protein (Ssp) A and B.[4,6] These cell surface proteins—serine-rich repeat adhesins, lipoproteins, peptidoglycans, and lipoteichoic acids—allow *S. gordonii* to bind platelets and erythrocytes when it enters the bloodstream.[4,6-7,9-11] This bacterium-platelet complex is more likely to adhere to the fibronectin-rich extracellular matrix of heart valves, which can result in the growth of vegetations and biofilm.[4,6,9] Moreover, this results in the production of inflammatory cells such as macrophages and cytokines like interleukin (IL)-6, IL-8, and NF-κB, which can cause a significant systemic inflammatory response.[4,6-7,9-11]

The modified Duke's criteria can help diagnose endocarditis, and our patient met both of the major criteria of positive blood cultures and vegetation on echocardiogram.[1,12,13] A tailored, long-term antibiotic regimen based on sensitivities and early pathogen identification is critical to treating IE.[12,13]

Conclusion

IE is a rare but life-threatening disease of the heart valves and endocardium. Practices like licking needles and injection sites can potentially cause oral bacteria to spread into the bloodstream, leading to systemic infections in patients with predisposing factors. This case highlights that *S. gordonii*, though uncommon, should be considered a potential cause of IE, especially in persons who inject drugs.

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Consent: The authors contacted the patient over the phone on Friday, January 12, 2024, at 10:45 a.m. The patient was informed about the case report/manuscript and reassured that no patient identifiers were listed in the manuscript. The patient wholeheartedly gave consent for the manuscript to be published. The authors gave the patient the option to receive a copy of the manuscript once it was published, to which he agreed.

Clinical Practice

Five things to know about cancer-associated thrombosis

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Cancer-associated thrombosis (CAT) is common and is the second leading cause of death in patients with cancer.

20-30% of first venous thromboembolic (VTE) events are associated with cancer.[1] This can occur in patients with cancer who otherwise do not have risk factors for VTE. Patients with cancer have a 4-7-fold higher risk of VTE compared to the general population.[1] The risk of VTE is greatest during the first three months after diagnosis due to a multitude of factors, including patient-related risk factors (e.g. reduced mobility, comorbidities, older age), cancer-related risk factors (e.g. cancer type, disease burden), and treatment-related risk factors (e.g. surgery, chemotherapy, central venous catheters).[1]

Incidental CAT requires treatment because this diagnosis carries a high risk of recurrence and high mortality rate.

28% of CAT diagnoses are identified incidentally on routine imaging.[2] A post-hoc analysis of the Hokusai VTE Cancer Study population found that incidence of VTE recurrence after 12 months of anticoagulation was similar between patients with incidental CAT and symptomatic CAT (7.9% vs. 10.9%, aHR 0.68, 95% CI 0.42-1.11).[3] Likewise, both populations had a similar all-cause mortality rate (37.2% vs. 38.1%, aHR 0.83, 95% CI 0.65-1.05). These findings are in alignment with current guidelines which recommend treatment of incidental CAT like symptomatic CAT.

Low molecular weight heparin (LMWH) and direct acting oral anticoagulants (DOACs) are the preferred agents to treat CAT.

LMWH was the preferred treatment option for CAT prior to recent studies assessing the role of DOACs for CAT. This recommendation was based on data showing a reduced VTE recurrence rate and non-significant increased risk of bleeding when comparing LMWH to vitamin K antagonists.[4] The Hokusai VTE,[5] SELECT-D,[6] CARAVAGGIO,[7] and ADAM-VTE[8] trials compared individual DOACs against LMWH for the treatment of VTE in patients with cancer.[9] These studies demonstrated that DOACs were non-inferior to LMWH with respect to VTE recurrence and major bleeding.

DOACs might not be suitable in certain circumstances.

DOACs are now regarded as the treatment of choice for CAT. However, DOACs should not be considered interchangeable in patients with gastrointestinal (GI) malignancies. Specifically, compared with LMWH, edoxaban and rivaroxaban are associated with increased risk of bleeding in patients with GI malignancies whereas apixaban does not have this association. In the Hokusai VTE population, patients in the edoxaban arm had a greater incidence of major bleeding events (6.1% vs. 3.1%, HR 2.0, 95% CI 1.09-3.66, p=0.025).[10] The group's elevated risk was attributed to an increased rate of upper GI bleeding events primarily occurring in patients with GI malignancies (12.7% vs. 3.6%, HR 4.0, 95% CI 1.5-10.6, p=0.005). Similarly, SELECT-D showed that rivaroxaban was associated with a greater cumulative major bleeding rate at six months (6% vs. 4%, HR 1.83, 95% CI 0.68-4.96) compared to LMWH,[6] and the patients with GI malignancies tended to experience more major bleeding events (36% vs. 11%). In contrast, the CARAVAGGIO trial did not show a significant difference in major bleeding events (3.8% vs. 4.0%, HR 0.82, 95% CI 0.40-1.69) or major GI bleeding events (1.9% vs 1.7%, HR 1.05, 95% CI 0.44-2.50) between apixaban and LMWH treated groups.[7]

Finally, patients who have GI tract resections, take medications that alter P-glycoprotein and/or CYP3A4 metabolic pathways, and/or are at the extremes of weight may have DOAC levels outside of the expected range. There is a paucity of high-quality evidence for these situations.[11]

Most patients with CAT will receive anticoagulation for six months. After this period, patients require reassessment for the benefits and harms of continuation.

Patients with CAT require follow up at least every three months to consider the need for ongoing anticoagulation.[11] This should be guided by a clinician comfortable in VTE man-

agement as this requires evaluation of the risk of recurrence and bleeding. Expert guidelines recommend continued anticoagulation if the patient is receiving systemic chemotherapy, has active disease, or has risk factors of recurrent thrombosis and a low bleeding risk.[12]

Table 1. Treatment Options for Cancer-Associated Thrombosis*

	Drug	Dosage	Interactions	Considerations
DOACs	Apixaban	10 mg BID p.o. for 7 days then 5 mg BID p.o.	Contraindicated with CYP3A4 and Pgp inhibitors	CrCl <15 mL/min – not recommended CrCl 15-29 mL/min – use with caution
	Edoxaban	60 mg daily p.o. after 5 days of parenteral LMWH at therapeutic doses	Avoid with CYP3A4 and Pgp inducers	CrCl <30 mL/min – not recommended CrCl 30-50 mL/min or ≤60kg – 30 mg daily p.o.
	Rivaroxaban	15 mg BID p.o. for 3 weeks then 20 mg daily p.o.	Contraindicated with CYP3A4 and Pgp inhibitors	CrCl <30 mL/min – not recommended Take with largest meal to maximize absorption
LMHWs	Dalteparin	200 units/kg daily s.c. for first month then 150 units/kg daily s.c. or 200 units/kg daily s.c. for duration of treatment	Bleeding risk with ASA and oral anticoagulants	Dose based on actual weight Use with caution in patients with renal dysfunction

*Adapted from Carrier et al,[11] Thrombosis Canada,[12] and Compendium of Pharmaceuticals and Specialties[13]
Abbreviations: ASA, acetylsalicylic acid; BID, twice daily; CrCl, creatinine clearance; DOAC, direct oral anticoagulant; LMWH, low molecular weight heparin; p.o., by mouth; s.c., subcutaneously

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Commentary

Building bridges between provinces: The Conference of Atlantic Medical Students

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The seventh annual Conference of Atlantic Medical Students (CoAMS) was held from April 26-28, 2024, at Dalhousie University in Halifax, Nova Scotia. This student-led initiative brought together over 100 medical students from the four medical school campuses in Atlantic Canada. The goals of the conference were to convene like-minded medical students, encourage networking, stimulate intellectual discourse, and provide learning opportunities through a variety of practical workshops. In this article, we reflect on the importance of this successful weekend to ensure continued enthusiasm for CoAMS amongst medical students in Atlantic Canada.

The Conference of Atlantic Medical Students (CoAMS) was founded in an effort to bridge the geographical divides within the Atlantic provinces by providing a platform for medical students in the region to network, share research, and learn from one another. The conference is hosted annually by a different campus on an alternating basis and has been growing rapidly since its return to full in-person programming following the pandemic. The participating medical schools are Dalhousie University (Halifax, NS and Saint John, NB), Centre de formation médicale du Nouveau-Brunswick (Moncton, NB), and Memorial University (Saint John's, NL). Following a successful CoAMS in Saint John's in 2023, Halifax had a clear mandate to build on this momentum. After months of hard work by a dedicated committee of medical students, we achieved this goal in April when CoAMS 2024 was hosted at Dalhousie University.

Planning for CoAMS 2024 began in late 2023, against the backdrop of a particularly harsh summer and fall marked by widespread wildfires, floods, and hurricanes that caused significant devastation throughout Nova Scotia and the other Atlantic provinces. In May 2023, 200 homes were destroyed when fires tore through several communities outside Halifax, stretching the resources of Nova Scotia's fire departments and displacing 16,400 residents.[1] Mere weeks later, a provincial state of emergency was declared after historic floods destroyed roads, bridges, and homes.[2] The impact of Hurricane Lee in late 2023 further fractured a province that was still recovering from Hurricane Fiona, which had occurred a year earlier.

This difficult year highlighted the challenges that await future physicians in Canada, revealing the stark reality that our practice will occur in an increasingly different world compared to previous generations. Bringing together medical students, who will be future physician colleagues, to have open discussions about current challenges and potential solutions is perhaps more important now than ever. CoAMS 2024 provided a platform to achieve this.

It was in the context of these pressing challenges that the theme of CoAMS 2024, *Innovation and Inspiration: Resilience in a World of Change*, was aptly chosen. To facilitate comprehensive discussion of this multifaceted and complex theme, two areas of focus were prioritized: 1) Climate Change and Disaster Response, and 2) Mental Resilience. These focal areas were addressed through a series of keynote speakers and hands-on workshops. In addition to these sessions, the conference provided a platform for student-led research presentations, showcasing the academic dedication and achievements of Atlantic medical students. In all, CoAMS 2024 hosted 125 delegates, who participated in 40 research poster presentations, 24 oral research presentations, ten hands-on workshops, and five keynote speaker sessions across three days. The following discussion will summarize those events and provide commentary on 1) the importance of this weekend, and 2) why future participation in CoAMS should be encouraged.

The Conference

Following the welcome ceremony and networking exposition in the Sir Charles Tupper Medical Building on Friday night, CoAMS 2024 commenced on Saturday morning with a student-led academic research session. Delegates were fortunate to welcome Drs. Jon Bailey, Beata Derfalvi, Ron El-Hawary, Sarah Fraser, Liane Johnson, Matthew Oldfield, and Ellen

Sweeney, as judges. Students from all participating universities were invited to submit abstracts and present their research to judges and fellow delegates, either through a poster presentation or a five-minute oral presentation. The breadth and quality of research presented was remarkable, with ten research prizes awarded for the best presentation in the categories of Medicine, Surgery, Community/Global Health, Humanities, and Basic Science. A list of winners, along with their research project, can be found in Table 1.

Discussions around disaster response began Saturday afternoon with a keynote address by Dr. Andrew Travers. Dr. Travers captivated the conference audience during an hour-long session, where he outlined general strategies for managing emergency scenes and disaster response. In what was already a fascinating talk, Dr. Travers concluded with a personal account of his experience as a first responder during the 2001 9/11 disaster in New York City, having been in the city for a conference at the time.

Following this keynote session, delegates solidified their newfound knowledge through hands-on learning opportunities. Four workshops (Primary Surveying, Airway Management, Trauma Teams, and Tourniquets/Wound Care) were led by emergency medicine, family medicine, and orthopaedic surgery residents. These sessions allowed students to learn practical skills they would soon apply in real-time during a full-scale mass casualty simulation held in the Collaborative Health Education Building. During the simulation, participants assumed various roles within trauma teams, where they were responsible for triaging and medically stabilizing several patients. After stabilizing the patients, the delegates handed their patients over to paramedics, providing instructions on triage level for hospital transport. For many students, this session was their first ever exposure to concepts such as triaging emergency scenes and working in a trauma team, making the simulation a standout experience of the weekend.

The excitement of Saturday's activities concluded with the CoAMS social event, held that evening at Bulwark Cider House. The gathering provided delegates with an invaluable opportunity to further cement the professional networks and personal friendships that had developed over the weekend.

Sunday morning's program featured two keynote speakers who addressed Climate Change and Planetary Health. Dr. Geldenhuys and Dr. McEachern delivered compelling talks on the social and commercial determinants of health. They highlighted the significant impact of healthcare on our environment, often due to waste and inefficiencies, and practical ways to get involved with promising initiatives in Nova Scotia and other Atlantic provinces. Such programs, working hard

Figure 1 | Delegates are addressed during the CoAMS 2024 opening ceremony.

to ensure sustainable practices within healthcare and our society, include the Canadian Association of Physicians for the Environment and the Ecology Action Centre.

At the conclusion of these sessions, delegates participated in a combination of procedural skills and wellness sessions, facilitated by a number of healthcare professionals and community members. Procedural skill sessions included knee aspirations, punch biopsies, pap smears/IUD training, and lumbar puncture; all sessions were facilitated by a resident physician and featured hands-on practice with training models. The wellness sessions included art therapy, a discussion with the Student Affairs office around combating burnout, and a CaRMS Tips & Tricks discussion with family medicine and pediatric residents.

The conference closed on Sunday afternoon with a final keynote discussion by Martha Reid and Dr. Timothy Christie, focusing on mental health and resilience. Martha Reid explored the psychosocial hazards prevalent in healthcare settings, emphasizing their potential to profoundly impact patient care if not adequately managed. Dr. Christie underscored the critical role of advocacy within the medical profession. This engaging discourse provided a fitting conclusion to CoAMS 2024.

Discussion

In this article, we aim to highlight the success of CoAMS 2024 and encourage buy-in for the organization and planning of future events. Below, we outline how a 100% student-led initiative was able to utilize Dalhousie University resources, community partners, and student enthusiasm to deliver a high-quality conference experience to over 100 medical students. The connections forged at CoAMS 2024 are sure to develop into lasting relationships between colleagues, highlighting the importance of similar events continuing in the future.

The CoAMS 2024 committee received an incredible amount of positive feedback, both during and after the conference weekend. Delegates greatly appreciated the opportunity to meet and network with peers from other medical schools, as well as the fantastic facilities and resources provided by Dalhousie University, which contributed significantly to the conference's success. A considerable portion of equipment used during the conference was generously provided by various schools, community clinics, and individual interest groups. Without this extensive network of resources, the hands-on learning experiences offered to participants would have been greatly reduced.

Table 1 | Prize winners from CoAMS 2024 Research Day.

Prize Winner	Category	Research Title
Poster Presentations		
Madeleine Crawford (DMNS)	Medicine	Using artificial intelligence as a melanoma screening tool in self-referred patients
Kate Chua (DMNS)	Surgery	Predictions and outcomes of complications after pancreaticoduodenectomy in the geriatric population versus non-geriatric population: Assessment of the ACS NSQIP risk assessment tool
Jennifer Akerman (DMNB)	Global Health	Barriers and promising practices in accessing stable housing for birthing people who use substances (BPWUS) in New Brunswick: A mixed-methods study
Jill Lamb (DMNS)	Humanities	Thematic analysis: can being exposed to going to the doctor through play alleviate children's anxiety?
Nicholas Zink (DMNS)	Basic Science	Mllt11/Af1q/Tcf7c is required for trigeminal innervation of the masseter
Oral Presentations		
Olivia Piccolo (DMNS)	Medicine	Impact of income quintile and distance to cancer center on survival in pediatric extracranial solid tumours: A report from the Cancer in Young People in Canada (CYP-C)
Christi Joyce (DMNS)	Surgery	Effects of surgical modality on post-operative post-void residual in men undergoing surgery for benign prostatic enlargement
Omar Altourah (DMNS)	Global Health	Analysis of influencer videos and their credentials in TikTok for information citation on nutrition advice and sponsorship
Gizelle Francis (DMNS)	Humanities	Exploring supports in place for mothers in medical school – a qualitative interview study
Zack Clancy (MUN)	Basic Science	The effects of total parenteral nutrition and methyl supplementation on glucose homeostasis

Registration numbers and delegate participation for CoAMS 2024 surpassed initial projections. Despite early logistical concerns related to travel and navigating complex scheduling of multiple medical schools, over half of delegates were students from Memorial University or Centre de formation médicale du Nouveau-Brunswick. This high attendance may have been facilitated by the substantial travel bursaries awarded by CoAMS, thanks to the generous support of sponsors. These bursaries were awarded to all delegates who applied, using an equity-based approach that considered factors such as the method of travel, accommodation requirements, and financial support from their respective schools. This approach resulted in a diverse and enthusiastic delegation of medical students, whose active participation significantly contributed to the weekend being a great success.

It is also worth reflecting on the substantial effort by the CoAMS 2024 team to host and deliver this conference. In the six months leading up to April 26th, the entirely student-led committee meticulously planned every aspect of the weekend, all while balancing the demands of being full-time medical students. This endeavor exemplified a resilient team effort in the face of various personal and academic stressors throughout the year. The committee's ability to tailor the conference to the interests of medical students was integral in providing an optimal experience for all delegates.

Figure 2 | Delegates practice lumbar punctures during Sunday's procedural skills session.

The weekend, however, was not without its challenges. Ensuring an equity-based approach to funding distribution, with consideration to different financial situations and geographic travel, proved difficult. Ultimately an algorithm was decided on by committee members; however, future committees should refine this process to ensure no student is unable to attend due to financial barriers. Additionally, a slew of technology problems threatened the success of the mass casualty simulation, and attendance at some sessions was notably less than others. This may have simply been the toll of a busy weekend schedule, or because some sessions were deemed less relevant by delegates. Future conference planning could benefit from a more pragmatic approach to scheduling relevant talks, using information obtained in advance from delegates on what sessions would be of most benefit to them.

Nevertheless, CoAMS 2024 served as a strong reminder that the field of medicine is full of brilliant, inspirational, and compassionate individuals who are eager to make a meaningful impact on the world. The success of the conference was significantly bolstered by the generosity of clinics, staff, and residents, as well as the delegates' willingness to engage, network, and learn new skills. Despite the demanding nature of medical education and the broader challenges facing healthcare today, 125 delegates, along with over 30 volunteers, residents, and planners, came together at CoAMS 2024 to create a vibrant, educational environment for connection and knowledge sharing. The significance of events such as this, and the opportunities they provide, cannot be overstated. As medical students in the Atlantic provinces navigate a landscape of evolving challenges, the connections fostered at events like CoAMS will continue to ensure medical students are well-equipped to enter the healthcare workforce.

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Opinion

Improving physical health and survival of children and youth in Canada

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UNICEF recently warned that many children and youth in Canada have poor physical health and are struggling to survive. The challenges of income inequality, social exclusion, and poor food quality drive this problem. Physicians can tackle these challenges and boost children's physical health and survival by working with impacted communities and advocating for policy change. First, physicians should address income inequality by collaborating with other key groups such as social pediatric hubs, social workers, nurses, and food banks, and by advocating for universal basic income to help support families financially. Second, physicians should tackle social exclusion by identifying and remedying direct and indirect forms of discrimination against underserved populations in the healthcare setting, as well as by improving anti-racism education and policies. Finally, physicians should promote food quality by educating the public about quality food resources and collaborating with governments to hold the private sector accountable for food quality deficits.

Introduction

Despite being one of the world's richest countries, Canada is failing to keep its children and youth healthy. According to UNICEF's 2020 report card, Canada ranked 30th among 38 wealthy countries in the well-being of children and youth under 18 years of age.[1] To improve their health and well-being now and in the future, physicians should advocate for policy change and work collaboratively with impacted communities, government, healthcare providers (HCPs), patients, and the private sector.

While the health and well-being of children is a multi-faceted topic, this opinion piece focuses primarily on physical health and survival as this dimension is foundational to achieve the other dimensions of well-being.[2] UNICEF defines poor physical health and survival as high child mortality rates across ages 5 to 14 years old.[1] Income inequality, social exclusion, and food quality are the main factors driving Canada's low physical health and survival ranking. This article addresses these three factors and pairs each factor with solutions on how physicians can help. First, this article addresses economic stability for families and how parental unemployment can have significant impacts on child and youth well-being. Second, this article considers underserved populations within Canada and how social exclusion, a form of discrimination, is associated with child mortality. Third, this article tackles diet quality in Canada and how poor food quality negatively impacts physical health. These interconnected factors must be addressed to improve the health and well-being of children and youth in Canada.

Income Inequality

Income inequality drives child mortality.[3] Household poverty can negatively impact many aspects of child and youth well-being, including cognitive development, physical health, increased rates of unintentional injury, poor vision, and iron deficiency anemia.[4] The COVID-19 pandemic and the resulting school closures worsened these existing inequalities.[5] These problems are especially concerning in Nova Scotia, where child poverty increased more in 2022 than in any other province.[6]

Physicians should tackle these issues by advocating for better policies and working with impacted communities. To drive progressive policy change, physicians should advocate for maintaining and increasing financial support for children and their families and caregivers.[7] The UNICEF report shows that such support measures, including the Canada Child Benefit and additional supports in response to the pandemic, significantly reduced child poverty.[8] However, the end of these pandemic measures threatens to reduce these hard-won gains, and leaves the current financial support measures insufficient to keep up with rising inflation rates and cost of living. This is why Canada's federal, provincial, and territorial governments must boost financial support to prevent a rise in childhood poverty. Governments can achieve this by providing regular funding, such as child benefits (universal or quasi-universal) and Universal Basic Income to support families of low socioeconomic status, as well as by supporting sustainable community centers.[7]

At the community level, physicians can also work with community services to improve physical health outcomes for children regardless of their financial situation. For example, in Montreal, the Dr. Julien Foundation largely inspired the social pediatrics movement.[9-10] This movement improves the social determinants of children's health by integrating health and social care clinics, engaging the whole family, and taking a holistic view that focuses on children's and families' needs and aspirations, not merely their medical problems.[9-10] Similar active but isolated initiatives exist in Ottawa with the More Than Just Soup program, as well as in Vancouver with the RICHER (Responsive, Intersectoral-Interdisciplinary, Child-Community, Health, Education and Research) Social Pediatrics Model, to foster access and reduce inequities in inner city children's health.[11-12] The Community Social Pediatrics model has been shown to reach many children living in vulnerable conditions and provide them with medical, social, and legal services.[13] However, these initiatives are currently small-scale, confined to a few cities, and face challenges related to funding and sustainability.[14] Pediatric physicians and hospitals need to integrate social pediatrics by expanding existing programs to reach those who currently lack access.

Social Exclusion

Social exclusion, defined as the process by which certain groups of people are systematically excluded or neglected, is one of the strongest predictors of morbidity and mortality risk early in life.[2,15] Canada has historically discriminated against underserved populations such as Black, Indigenous, and immigrant and refugee populations.[16-17] This is still a problem today. For instance, areas with a high concentration of Indigenous people have up to 3.9 times higher infant mortality rates compared to areas with low concentrations of Indigenous people.[18] In addition, the number of immigrants and refugees is growing.[19] The UNICEF report highlights Canada's poor performance concerning vaccination rates, suggesting that our public health policies may not be inclusive enough to protect all children against serious and potentially life-threatening illnesses such as measles.

Physicians must help policymakers and government officials understand how current health and social polices affect equity-deserving groups in Canada. Efforts should begin by gathering data about the circumstances of and impact of policies on specific underserved populations, as the European Coalition of Cities Against Racism's recent action plan has proposed.[20] Equipped with this information, physicians can then help modify existing policies or create new policies that are more equitable to underserved populations. Some ways to accomplish this include intervening to ensure equal opportunities, particularly for access to education, such as developing teaching materials on respect for human dignity, peaceful coexistence, and intercultural dialogue. At the educational policy level, Dr. Kannin Osei-Tutu and colleagues (2022) proposed adding anti-racism as a new CanMEDS role.[21] This is important to overcome Western medicine's historical legacy of exploiting and dehumanizing underserved populations.[22] It will also educate medical trainees entering the profession about their valuable social responsibilities.

Addressing discrimination is also important. In Canada, the federal government is in the process of doing so with their new anti-racism strategy 2024-2028.[23] Physicians should advocate for these policy strategies including continued implementation of the United Nations Declaration on the Rights of Indigenous Peoples and the United Nations Declaration Act, advancing Indigenous language revitalization, providing federal grants and contributions to help increase the capacity of grassroots not-for-profit organizations serving Black communities, and combatting anti-Black racism in Canada through the Supporting Black Canadian Communities Initiative.

Physicians have an important role as leaders and advocates to prevent social exclusion experienced by children and youth. Physicians should lead and advocate in collaboration with other HCPs including nurses, receptionists, social workers, and other allied health. As an example, a successful initiative called "Our Kids' Health" by Dr. Ripudaman Singh Minhas, a developmental pediatrician in Toronto, tackles social exclusion by translating and adapting evidence-based pediatric healthcare information to better inform minority groups, including in languages such as Punjabi, Tamil, Arabic, Ukrainian, Inuit, and Filipino.[24] While exercising their social responsibilities may be challenging for physicians who are overwhelmed with their other responsibilities, open communication and collaboration will help address this challenge.[25]

Food Quality

Finally, this article addresses the quality of food and goods available to children and youth. While childhood obesity is a complex challenge, one of its principal policy-level causes is high-calorie consumption due to the affordability and availability of processed and marketed foods.[26-27] The types and quantities of imported foods and tariffs can precipitate increased supply and potential consumption of unhealthy food items in the population's diet such as high-fructose corn syrup. By lowering tariffs, trade agreements such as the North American Free Trade Agreement make it easier for people to eat unhealthy foods.[28] In Canada, the more severe the household food insecurity, the higher the consumption of ultra-processed foods and the lower the diet quality among children and youth.[29]

Solving this problem requires policy changes, particularly in collaboration with the private sector. Since the private sector produces most of our society's food, governments must engage in ongoing dialogue with these entities and enforce policies that hold them accountable for the harm they may cause. The Commercial Determinants of Health (CDOH) are defined as the private sector activities that affect people's health with some risk factors including obesity, physical inactivity, social media and news platforms, smoking, vaping, air pollution, and alcohol use.[30-32] The CDOH affects everyone, but especially children and youth.[31] The current CDOH model suggests that governments may prioritize private sector profits over public health, which prevents effective public health efforts to

improve children and youth's food quality and diet. As such, there is an urgent need for political and economic change to redirect current norms towards the public's best interest, as well as remind the government of their obligation to prioritize healthy food quality and not merely corporate freedoms and profits.[33] At this policy level, regularly involving research and content experts such as Health Canada Food Inspection representatives, clinical nutritionists, and financial advisors in policy decisions will be important to make informed policy choices. For example, a public procurement policy where the government purchases healthy local foods for children and youth at school has been shown to improve kids' health while supporting the local economy and encouraging healthy food production.[34]

Physicians can leverage their health expertise and influence in society to improve food quality for their younger patients by working with these groups. A study in Guelph, Ontario found that a Fresh Food Prescription (FFRx) program significantly increased the families' consumption of healthier foods including fruits and vegetables.[35] They also found that families preferred food prescribing rather than going to the food banks due to the convenience, food quality, and less stigmatization. The concept of food prescribing has also inspired a more general social prescribing movement in Canada. Initiatives include the Rx: Community Social Prescribing Pilot of the Alliance for Healthier Communities across Ontario as well as the national Canadian Institute for Social Prescribing. While prescribing food is still in the early stages, preliminary findings such as the FFRx study described above have been encouraging.[36] Furthermore, these incremental improvements add up and may result in life-changing impacts for Canada's children and youth.

Conclusion

This article highlights the challenges children and youth in Canada face to achieve optimal physical health and survival. Issues surrounding income inequality, social exclusion, and food quality in Canada need to be addressed at a policy level and community level to improve the physical health of children and youth. Key recommendations include:

1. **Address income inequality**: Physician involvement and support to integrate health care and social care is critical; particularly in addressing challenges families may face such as food insecurity. At the community level, this involves collaborating with various local groups such as social pediatric hubs, social workers, nurses, and food banks. At a policy level, this involves policy changes to provide universal basic income to help support families financially.
2. **Tackle social exclusion**: Physicians should advocate for the health and well-being of all children and youth, with a focus on identifying and tackling direct and indirect forms of discrimination against underserved populations such as Black people, Indigenous people, immigrants, and refugees. At the community level, this involves increasing access by providing healthcare services in multiple languages as well as by collaborating with all HCPs including medical learners. At a policy level, this involves improving education and policies to actively fight against racism in Canada.
3. **Promote food quality**: Physicians should use an evidence-based approach to communicate and educate key groups about quality food resources in Canada. This is important to improve the health of children, youth, and their families. At a policy level, this involves advocating for public health efforts and collaborating with the government to hold the private sector accountable.

Successful implementation of these recommendations will require a joint effort between physicians, other HCPs, government, patients, and the private sector. By working together, we can create a healthier future for children and youth in Canada.

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Humanities

Medicine in film: Exploring dementia in *The Father* (2020)

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Worldwide, an estimated 57 million people are affected by dementia, a broad term used to describe neurocognitive decline that impacts daily functioning, and the etiologies are heterogeneous, ranging from Alzheimer's disease to traumatic brain injury.[1,2] Presentations of dementia are also variable but can include progressive memory loss, hallucinations, or agitation.[1,3] When medical students learn about neurological disorders through traditional means, such as lectures or medical literature, the descriptions of signs and symptoms, while helpful, may lack a patient perspective. Often, the focus is on the disease process and management with little attention, if any, to the lived experiences of patients. As a result, it may be difficult for learners to appreciate what patients with dementia and their families experience daily, which can negatively impact the patient-provider relationship. What do these symptoms look like? How do they affect day-to-day functioning and familial interactions? Without firsthand experience seeing it, one can only imagine. Considering many medical students view their education as lacking sufficient exposure to dementia and feel unprepared to work with this patient population, learning through film may prove beneficial.[4–6] Through this medium, it may be possible to have a nuanced and insightful exploration of dementia and how it might manifest. Spoilers ahead!

The Father (2020), directed by Florian Zeller, follows the life of 80-year-old Anthony (Anthony Hopkins) and his daughter and caretaker, Anne (Olivia Colman), through his experience living with dementia.[7] Although the specific type of dementia is never revealed, what is important is his experience rather than the diagnosis itself. The non-linear story arc presented from Anthony's perspective invites the audience to enter his world and experience his dementia together. I hope to highlight three aspects of dementia that were portrayed—cognitive fluctuations, changes in mood, and impact on relationships.

We are first introduced to Anthony arguing with Anne over a caretaker whom he suspects has stolen his watch that he purposefully left out in the open. When pressed about where he placed his watch, Anthony hastily replies, "I don't know and I don't remember" (04:38-04:39). His response encapsulates the mental state that we observe for the rest of the film, one filled with confusion and declining memory. However, our objectivity as observers is soon called into question in the next scene as Anthony finds a strange man in his flat who claims to be Anne's husband. As Anne returns home and Anthony goes to clear up this misunderstanding, we see the shock and fear in his eyes as he realizes Anne is not the same Anne we previously met. Rather, she is a different person altogether (now played by a different actress). We come to understand that our perception of reality, presented through Anthony's experience, is distorted, forcing us to question who Anne truly is. As the film progresses, these distortions in his perspective occur repeatedly through changes in the physical environment or the people themselves. We learn that Anthony is weaving together a narrative from his memories both past and present, but never one that truly represents the real world.

This film also skillfully exhibits Anthony's erratic emotional states. In many instances amidst his forgetfulness, he is presented as a passive and frail individual who accepts the reality he is told. However, when Anne introduces Anthony to a new caretaker, he is surprisingly charming, sharp, and witty, bringing this guest to laughter, yet moments later, he halts the cordiality by describing the guest's laughter as inane. He then goes on to command the situation, capturing the attention of everyone in the room, and clearly articulating that he does not need assistance and will not leave his flat. A completely new side of Anthony is revealed, not the Anthony we have previously seen who is forgetful, slow, and confused. Instead, we get a glimpse of Anthony in his prime, a force to be reckoned with. In contrast, by the end of the film, Anthony finds himself in a nursing home, breaking down and crying for his mother, "I don't know what's happening anymore. Do you know what's happening?" (1:29:46-1:29:51). The sad truth is, no, we don't. As much as we want to help Anthony, we are just as lost and powerless as he is.

Another central theme is the toll that dementia can have on familial relationships. Anthony deeply cares about Anne, and when she informs him that she will be moving to Paris, he believes that she is "abandoning [him]," (09:43-09:44) and wonders "[w]hat's going to become of [him]" (09:52-09:53). Later at the dining table, Anthony walks in on Anne's husband trying to convince her that a nursing home is where her father would have the most appropriate care. Anthony pretends as if he heard nothing to avoid making a scene. However, his dementia soon manifests itself when he departs for more food only to re-enter the dining room overhearing the exact same conversation again. Anthony's loss of temporal aware-

ness forces us to relive this feeling of betrayal as matters are discussed behind his back. In yet another poignant scene, Anne's husband is fed up with Anthony and slaps him across the face multiple times as Anthony cowers in fear. As Anne rushes into the commotion, her husband is not the same man we saw hurting Anthony (the actor has once again changed). By this point, we know Anthony's perspective, like ours, is flawed and are uncertain if we witnessed the real abuse of a vulnerable senior or simply his mental projection of his failing relationships and feelings of abandonment. Ultimately, everyone seems to be in a losing situation; Anne eventually places her father in a nursing home and feels heartbreak for being unable to care for him, while Anthony cannot adjust to the unfamiliar environment he finds himself in.

Overall, *The Father* offers a vivid and authentic look into dementia and its various manifestations by having the audience experience Anthony's dementia and its progression firsthand. Perhaps no other film has been able to achieve this feat, where the pain and brokenness of patients and families is palpable. You may be wondering why this is important. In Canada, there are currently over 600,000 people living with dementia, and this number is expected to increase as the population ages.[8] A diagnosis of dementia is life-changing and devastating for many,[9] and as future healthcare providers, we will undoubtedly encounter patients and families living with dementia. Thus, it is of utmost importance that we are prepared and equipped to provide care that is empathetic, compassionate, and patient-oriented so that patients feel supported in their health journey. While this film showcases only one man's experience with dementia, it is undoubtedly a good resource for those interested in beginning the learning process surrounding dementia.

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