Peripheral Arterial Disease And Diabetes In Canada: Is Health Care Really Equitable?

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Introduction

In Canada's current health-care system, the intersection of patient expectations and outcomes has created a situation of inequity, especially for those with peripheral arterial disease and diabetes. Phillips et al.[1] stated that demands on the health systems were likely to increase due to expanding wound care needs and other chronic conditions. Similarly, Gottrup[2] noted that non-healing wounds accounted for a significant portion of health-care budgets. Today, health-care demands are rapidly outstripping resources due to ageing populations with increasing multimorbidity,[3] requiring the examination of our health systems.[4] If health care is to be sustainable, it needs to focus on value, stewardship and equity.[5]

Peripheral arterial disease (PAD) has high morbidity and mortality[6,7] and is often linked to other highly complex diseases such as diabetes,[8,9] cardiovascular disease and stroke.[10] PAD is associated with high resource use and costs related to interventions, medical treatments and chronic wounds. The worldwide prevalence of PAD is over 200 million individuals,[8] with an increase of 25% over the past decade alone.[6] Additionally, diabetes and PAD are increasing in prevalence, creating a pandemic for the 21st century.[11] PAD, even without diabetes, is associated with significant inequities resulting in disparate outcomes.[12,13] If populations, including people with multimorbidity, are to be ensured health and health-related quality of life (HRQoL), a culture shift is needed towards value-based health care and stewardship.[4,11] This article will examine the realities of certain Canadian populations with PAD and diabetes in the 21st century, their outcomes and some strategies to bring Canada back to our original health-care principles for all Canadians, not just the few.

- In Canada health-care demands are currently outstripping resources
- Chronic diseases are associated with high resource use and costs
- Diabetic Foot Ulcers are the most common cause of hospitalization for those with diabetes
- PAD combined with diabetes results in a fourfold increase in minor and major limb amputations
- The elderly and Indigenous are populations in Canada with high rates of amputations secondary to PAD and diabetes

The Canadian Health System

Canada is a vast country with approximately 39,000,000 people in 13 provinces and territories. It has a universal medical system known, informally, as medicare, which is taxation based, publicly funded and, generally, administered by individual provinces and territories. This is in contrast to the USA, which has the most expensive health care in the world,[14] covering a population of just over 340,000,000, nearly ten times that of Canada. Medicare's founding principle was access for all based on need rather than ability to pay.[15] The system originated in 1947 in the province of Saskatchewan[16] and was adopted country-wide by the 1960s, becoming federal law in 1984 via the Canada Health Act.[5,17] This act declared that health care should be funded for medically necessary care, hospitals, diagnostics and physician services.[18,19] Despite its principles, it has not been without controversy. For example, it has been criticized for only covering a narrow range of services, producing long wait lists for elective procedures and being more decentralized than universal[20,21] This last point denotes that funds are transferred from the federal budget to the provinces/territories, which are ultimately responsible for health-care delivery.[22]

Further, the system has profound inequities, especially regarding vulnerable populations such as Indigenous and immigrant populations[23,24] and those of low socio-economic status (SES).[21] These populations have the greatest health-care burden related to PAD, diabetes and their subsequent comorbid conditions.[6,8,12]

Epidemiology Of Peripheral Arterial Disease And Diabetes

PAD is increasing worldwide,[25] for example, its prevalence is as high as 50% in older people with diabetes and is associated with several co-morbid conditions. When combined, PAD and diabetes result in a four-fold increase in foot complications including minor and major limb events (MALE).[8,12,13,26] Contrastingly, while the prevalence of diabetes and PAD are escalating, the rate of lower extremity amputations (LEA) declined in the late 20th century.[27] However, the last decade has shown LEA rates plateauing or escalating, highlighting a possible resurgence of LEAs in those with PAD and diabetes.[27,28] Currently in Canada,[7] 405 LEA are preformed each year with primary etiologies of diabetes and PAD.[29] In fact, diabetic foot ulcers (DFU) are the most common cause of hospitalization associated with diabetes and 85%

of all LEAs in those with diabetes are preceded by a DFU.[30] The potential effect on the system will be profound due to the costs, both direct and indirect, of amputation, and these costs will continue to rise.[10] A 2015 cost analysis predicted that, by 2023, diabetes would cost over $16.9 billion, 17% of Canada's 2023 health-care budget.[31]

The Canadian Institute for Health Information (CIHI) provides disease and health statistics for Canada; however, statistics specific to PAD are not well reported. Nevertheless, we know that in 2022, there were 5,579,200 people with hypertension and 2,372,700 people with diabetes. In contrast, only 160,441 people over the age of 18 self-reported physical activity of 150 minutes per week.[32] Due to the lack of Canadian-specific data, figures from the USA are often used to determine disease effects, costs and resource allocation. However, there are many glaring differences between Canada and the USA, including race, SES, and education;[14,15,33,34] therefore, these data must be interpreted with caution. In the USA, the incidence of PAD is highly impacted by race, geography, SES, education level and income.[8,35]

The American Heart Association (AHA) describes atherosclerosis (AS) as a, "chronic, reparative, inflammatory process that affects the arterial tree systematically".[8] PAD, as a consequence of AS and associated with diabetes, is highest in marginalized demographics[6,10,35] and is associated with ageing, with a prevalence of over ten percent in those aged 60-70 and even higher in those over 80.[7]

A pivotal review of Canadian ageing and health care by Wister and Speechley[20] examined the health-care system and its demands. They identified tensions in three areas: increasing life expectancy with concurrent multimorbidity, interrelationships of the Baby Boomer (1945-1965) generation's health status and health-care improvements and, finally, the disconnect between health-care demands, system efficiencies and patient expectations. The authors identified health costs in 1975 as nine billion, which increased to 148.2 billion in 2013, far exceeding prior projections. They also recognized that older adults consume the majority of those costs, with those over 65 years old (15% of the population in 2011) responsible for 44% of health-care costs. These authors cited five leading contributors to health-care costs in Canada: smoking, alcohol use, lack of exercise, obesity and stress. In looking at the boomer generation, they found that while these individuals had lower smoking and alcohol consumption, they were more sedentary and had more obesity and stress. This resulted in an improvement in some costs, i.e. for lung and liver disease, but increases in others, such as cardiovascular diseases and diabetes.[20] Moreover, in an article by Sun and Rieder,[36] chronic wounds, often associated with PAD and diabetes, were a significant cause of personal stress.

In Canada, much of the research regarding PAD, health-care demands and disparities has been done in vulnerable and rural populations. For example, in a retrospective review by Shah et al.,[9] the authors found that more than 80% of LEAs in Canada were a result of diabetes and were preceded by non-healing wounds. In Ontario, they found that First Nations (FN) people, also referred to as Indigenous, have a high and escalating prevalence of diabetes. Despite similar rates of MALE for Indigenous and nonindigenous people, Indigenous individuals still had higher rates of LEAs despite age or gender. The authors used CIHI data for Ontario, excluded non-PAD-related amputations and followed these people forward for all-cause mortality finding that they also had a higher rate of mortality than non-indigenous people with LEAs. The median survival of FN people after LEAs was 3.5 years, compared to 4.1 years for nonindigenous Ontarians.[9]

In another Canadian study, using a retrospective cohort design from a purely geographic perspective, the authors found that LEA occurred most often in people living in a rural location (northern Ontario).[37] Specifically, there was an inverse relationship between the number of chiropodists and podiatrists per 100,000 population and amputation rates. Moreover, access to vascular specialists supported lower rates of LEAs. These findings highlight the existence of health-care inequities for people with PAD and diabetes related complications, especially in non-urban areas. The

authors identified three strategies to best address these inequities: screening those with diabetes for PAD, improving access to specialists and timely revascularization when required.

Referrals to specialist care in Canada vary greatly.[38] However, strategies to address these inequalities could include virtual care, satellite multidisciplinary clinics and preventative initiatives to lessen the burden of disease, thereby lessening the burden on the system.[39,40]

Equity And Health-care Demands

Worldwide, amputations related to diabetes occur at a rate of one every 30 seconds.[12] In a study by de Mestral et al.,[37] the authors undertook a complex analysis of health-care services in Ontario, focusing on LEAs related to diabetes and PAD. By linking databases to best reflect the population and using a detailed costing analysis, they were able to identify regional variations in outcomes and health-care provision. This study also showed that Ontarians living in remote regions, who are often Indigenous, did not have access to the same health care as regions where amputation rates were lower. However, they were unable to quantify how many LEAs may have been avoided if individuals had lived in a region with better access to care. Another limitation of the study was the inability to adjust for confounding variables, such as smoking, comorbid conditions and SES.

Further, the study by Shah et al.,[9] which also focused on an Indigenous population, found that despite the region, this population had a greater prevalence of diabetes compared to nonindigenous Ontarians. Their data corroborated the existence of differences in the provision of and access to health care between urban and rural settings, despite ethnicity. They also showed that while the rate of revascularization procedures was not dissimilar, LEA rates were higher in people of Indigenous origin. This was regardless of region, potentially supporting the concept that race alone may affect the incidence of atherosclerosis. However this study's limitations were a lack of SES data, its retrospective methodology and that it did not distinguish between diabetes types. Ultimately, the conclusion was that health inequities related to the care of diabetes and PAD exist for Indigenous Canadians. This inequity is likely associated with a decreased HRQoL. Despite there being only a few studies on PAD and HRQoL, those that exist have shown that PAD produces a significant decline in HRQoL.[41,42]

Health literacy also plays a part in addressing equity, with a person's ability to access accurate, understandable information either supporting or detracting from their ability to satisfy their expectations.[43] In one article, health literacy was noted as essential for managing illness and promoting self- agency towards wellness.[44] In another article by Wister and Speechley,[20] these authors also recognized the role of health literacy and education as being protective of health while expectations and a sense of entitlement potentially increased system stressors. However, they contrastingly noted that the boomer cohort was highly heterogeneous and included many without health literacy or education. Vomos et al.[44] noted that nine out of ten Canadian seniors were unable to interpret, understand and participate in health-care decisions on their own. By addressing these issues, both HRQoL and equity can be impacted to help manage health-care demands and improve HRQoL.

Patient Expectations And HRQoL

People with PAD report fatigue, loss of activity, social isolation, loss of productivity and depressive moods.[45,46] Patient-related outcome measures (PROMs) are a powerful way to translate symptoms into understandable data.[47] PROMs have been utilized to help gain the patient's perspective and capture HRQoL data, leading to improved guidelines and registry information related to PAD.[41,48] Additionally, a therapeutic empathic approach by clinicians has been shown to impact patient satisfaction and further improve HRQoL.[49-51] These strategies to include patients in research and decision making, especially those with PAD and diabetes, can profoundly impact their HRQoL.[7,45]

Amputation-free survival (AFS) is an important outcome for HRQoL in persons with PAD and diabetes, as AFS is associated with decreased

mortality and improved productivity.[10] However, in a multicentre retrospective cohort analysis, the authors included no PROMs.[52] Despite the authors going into extensive detail on definitions, guidelines, treatments, and outcomes, the lack of PROMs limits the validity of their results. Research including PROMs in this group of patients could ensure that they, not just clinicians, see outcomes as successful. Moreover, engaged patients are often more likely to be invested in outcomes, which can reduce costs associated with late diagnoses and complications.

Strategies For Sustainability

While it is challenging to calculate costs associated with health care for PAD and diabetes in Canada, research has shown that prevention would be less expensive than treatment. In the study by de Mestral et al.,[37] total costs one year prior to amputation were between $51,189 and $74,532 per person and by region (2017 dollars), higher than those for the average Canadian with PAD and diabetes who did not have an amputation.[53] These costs included hospital and home care, procedures and diagnostics, physician fees, rehabilitation, allied care, assistive devices and funded podiatry. These authors proposed that multidisciplinary teams could not only prevent LEAs, but also contain costs with early recognition and standardization of care.

PAD and diabetes create a heavy burden on the health-care system, necessitating early recognition and preventative strategies.[8,54] Guidelines were first issued in the 1980s to aid clinicians and patients in decisions about appropriate care for specific conditions such as diabetes.[55,56] The uptake of guidelines, however, was not standardized,[35] and the USA and the United Kingdom introduced a variety of methods to push for their use.[57] As a result of such initiatives, guidelines have evolved and become a standard part of many practices. Today, organizations such as the AHA,[8] the Canadian Diabetes Association,[58,59] Wounds Canada,[60] the World Federation of Vascular Societies[61] and the International Wound Group on the Diabetic Foot,[40,62] have all created evidence-informed guidelines and/or best practice recommendations to address the burden of PAD and diabetes. Ideally, the use of these will improve practice and contain costs. The standardization and utilization of these guidelines are needed to ensure the sustainability of the Canadian health-care system. Nevertheless, in Canada, only Ontario, Alberta, British Columbia and Quebec have undertaken major system reforms, with varying degrees of effectiveness,[5] and guidelines are still not standardized into practice. In 2011, a review of primary care reforms in Ontario identified little value for dollars spent.[22] In contrast, longer term data from the same review showed improved access to primary care teams and diabetes screening, suggesting time is needed to indeed see effect. Supporting this, patient-reported experience did not improve in the time frame of the study. HRQoL, value-based care, and standardization are all needed to create a sustainable health-care system in Canada today and into the future.

Conclusion

PAD and diabetes, their comorbidities and complications, such as hard to heal wounds, result in significant health-care expenditure. Determining actual costs beyond just efficacy, is needed to determine value.[63] Beyond redesigning the health-care system, a culture shift is needed as the demands on the system are neither unidirectional nor easily predictable. Lack of improvements in health literacy, education and SES in some demographic groups, are creating an increasing divide between those with and those without these benefits. This is causing a convergence of multidimensional demands stressing the system.[64,65] Health-care systems need to be proactive and responsive, focusing on prevention, collaboration and efficiency while not letting quality suffer.[20,35,63] PAD, diabetes and their subsequent comorbid conditions, including wounds, are, and will be, drivers of these system demands.[8,66] Early diagnosis and management that takes the patient's experience and knowledge into account requires system redesign. The original Canada Health Act needs to evolve to achieve sustainability. This must involve multi-

disciplinary teams, the use of evidence-informed guidelines, improving health literacy and ensuring equitable access for all.[8,10,15]

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