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Canadian Healthcare System: Trends, Solutions and Implementation Scenarios

January 2024

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Abstract

Healthcare systems encompass a wide range of elements, including healthcare facilities, healthcare professionals, funding mechanisms, government agencies, public health initiatives, and the overall infrastructure designed to provide healthcare services and promote the well-being of individuals within a specific geographic area or country. These systems are often quite complex due to the multitude of factors involved, and they play a critical role in maintaining and improving the health of a population.

The Canadian healthcare system, like healthcare systems around the world, is constantly evolving in response to changing demographics, medical advancements, and societal needs. The purpose of this paper is to 1) Elaborate the trends in the Canadian healthcare system, 2) Describe the Canadian healthcare system – stakeholders, challenges, and opportunities 3) Consolidate best practice examples and 4) Propose recommendations, scenarios, and roadmap - Innovations and policies that could accelerate implementation.

To address the challenges in healthcare system of Canada and to discuss innovative solutions, Innovation Think Tank Siemens Healthineers Canada organized 4 Capacity Building programs which included the participation of over 150 students, academia, industry professionals, and executives from different parts of the world. The programs focused on topics like frugal biomedical innovations, digitalization, access to care in low resource settings, disease pathways, impact of digitalization and artificial intelligence on different disease pathways, cost containment of Healthcare Systems and many more. The outcomes from the workshops were presented to juries, including academic and industry experts. The key opinion leaders also shared their valuable insights on relevant topics with the participants throughout the program.

The Innovation Think Tank Healthcare System Framework (ITT HSF) was used to collect, examine, and validate information about trends and challenges related to the Canadian Healthcare System. Learnings during this process also gave insights into improvement of the framework.

Keywords: Healthcare System of Canada, Innovation Think Tank, Healthcare System Framework, trends, challenges, Siemens Healthineers

Introduction

Canadian Healthcare System

Founded on Indigenous lands and the product of a Confederation that united former French and British colonies in 1867, Canada is a complex project. More than forty million people from a wide range of ethnocultural backgrounds live across six time zones and eight unique temperature zones over a huge landscape surrounded by the Arctic, Pacific, and Atlantic Oceans [1].

Canada's healthcare system has undergone various evolutions over the last several decades, culminating in a largely publicly funded system, driven by the country's ten provinces and three territories. As such, and notwithstanding federal government funding conditional on compliance with certain requirements outlined in the *Canada Health Act*, Canada's healthcare system is, in fact, thirteen different systems, each of which is heterogeneous due to varied geographies, demographics, histories, healthcare provider profiles, and some remaining private provision (e.g., mental health and pharmaceuticals) within the respective provinces and territories [2]. This decentralized system of governance is consistent with Canada's longstanding system of federalism, which results in provincial and territorial autonomy in a variety of public policy domains. As a consequence of this heterogeneity, Canadian provinces and territories have the capacity to act as individual incubators of healthcare innovation.

Indeed, Canada's journey toward a robust system of public funded healthcare resulted from the public policy entrepreneurship of the Government of Saskatchewan, which was the first Canadian jurisdiction to introduce public hospital care in 1940s. Gradually, other provinces and territories replicated the Saskatchewan model, in part due to an eventual federal commitment to fund a portion of such services. Then, in the 1960s, this pattern repeated itself, with Saskatchewan expanding its publicly funded healthcare regime to services provided outside of hospitals. Once again, the other provinces and territories gradually followed suit, encouraged by further federal funding [3].

In many ways, regional autonomy within a broad national framework is the 'secret sauce' of the Canadian healthcare system. This dynamic allows for a strong and consistently upward-moving floor for the quality of care in the country, while not preventing locally responsive healthcare services. Though a degree of fragmentation might slow the rapid scaling of healthcare successes, it also constrains the downside risk of less successful health policy experiments and does not preclude the emulation of breakthroughs in healthcare delivery and administration—as demonstrated through the aforementioned policy developments in the 1950s and 60s. Any analysis of innovation in Canadian healthcare must be keenly aware of this dynamic of decentralization, and the enablers and roadblocks it entails.

Current Challenges, Government Policies and Trends in Canadian Healthcare System

Akin to other healthcare regimes across the globe, Canadian healthcare systems continue to manage operational scarring resulting from the COVID-19 pandemic.

A build-up of diagnostic and surgical backlogs, a burnt-out healthcare workforce, and a demand for vastly improved long-term care and homecare services have each generated unique complexities and unique policy responses within provincial and territorial healthcare systems. Notwithstanding these more recent pressures, however, Canadian healthcare systems continue to struggle with more conventional healthcare challenges, including an aging population, lack of access to primary care and mental healthcare, and escalating healthcare costs. In short, Canadian healthcare systems are systems under strain.

With respect to cost, total healthcare spending in Canada in 2022 exceeded $330 billion, following annual growth rates of 13.3% and 7.6%, in 2020 and 2021 respectively. Roughly one quarter of healthcare spending across the Canadian systems is committed to hospitals; thirteen percent of healthcare spending is committed to physicians; and an additional thirteen percent of spending is committed to drugs. These spending totals result in Canada being one of the highest per-capita healthcare spenders in the Organization for Economic Co-operation and Development (OECD) [4].

With respect to current operational pressures, the Canadian Medical Association (CMA) has estimated that: cancer screening remained 20%-35% below pre-pandemic levels, as of 2021; in-person visits for chronic disease care decreased 68%-94% between 2019 and 2020; and there were 4000 excess deaths not related to COVID-19 and due to delayed care, in 2020. In their November 2021 report, the CMA indicated a national procedural backlog of 327,800 [5].

More promisingly, however, Canadian healthcare systems are increasing adoption of emerging medical technologies, including: remote diagnostics, patient monitoring, and care management; improved point-of-care testing; and artificial intelligence (AI) in healthcare [6]. These developments will be key in addressing the aforementioned challenges, and significantly improving performances in other areas of the provincial-territorial systems.

Materials and methods

Innovation Think Tank (ITT), the central innovation function within Siemens Healthineers (SHS), serves as a bridge between various business lines within SHS and the wider customer community. ITT leverages its co-creation activities to offer a collaborative environment for the advancement and commercialization of healthcare solutions in a sustainable manner.

ITT activities in Canada commenced in October 2021 with the first ITT Capacity Building Program addressing critical healthcare challenges at the BioNext medtech incubator at Western University, London, Canada. Soon after the workshop, the Western University researchers wrote a proposal to the University's Strategic Priorities Fund to establish a new program in Frugal Biomedical Innovation

within the School of Biomedical Engineering. ITT was happy to support the application through a letter of support as an industrial partner willing to collaborate on the delivery of ITT programming targeting the effective development of medical devices and medical imaging technology for low-resource settings. Following the grant approval, Western University researchers and SHS collaboratively organized the second ITT CP in July 2022, focusing on frugal biomedical innovations. In addition to the London institutions and SHS, collaborative partners from universities in Kenya and Uganda - including Kenyatta University, Mbarara University of Science & Technology, and Makerere University - played a crucial role in organizing and conducting the workshop. The program focused on translational solutions to address identified healthcare needs in remote and low resource settings [7].

Soon after London, a Pan Canadian ITT capacity building program was organized in September 2022 at the University of Montreal Hospital Research Center. This program focused on investigating how digitalization and AI impact crucial disease pathways.

Due to the favorable outcomes and constructive responses from previous programs, a fourth Capacity Building program was arranged at Western University in March 2023. This program was initiated in response to a request made by the student body of the Imaging Network Ontario (ImNO) during their annual symposium, reflecting the demand and interest from the attendees. The primary areas of emphasis for this program were controlling healthcare system expenses and translating innovative concepts into clinical practice.

Throughout all these workshops, participants were selected based on their diverse backgrounds, skills, and qualifications spanning various disciplines like medicine, nursing, medical science and technology, molecular biology, economics, engineering, architecture, management, and entrepreneurship. During these hybrid programs, over 16 institutions worldwide were represented by more than 150 participants both in person and online to co-create by learning the ITT methodology and applying it to actual challenges. Impulse speeches from key opinion leaders (KOLs) in the Canadian healthcare system ignited inspiration among the participants and offered valuable insights into the substantial challenges and emerging trends across the program's diverse workstreams.

Results

Program outcomes

The four capacity-building programs, each spanning five days, collectively consisted of a total of 400+ trends, 200+ KOL voices, 1000+ pain points and 90+ solution clusters identified and proposed by over 150 participants.

A visualization of the *Canada Healthcare System* was generated and shared with the participants [Figure 1]. This visualization depicted the patient's journey in Canada, the diverse stakeholders engaged, their interconnectedness, healthcare expenditure, insurance, available workforce, and more.

Participants offered their insights and feedback on the trends and challenges related to the Canada healthcare system. The primary highlights are mentioned below.

Cost of providing services to a rapidly aging population

In Canada, a significant portion of the population, specifically 19%, equating to approximately 7 million people, falls within the age group of 65 and older [8, 9]. Looking ahead to 2046, it is projected that the number of Canadians aged 85 and above will triple, reaching approximately 2.5 million individuals.

Additionally, there has been a noteworthy 16% increase in the population of Canadian centenarians since 2016. Interestingly, the demographic landscape is shifting, with more Canadians now being aged 65 and older than there are children under 15 [10].

This demographic shift in Canada, with the aging of the largest cohort, is set to have a profound impact on healthcare demands in the coming decade. Advances in medical technology, such as cancer treatments, diabetes medications, and improved management of autoimmune conditions, have contributed to longer lifespans. This growth in demand will involve an increase in individuals in need of care, those waiting for long-term care placements, and those who currently rely on informal home care but are seeking professional healthcare services. Addressing the rising costs in the Canadian healthcare system will require a substantial financial commitment and the implementation of effective policy solutions [11].

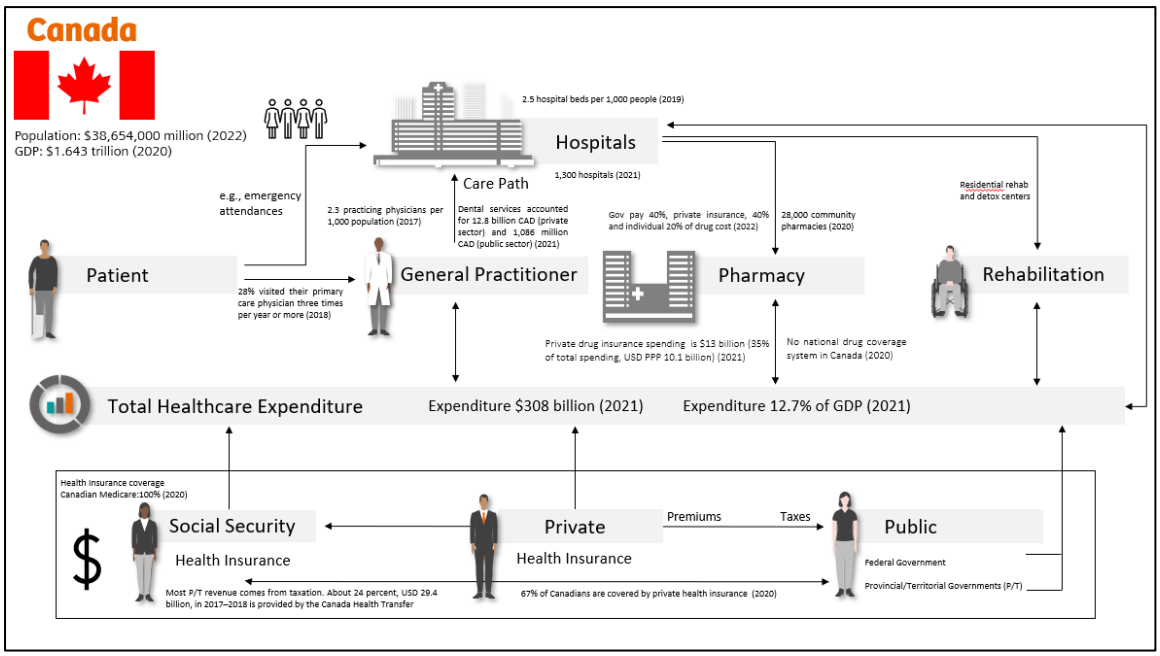

Figure 1: Healthcare system of Canada

Shortage of healthcare staff

From a Canadian healthcare standpoint, the increasing need for medical care among the expanding baby boomer population is coinciding with a notable retirement wave among healthcare professionals from the same generation. This foreseen staffing shortage is exacerbated by an insufficient influx of new graduates into diverse healthcare specialties. At the same time, attrition within the existing healthcare workforce is accelerating, largely due to high stress working conditions, overwhelming caseloads, and limited prospects for career growth.

As Canada anticipates a 7.7% increase in its population by 2028, the country is projected to face a deficit of approximately 44,000 physicians by 2028, with family doctors accounting for 72% of this shortfall. To bridge this gap and reach the average number of doctors per capita in comparison to OECD peers, Canada will need to either train or recruit an additional 30,000 physicians by 2028 [12].

The bottlenecks in this process have emerged due to limited residency positions, a shortage of professionals to assess prospective physicians, and funding limitations. These shortages are exacerbating the strain on the already overburdened healthcare system, as patients unable to secure family doctors resort to emergency rooms**.**

In summary, addressing the chronic shortages will require the recruitment and training of more doctors, especially in high-demand specialties. Increasing the number of residency positions for both domestic and international medical graduates can help tackle some of the long-term challenges. Additionally, implementing technology for virtual healthcare and policies that support the existing healthcare workforce can enhance overall efficiency.

Backlog of procedures

A substantial backlog of surgical procedures, including hip and knee replacements, cataract removal, and the treatment of conditions like breast cancer and lung cancer, has emerged as a result of the pandemic. Additionally, these delays are exacerbated by the fact that hospitals consistently function at near-maximum capacity due to the high volume of patients in need of various levels of care.

Long waiting time

In the years since the Supreme Court of Canada ruled that lengthy wait times for surgeries and treatments could constitute a violation of the Canadian Charter of Rights and Freedoms, the problem has only gotten worse. Health care systems throughout the country grapple with the challenges posed by increasing demographic pressures, backlogs resulting from the pandemic, and the rising demand for mental health services. Additionally, Canada lags behind many other nations in terms of the number of doctors, hospital beds, and diagnostic technologies available, and in a scenario of limited resources and rising demands, the necessity for rationing becomes

unavoidable. Consequently, extended wait times are an inherent consequence of this situation [13].

Health inequity in low resource setting areas

In Canada, there are two fundamental and interconnected structural factors that contribute to healthcare inequalities. The first factor is the unequal access to healthcare services for individuals residing in northern and remote regions of the country. The second factor involves the declining viability of northern and remote communities and the resulting impact on healthcare services available to their residents. Residents in Canada's northern and remote regions face limited accessibility to a diverse range of hospitals, healthcare facilities, specialized clinics, and treatment centers, as these resources are predominantly concentrated in the southern areas of the country. Due to the presence of mountainous terrain, numerous lakes, and fewer roadways, the availability of medical care is restricted [14].

Among Canada's one hundred and two universities, only a dozen are situated in central, northern, or remote regions, and among these, very few provide Medical or Allied Health programs. As a result, many Medical and Allied Health professionals are educated in the southern, urban areas of Canada. This training exposes them to urban and metropolitan healthcare models and practices, leaving them with limited comprehension and abilities for practicing in smaller or more remote settings [15].

To tackle these regional imbalances, diverse telecommunication technologies can be employed. While telemedicine has played a role in mitigating these discrepancies in the northern and remote regions, many extensive areas in northern and remote Canada suffer from inadequate or nonexistent internet connectivity. As a result, the primary step should prioritize improving internet accessibility and speed, as well as ensuring that residents are proficient in utilizing it. Subsequently, comprehensive training should be provided to healthcare professionals for the delivery of telehealth services.

Socio economic determinants

While Canada's healthcare system is considered universal, it still grapples with social and economic disparities. To begin with, the relationship between income and health is multifaceted. Poverty is linked to numerous health hazards rooted in social circumstances, such as housing insecurity, psychological and social isolation, limited access to nutritious food, trauma, injuries, and substance use disorders.

Furthermore, Canada's medicare system covers only specific healthcare services. Prescription drugs, mental health counseling, the majority of home care, physiotherapy, and various other services lack consistent public insurance. This results in many individuals with lower incomes being unable to afford these services, leading them to seek care in emergency departments and hospitals for issues that could have been addressed earlier or prevented altogether.

Lastly, even when services are publicly funded, economically disadvantaged patients tend to utilize fewer preventive and outpatient services compared to those with higher incomes. The grip of poverty continues to present subtle barriers, even when services are ostensibly provided at no cost.

Recommendations proposed

The challenging state of Canada’s healthcare systems can be attributed to a range of factors, encompassing insufficient healthcare infrastructure, ineffective health policies, and inadequate funding.

Canadian healthcare systems must shift focus from simply addressing illnesses to actively promoting and preserving good health. This transformation entails implementing policies that foster healthy lifestyles and enable early intervention for potential health issues.

Governments must also recognize that the healthcare needs of the population are diverse and complex. Therefore, the solutions must also be multifaceted and adaptable to meet these varying needs.

Sufficient funding stands as a pivotal element of a resilient healthcare system. This funding is vital for upgrading healthcare infrastructure, elevating service quality, and ensuring universal access to care for all Canadians. Hence, governments must give priority to healthcare in budget allocations and ensure judicious and efficient use of the allocated funds.

Train and register more healthcare staff

To alleviate the workload of existing healthcare professionals, it is essential to expand the pool of registered and trained individuals in the healthcare sector. This can be achieved by increasing funding for

additional positions in nursing programs at universities and colleges and implementing a more uniform accreditation system. Such a system would enable doctors and nurses interested in working in another province to transition seamlessly, without having to navigate a protracted and costly licensing process.

Build standalone centers to catch up on surgical backlog

Establish publicly funded, independent healthcare centers capable of conducting less complex outpatient surgeries and procedures. This initiative would create additional capacity within hospitals, leading to reduced patient waiting times and facilitating the resolution of the surgical and procedural backlog.

Implement a system to track, prevent staff shortages

Province-wide systems are essential to monitor staffing levels in various healthcare facilities, ensuring a well-balanced distribution of the workforce and averting any interruptions in service.

Provide innovative remote care

In the foreseeable future, advanced technology will empower wearable devices to analyze an individual's sweat, facilitating early disease detection and treatment monitoring, thereby diminishing the necessity for frequent blood tests and medical appointments. These pioneering advancements, including Bluetooth-enabled stethoscopes and blood pressure monitors, will fortify remote healthcare services, with a particular emphasis on underserved communities. Prioritizing the integration of this forthcoming technology, coupled with AI algorithms, into healthcare decision-making is imperative.

Access to electronic health information

Having digital access to health information enhances health management and often leads to a reduced need for in-person visits to primary care providers or emergency departments.

Reduce burden on Emergency Rooms

Develop and utilize interactive questionnaires, AI algorithms, and telehealth to assess patients' urgency and determine whether they should be directed to an emergency room or if they can be effectively treated in a 24/7 intermediate-care facility.

Discussion

In the realm of healthcare, innovation, creative approaches, and essential tools are vital to formulate answers to the current challenges. Canada's healthcare systems are witnessing the emergence of several noteworthy technological advancements. These include the evolution of AI and wearable medical technology, ongoing innovation in telehealth, and the expansion of mental health treatment. These trends are interconnected, giving rise to a dynamic ecosystem of cutting-edge healthcare solutions that are both intricate and full of promise.

ITT offers valuable ideas covering a range of aspects, including individuals, technology, and policies. By consolidating discussions, brainstorming sessions, input from KOLs, proposed solutions, and survey findings, a comprehensive **CARE Canada** implementation plan has been proposed to serve as a guide in tackling the issues within the Canadian healthcare system [Figure 2].

C - Collaboration and Coordination for building Capacity: Foster collaboration among all stakeholders, including government, healthcare providers, MedTech organizations and institutions, to coordinate efforts and resources effectively with the goal of enhancing the capacity of innovation, entrepreneurship, and commercialization.

A - Access Expansion: Prioritize increasing access to healthcare services, especially in underserved regions, through telehealth, mobile clinics, and community healthcare centers.

R - Research and Innovation: Promote research and innovation in healthcare, supporting the development of new treatments, technologies, and healthcare delivery models.

E - Equity and Inclusivity: Ensure healthcare services are equitable and inclusive, addressing disparities among different population groups and regions.

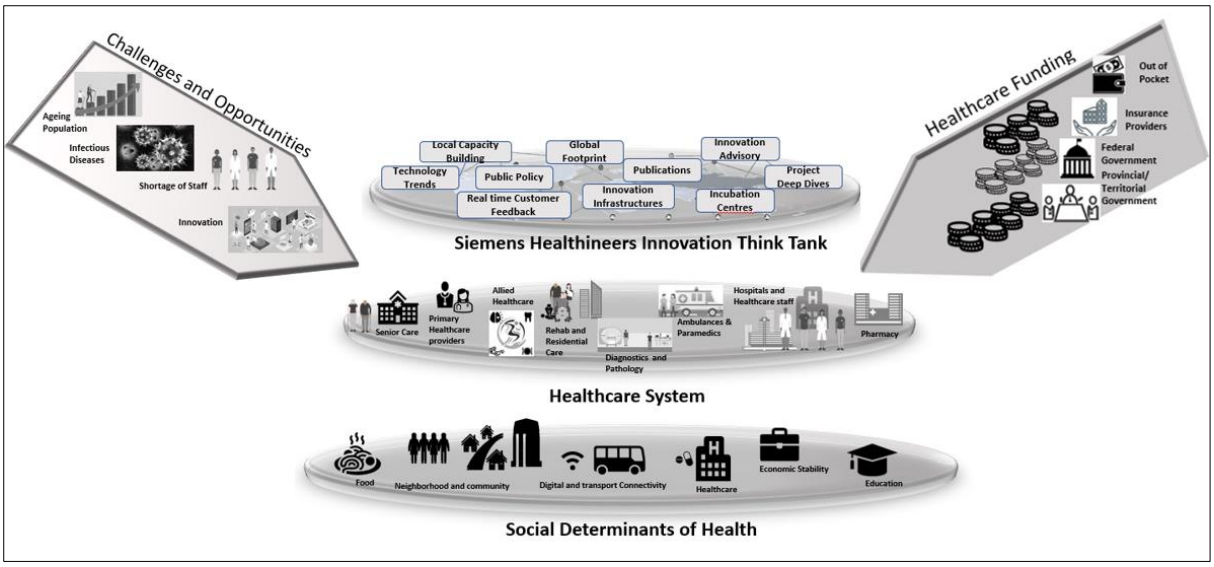

Figure 2: Innovation Think Tank addressing healthcare landscape of Canada

ITT Capacity Building programs play a pivotal role in nurturing the capacity for innovation, entrepreneurship, and commercialization among healthcare stakeholders at all levels. The methodical and well-documented approach to innovation encourages students and researchers to address innovation in a structured manner. This not only reduces turnaround time but also enhances the potential for generating effective solutions. The capacity building initiatives, crafted to confront the challenges of the region, serve as incubators for project ideas that can be explored more extensively to generate distinctive and groundbreaking products or services.

ITT also facilitates the creation of Labs and Incubation Centers, that offer the necessary infrastructure for in-depth exploration of projects and encompass various state-of-the-art technological areas. The global ITT network serves as a readily available group of experts, including clinicians, engineers, and researchers, for internal and external validation processes of products and services. Real time prototyping and productization can be realized taking innovative solutions to the next level of commercialization viability in an Incubation Center. It is widely recognized that technological entrepreneurship plays a pivotal role in expediting economic growth, and one of the primary approaches to stimulate entrepreneurship is by creating incubators.

As government policies significantly influence a country's strategy for supporting innovation, the ITT provides guidance across various aspects of public policy. This encompasses assistance in shaping medical curricula, establishing financial structures for different courses and programs, as well as integrating research-focused initiatives. ITT also offers organizational strategy advisory in identifying the key healthcare trends that impact a customer's business demand, conducting customer innovation organizational assessment to understand the success factors, strengths and weaknesses of the client's innovation system and then defining the best path to obtain them, whether through corporate venturing, partnership, acquisition, or internal organizational development.

Rapid changes in technology are compelling and propelling innovation in the healthcare sector of Canadian life increasing the incorporation of technology in healthcare, such as telehealth, AI, wearables, point of care (POC) devices and other diagnostics and therapeutic devices pioneered and offered by Siemens striving to bring affordable and accessible healthcare to everyone everywhere.

Conclusion

Since publicly funded health care began in Canada, health care services and the way they are delivered have changed a lot. In the current state of affairs, Canadians are enjoying better health than ever before, and in various aspects, the quality of healthcare provided to them has shown significant improvement. However, notable disparities continue to exist between the high-quality healthcare recognized as ideal and the care that a substantial number of Canadians receive.

Enhancements in healthcare can only be realized through the commitment and active participation of all relevant parties, including patients, frontline healthcare professionals, policymakers, funding organizations, insurance providers, medical equipment manufacturers, researchers, and catalysts for innovation like the Innovation Think Tank.

Author contributions

SH has established and confirmed the paper's framework as well as guided and initiated the paper's context. All authors have provided crucial insights and aspirations for the Canadian healthcare context. FN collected the data, analyzed the results, and added content to the whitepaper. All authors contributed to the paper's drafting and approved the final version. The authors do not state any competing interests.

Acknowledgements

We are thankful to our ITT SHS and SHS Canada colleagues for their support in organizing the ITT Capacity Building programs in Canada and compiling this publication. We would like to thank the jury members and the inspirational speakers of each program for providing their valuable insights and discussions during the co-creation events. Finally, we would like to acknowledge all the participants and respondents for their efforts and contributions.

Disclaimer

The information shared in this paper is not an all-inclusive or comprehensive picture of the Canadian healthcare system and is a result of data collection received through surveys and Innovation Think Tank Capacity Building programs. The key purpose of this paper is to provide pertinent information-to decision makers, and budding innovators to systematically analyze the healthcare system and its respective impactful trends and challenges. Some statements in this paper may be forward-looking statements that are based on trusted source research. Survey data may differ factually based on the subjectivity of the surveyors. Large language models were utilized for paraphrasing purposes only.

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Siemensst. 3
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Published by
Siemens Healthineers AG
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