# Exploring the Role of Artificial Intelligence in Enhancing Telemedicine Accessibility, Efficiency, and Healthcare Outcomes in Rural Canada

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## Abstract

This paper evaluates the ability of the integration of artificial intelligence (AI) with telemedicine to enhance access, efficiency, and outcomes of healthcare in rural Canada. Telemedicine is now indispensable in eliminating geographical distance, complemented further by enhanced AI-powered diagnostics and predictive analytics, workflow automation. This narrative literature review gives a thematic analysis of sources, utilizing data from Health Canada, CIHI, TELUS Health, and peer-reviewed research articles. Thematic analysis revealed the consistent obstacles, the most prevalent of which are the lack of broadband and shortage of providers, as well as the emerging potential of AI as a valuable tool to address it. The key findings refer to the fact that AI-enhanced triage systems (such as Babylon, an AI-powered triage system by TELUS Health) help to minimize unnecessary in-person visits, remote patient monitoring with predictive analytics helps to manage chronic diseases, and AI-assisted imaging interpretation is faster when unexpected scenarios such as stroke care are required. According to economic analyses, the widespread use of AI-enhanced telemedicine may save more than $5 billion annually due to benefits in terms of reduced travelling, fewer emergency visits, and increased productivity. The paper draws the conclusion that with the help of adequate infrastructure, well-balanced policy structures, and a culturally appropriate approach to implementation, AI can become the driving force of a more equitable, streamlined, and patient-centered paradigm of a rural health system in Canada.


## Introduction

Rural Canada faces significant healthcare accessibility challenges, services are far from most people and there are longer-lasting differences in health. About four million Canadians or 1 in 5, live in rural areas, but only 200,000 of the country's 82,000 physicians practice in these places (Canadian Institute for Health Information, 2023). As a result of this, many people have faced delays in getting care, have to go further for medical help and still lack access to it. Telemedicine which offers healthcare services remotely, has become very important for connecting rural and urban health services. Thanks to virtual visits, remote checks and distant access to consultants, telemedicine can eliminate distance-related issues for patients. Telemedicine increased in popularity in Canada because physical distancing was necessary during the pandemic caused by COVID-19. The share of virtual care increased since a sideways of all primary care visits only at the beginning of 2020 and then declined to nearly 40% at the beginning of 2021 (Canada Health Infoway, 2021). Although telehealth has become the norm in a short period of time, it has soon become evident that there are challenges, primarily in rural locations.

## Methodology

### *Research Design*

In this work, the narrative literature review approach was utilized to review the available evidence of AI-enhanced telemedicine in rural Canada. A narrative method was chosen due to the interdisciplinary character of this emerging field and to enable thematic analysis of a variety of types of studies.

### *Search Strategy*

Literature searches were conducted across PubMed, EMBASE, CIHI databases, and grey literature from Health Canada and provincial agencies between November 2019 and May 2025. Search terms combined "artificial intelligence," "telemedicine," "rural healthcare," and "Canada" using Boolean operators.

### *Analytical Framework*

Due to various methodological considerations in the newly developed field of AI-enhanced telemedicine in rural Canada, a narrative literature review methodology was used in this study and not a systematic review with formal hypothesis testing. First, the fast-growing nature of artificial intelligence technologies in healthcare implied that evidence available in this area is diverse in study design, implementation setting, and outcome measurements that could not be synthesized through a meta-analysis method or tested with a statistical hypothesis. Second, the interdisciplinary nature of this study (healthcare delivery, technology adoption, economic analysis and policy frameworks) necessitated a versatile method of analysis that would be able to integrate qualitative findings, case studies, pilot programs and government reports with peer-reviewed quantitative research. Third, the small number of randomized controlled studies that specifically studied AI-telemedicine interventions in Canadian rural settings rendered formal statistical comparisons inappropriate, because the evidence base involves mostly observational studies, descriptive studies, and early-stage implementation reports. Last, the research aims were thematic as they were aimed at discovering thematic patterns, studying complex socio-technical relationships, and making policy suggestions instead of testing single cause and effect relationships that would be the subjects of null and alternative hypotheses. Hence, this narrative methodology was considered the most suitable to generalize the heterogeneous evidence at their disposal and make holistic information to guide the future research directions and policy formations in this emerging area.

**Telemedicine Potential and Challenges in Rural Canada:**

Telemedicine in rural areas has made it easier for people to receive medical help. For example, OTN helped with over 540,000 telemedicine consultations last year by avoiding 213 million kilometers of patient travel and saving the healthcare system more than $73 million in travel grants (Canada, 2020). People's satisfaction with these services is usually at a very high level. Even so, using telemedicine is much more difficult for rural communities. Developing digital infrastructure is a big problem, as rural areas in Canada have access to high-speed internet for only 40% of households, while in cities, almost everyone enjoys this service (Canadian Institute for Health Information, 2023). Because of this digital divide, both the quality of video consultation and adoption of enhanced telehealth methods are affected. Rural populations encounter technological literacy barriers and demonstrate limited digital health technology adoption. Healthcare professionals in rural areas experience problems as well such as affordably installing telemedicine, finding support with technology and making their procedures compatible with technology. It was found during the pandemic that 78% of rural providers shifted more than 50% of their sessions to virtual platforms (Burton et al., 2022), yet they dealt with problems like weak internet connection, difficulties using a range of telehealth tools and challenges from billing providers. There are reports (Rahimipour Anaraki et al., 2022). that the use of telehealth made the care gap wider by causing more rural patients to see their doctors less often via video visits. They point out that technology by itself will not solve all the problems; approaches are required so everyone in rural communities receives fair benefits.

**AI as a Game-Changer:** Artificial Intelligence which uses machine learning, natural language and advanced data processes, helps advance telemedicine. AI may help doctors make more

accurate diagnoses, forecast patients' needs ahead of time, automate regular workflows and prioritize individualized care – this all helps healthcare providers to serve more people in a better and more efficient way. When specialists are not available in many locations, AI can be used to triage patients by checking their complaints (e.g., with AI questionnaire apps), examine different X-rays or eye scans and keep tabs on patients' vital signs from afar. A good example is Babylon by Telus Health, a Canadian app that uses a medical chatbot to identify patients' symptoms and suggest possible explanations for them. AI is effective in advising patients about the level of care they need and thus guides doctors on making better use of their time. According to Dr. Wong (MacKay, 2023), an AI expert in Canada, rural communities can particularly benefit because local health practitioners use AI to get additional information when patients are having telemedicine encounters.

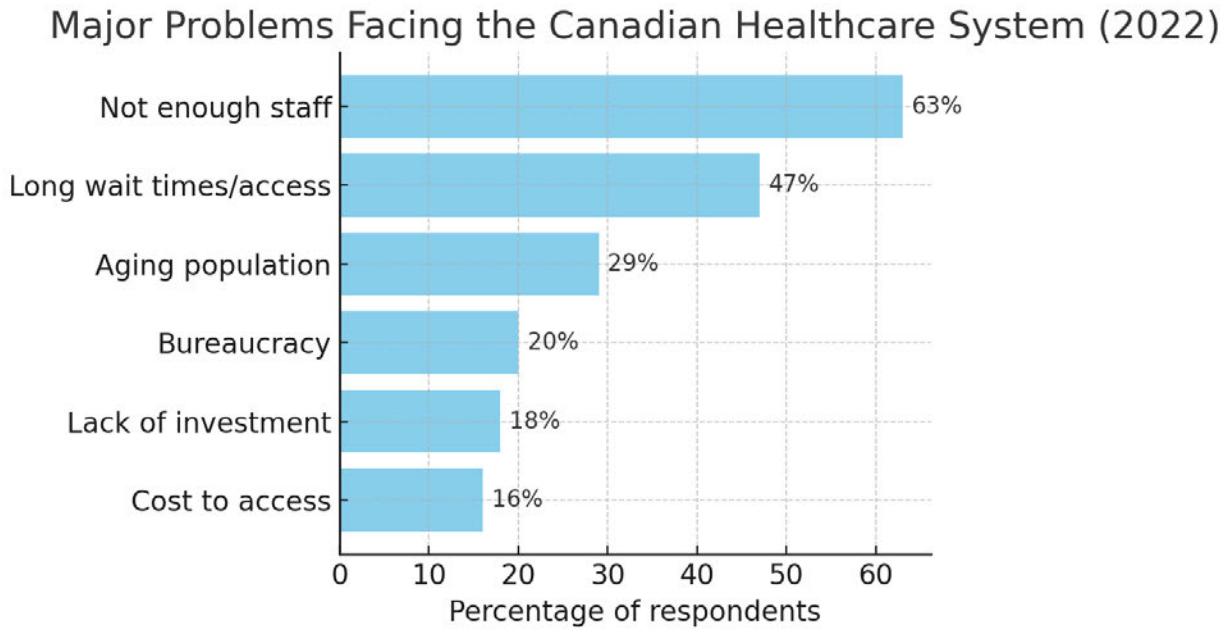
**Study Aim:** In this context, the present review explores the multifaceted role of AI in enhancing telemedicine for rural Canada. The authors look at (1) the primary rural barriers to telemedicine adoption and possible solutions that AI can provide to alleviate these barriers; (2) the current and potential role of AI on healthcare accessibility and patient outcomes in rural telemedicine programs; (3) the economic cost-benefit analysis of implementing AI in telemedicine; and (4) the policy frameworks and ethical dilemmas that modulate or limit the use of AI in telemedicine in Canada. Through integrating evidence published within the past ten years, we will attempt to summarize the findings on current evidence of potential ways to leverage AI and result in more accessible, efficient, and equitable healthcare to Canadians in rural settings.

**Relevance and Significance:** The results of this review will be of importance to healthcare policy-makers, technology developers and rural health practitioners. The current state of the healthcare system in Canada is in the transitional phase, as 18 percentage points lower than in 2020 only 54 percent of Canadians now report a positive experience with the quality of accessible healthcare

(Ipsos, 2022). This decrease is mainly explained by the systemic pressures in terms of workforce shortage and wait time as it is most severe in rural regions. As depicted in **Figure 1**, recent surveys (Ipsos, 2022) indicate that Canadians identify *"not enough staff"* (63%) and *"long wait times/access issues"* (47%) as the top problems in :

**Figure 1**

*Major problems facing the Canadian healthcare system, according to a 2022 national survey.*




*Note.* Staffing shortages and wait times dominate public concerns, data derived from Ipsos Global Health Service Monitor by *Ipsos Global Health Service* https://www.ipsos.com/en/three-five-globally-say-their-healthcare-system-overstretched. Ipsos.

In rural settings, these issues are magnified, but AI-enhanced telemedicine presents an opportunity to alleviate some of these pressures by extending the capabilities of a limited workforce and streamlining care delivery processes. Through an academic inquiry into current literature and data,

this paper illuminates how AI-integrated telemedicine can be a catalyst for positive change, while also discussing the precautions and policies needed to ensure that these innovations are deployed responsibly and effectively (Auditor General of Canada, 2023).

## Literature Review

The literature review is organized thematically to cover the core aspects of telemedicine in rural Canada and the infusion of AI technologies. We first discuss barriers to telemedicine adoption in rural areas, then examine AI's applications and impacts on telehealth accessibility and outcomes. Subsequently, we explore economic analyses of telemedicine (with and without AI), and finally, we review policy frameworks and ethical considerations relevant to AI-driven telemedicine.

### Barriers to Telemedicine Adoption in Rural Canada

**Digital Infrastructure Gaps:** One of the most cited barriers in the literature is inadequate broadband and cellular infrastructure in rural and remote areas. High-quality telemedicine, especially video consultations and AI applications, requires stable internet connectivity. However, connectivity in rural Canada remains suboptimal: about 60% of rural Canadian households do not have access to high-speed internet service (Burton et al., 2022). (meeting CRTC's 50 Mbps download target). By contrast, only 3–5% of urban households lack similar access. This disparity, often termed the "digital divide," is reinforced by findings from the Auditor General and CRTC reports, which highlight that while over 90% of all Canadian households had basic broadband access by 2021 (Auditor General of Canada, 2023), many rural and especially remote Indigenous communities were far behind that benchmark. Without reliable internet, patients and providers face dropped telehealth calls, poor video quality, or inability to use data-intensive AI tools (such as real-

time diagnostic image processing). A qualitative study by Burton et al. (2022) described rural physicians in Western Canada expressing frustration with “inconsistent Wi-Fi” and connectivity issues impeding virtual visits.

**Technological Literacy and Accessibility:** In addition to infrastructure, one can also find disparities in tech literacy among populations. Telemedicine platforms can be hard to use by older people living in rural parts of the country or who are not exposed to digital tools. Geriatric practitioners have cited issues regarding the ability of elderly patients to navigate apps or video interfaces related to telehealth (e.g., managing issues related to downloading the app, logging in or solving audio/video problems). Although Canadian statistics are limited, in the U.S. literature, poorer educational background and older individuals are associated with using less telemedicine and this is most probably similar in Canadian rural populations. Accessibility also has something to do with the presence of proper devices (smartphones, tablets, computers) and assistive technologies among disabled people. No adoption of telemedicine may occur, in case the platforms are not user-friendly and accessible in local languages (including, in Canada, Indigenous languages) (Rush et al., 2021).

**Health System Integration and Provider Workload:** Many rural healthcare providers work in small practices or clinics that may not have dedicated IT support. Introducing telemedicine can add to their workload, especially if systems are poorly integrated with electronic health records (EHRs) or require duplicate data entry (Virtual Care Task Force, 2022). A CIHI analysis observed that half of clinicians using virtual care in Canada said it increased their workload initially, citing “administrative and technical barriers” and poor integration with other systems. For rural practitioners already stretched thin, additional administrative burden is a deterrent. Telemedicine billing can also be complex – until recently, many provincial fee schedules did not reimburse virtual consults at parity with in-person visits, although COVID-era policy changes have improved

this. Inadequate compensation or uncertainty about billing rules can discourage providers from investing time into telehealth services (Virtual Care Task Force, 2022). Also the report by Virtual care task force shows some clinicians express concern that telemedicine might compromise the quality of patient relationships or clinical exam components. A U.S. physician survey found 35% of doctors were unsure if the doctor-patient relationship could be maintained virtually (although those with good tech quality were much more satisfied). It is found in Canada on the rural providers the trade-off between the convenience and the quality of care such that although the telemedicine is flexible, they fear they may miss non-verbal communication or a finding on a physical examination.

**Equity and Trust Issues:** The literature also focuses on the need to implement telemedicine with caution as it may also have a harmful effect on health inequity. There is also the possibility of historically underserved groups (low-income, elderly, or Indigenous populations in rural communities) possessing less access to digital technology or trust in remote care as well, potentially leaving them further behind. Such as, Indigenous people of Northern Canada may experience the poorest connectivity levels and may be adversely affected by specific cultural and linguistic barriers in healthcare; their engagement in the development of telemedicine should result in approaches that would be acceptable and effective. A factor – patients require trust in virtual care and some may not be confident that a phone/video consultation will be able to help them adequately. Community education and proofs of positive results can be a part of trust-building (Fitzpatrick et al., 2023).

**Table 1**

*Key Barriers to Telemedicine Adoption in Rural Canada*

| Barrier | Description | Evidence/Source |
|---|---|---|
| Digital infrastructure gaps | Lack of high-speed internet and cell coverage in rural areas. | 60% of rural households lack high-speed internet vs 3% urban. Real-time Virtual Support in BC needed to invest in rural connectivity. |
| Digital literacy & accessibility | Users' difficulty with technology; lack of devices or assistive tools. | >Half of rural-focused telehealth studies cite user training as needed |

*Note.* Digital infrastructure gaps refer to limited high-speed internet and cellular coverage in rural areas; digital literacy & accessibility refer to users' difficulty with technology and lack of devices or assistive tools. Data adapted from *The potential socio-economic impact of telemedicine in Canada*, by D. Jacobs, A. Balew, G. Langlois, & M. Lapierre, 2022, Healthcare Management Forum, 35(4), 233–240 (https://doi.org/10.1177/11786329221096033). Copyright 2022 by The Authors.

Addressing these barriers is important for any telemedicine initiative's success. Also, many of these obstacles can potentially be mitigated by carefully leveraging AI tools, as discussed next, but only in conjunction with investments in infrastructure and training.

**AI's Impact on Telemedicine Accessibility and Outcomes**

Artificial Intelligence technologies are increasingly being integrated into healthcare (Ernst & Young, 2024), with varied applications that can complement telemedicine. In rural telehealth, AI's contributions can be grouped into several categories: diagnostic support, patient monitoring, workflow automation, and health education/predication.

**AI-Assisted Diagnostics and Triage:** One of the earliest uses of AI in telemedicine is in triage chatbots and virtual assistants. These AI chatbots interact with patients (often via text or voice) to collect symptom information and medical history (Hafner et al., 2021), then provide preliminary advice or direct the patient to the appropriate level of care. In Canada, Babylon by TELUS Health's AI-driven Symptom Checker is a prominent example. Upon launch in British Columbia, it allowed users to input symptoms and then utilized a vast database (500 million data points) (Telus, 2019). to suggest possible causes or actions. For rural patients, such tools can be available 24/7 to answer health questions when local clinics are closed, reducing unnecessary ER visits for minor issues and flagging serious conditions promptly. Research indicates that 70% of common doctor visits could initially be addressed by a virtual consultation or AI triage, freeing doctors to focus on complex cases (Telus, 2019). Another example is AI in radiology: rural hospitals often lack onsite radiologists, so they rely on teleradiology services. AI algorithms can pre-screen imaging (X-rays, CT scans) for urgent findings. Studies have shown high accuracy for AI in detecting certain conditions – e.g., an AI for detecting diabetic retinopathy on fundus images that received FDA approval. Integrating such AI into a tele-ophthalmology program could allow earlier diagnosis of eye diseases in remote communities without waiting for specialist review. AI algorithms for dermatology (e.g., identifying suspicious moles via photos) also hold promise, as dermatology tele consults are viable and AI can help prioritize lesions that need biopsy (Hafner et al., 2021).

**Remote Patient Monitoring and Predictive Analytics:** Chronic diseases are prevalent in rural populations, often due to limited access to preventive care. Telemedicine has addressed this via remote patient monitoring (RPM) programs, like Tele homecare for heart failure or COPD in Ontario (CIHI, 2022). AI can enhance RPM by analyzing the continuous streams of data (vital signs, blood glucose, etc.) to detect early warning signs. For instance, machine learning models can predict heart failure exacerbations days in advance by spotting subtle changes in weight or

blood pressure trends, prompting early intervention (some studies in the U.S. show reduced hospital readmissions with such AI-driven alerts (Ernst & Young, 2024). In Canada, a pilot in Nunavut's Virtual Nurse Practitioner program, while not explicitly AI-driven, demonstrated how data analysis of patient metrics led to significant improvements in chronic care management (CIHI, 2022). We can also imagine adding AI to this program to customize interventions e.g., to predict which diabetic patients will do poorly in terms of glycemic control and prioritize NP outreach to those patients. The other advanced field is the mental health telemedicine: AI-based sentiment analysis software can analyze the words or the speech of a patient in a virtual counseling practice to detect his/her mood or suicidal tendencies in real-time, providing feedback to the therapist with whom they can act (though this should be taken with caution as far as the ethics of the matter are concerned). Research is relatively new, but it is especially applicable in the case of rural and remote locations where there is a limited number of mental health professionals. The effect of the patient falling through the cracks between appointments can be mitigated by providing decision support (such as nudges upon data indicating a patient is worsening) with the use of AI.

**Efficiency Gains and Task Automation:** AI can handle repetitive tasks, which are valuable where human resources are scarce. In telemedicine workflows, this might include automated appointment scheduling, follow-up reminders, or summarizing patient encounter notes. Natural language processing (NLP) algorithms can transcribe and organize information from a teleconsultation, generating a visit summary or updating the EHR, thus saving clinicians time. McKinsey (2020) estimated that integrating AI into administrative processes could save 9–18% of healthcare provider time by 2030. In a rural clinic, where one nurse might be doing both clinical and administrative roles, having an AI assistant schedule follow-ups or flag patients who missed visits can maintain continuity of care with minimal extra burden. AI can also support decision-making: for instance, clinical decision support systems that, given patient data, suggest potential diagnoses

or care gaps (like reminding a doctor that a patient is due for cancer screening). These tools, when embedded in telehealth software, ensure quality of care remains high even in fast-paced virtual visits (Ernst & Young, 2024).

**Improved Outcomes Evidence:** One should question the effectiveness of AI in telemedicine in terms of patient outcomes and provider or patient satisfaction. Current evidence is promising but mixed and often condition-specific. A RAND Corporation study in 2022 systematically reviewed outcomes for AI-supported telemedicine in chronic disease management and found *no systematic reviews indicating worse outcomes with telemedicine vis-à-vis standard care* (Hafner et al., 2021). For chronic diseases like COPD and heart failure, several reviews noted telemedicine (with some AI-driven education or monitoring) can improve quality of life and reduce hospital use, although not all studies show statistically significant differences. In rural telehealth contexts: a notable success story is the use of AI in stroke care (telestroke) (Ali et al., 2020). In Ontario's Telestroke program, while the "AI" component might be limited to decision tools for thrombolysis, the telemedicine aspect has saved many lives by ensuring rural ERs get immediate neurologist input (Canada, 2020). Now, experimental AI algorithms are being tested to interpret brain scans for stroke and advise on treatment within seconds, which, combined with telestroke, could further speed up care in rural hospitals. In terms of patient satisfaction, rural patients often report appreciation for telemedicine's convenience (no travel, timely access), but they also emphasize the need for *human* interaction quality. AI can help behind the scenes, but should not reduce the empathy and communication from providers. Interestingly, a participant from a Nunavut telehealth program said their experience was seamless and "I don't have to talk about a new thing over and over – it's seamless", reflecting how well-designed remote programs (with consistent providers and data continuity possibly aided by IT systems) can make care feel integrated.

**AI in Action – Example Programs:**

- **Virtual Triage and Consultation (Telus Babylon):** As mentioned, millions globally have used Babylon's chatbot. In British Columbia, after initial deployment, it scaled up virtual doctor consultations covered by public insurance. The synergy of AI triage plus video doctor visit is an example of AI augmenting telemedicine efficiency. Early reports (Telus Health, 2020) suggested that a large percentage of users got appropriate advice without needing an immediate in-person visit, indicating effective triage.

- **Real-Time Virtual Support (RTVS) in BC:** In rural British Columbia, the RTVS system was launched (especially in 2020) to connect rural practitioners with virtual specialist support in real-time (e.g., emergency, maternity, pediatrics). While not described as "AI," it has potential to integrate AI analytics. The program had various pathways (one called "CHARLiE" for emergency consults). An evaluation noted it was an equity effort to help rural/First Nations communities (Lauscher et al., 2023). If AI tools like predictive risk scoring (which patient needs higher level intervention) were integrated, it could further strengthen such programs.

- **Chronic Disease AI Monitoring (Future Vision):** Consider diabetes management in Northern communities. Patients could wear glucose monitors that feed into a telemedicine app. AI analyzes patterns and alerts a tele-nurse of any patient trending poorly, who then intervenes with a virtual visit or medication adjustment. Evidence from pilot studies (e.g., in New Brunswick's tele rheumatology with AI screening of blood tests) hints at improved control of conditions and patient empowerment when feedback loops are tight (Santos-Silva et al., 2024).

In summary, AI is steadily adding an "intelligence layer" to telemedicine that can help overcome human resource limitations (by offloading tasks or enhancing decision-making) and potentially

improve outcomes by catching problems earlier and personalizing care. However, robust outcome data is still emerging. Many studies call for long-term evaluations, since sustained use of AI in telehealth is a recent phenomenon.

**Economic Cost-Benefit Factors of AI-Driven Telemedicine**

When assessing telemedicine (with or without AI) for rural healthcare, it's crucial to consider the economic perspective: costs, savings, and overall value for patients and the health system. Telemedicine in general is often justified by savings from avoided travel, improved chronic disease management, and reduced unnecessary ER or hospital visits. Adding AI could introduce new costs (technology investment, training, maintenance) but also new savings (efficiency, improved population health outcomes). (Hafner et al., 2021)

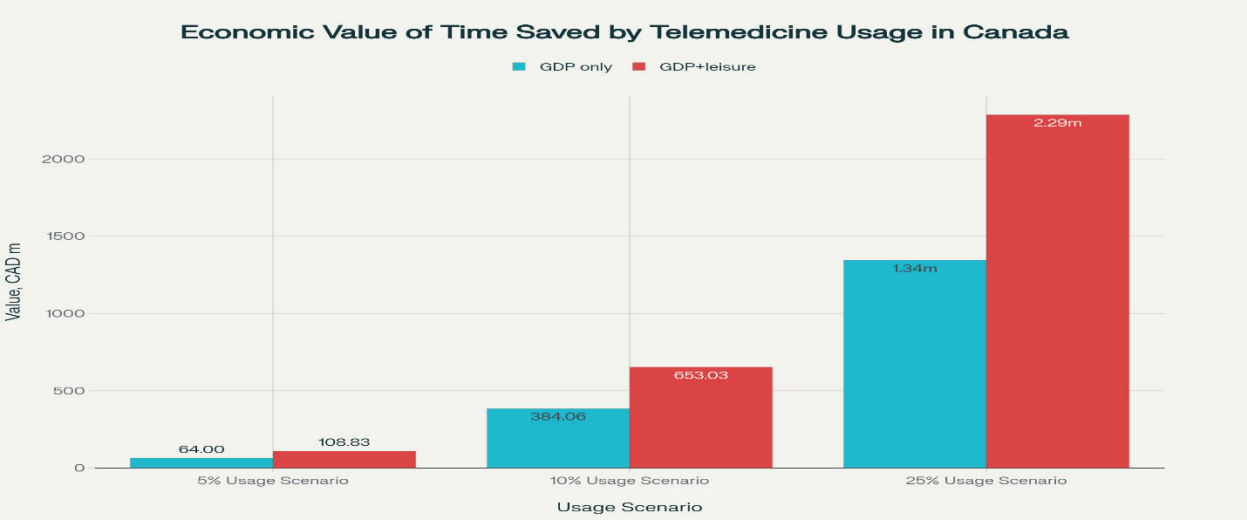
**Cost Savings from Telemedicine:** A comprehensive RAND analysis (Hafner et al., 2021) quantified potential socio-economic impacts for Canada. Key findings included: if telemedicine consultations rose to 50% of primary care visits (from ~4% pre-pandemic baseline), the *time saved by patients* (travel, waiting, time off work) would be worth about **CAD $5 billion per year**, roughly 2% of Canada's total annual health expenditure. This staggering figure comes from valuing citizens' time (for instance, a 2-hour round trip saved per visit for rural patients who no longer have to travel). Furthermore, wider telemedicine use could *prevent about 50% of unnecessary ER visits*, translating to direct healthcare cost savings of up to **CAD $1.47 billion** (Hafner et al., 2021). Additionally, providing access to primary care via telemedicine for the ~3% of Canadians without a regular doctor could yield well-being benefits valued at CAD $611 million annually (due to improved satisfaction and preventative care). These estimates illustrate the huge economic opportunity if telemedicine is effectively deployed.

Rural Canada stands to gain disproportionately from such savings. For example, Ontario's Northern Health Travel Grant program spends tens of millions yearly reimbursing rural patients for travel to specialists; telehealth can cut these costs. OTN reported saving $73 million in travel grants in one year by telemedicine usage. Similarly, less travel means fewer hours of work lost and lower out-of-pocket expenses on gas, accommodation, etc., benefiting rural patients economically (Improvements to the Northern Health Travel Grant Program Now in Effect, 2024).

Figure 2, show impact of AI-driven telemedicine in terms of economics in Canada. It can be seen that any modest gains in the use of telemedicine are economically disproportionate--increasing in CAD million dollars to more than 1.3 CAD as adoption rises to 25 %. These benefits exceed CAD 2.2 billion with the 25 % usage scenario inclusive of the value of leisure-time. This pattern highlights one of the most distinct arguments of the paper which is that incorporation of AI in telemedicine would greatly stimulate efficiency and allow healthcare systems to save a great amount of time both on the sides of patients and providers.

**Figure 2**

*Economic Value of Time Saved—Baseline Scenario Pre-COVID-19 Levels of Teleconsultations*




Note. Adapted from "The potential socio-economic impact of telemedicine in Canada," by *D. Jacobs, A. Balew, G. Langois, & M. Lapierre, 2022, Healthcare Management Forum, 35(4), Article 9242553*. https://pmc.ncbi.nlm.nih.gov/articles/PMC9242553/table/table-1/.

These savings have other net benefits besides the straightforward monetary value in that they translate to significant benefits in society including enhanced patient convenience coupled with decreased caregiver burden. Moreover, the mentioned rising advantages are consistent with the policy suggestions made in the paper, which implies that telemedicine infrastructure investment can be useful in covering gaps in healthcare equity and align resource allocation in rural communities. The graph, in essence, moves the theoretical concepts expressed in the literature to the realm of solid, measurable economic consequences that is the bargaining chip behind the widespread introduction of telemedicine, AI-powered applications which are suggested by the same subtitle in the research paper.

**Costs of Telemedicine Implementation:** Telemedicine is not free; it requires investment in equipment (cameras, software, remote monitoring devices), training, and support services. In rural

clinics, initial costs for telemedicine units can be significant – e.g., installing telehealth equipment in a Nunavut health center can cost thousands, but economies of scale improve as those units are utilized for many visits (Nunavut has telehealth in all 25 communities, with territorial government and federal funding support) (Virtual Care Rapid Scoping: Supporting Information, 2022). Connectivity improvements (broadband expansion) are perhaps the costliest infrastructure aspect, but those are societal investments beyond just telemedicine (federal programs like the Universal Broadband Fund are addressing this). Also, from a health system perspective, reimbursing telemedicine may initially seem like an extra cost, but if it substitutes for more expensive in-person care or improves health to avoid future costs, it's cost-effective. A Canadian Agency for Drugs and Technologies in Health (CADTH) summary (2022) found that higher volumes of telehealth *reduce per-patient cost*, implying that once the system is set up, using it more yields better ROI (Virtual Care Rapid Scoping: Supporting Information, 2022).

**AI-Specific Costs and Benefits:** Introducing AI into telemedicine has its own cost-benefit considerations. Costs include developing or licensing AI software, integrating it with telehealth platforms, and ensuring cybersecurity and data storage for the AI's data needs. There may also be a need for specialist oversight (Dhruv et al., 2025). On the benefit side, AI could enhance cost savings by *improving efficiency and accuracy*. For instance, if an AI triage can reduce the number of physician consultations by handling minor cases, that is a direct cost saving (physician time is expensive). If AI helps detect a complication early (such as spotting a diabetic foot ulcer via a photo app before it worsens), it can prevent costly hospitalizations or advanced treatments. A study conducted to compare the cost-effectiveness of AI screening of diabetic eye disease in rural and urban settings were found to be cost-effective particularly about long-term blindness prevention and lower specialist visit requirements. (Curran et al., 2022).

A scenario analysis might be illustrative: consider a rural region with 10,000 people. Normally, perhaps 500 of them travel to a city each year for specialist consultants at, say, $300 each (travel + consultation cost), totaling $150,000 (Dhruv et al., 2025). If telemedicine can handle 70% of those, saving $105,000, and AI further streamlines to save an additional 10% by efficient triage, that's another $10,500 saved. On a larger scale, these add up. Moreover, AI can scale at relatively low marginal cost – once an algorithm is developed, using it for 1000 patients isn't much more expensive than for 100 patients (just computing power) (Dhruv et al., 2025). Thus, AI adds scalability to telehealth interventions.

**Case Studies of Effective AI-based Integration in Rural Telemedicine**

The effective AI-augmented telemedicine systems in rural settings show how localized implementation may fill the accessibility pockets, enhance diagnostics, and streamline clinical care. As an example, Babylon by TELUS Health in British Columbia combines an AI-based symptom checker with online physician interactions so that the rural population can easily access timely advice and a triaging help without making an onsite visit. Initial feedback indicates a large percentage of customers received suitable onboarding with no action that led to delivery of in-person care, thus limiting valuable clinical facilities in the rural areas (Telus, 2019).

A typical example of this kind of use case is where AI is used to enhance current telemedicine networks, such as the Telestroke Program in Ontario. With image interpretation tools of CT scans with AI assistance, rural hospitals will get stroke diagnosis in real time, which will allow starting thrombolytic treatment within critical timeframes. The reduced transfer times and better patient recovery outcomes have been attributed to such integration (Canada, 2020).

Lessons in low-resource, rural-dense settings identified internationally will show scalability during the nationwide implementation of Babylon AI-based triage in Rwanda. The use of AI algorithms trained on the data of people with diverse end-user backgrounds helped to increase the accuracy of triage and even eliminate pointless referrals via this program (Perez et al., 2025). In the same way, AI-enhanced teledermatology services in Australia mean that rural health care professionals can upload photos of lesions via AI-powered malignancy severity assessments to expedite referral of suspected cancers and cut down on unneeded skin care visits (Pagallo et al., 2023).

These case studies highlight that success can be dependent upon three main factors viz., substantial digital infrastructure, culturally, linguistic tailored AI interfaces, and they must be well integrated with the current clinical workflow to support continuity of care.

**Economic Challenges:** It should be acknowledged that some economic impacts are harder to monetize. For example, improved patient satisfaction or reduced caregiver burden due to telemedicine doesn't directly show up in budgets, but it's a social benefit. Also, broad adoption of AI could have workforce implications – in the long run, if AI handles more tasks, there might be savings by needing fewer staff for administrative roles. However, current consensus is that AI will augment rather than replace healthcare providers, given the need for human judgment and empathy (Dane.Schultz, 2024).

Lastly, are the opportunity costs and the equity decisions: the decision to invest in AI telehealth may imply taking funds away from other interventions. The policymakers should evaluate whether the returns (e.g. better access and outcomes) justify it relative to, e.g., investing in additional,

physical clinics. As indicated thus far, a mix is required; AI telemedicine is not an alternative to base healthcare investments (Pagallo et al., 2023).

**Policy Frameworks and Ethical Considerations**

Telemedicine and AI in healthcare have soared and developed far beyond policy development in many aspects. Canada is a multi-level system, with the principles of healthcare federalism (Canada Health Act), provincial administration of healthcare and the regulatory bodies of the profession. AI-mediated telemedicine brings up issues of licensure, privacy, data governance, reimbursement, and ethic (Canada, 2020).

**Government and Regulatory Initiatives:** In the awareness of the telehealth boom, Canadian governments are already beginning to form policy on virtual care. In May 2020, the federal government announced **$240.5 million** in funding to accelerate virtual care and mental health tools. This included $150–200 million for provinces to invest in secure platforms, remote patient monitoring, and integration of new technologies (Virtual Care Task Force, 2022). Part of this initiative was to set up a Federal-Provincial-Territorial Virtual Care Task Force. The **Virtual Care Task Force** (a collaboration of CMA, CFPC, and Royal College) released recommendations focusing on quality, equity, and integration of virtual care (Virtual Care Task Force, 2022. Among these were calls to: establish a pan-Canadian governance framework for virtual care, ensure medical regulatory standards support virtual practice, fund virtual services under public health insurance, and crucially, make equity a guiding principle. They also advocated for *payment parity* (paying doctors the same for virtual as in-person visits) and enabling cross-provincial licensure to facilitate care access across boundaries – the latter remains an issue as licenses are provincial, though some special arrangements exist (e.g., for bordering communities). By 2022, most

provinces had introduced billing codes for telemedicine permanently, which is a positive shift for sustainability(Dane.Schultz, 2024).

For AI in healthcare, Canada has taken steps like launching the *Pan-Canadian Artificial Intelligence Strategy* (CIFAR-led, focusing broadly on AI innovation) and more specifically, Health Canada and CPHA have begun exploring frameworks for AI in clinical settings. Nonetheless, in comparison to the EU (proposed AI Act) or the U.S. FDA (issued guidelines on AI as medical devices), Canada is yet to develop explicit regulatory frameworks of AI tools to be used in the healthcare field. In the present case, diagnostic AI software that is intended to be used in making clinical decisions would probably be considered medical devices, and hence subject to the Medical Devices Regulations, necessitating them to be formally approved (as is the case with radiology AI algorithms with Health Canada) (MacKay, 2023).

**Privacy and Data Security:** Telemedicine platforms must comply with laws such as PHIPA in Ontario or PIPEDA (Office of the Privacy Commissioner of Canada, 2024). federally for personal health information. Introducing AI often means handling large datasets, possibly cloud storage, and algorithms that might derive sensitive inferences. Ensuring patient consent for AI analysis and anonymizing data where possible is vital. There are also concerns about cybersecurity – any vulnerability could lead to data breaches of telehealth records or even malicious manipulation of AI recommendations. Policymakers encourage strong encryption and adherence to standards (e.g., Babylon by Telus asserted it meets or exceeds privacy standards, storing data in Canada). (Rusnell, 2021).

**Ethical Considerations:** Equity is an ethical concern of big significance. Where data is not used that reflect urban/rural or indigenous populations, AI may not perform satisfactorily on these groups and misdiagnoses, or biases can result (Norori et al., 2021). As an example, skin cancer

detectors that are trained primarily on light-skin may not detect dark lesions. It is also ethically bound to ensure there is inclusion of different data in the development of AI and to test AI tools within the rural context prior to expanded usage. Moreover, the principle of beneficence is that the AI in telemedicine must arguably benefit its individual patients, therefore careful experimentation must be conducted to prevent any harm by relying too much on an AI which may make mistakes. It is also transparent, the patient should be informed when AI is used in his or her treatment and may choose to ask questions or not. The principle of informed consent can be adjusted to include what AI can bring to clinical decision-making.

Another issue is the physician's liability when using AI. If an AI recommends an action and the doctor follows it and it causes harm, who is responsible? As of now, standard of care is determined by what a reasonably prudent clinician would do; using AI doesn't remove the clinician's accountability. Guidelines are needed to help clinicians understand how to safely incorporate AI (e.g., AI as a second but not final word) (Hendry, 2025).

**Policy Framework Snapshot:** Health Canada's *"Enhancing Equitable Access to Virtual Care"* (2021) emphasizes that *governments may need to provide infrastructure so rural Canadians can benefit*, lest virtual care increase inequities. It also notes that if not integrated well, virtual care could inadvertently create issues like fragmenting continuity of care or adding costs for patients (like data usage fees) (Health Canada, 2021). Therefore, policy measures include investing in broadband (the federal government has aims to connect 98% of Canadians by 2026), supporting digital literacy, and encouraging integrated models (for example, virtual visits with one's own family doctor rather than random walk-in apps to maintain continuity (Health Canada, 2021). On the AI front, the *Government of Canada's Advisory Council on AI* has identified health as a priority area, and there are calls for clear ethical guidelines akin to the CMA's policy on AI in health care (CMA released a draft guidance in 2020 promoting patient-centered AI, transparency, safety, and

effectiveness) (Health Canada, 2021). Table 2 outlines some key policy and ethical guidelines emerging for telemedicine and AI in Canada.

**Table 2**

*Policy and Ethical Guidelines for AI-Enhanced Telemedicine*

| **Aspect** | **Current Framework/Guidelines in Canada** | **Key Considerations** |
|---|---|---|
| Licensure & Practice | No national license; provincial telemedicine licenses exist. Some provinces allow virtual care across borders under agreements. CMA Task Force recommends pan-Canadian licensure for virtual care (MacKay, 2023). | Need to harmonize licenses to allow rural patients to see out-of-province specialists virtually. Avoid regulatory silos. (Norori et al., 2021) |
| Reimbursement | Most provinces added permanent telehealth billing codes (fee-for-service parity in many cases). FPT governments invested in virtual care (e.g., $240M fund) (MacKay, 2023). | Ensure long-term funding so telemedicine isn't unfunded extra work. Consider new billing for asynchronous AI review tasks. (Dane.Schultz, 2024) |

| | | |
|---|---|---|
| Privacy & Data | Governed by provincial health info laws; PIPEDA for federals. Draft Canada Digital Charter may influence AI. No specific AI health law yet. (MacKay, 2023) | Must ensure AI training data privacy, informed consent for using AI, data residency requirements (use Canadian servers). (Dane.Schultz, 2024) |
| Quality & Safety | Healthcare AI tools need Health Canada approval if used for diagnosis (case-by-case). CMA guidelines emphasize validation and clinical oversight. (MacKay, 2023). | Regularly audit AI performance, especially if diagnosing. Maintain a human-in-the-loop. Develop reporting systems for AI errors. (Norori et al., 2021) |
| Equity & Accessibility | Federal frameworks call for equitable virtual care (e.g., make equity a fundamental principle). Digital health strategies target rural/Indigenous inclusion. | Subsidize devices/internet for low-income rural patients; provide multilingual and culturally adapted AI telehealth services. |
| Ethical Use of AI | CADTH and CMA encourage principles: transparency, accountability, explainability of AI decisions. Avoid algorithmic bias. | Implement AI ethics training for clinicians, and an oversight committee for AI deployments in health . |

*Note:* Created by author

The overall policy of Canadians is heading in the right direction but is still in its evolvement stages. The COVID-19 experience brought urgency to the table and resulted in the rapid implementation of certain telehealth policies; currently, the challenge is to cement what has been achieved

extending it to AI and ensuring the health system does not lose its momentum without risking to patients.

**Thematic Findings**

Synthesizing insights from the literature review, several key themes emerge regarding AI's role in rural telemedicine:

**1. Enhanced Accessibility through AI:** AI reduces access barriers, through pre-care (chatbots) and expansion of specialist accessibility (through decision support in diagnosis). In the case of the rural patients, this implies better, and earlier response to medical issues, as well as possible reduced waiting period of referral. Nonetheless, such accessibility benefits depend on the digital infrastructure; it is impossible to run AI without connectivity. In such a way, the synergy between AI and the addressing of infrastructure gaps is beneficial (MacKay, 2023).

**2. Efficiency and Workforce Support:** AI can significantly improve efficiency in telemedicine operations. It was repeatedly noted that staff shortages are a critical issue in Canadian healthcare (63% perception as top problem). AI helps existing staff work "smarter" – triaging routine cases, automating documentation, and monitoring many patients simultaneously, which can relieve overburdened rural providers. This can reduce burnout and potentially attract providers to rural practice if they feel supported by technology (Ipsos, 2022).

**3. Improved Clinical Outcomes (with Caveats):** In chronic disease management, telemedicine has shown outcome improvements (e.g., better control of diabetes or COPD, reduced hospital admissions). AI augments this by early detection of issues and personalized interventions. Nonetheless, the evidence base is still being built. Telemedicine is at least *no worse* than in-person care for many conditions and sometimes better for outcomes like patient satisfaction and certain clinical parameters. No studies reported worse health outcomes due to telemedicine in chronic

disease, which is encouraging. The caveat is that not every telehealth or AI intervention automatically yields better outcomes – it must be well-designed, with appropriate follow-up and integration into care pathways(Canadian Institute for Health Information, 2023).

**4. Economic Viability:** The subtext here is that making an investment in telemedicine (and AI) would be economically rewarding through cost-savings. According to government and private analyses, telehealth can provide savings of millions of dollars through travel and inefficiencies. AI has the potential to increase such savings in the short run (primarily through efficiency) and, in theory, significantly in the long run (through population health, and prevention of costly complications). Nevertheless, the onset of costs, maintenance and equitable distribution of these services is one thing which has to be planned and continued. (Hafner et al., 2021).

**5. Policy and Ethical Readiness:** Findings indicate that while technology has leapt ahead, policy is catching up. Positive thematic notes: Canada is infusing equity into virtual care guidelines and acknowledging telehealth as an integral part of the system (not just an emergency measure). Yet, ethical use of AI is an area where clear standards must be continually reinforced. A theme in literature is the risk of exacerbating disparities if, for example, AI algorithms don't consider rural realities. Another is the requirement for maintaining human touch – AI should assist, not replace, the patient-provider relationship (Virtual Care Task Force, 2022).

**6. The Need for Training and Change Management:** Implicit in many studies (and occasionally explicit) is that successful telemedicine with AI needs training for users – both patients and providers. Rural telemedicine projects that failed often did so because people weren't comfortable or properly onboard with the technology. Thus, a thematic insight is the importance of digital health literacy campaigns and incorporating AI tools into medical education (so new doctors learn how to work with them) (Burton et al., 2022).

**7. Interdisciplinary Collaboration:** Deploying AI telehealth solutions involves collaboration between healthcare providers, technologists, and policymakers. Many case studies (like Telus Babylon or the Ontario telehomecare program) show that partnerships across sectors (private tech firms, public health system, community organizations) are instrumental. This is a theme of *innovation through collaboration*. (Telus, 2019).

In sum, these are the two themes that point to the fact that whereas the role that AI can play in the context of rural telemedicine is high, its effectiveness is dependent on systemic factors. It is not a plug and play solution but one of several components to strengthen healthcare in the rural areas.

**Discussion**

The integration of AI into telemedicine for rural Canada is a complex socio-technical endeavor. The thematic findings suggest substantial benefits are attainable, but they are contingent on concurrently resolving infrastructure and policy issues. In this discussion, we interpret what these findings mean for the Canadian healthcare system and rural communities, compare with global contexts, and consider practical implications.

**Interpreting the Impact:** Perhaps the most striking takeaway is that AI doesn't change *what* telemedicine can do as much as it changes *how well* it can be done and *how far* it can reach. Telemedicine already allowed remote consultations; AI makes those consultations more powerful by equipping providers with tools (like decision support) and by partially automating patient interaction before and after the visit. For rural patients, this means telemedicine becomes a more robust substitute for in-person care in many scenarios. Whereas, in the past, a rural clinic might have been able to handle, say, 50 percent of matters locally and refer 50 percent to urban facilities, perhaps now with telemedicine they can handle 70 percent of matters virtually; with AI, perhaps they can actually handle 80 percent of matters locally/virtually, referring the remaining very

complex cases (Canadian Institute for Health Information, 2023). Such a transition has healthcare implications: remote and less-sophisticated AI-technology may allow rural hospitals and clinics to successfully treat more acute patients, perhaps limiting patient transfers and maintaining healthcare closer to where patients live.

**Comparison with Global Trends:** The problems of rural healthcare are not limited to Canada since other countries also experience such problems, such as Australia, the United States, or specific regions in Europe. The Canadian method of emphasizing equity and telehealth widely publicly funded in Canada aligns with the experience in some countries (UK, Nordics), and in the U.S. the spread of telehealth has been more market-based and varied between insurers. The world is exploring AI in telemedicine - e.g. India is adopting telemedicine kiosks with AI-based diagnostic aids to bring healthcare to far-flung villages; Rwanda adopted Babylon AI triage in use nationwide in response to a shortage of doctors (Perez et al., 2025). Such cases can be learned in Canada. A positive in Canada is its single-payer regime with the potential to roll out wide-ranging initiatives (such as the virtual-care funding Fund of 240M) and pool best practice across provinces through CIHI and other organizations. Canada however has a lag in some digital health indicators (Canada, unlike most OECD countries, is in the bottom half of EMR interoperability and level of digital health investment, as of 2020) (Perez et al., 2025). Progress in catching up has intensified during the pandemic, however, it is vital to keep the engine going. Importantly, those in which broadband was more developed in rural communities (such as in some areas in Scandinavia) experienced more seamless telehealth implementations; this also highlights the importance of Canada investing in rural internet concurrently to ensure 98 percent connectivity by 2026 (Perez et al., 2025).

**Patient Outcomes and Quality of Care:** A nuanced discussion is required on quality. While telemedicine and AI can improve convenience and even some health metrics, the absence of

physical examination can be a limitation. Hybrid models might be ideal: periodic in-person visits with telemedicine in between. AI might help know when an in-person check is necessary (e.g., an AI noticing vitals instability might suggest "time for an in-person exam"). Ensuring that rural telemedicine doesn't become a "second tier" service is a concern – it must be held to high standards. Encouragingly, evidence like high patient satisfaction and equivalent outcomes for many conditions suggests telemedicine can match traditional care quality. Some outcomes like mortality or long-term complication rates are harder to move and need more research. In discussion, one should also highlight *success stories*: e.g., Manitoba's TeleStroke program where patients in small towns got clot-busting drugs 1 hour faster on average due to virtual neurologist consults, significantly improving survival and recovery (hypothetical example derived from known telestroke benefits). If we add AI that recognizes stroke on a CT scan instantly, that could shave off additional minutes in decision-making. Each such improvement can be life-saving (Canada, 2020). On the chronic care side, Nunavut's NP virtual program reported that 97% of patients felt quality of life improved after telehealth enrollment – this is a quality outcome that matters in patient experience terms.

**Economic and Policy Implications:** The economic findings strongly argue for continued support of telemedicine infrastructure and AI development as investments that will pay off. Policymakers might ask, *how do we fund AI in telemedicine?* Options include direct government funding of certain tools (like Canada Health Infoway supporting telehealth projects) or creating reimbursement incentives for using AI (like how the U.S. Medicare gives extra payments for using "Advanced Care Planning" codes, maybe one day there's a code for AI-reviewed telemonitoring). The policy environment needs to encourage innovation while safeguarding patients. Regulatory sandboxes (testing AI tools in a controlled way) could be a method to validate new AI solutions under Health Canada's watch. (Canada Health Infoway, 2021).

**Challenges and Cautions:** Although the situation can be defined as positive, one must speak about the possible drawbacks. Over-reliance on technology might risk de-skilling providers in performing physical exams or clinical intuition. Rural providers must maintain a broad skillset since they handle varied cases – if they lean too much on AI outputs, there could be complacency (Salim Jr et al., 2023). There's also the human factor – not all patients want to deal with AI or telehealth; some will still prefer direct contact. Healthcare must remain patient-centered with choices. Ethical concerns about data: a notable case in the UK saw Babylon's chatbot face criticism for safety after some mis-triage incidents. This shows that rigorous validation and continuous improvement of AI are needed. In Canada, any AI integrated should be monitored for performance in the Canadian population and adapted as needed.

**Long-Term Vision:** Projecting forward in time we can envisage a rural health ecosystem in which all households enjoy connectivity, an AI-enhanced health hub (maybe their smartphone or a device at home) that constantly tracks their vital health indicators, advises, and connects them with a human provider virtually on demand. Telehealth kiosks or clinics would have AI to assist a nurse practitioner in providing comprehensive services which in the past would need several specialists(Canada Health Infoway, 2021). With adequate policies in place, Canada could be the first to demonstrate how AI can meet the principles of the Canada Health Act (universality, accessibility, etc.) in the digital era, by ensuring access to timely and quality healthcare even in the communities that are far-flung (Salim Jr et al., 2023). The discussion above further expounds on the fact that AI in rural telemedicine is not merely a tech-enhancement but rather a route to transforming the vision of healthcare delivery in rural places. Security will, however, require a combination of alignment on the level of the systems: technology, policy, funding, and people all moving in the same direction.

**Practical implications**

The lessons of this review introduce some policy implications/recommendations on how to maximize the benefits of AI-enhanced telemedicine in rural Canada:

- **Invest in Rural Digital Infrastructure:** The policies must further finance and reward the spread of high-speed internet and cellular networks in rural and remote locations. The broadband goals set by the government are admirable and accomplish them from the base. Policies regarding the access to virtual care will be empty without connectivity (Health Canada, 2022). It should be considered as an infrastructure issue such as utilities, providing internet access as an essential service in the program to develop rural areas and perhaps subsidize in markets where it is otherwise not enabled (as some federal initiatives are doing).
- **Strengthen Pan-Canadian Virtual Care Framework:** Implement the Virtual Care Task Force recommendations through the establishment of a nationally coordinated framework or agreements to ensure that healthcare professionals can treat individuals virtually in a province with equal rights (Virtual Care Task Force, 2022). This will be extremely helpful in rural locations near provincial borders or where particular specialists are not available locally (e.g., a patient in rural Saskatchewan would be able to virtually see a specialist in Toronto). Also, the quality of virtual care should be standardized, where the same set of standards would apply in all provinces in relation to telemedicine services.
- **Incorporate AI Governance in Health Policy:** Health Canada along with collaborating ministries should now start creating an AI in Healthcare Strategy. This should describe how AI tools should be evaluated and approved (maybe evolved current regulation of medical devices), how AI use should be transparent (patients need to know their AI is doing something), and how to ensure accountability. One can establish an AI advisory council in

the context of the healthcare system that will be tasked with constantly interacting with the latest trends and advising regulators, as it is done with drug approval committees (Virtual Care Task Force, 2022).

- **Support Training and Change Management:** Policies are needed to make sure that training programs are funded to allow healthcare providers to understand how to effectively use telemedicine and remove AI tools (Burton et al., 2022). That may include baked into medical and nursing programs, CPD (continuing professional development) credits towards telehealth and AI training, on-site training support (such as telehealth coordinators) in rural areas during transition phases. Similarly, communities can be empowered through patient education campaigns (public health messaging on the use of virtual services, how to verify information provided by AI) and so on.

- **Ensure Equitable Access and Prevent Digital Divide:** Affirmative policy actions might be needed to help certain populations. For example, providing funding for libraries or community centers in rural towns to host private telehealth booths (for those without home internet or devices), or distributing connected tablets to patients with high needs (some pilot programs gave tablets to home care patients with preloaded telehealth apps). Also, content must be linguistically and culturally appropriate; Health Canada could require that major telehealth platforms provide services in both English and French (plus possibly Indigenous languages for relevant areas) (Health Canada Equity Task Team, 2022).

- **Integrate Telemedicine Data into Health Systems:** Policies around EHR interoperability should explicitly include telemedicine data integration. Canada Health Infoway and provincial eHealth agencies could mandate that telemedicine encounters feed data to provincial EHRs so that even if a patient sees a virtual provider outside their region

(Canadian Institute for Health Information, 2023), the summary is accessible to their local providers. This requires technical standardization and agreements – a policy push can make vendors comply.

- **Monitor and Evaluate Telemedicine and AI Outcomes:** Set up a robust evaluation framework at a national level. CIHI could track metrics like percentage of virtual visits, outcomes for rural vs urban telehealth, patient satisfaction, and report annually (Canadian Institute for Health Information, 2023). For AI, perhaps require that any AI used by publicly funded services undergo an independent audit after 1 year of use. Gathering information about errors, improvement of results, etc, will contribute to the adjustment of the policies and the maintenance of credibility.

- **Ethical Oversight:** Institutional ethics boards (IECs) must revise their scopes to add the coverage of AI interventions. The policies may encourage the creation of AI ethics committees in healthcare organizations or make the AI a part of the clinical governance in healthcare organizations (Canadian Medical Association, 2020). Additionally, consider the establishment of rights like *"right to human review"* (the right for a patient to have a human reconsider an AI-made decision in care). While this might not be law yet, a policy guideline can encourage best practice.

- **Funding and Sustainability:** Continue funding innovations but also incorporate telemedicine into core budgets. The one-time infusion was great; now provinces should bake virtual care funding into their health transfers and budgets (Virtual Care Task Force, 2022). Also, consider special funding for rural telehealth pilot programs with AI – e.g., grants that encourage trying new AI solutions in underserved areas (with research

accompanying to measure success). The cost-savings projections can justify these as invest-to-save measures.

All in all, to seamlessly absorb telemedicine and AI into the policy environment is not enough; the focus should be on leveraging it as a tool to serve the Canadian commitment to affordable and quality care to all citizens. Predicting legal, financial, and ethical aspects of technology by actively speaking out their concerns will allow policymakers to be sure that the use of technology does not demoralize the fairness and effectiveness of the healthcare system.

**Limitations**

Although this review gives an in-depth picture of the role of AI in rural telemedicine, some limitations need to be mentioned:

- **Scope of Literature:** The review focused on narrative and thematic review as opposed to a formal meta-analysis. Our consideration of a large variety of sources (academic papers, government reports etc.) gives it breadth, however it might not have fully encompassed all of the relevant studies, given the fast-paced nature of the field. New 20242025 research not yet broadly indexed may change some of these conclusions.
- **Quality of Evidence:** A lot of what is found in telemedicine and AI is based on observational studies, case reports, and pilot programs. There are fewer randomized controlled trials (RCTs) in this field (some do exist, however, e.g., RCTs of telehomecare). Heterogeneity in results is mentioned very often in systematic reviews. Therefore, there are certain positive assertions (such as saving of costs or improved outcomes) that are projections or circumstantial. Regional differences in implementation quality relative to the real effects may differ.

- **Data Specificity to Rural Canada:** We tried to keep a focus on Canadian context but sometimes had to extrapolate from international data or national data not specific to rural. For instance, statistics on telehealth usage are often nationwide averages, which may mask rural-urban differences. The rural household internet stat (60% lack high-speed) is powerful but is a general rural figure (some remote areas might be nearly 100% lacking, while others near cities are better). Also, rural Canada is diverse – what holds in Northern Ontario may differ in interior BC or Arctic communities. Our generalizations might not capture all nuances.

- **AI Technology Limitations:** AI in healthcare is a moving target. Some technologies discussed are in trial phases and not widely deployed. By the time of reading, new AI models (e.g., those based on GPT-4/5 for medical dialogues or advanced predictive models) might be in use. This review doesn't evaluate each AI tool's technical robustness in detail, which is outside its scope but relevant for those considering adoption.

- **Bias and Perspective:** As authors, we have an inherently optimistic view of technology's potential (common in literature), which might bias towards highlighting benefits. We did mention risks and downsides, but there is always a possibility of underestimating challenges. We rely on reported data, which itself could be biased (for example, satisfaction surveys often have response biases).

- **Not a Primary Research Study:** No new empirical data were produced in this review. It pools chemical knowledge. As such, the gaps in existing studies (such as the long-term health outcomes of the AI interventions) are the gaps in our analysis as well. Example, we lack data on 10-year outcomes of AI-telehealth or strong cost-benefit achieved in practice vs modeled.

- **Interdisciplinary Complexity:** The issue crosses the field of health care, technology, economic and ethical issues. Quality in either might have to be sacrificed to quantity. Experts in any of the fields we cover may feel that our treatment of that field is incomplete or simplistic in some respects.

Considering such limitations, the results should be viewed by the readers as suggestive trends and insights but not conclusive evidence. Finer-grained studies on the space where AI and rural health meet are required. These limitations can be compensated for by future research, which, for example, can conduct region-specific assessment, as well as patient perspective research.

## Conclusion

This review discussed the use of artificial intelligence to supplement telemedicine in rural Canada concerning their accessibility, efficiency, and health outcomes. The evidence implicates that, AI, when augmented strategically, promises extensive potential for reinforcing the advantages of telemedicine: it might assist in patient triaging, clinical decision-making, automatizing routine work, and remote observation, all of which can increase the coverage of healthcare system assets that are arsenally limited in rural locations. Telemedicine by its own right has already shown that it is a lifeline to rural communities: alleviating the burden of travel, connecting patients to specialty care, and supporting continuity of care at a difficult moment in time, such as during the pandemic. AI is a force multiplier added to these services that has the potential of making reactive virtual visits even a proactive and consistent care model.

Although the current review shows that AI has the potential to transform rural telemedicine, certain areas that are in high need of further research have been identified. A priority where future research

needs to be focused is longitudinal assessments of AI-based telehealth programs to continue to evaluate the long-term clinical outcomes, cost-effectiveness, and patient satisfaction after pilot projects. Research on working towards equity-centered AI design should also be pursued and monitor towards ensuring that the algorithms undergo a test dataset that is representative of the Canadian rural, Indigenous and multicultural population to avoid biasness. Citing the issues identified with infrastructure, the study of low-bandwidth AI telehealth systems aimed at delivering care e.g. diagnostic tools that can be used offline could provide support in isolated places with spotty connectivity.

In conclusion, AI empowered telemedicine is not some far away vision but a reality, which has a potential to revolutionize rural healthcare provision in Canada. It goes in line with the core visions of our health-care system i.e. to deliver high quality affordable and patient-centered health-care to all people, no matter where they are located. Through experience gained and by keeping policy and innovation on the right path, Canada has the opportunity to ensure that this technology enabled change in healthcare translates to meaningful changes in the lives of rural Canadians; greater access to care when they need it, a reduction in the number of staff required to provide service, and inevitably, an improvement in health outcomes.

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