Ontario's Digital Health Vision in the post-COVID-19 Pandemic Era: A Canadian Perspective

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ABSTRACT

The Canadian healthcare system has successfully enabled the average Canadian to live a longer life since the early 1980s. Yet, the prevalence of chronic diseases among Canadians is higher than ever, thereby increasing pressure on the healthcare system to develop a new vision based on the realities of the post-COVID-19 pandemic. The responsibility for Canada's healthcare is allocated amongst multiple actors and/or agencies, as the federal government and provinces/territories have significantly different responsibilities. Our study aims to discuss digital health strategies in Ontario, Canada. We examine best practices across the world and propose a digital health vision for Ontario and elsewhere. The lack of an integrated healthcare system often limits access to digital health tools, thus creating a fragmented digital health environment with organizational silos of health information. As a result, healthcare services may not use the advantages of digital health tools efficiently and effectively. We discuss some of the challenges of creating a digital health vision, such as financial feasibility, privacy, ease of use, and reaching vulnerable populations.

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INTRODUCTION

In the post-COVID-19 pandemic era, healthcare modernization is being driven by the rapid development and innovation of digital health technologies, thus providing a significant opportunity for addressing various shortcomings in healthcare (Desveaux et al., 2019). Digital health can be broadly defined as "the transfer and delivery of healthcare and health resources and services through information and communications technologies" (Hyman et al., 2022). The various applications of digital health technologies range from diagnosis and treatment to health management and healthcare delivery (Mathews et al., 2019). Digital health innovations equip healthcare providers with the tools needed to get a more holistic view of patient health through an intersection between technology and healthcare. Recent digital health innovations offer an opportunity to improve health and healthcare delivery by empowering consumers to access their health information through a variety of digital tools, giving patients more control over their health (Ontario Ministry of Health, 2022).

Over the last 40 years, the Canadian healthcare system successfully enabled the average Canadian to live a longer life with fewer disabilities (Lattimer et al., 2019). However, the prevalence of chronic diseases among Canadians is higher than ever before, thereby increasing the pressure on the healthcare system and placing more responsibilities on individuals for managing their own health (Lattimer et al., 2019). Despite the constant innovations of digital health technologies, the operating model for delivering healthcare in Canada remains the same (Hyman et al., 2022). As users within the Canadian healthcare system are becoming more involved with their health and gaining increased access to their health information, Canada needs to re-evaluate its healthcare model. The variability between and within provinces and territories in digital health technologies contributes to the complexity of the healthcare system, thus making it challenging to adopt a new operating model that is more effective (Barr & Randall, 2021). New policies and practices are needed to address the complex stakeholder environment and seamlessly merge the gaps created by high-level policy barriers between the Canadian healthcare system and patients (Lattimer et al., 2019). Given that the responsibility for Canada's healthcare is allocated amongst multiple actors and/or agencies as the federal government and provinces/territories have significantly different responsibilities, this study discusses the digital health strategies in Ontario, examines best practices across the world, and proposes a digital health vision for Ontario and elsewhere. Moreover, this study discusses some of the challenges of creating a digital health vision, such as financial feasibility, privacy and ease of use, and reaching vulnerable populations.

Digitization of Ontario's Healthcare System

The Government of Ontario shifted their focus onto Digital Health in 2015 by introducing the Digital Health Strategy (Desveaux et al., 2019). The Digital Health Strategy assessed existing public health programs and identified whether digital innovation could be integrated into those programs (Desveaux et al., 2019). The University Health Network, Canada's largest academic research hospital, laid the foundations for digital health with the implementation of ConnectingGTA, a digital health service that electronically integrates patient data across the healthcare continuum (Isaackz & Chang, 2019). As a result, clinicians and patients have a better experience at the point of care because clinicians can easily access relevant patient information, thus providing faster and more coordinated care to patients (Isaackz & Chang, 2019). ConnectingGTA allows providers to share health information more effectively and improve treatment waiting times (Isaackz & Chang, 2019). Although the digital health landscape was transformed through the introduction of ConnectingGTA, especially the way data is used to collaborate, the digital health environment is fragmented due to silos of personal health information (Isaackz & Chang, 2019). Unfortunately, in many cases, digital health technologies remain to be used at the local scale.

Desveaux et al. (2019) identified various target areas at the policy level that should be prioritized in order to catalyze digital health innovation in Ontario. Firstly, Desveaux et al. (2019) suggests that a system-level definition of innovation is needed since the current broad and varied definitions of innovation across key stakeholders hinder effective communication and collective action (Desveaux et al., 2019). Furthermore, Desveaux et al. (2019) proposed that a clear overarching mission for digital health innovation would reduce tension between the healthcare system and patient benefit. The publicly funded nature of the healthcare system results in pressure between the needs of the healthcare system and the benefits experienced by the patient, which is exacerbated by the fact that while the patient benefits from the service, they do not pay for the service (Desveaux et al., 2019). Currently, virtual care is driven by the needs of individual organizations, and the patient experience is seldom considered, leading to virtual care initiatives that are characterized by a top-down approach instead of a frontline approach (Desveaux et al., 2019). The Council of Academic Hospitals of Ontario (CAHO), one of Ontario's Ministry of Health's selected innovation brokers, represents Ontario's 23 research hospitals and acts as an entryway for innovations into Ontario's healthcare system (Chahal & Rudnick, 2019). CAHO published a list of critical problems that required intervention from digital health innovators, resulting in innovators responding to the specific needs of the CAHO member hospitals (Chahal & Rudnick, 2019). With each member hospital having

an independent decision-making process for the proposed digital health projects, a series of challenges arise, namely hospitals struggling to process the numerous digital health projects and having an acceptance criterion that rejects/defers 90% of the proposals (Chahal & Rudnick, 2019). Digital health innovators responding to the critical issues published by CAHO is an example of virtual care initiatives that cater to the needs of individual organizations. Furthermore, clinician resistance is another reason a less effective top-down approach is favoured since clinicians oppose the implementation of digital health innovations they perceive to be disruptive (Desveaux et al., 2019). Palacholla et al. (2019) supports these findings, and further suggest that the adoption of emerging digital health technologies is strongly influenced by its ability to integrate into the existing workflow of healthcare providers. Digital health technologies that were ready to be utilized within pre-existing clinical workflows were less likely to face clinician resistance (Palacholla et al., 2019).

Ontario's key players within the virtual care environment are fragmented and operate as independent organizations, leading to a lack of accountability and the absence of an agenda to follow (Desveaux et al., 2019). Ontario's Ministry of Health developed a Digital Health Board that acts as an advisory committee (Desveaux et al., 2019). The Digital Health Board is defined as a "sponsor" of digital health, and as a result is acquitted from taking any accountability for Ontario's digital health innovations (Desveaux et al., 2019). The lack of a fully responsible agency creates a significant challenge to implement digital health innovations efficiently and timely in Ontario. The most recent attempt to coordinate health care delivery was the formation of Ontario Health agency in 2019.

Another consequence of the fragmented virtual care environment is a virtual landscape with a varying range of digital health technologies (Desveaux et al., 2019). As a result, hospitals across Ontario do not have a uniform approach regarding virtual care because they acquire digital health technologies driven by a procurement process specific to the institution (Desveaux et al., 2019). Although Ontario's Ministry of Health has recently developed guidelines regarding data access and exchange of data between hospitals and primary healthcare providers in Ontario, it has left interoperability specifications to be prioritized at a later date (Ontario Ministry of Health, 2022). Desveaux et al. (2020) claims that existing regulations and incentives in Ontario stifle digital health innovation by reinforcing the status quo, which in turn results in institution-specific procurement processes for digital health innovations, thus resulting in operational silos that exacerbate the fragmented nature of the digital health environment in Ontario.

The Province of Ontario currently uses two main platforms in the context of digital health system: 1. Ontario Telemedicine Network; 2. E-health Ontario with overarching goals of supporting clinical decision-making, enhancing healthcare services and improving the health of Ontarians (Ontario Health, 2023). It took several years to develop and activate the electronic medical record programs such as Digital Health Drug Repository (DHDR), Clinical-Connect, Clinical-Viewer. The aforementioned digital health programs are connected to all of the heath care provider offices and institutions (Ontario Health, 2023). The next main challenge is developing systems that can reach vulnerable populations such as older adults in their homes which will consequently reduce pressure in the health care facilities.

Barriers to Establish an Effective and Efficient Digital Health System in Ontario

As digital health technologies evolve outside the health system and become increasingly available to consumers, the need for a digitally integrated healthcare system grows. According to a large Canadian study, 39 percent of Ontario's population track one or more aspects of their health using digital health technologies (Parè et al., 2018). Moreover, close to 86 percent of family doctors in Canada are utilizing a digital system to access electronic records, a 13 percent increase from 2015 (Canadian Institute for Health Information, 2020). Canadian provinces lag far behind peer countries with regard to accessing digital health services (Neumeier, 2019). Canada was ranked last out of eleven countries in terms of access to care in the 2017 Commonwealth Fund rankings, indicating that while digitally integrated tools for healthcare have advanced considerably, the healthcare system still falls behind (Neumeier, 2019). A key driver of this is the misalignment between the needs of patients and the design of the healthcare system with regard to digitally integrated tools (Hyman et al., 2022). Challenges to Ontario's ability to implement a digitally integrated framework that will adequately meet patient needs include financial feasibility, privacy and cybersecurity, and ease of use.

The fragmented nature of the healthcare system has resulted in healthcare institutions utilizing institution-specific processes to obtain digital health technologies (Desveaux et al., 2019). Since Ontario's healthcare organizations have different approaches to procuring digital health technologies, it is difficult to maintain consistency.

A large survey conducted in Alberta indicated that older Canadians and Canadians with lower education were less likely to utilize digital health tools, especially if the digital health tools were only available in English (Hyman et al., 2022). Ontario needs to avoid creating a digital divide by integrating digital health services that do not consider language barriers and the digital health literacy of the population (Superina et al., 2021). Digital health tools need to be tailored for minority populations, especially immigrants and older ethnic

minorities. Hyman et al. (2022) conducted a study in British Columbia and found that immigrants, older adults, and older ethnic minorities are less likely to use digital health tools due to low English and technology literacy (Hyman et al., 2022). Therefore, the implementation of digital health innovations must involve an assessment of the needs of ethnic minority groups concerning their digital health literacy (Hyman et al., 2022). The design of digital health tools should incorporate cultural norms and preferences in order to increase the accessibility of the tools to marginalized communities (Hyman et al., 2022). With healthcare systems rapidly transforming to adopt digital health innovations, it is critical to emphasize the importance of community participation to develop effective and culturally appropriate digital health tools (Hyman et al., 2022).

Although the use of digital health technologies has great potential to alleviate the stress placed on the healthcare system, there is an increased concern with cyber security as there will be a financial incentive to exploit personal data (Baumgart, 2020). Given the rising concerns of cyber security, legislation calling for tighter data protection is required (Baumgart, 2020). The current guidelines that govern the use of personal health data across Canadian provinces have a large degree of variation on what is covered under the guidelines and the level of details provided (Barr & Randall, 2021). Ontario offers several guidelines covering topics that range from encrypting and securely storing personal health information electronically to the proper disposal of electronic information (Barr & Randall, 2021). Moreover, Ontario is among the only provinces in Canada that provided specific guidelines regarding the collection, transfer, use, storage, and destruction of digital health information (Barr & Randall, 2021). As healthcare delivery becomes more reliant upon digital health technologies, the vulnerability to cyber-attacks increases as well (Ontario Ministry of Health, 2022). One particular challenge for Ontario will be to establish an electronic medical record system across large hospitals and smaller physician practices that is resistant to being penetrated by malware (Siegel, 2020). Currently, OntarioMD certifies electronic medical records based on pre-established requirements for privacy and security of patient data (Siegel, 2020). However, with the introduction of a digitally integrated system that has the ability to transfer data within Ontario's healthcare system, the security standards must be updated to minimize the chance of cybercriminals launching successful ransomware attacks (Siegel, 2020). The 2019 LifeLabs hack allowed cybercriminals to steal the health data of 15 million patients in Ontario and British Columbia and shut down computer systems of three hospitals in Ontario by successfully downloading malware onto one laptop that was connected to the entire health network (Siegel, 2020). Therefore, Ontario will have to develop tools and resources for clinicians and patients in order to actively safeguard health information and prevent cyberattacks.

Organizations that develop digital health innovations are financially responsible for procuring funding and maintaining ongoing funding throughout the development and implementation of digital health innovations (Desveaux et al., 2019). Innovations are primarily funded through institutional operating budgets or public grants through national agencies like the Canadian Institutes of Health Research (Desveaux et al., 2019). The delicate funding structure impacts the sustainability of innovations and results in siloed investments that challenge the implementation of innovations. As a result, Ontario will need to design policies that take into consideration funding structures, since currently the responsibility for sustained funding is on the organization, thereby impacting the sustainability of the digital health project (Desveaux et al., 2019). Additionally, the lack of financial means acts as a patient-level barrier for the usage of digital health tools (Whitelaw et al., 2021). Ontario will need to create guidelines that allow digital health technologies to be tailored depending on the affluence of the region they will be implemented in (Whitelaw et al., 2021). This includes pricing digital health tools fairly, so they can be used by the target users, the ability for patients to claim digital health tools through insurance plans, and the development of infrastructure that will allow digital health tools to operate in remote region (Whitelaw et al., 2021). The pandemic response enabled the testing and the use of newer digital health technologies but there still need to be future planning in regards to staff training and financial feasibility. Ensuring health equity when developing digital health technologies should be an integral foundation.

Best Practices in Digital Health Systems

The use of digital health technology in Canada was of great benefit during the COVID-19 pandemic and can be of even more significant benefit in the future if the potential is realized and harnessed. According to Hyman et al. (2022), if every Canadian had access to digital health tools there would be an approximate decrease of 47 million in-person visits to healthcare providers, resulting in significant financial gain. Clearly, digital health innovations have tremendous potential in meeting the healthcare needs of Canadians, and policies that encourage digital health innovations and expand access to digital health technologies for Canadians can assist the Canadian healthcare system to evolve.

Healthcare strategy should focus on the patient experience rather than the institution, and the implementation of effective digital health technologies can achieve that. The UK National Health Service (NHS) utilizes Amazon to deliver virtual care to NHS patients, in an effort to make clinical services available digitally to patients (Webster, 2019). Utilizing Amazon to deliver virtual care allowed the NHS to divert

patients from having to visit physical healthcare facilities, and instead enjoy the benefits of a virtualized setting, thus mitigating backlogs and excess waiting times (Webster, 2019). The introduction of technology companies into the digital health realm led to the successful implementation of digital health technologies in many countries such as India and Brazil (Webster, 2019). For example, an online pharmacy named "1mg" launched an e-pharmacy in India that allowed its services to become available to patients living in small villages that did not have access to physical pharmacies (Webster, 2019). By allowing digital health innovations to be delivered by technology companies that can fulfill the demand for digital health services, the NHS was able to effectively integrate patient-focused health innovations.

Germany has specific legislation targeted toward having a uniform definition of standards, which results in healthcare digitization occurring under a standardized framework (Weber & Heitmann, 2021). The legislature in Germany defines interoperability as the ability for systems and organizations to work together seamlessly and has initiatives that emphasize collaboration between systems throughout the healthcare system (Weber & Heitmann, 2021). Germany regulates the exchange of information in the health care system by requiring the digital health documents to be designed in such a way that the data can be exported in suitable interoperable formats and used throughout the healthcare continuum (Weber & Heitmann, 2021). Moreover, the digital health innovations in Germany are required to use interoperable interfaces, in an effort to readily integrate into the healthcare system (Weber & Heitmann, 2021). Since health organizations, health systems, and digital health innovations are required to use interoperable interfaces, data exchange between digital health technologies and the healthcare system is possible (Weber & Heitmann, 2021). This allows Germany to store patient data in a centralized electronic health record, which allows patients to quickly access their updated health data and transfer data from their digital health tools into the centralized electronic health record (Weber & Heitmann, 2021).

An innovative approach to digital health system was developed by Turkey in 2015 with the establishment of a web-based, mobile Personal Health Record (PHR) system, e-Pulse (Şık, Aydınoğlu, & Son, 2021). The e-Pulse enables both health care providers and patients reach personal health data conveniently. The system integrates the information systems of all health institutions so that the members of the public can view their lab results, medical images, prescription and medication details, emergency information, diagnosis details, reports and health records conveniently.

The government of Israel has implemented policies that allow health information to be shared through a central repository that collects health data from electronic medical records and makes it available to researchers (Lattimer et al., 2019). Similarly, the Alberta Health Services, responsible for administering healthcare services and delivery to the residents of Alberta, developed the most extensive integrated digitalized healthcare system in Canada by creating a central repository to seamlessly disseminate health data across the province (Baumgart, 2020). The Alberta Electronic Health Record Information System (EHRIS) provides access tools through the Alberta Netcare Portal, thereby allowing users to view their health data electronically (Baumgart, 2020). The Alberta Netcare Portal is linked to the Connect Care system, which is a central access point that collects and stores health information and disseminates health information as required to patients and healthcare providers (Baumgart, 2020). The digital infrastructure initially developed for the Connect Care system allowed Alberta Health Services to implement various virtual health services during the COVID-19 pandemic (Baumgart, 2020). Thus, Alberta's ability to develop an integrated digital health infrastructure allowed Alberta's population to appreciate elements of digital health like electronic referrals to healthcare providers, virtual consultations, and access to their own medical records (Baumgart, 2020).

The Australian Digital Health Agency (ADHA) formed the National Digital Health Strategy in an effort to improve the Australian health infrastructure and lay the foundation for a seamless transition to digital healthcare (Australian Digital Health Agency, 2022). The ADHA established seven strategic priorities that it aims to achieve by 2022 (Australian Digital Health Agency, 2022). One of the key strategic priorities is providing access to health information to both patients and healthcare providers (Australian Digital Health Agency, 2022). The introduction of My Health Record, an electronic health record system, in 2018 allowed every Australian to have immediate access to their health information (Australian Digital Health Agency, 2022). Moreover, starting in 2022, healthcare providers were also able to access and manage patient's My Health Record, thus allowing for faster dissemination of information across the healthcare system (Australian Digital Health Agency, 2022). Australia's My Health Record provides similar advantages to Alberta's Connect Care system which includes better coordination of healthcare services, a more efficient healthcare system, reduction of duplicate testing, and immediate access to patient data (Australian Digital Health Agency, 2022). The use of digital health records provided clinicians with comprehensive medical records and reduced duplicated pathology tests by 18% per week (Biggs et al., 2019). The My Health Record platform allowed health information to be securely exchanged through protected digital channels (Australian Digital Health Agency, 2022). Furthermore, My Health Record utilizes a standard method to collect patient data, thus making the system interoperable in various public and private clinical settings (Australian Digital Health Agency, 2022).

Another advantage of My Health Record is healthcare providers will minimize harm to patients by preventing adverse drug events and medication errors, since all prescribers and pharmacists will have access to the patient health information (Australian Digital Health Agency, 2022). According to Biggs et al. (2019), 2-3% of hospital admissions in Australia each year relate to a medication error, and cost $1.2 billion annually. The improved access that My Health Record provides to patients and clinicians should reduce the number of medication errors (Biggs et al., 2019). Although there are considerably well-designed programs in some countries around the world, it is evident that there is not one best solution where a digital health system addresses the all of the challenges including financial feasibility, privacy, ease of use, and reaching vulnerable populations.

Proposed Solutions to Ontario's Digital Health System

As a consequence of the Canadian healthcare system being under both provincial/territorial and federal jurisdictions, the access to health information is limited at the patient level, resulting in patients having to personally communicate their healthcare information at every point of care (Canadian Institute for Health Information, 2020). Access to digital health tools is further limited by the lack of an integrated system, thus creating a fragmented digital health environment with organizational silos of health information that make it difficult for digital health tools to utilize health data to improve the patient experience (Lattimer et al., 2019). Efforts have been made on a local scale to create an integrated digital health system, such as the Ottawa Hospital partnering with five other health organizations to implement a central digital health information system, or the ConnectingGTA program electronically integrating patient data across the healthcare continuum (The Ottawa Hospital, 2019). Ontario used ConnectingGTA as a blueprint to roll out a provincial electronic health record, somewhat improving the integration of care (Isaackz & Chang, 2019). However, the electronic health record has varying success in integrating into clinical workflows, making it more likely to face clinician resistance (Mehta et al., 2020). Furthermore, the heterogeneous nature of the electronic health record results in minimal interoperability between platforms (Mehta et al., 2020). Policies and regulations need to be updated to ensure they allow health data to be shared efficiently across the healthcare system while maintaining confidentiality (Lattimer et al., 2019). Furthermore, digital connectivity that allows for the seamless dissemination of health data while preserving data security will significantly improve digital health technologies that depend on data analytics (Lattimer et al., 2019). To establish an effective digital health framework, Ontario needs to implement a system-level definition of innovation for key stakeholders to follow, create a central database for patients to access their health information, and resolve the lack of interoperability that is preventing the development of new digital health innovations (Lattimer et al., 2019). The lack of a system-level definition for digital health innovations identified in Ontario hinders effective communication and collective action in the development of digital health technologies (Desveaux et al., 2019). Existing digital health frameworks that have been developed in other provinces and overseas can provide direction to Ontario's digital health framework.

Digital health innovations lack a clear overarching vision and instead are driven by the requirements of individual organizations (Desveaux et al., 2019). Ontario needs to focus on developing a client-driven strategy that will allow digital health innovations to be better implemented across the province (Choudhury, 2020). This can be achieved by establishing a standardized interoperable interface for digital health systems across the province.

The integral step to establish a better digital health framework is crating an agency with a mandate to develop and maintain digital health systems. This proposed agency should be at both provincial and federal levels so that the unity can be maintained across Canada. Another key component will be the implementation of legislation that creates a uniform definition of standards, resulting in healthcare digitization occurring under a standardized framework. Ontario can utilize Alberta's EHRIS as a blueprint for developing a central repository of digital health data and superimpose it with policies similar to the ones Germany implemented, thus allowing data to be easily integrated. A standardized framework that regulates information in the healthcare system and requires data to be collected in an interoperable format would encourage collaboration throughout the healthcare continuum and create a better initiative for digital health innovations to integrate seamlessly into the healthcare system. A central repository would also address the fragmentation of the digital health environment resulting in silos of personal health information. Ontario can utilize organizational repositories to develop an infrastructure that has the ability to connect the organizational repositories that captured, store, and maintained patient diagnostic, treatment, and care information, to a central repository as done in Israel.

A central repository was one of the key strategic priorities in Australia's digital health framework, resulting in faster dissemination of information across the healthcare system. The development of My Health Record allowed Australia's healthcare system to appreciate immediate access to patient's health information, resulting in better coordination of healthcare services and a more efficient healthcare system. Therefore, an electronic health record system in Ontario that builds on the foundations laid by

ConnectingGTA and utilizes a central repository will be better structured and allow for the seamless dissemination of health data on a provincial scale across healthcare providers with varying electronic health record systems, thereby developing digital connectivity across Ontario. Investment in telehealth infrastructure will address health equity issues and result in considerable savings. Palacholla et al. (2019) states that the ability for a digital health innovation to integrate into existing clinical workflows is a significant predictor of the success of that digital health innovation. The formation of Ontario Health was a step in the right direction but has not been sufficient to address the future needs of Ontario's digital health framework. More investment including human and financial capital is required to enhance the current system.

CONCLUSIONS

The Canadian healthcare system has been successful in enabling the average Canadian to live a longer life since the early 1980s but the prevalence of chronic diseases among Canadians is higher than ever, thereby increasing pressure on the healthcare system to develop a new vision based on the realities of the post-COVID-19 pandemic. The responsibility for Canada's healthcare is allocated amongst multiple actors and/or agencies, as the federal government and provinces/territories have significantly different responsibilities. Based on our comprehensive review of the best examine best practices across the world, we argue that integrated healthcare system often limits access to digital health tools, thus creating a fragmented digital health environment with organizational silos of health information. We propose establishing a new organization at the provincial and federal levels with a sole digital health mandate to develop an effective and efficient digital health vision for Ontario.

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