

Evidence Brief

Planning Now for the Future of Technology-enabled Healthcare Work in Ontario

7 & 8 March 2023



HEALTH FORUM

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Evidence Brief:
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McMaster Health Forum

The McMaster Health Forum's goal is to generate action on the pressing health and social issues of our time. We do this based on the best-available research evidence, as well as experiences and insights from citizens, professionals, organizational leaders, and government policymakers. We undertake some of our work under the Forum banner, and other work in our role as secretariat for Rapid-Improvement Support and Exchange, COVID-19 Evidence Network to support Decision-making (COVID-END), and Global Commission on Evidence to Address Societal Challenges.

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Merit review

The evidence brief was reviewed by a small number of policymakers, stakeholders and researchers in order to ensure its scientific rigour and system relevance.

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KEY MESSAGES

Opportunities exist to plan now for the future, but taking advantage of them is challenging

Technological innovations hold promise for putting patients at the centre of the health system, and for addressing some of the most pressing healthcare challenges in Ontario now and in the future. Realizing the benefits of new technologies at scale is not easy for at least three reasons:

- 1) decision-makers' time is mostly taken up with 'putting out fires,' leaving little bandwidth to plan for the future
- 2) system leaders have found it difficult to plan in the right ways for the future of technology-enabled healthcare work
- 3) there are many long-standing barriers that get in the way of health-system transformation.

Past examples of successful initiatives in Ontario suggest these challenges can be overcome.

What do we know (from evidence syntheses) about four elements of a potentially comprehensive approach to plan now for technology enabled healthcare?

- Element 1 – Defining the role of health-system stakeholders (including government) in enabling compassionate, technology-enabled healthcare
 - This element could include clarifying: 1) the legal and regulatory frameworks needed; 2) the approaches to system financing, organizational funding, and provider remuneration needed for technology-enabled healthcare (as well as any changes to public and private insurance plans needed); 3) who is responsible for supporting the development of technological innovations; and 4) the necessary investments in infrastructure needed. We found 12 evidence syntheses that outlined how government policymakers can support the adoption of technology in health (e.g., providing strategic direction and incentives).
- Element 2 – Planning for a future health system where clinical encounters in all sectors and settings are less constrained by the geographical location of providers and patients
 - This element could include clarifying the care models that we need to support a future health system that provides technology-enabled healthcare (e.g., 'brick and mortar' versus digital-health only providers), and the system-level arrangements required to support these care models. We found 12 evidence syntheses, which addressed the adoption of digital technology generally, rather than care models for clinical encounters less constrained by geography.
- Element 3 – Planning for a future health system with more digitally supported care
 - This element could include clarifying digital-support models required for patients (e.g., online self-monitoring) healthcare workers (e.g., clinical-prediction tools) and system leaders (e.g., predictive analytics), and the system-level arrangements required to support these models (e.g., accountability frameworks). We found 22 evidence syntheses, which suggest digitally supported care can benefit patients overall in a range of ways.
- Element 4 – Engaging in health human resources (HHR) planning processes that align the workforce to health-system needs
 - This element could include clarifying altered levels of demand for different types of healthcare worker, and the system-level arrangements that enable this. We found two evidence syntheses, one addressing the role of technology in mitigating HHR constraints, and one about workforce-planning models.

What implementation considerations need to be kept in mind?

There are two overarching barriers that pose the biggest challenges: 1) politicization of the health system; and 2) a lack of fora for health-system leaders involved in 'small p' politics to broker agreement around the features of the future health system we want. Despite these barriers, there are windows of opportunity to consider, including patients and providers already embracing technology (and the COVID-19 pandemic accelerated this), the many technological innovations already in place in the province, the ongoing implementation of the Ontario Health Team model across the province, and the new funding agreement between the federal and provincial governments that may help support advances in digital health and data analytics.

REPORT

The role that technology plays in health systems around the world has expanded dramatically, but in most Organisation for Economic Cooperation and Development (OECD) countries – including Canada – healthcare still lags behind most other industries in making the most of the opportunities provided by technology.(1; 2)
Technological innovations hold promise for helping to create a stronger, more patient-centred health system.(2)

However, technology in and of itself is not a panacea, and the current challenges being experienced in Ontario’s health system – including the health human resources (HHR) crisis, surgical backlogs, and the ongoing impacts of the COVID-19 pandemic – exist despite the many technological innovations already being utilized at all levels of Ontario’s health system.

Making the most of technological innovations, including innovations associated with advances in digital technologies, telehealth, and mobile health (mHealth), requires intentional planning. A recent OECD report about what can be learned from the experiences of countries in expanding the use of telemedicine during the COVID-19 pandemic suggests that at a minimum, this planning requires efforts to: 1) build trust among key health-system stakeholders and patients; 2) advance their expertise and skills to effectively use technologies; and 3) adapt health-system structures (including governance, financial and delivery arrangements) to support the availability, uptake and use of such technologies.(3)

There should be optimism about decision-makers’ ability to seize the current opportunity and initiate transformative change at scale, given:

- the COVID-19 pandemic showed that key provincial stakeholders – elected politicians, leaders at the organizations providing strategic direction for and oversight of care delivery, leaders in health workplaces and practices, and leaders of organizations focused on specific categories of health workers – can work together to help steward broad system-wide transformation in timeframes previously thought to be unimaginable (e.g., a pivot to virtual care in weeks rather than years, the rapid and innovative use of digital technologies for population-wide vaccine surveillance systems, and the use of administrative data for real-time COVID-19 hospital capacity planning and public-health modelling)

Box 1: Background to the evidence brief

This evidence brief mobilizes both global and local research evidence about challenges, four elements of a potentially comprehensive approach to overcoming them, and key implementation considerations. Whenever possible, the evidence brief summarizes research evidence drawn from evidence syntheses and occasionally from single research studies. An evidence synthesis includes a summary of studies addressing a clearly formulated question and uses systematic and explicit methods to identify, select and appraise research studies and to synthesize data from the included studies. The evidence brief does not contain recommendations, which would have required the authors of the brief to make judgments based on their personal values and preferences, and which could pre-empt important deliberations about whose values and preferences matter in making such judgments.

The preparation of the evidence brief involved five steps:

- 1) convening a Steering Committee comprised of representatives from the partner organization (and/or key stakeholder groups) and the McMaster Health Forum
- 2) developing and refining the terms of reference for an evidence brief, particularly the framing of the challenges and four viable approach elements for addressing them, in consultation with the Steering Committee and a number of key informants, and with the aid of several conceptual frameworks that organize thinking about ways to approach the issue
- 3) identifying, selecting, appraising and synthesizing relevant research evidence about the challenges, approach elements, and implementation considerations
- 4) drafting the evidence brief in such a way as to present concisely and in accessible language the global and local research evidence
- 5) finalizing the evidence brief based on the input of several merit reviewers.

The four approach elements for addressing the challenges were not designed to be mutually exclusive. They could be pursued simultaneously or in a sequenced way, and each approach element could be given greater or lesser attention relative to the others.

The evidence brief was prepared to inform a stakeholder dialogue at which research evidence is one of many considerations. Participants’ views and experiences and the tacit knowledge they bring to the issues at hand are also important inputs to the dialogue. One goal of the stakeholder dialogue is to spark insights – insights that can only come about when all of those who will be involved in or affected by future decisions about the issue can work through it together. A second goal of the stakeholder dialogue is to generate action by those who participate in the dialogue and by those who review the dialogue summary and the video interviews with dialogue participants.

- the recent introduction and ongoing expansion and strengthening of Ontario Health Teams (OHTs) constitutes one of the most transformative changes to Ontario's health system in decades, providing an implementation vehicle for a shift towards a population-health management approach, where emphasis is placed on the proactive management of clinical care for citizens and patients with shared needs and shared barriers to accessing care (see Figure 1), which will require the deft use of digital solutions and data analytics (one of the eight OHT building blocks)
- the newly negotiated terms for the Canada Health Transfer and additional bilateral agreement will support a sustained injection of new funds, including for digital solutions and data analytics.

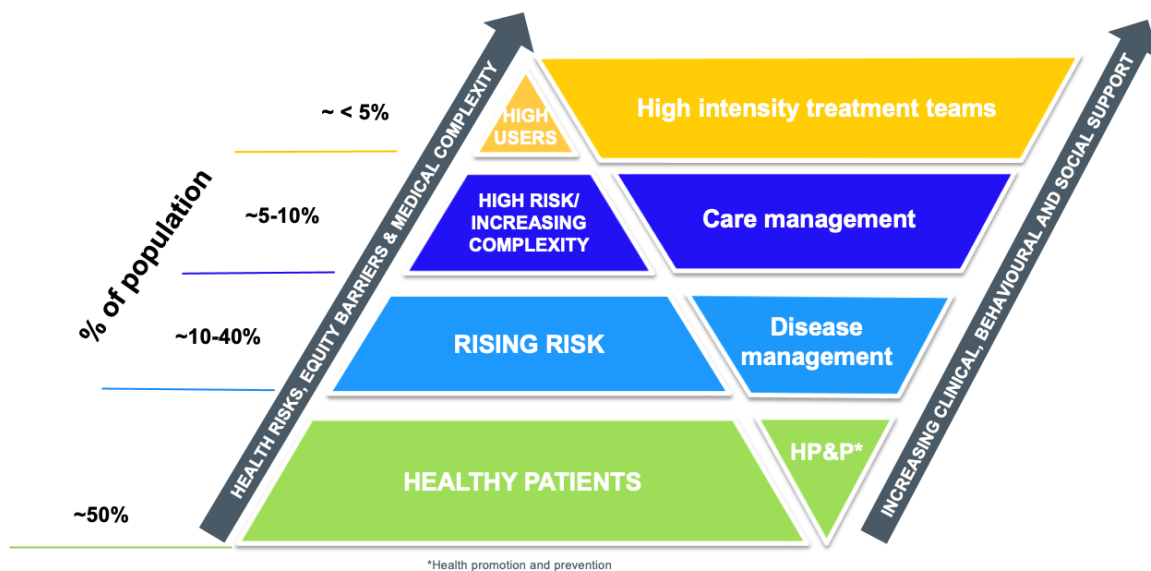
These three examples are key to establishing the platform upon which health-system leaders in Ontario can seize the present opportunity. Additionally, there are several aspects of the current context in Ontario that will also be important to consider (Box 2).

The aim of this evidence brief is to mobilize the best-available global evidence (i.e., evidence syntheses) and local evidence to clarify the challenges we face in planning now for the future of technology-enabled healthcare work, frame elements of a potentially comprehensive approach for overcoming these challenges, and outline key implementation considerations. It will be pre-circulated to 22-24 key thinkers and doers – a range of policymakers, system stakeholders, and researchers – to inform a stakeholder dialogue on the topic (additional background about the preparation of this brief and the dialogue can be found in Box 1).

Box 2: Important context for health-system leaders in Ontario taking steps to plan for the future of technology-enabled healthcare work

- 1) There is widespread commitment to equity-centred quadruple-aim metrics in the province (i.e., improving health outcomes and patient and provider experiences, while keeping per capita costs manageable). Such metrics can be used in monitoring the implementation and evaluating the impacts of technology-enabled healthcare work.
- 2) There are many opportunities to strengthen the digital-health landscape in care settings, particularly as Ontario continues to roll out the Digital First for Health Strategy. As with most provinces and territories, Ontario faces a fractured digital-health technology landscape, with cities like Hamilton, for example, having two electronic medical records (EMRs) that patients and providers need to pivot between depending on who is providing or where care is being provided on a given day.
- 3) There are opportunities for health-system leaders to play a greater role in signalling the digital solutions that will be of most benefit to Ontarians and aligning them with their vision for the future of the health system. For example, the current digital technology pipeline is moving quickly, although it is often uncoordinated and siloed with, for example, dozens of cognitive behavioural therapy apps emerging – with many targeting a single condition – that are at odds with patient and provider needing to have cross-functional and cross-condition technology supports (particularly in light of a shift towards integrated care and patient-centred, rather than condition-centred, system design).

Figure 1: Risk pyramid and care needs for patients in a population



Adapted from Kaiser Permanente, with the input of Rapid Improvement Support and Exchange (RISE) and the Health System Performance Network (HSPN) (4; 5)

OPPORTUNITIES EXIST TO PLAN NOW FOR THE FUTURE, BUT TAKING ADVANTAGE OF THEM IS CHALLENGING

Technological innovations hold promise for putting patients at the centre of the health system, and for addressing some of the most pressing healthcare challenges in Ontario now and in the future. Some examples of these technological innovations, many of which are already in place to some extent in the province, include:

- wearable technology and ‘smart homes’ (to support self-monitoring and remote monitoring)
- personalized patient decision support based on ‘best evidence’ as well as personalized peer support, coaching and other patient-targeted interventions (to support health promotion, disease prevention and self-management)
- self-scheduling tools (to optimize booking and enable data collection and triage that informs booking)
- virtual-care technology ranging from patient portal messages to tele- and video-consultations and virtual wards
- predictive analytics – both traditional and enabled by AI/machine learning (e.g., to predict which patients will worsen or can wait for a next-day appointment, to predict hospital length of stay, and to predict procurement needs as disease burdens and supply utilization vary)
- personalized clinical decision support – both traditional and enabled by AI/machine learning (to provide more personalized medicine)
- digital execution of administrative tasks, such as e-prescribing and digital lab requisitions, documentation and billing
- voice recognition to enable some or all of the above
- artificial intelligence (AI)/machine learning (to provide clinical decision support, reduce administrative tasks like documentation and billing, and predict available staffing pools and emergency-department patient flows)
- autonomous transportation (to move drugs, devices and other products to whoever needs them)
- population-level manifestations of the above (e.g., early warning systems based on wastewater).

Realizing the benefits of new technologies at scale is not easy for at least three reasons:

- 1) decision-makers’ time is mostly taken up with ‘putting out fires,’ leaving little bandwidth to plan for the future
- 2) system leaders have found it difficult to plan in the right ways for the future of technology-enabled healthcare work
- 3) there are many long-standing barriers which get in the way of health-system transformation.

In the sub-sections that follow, we expand on each of these reasons in turn. In the final sub-section, we highlight two examples of successful efforts to implement transformative change at scale in Ontario, which suggest that such change is possible in the province when the right facilitators are in place. In Box 3, we provide details about how we approached mobilizing evidence about the problem.

Box 3: Mobilizing research evidence about the problem

The available research evidence about the problem was sought from a range of published and ‘grey’ research literature sources. Published literature that provided a comparative dimension to an understanding of the problem was sought using three health services research ‘hedges’ in MedLine, namely those for appropriateness, processes and outcomes of care (which increase the chances of us identifying administrative database studies and community surveys). Published literature that provided insights into alternative ways of framing the problem was sought using a fourth hedge in MedLine, namely the one for qualitative research. Grey literature was sought by reviewing the websites of a number of domestic and international organizations, such as the Government of Ontario, Health Canada and the Organisation for Economic Co-operation and Development. Priority was given to research evidence that was published more recently, that was locally applicable (in the sense of having been conducted in Ontario or Canada, or had an explicit focus on Ontario or Canada), and that took equity considerations into account.

Decision-makers' time is mostly taken up with 'putting out fires,' leaving little bandwidth to plan for the future

Despite the need to 'look up and look long' and ensure that the health system is organized to adjust as technological innovations emerge and as population-health needs evolve, decision-makers' time is mostly taken up with 'putting out fires' (e.g., the HHR crisis, surgical backlogs, and growing mental health and addictions challenges), many of which have worsened during the COVID-19 pandemic.(6-8) The bulk of decisions are reactive (i.e., they respond to an acute problem that is getting a lot of attention at one particular point in time), targeted (i.e., they focus on problems related to a specific patient population, type of provider, or sector such as long-term care), and time-limited (i.e., the goal is to 'stop the bleeding' with 'band-aid' solutions, rather than push for system-level change that can improve things over the longer term).(3; 9; 10) For example, Ontario introduced temporary billing codes to scale up access to virtual-care visits during the pandemic, but these did not cover the full range of services patients may require, and many have now been discontinued or scaled back.(11)

System leaders have found it difficult to plan in the right ways for the future of technology-enabled healthcare work

While many technological innovations, such as telemedicine and virtual care have been in Ontario for decades,(1; 12; 13) planning for the future of technology-enabled healthcare work has tended to be haphazard and fragmented, with decision-making characterized by:

- chasing technology (rather than leveraging it), and assuming more technology is better, while forgetting 'first principles' and losing the big picture of how technology can best be used in efforts to keep Ontarians healthy through a population-health management approach
- adapting to, rather than creating 'fit for purpose' technological innovations
- not managing public expectations about how technology can (and can't) help improve healthcare (e.g., losing the battle to 'smart watch' advertisements)
- overlooking 'digital inclusion' and the implications for equity-deserving groups who are at risk of being left behind (e.g., lack of access to devices and the internet)
- failing to build capacity and develop the appropriate structures and processes to ensure the system – and the individuals working in it – can absorb new technological innovations as they become available
- no central 'vision' for, or active coordination of, health IT standards, which has resulted in care organizations and providers adopting technologies that aren't ideal for integrating across settings and providers.

There are many long-standing barriers that get in the way of health-system transformation

In addition to the challenges that are specific to planning for the future of technology-enabled healthcare, there are also more general and long-standing issues that make health-system transformation challenging in Ontario. These include:

- 'big P' politics involving elected politicians reacting to the 'crisis of the day' rather than planning beyond four-year election cycles
- 'small p' politics across various levels of the system, which include the leaders of:
 - a) health authorities and organizations providing strategic direction for and oversight of care delivery (e.g., Ontario Health)
 - b) health workplaces and practices
 - c) organizations focused on specific categories of health workers (e.g., regulatory bodies, professional associations and unions)
- a lack of capacity among those in leadership positions to steward and oversee the implementation of transformative change, with many pilot projects that are never scaled and spread and the focus remaining on 'tinkering at the margins.'

Examples of successful initiatives in Ontario suggest it is possible to overcome these challenges

Ontario has some notable examples of leaders driving significant health-system change over the last three decades. In Table 1 below, we provide details of two such examples – the Health Services Restructuring Commission (HSRC) and the integration of cancer services – to illustrate the key facilitators to widespread change at scale in the province. While these examples are not specific to technological innovations, they do suggest transformative change is possible when the right facilitators are in place. It is also important to acknowledge that there are lessons to be learned from apparent failures that relate more directly to the introduction of technological innovations in the province, such as Ontario’s long-standing challenges in implementing integrated electronic health records.

Table 1: Successful transformation initiatives in Ontario and the factors that facilitated them

Example of successful transformative change in Ontario	Key changes made	Factors that facilitated the changes
Health Services Restructuring Commission (1996-2000)	• Consolidation of previously competing acute-care hospitals in most of the province’s urban municipalities, through ordering amalgamations and ‘takeovers’ • Expansion of home-care services and the creation of more long-term care beds to accommodate alternative levels of care (ALC) patients • Creation of a vision for Ontario’s health system as a set of integrated, community-based health systems, and suggestions for ways to: ○ coordinate mental health services ○ organize small rural and northern hospitals through networks ○ develop capacity for effective health information management ○ reform primary healthcare ○ integrate health services ○ measure and assess improvements in the health system ○ establish academic health-science networks ○ improve health-system governance	• Mandated through legislative authority by a newly elected government, which provided it with the power to restructure public hospitals, and recommend through the Minister of Health other changes needed in Ontario’s health system • Made up of volunteer commissioners, who were private citizens with widely varying backgrounds and who were seen by many as working in Ontarians’ interest • Provided with administrative support and resources to plan and schedule an approach to address its mandate • Strong relationships forged with the minister and the Ministry of Health, and with hospitals and other provider organizations • Use of the media to inform and build relationships with members of the public about its goals and the approaches adopted to achieve them
Integration of cancer services in Ontario (2002-2004)	• Legally binding Cancer Program Integration Agreement voluntarily signed by 11 host hospital boards with the board of Cancer Care Ontario (CCO), to establish in each region a single integrated cancer program that brings together inpatient, outpatient and	• Strong leaders at Cancer Care Ontario, with experience leading hospitals, a willingness to champion a vision for change, and an ability to connect with and build coalitions among key stakeholders who would be

	some community-based oncology services (e.g., Ontario Breast Screening Program) under the leadership of a Regional Vice-President for Cancer Services • Establishment of new funding arrangements for hospitals that are tied to performance requirements related to volumes, cost, quality and reporting • Integration of regional cancer centres into host hospitals, which included transferring assets as well as approximately 3,000 employees working in 11 different locations from CCO's regional cancer centres to hospitals • Shift in CCO's role from day-to-day management of cancer centres to a focus on planning, performance improvement and system change across the province	involved in or affected by the proposed integration of cancer services (including hospital CEOs, board chairs, senior teams and staff within cancer centres, and health professional unions) • Use of a single law firm representing hospitals' interests during Cancer Program Integration Agreement negotiations • Buy-in and signals of support sent from senior leaders at the (then called) Ministry of Health and Long-Term Care • Dedicated funding from the ministry to support the process of integration (to ensure hospitals' budgets were not negatively affected) • A window of opportunity to move forward with reform amidst a growing appetite for change in how cancer services were delivered in Ontario, and a recent release of recommendations for reform in the 2001 Cancer Services Implementation Committee (CSIC) report • Risk-taking through setting aggressive timelines for milestone targets, and pushing for complex and widespread reforms that affected 12 of the largest healthcare organizations in Ontario • Focus (and framing of efforts) around the goal of improving quality of care for cancer patients in Ontario
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The information in this table was adapted from the work of Thompson and Martin (2004) and Sinclair, Rochon and Leatt (2005) (14; 15)

Additional equity-related observations about the challenges

Two groups of Ontarians can be used to illustrate the barriers to accessing and using digital technologies, namely older adults and those living in rural and remote communities (Box 4). In looking into equity-related observations about the challenges identified in the sub-sections above, two broad areas of concern emerged.

The first area of concern relates to gaps in internet use. The most recent Canadian Internet Use Survey suggests that the majority (92%) of Ontarians use the internet, and while not specific to Ontario, Canadian data show that a growing proportion of individuals are using it for health-related reasons – such as looking up health information online, using online tools to track aspects of their fitness and health, and connecting their ‘wearable’ devices to support things like blood pressure and glucose monitoring.(16; 17) The Canadian data also suggest there are gaps in internet use, which has implications for whether and how specific populations are able to take advantage of current and future technology-enabled healthcare that relies on an internet connection, specifically:

- older adults use the internet much less than the Canadian average – 62% of those over 75 use the internet compared to the Canadian average of 92% (16; 18) – which may be a particularly important issue given they often have greater healthcare needs than those who are younger
- those living outside a metropolitan area also use the internet less than the Canadian average (87% compared to 92%), (16) which may be a particularly important issue given at least some of the promise of virtual care centres on its role in serving rural and remote populations.

Ontario-specific data also point to concerning gaps in use. In particular it has been found that Ontarians from lower-income households have less access to the internet. A previous round of the Canadian Internet Use Survey found that only 62% of Ontarians from the lowest-income households have access to the internet in their home, compared to 93% in the highest-income quartile.(17)

The second area of concern relates specifically to some of the equity challenges created through the increasing use of digital-health technologies in Ontario. Work has recently been undertaken to identify some potential impacts on equity that digital-health technologies may have as they are increasingly introduced in Ontario, which were summarized in a discussion paper released by the Women’s College Hospital Institute for Health System Solutions and Virtual Care (WIHV).(19) The paper noted a digital divide in which certain communities have less access to connected digital devices, which can have an impact on their ability to benefit from digital-health technologies (e.g., those living in rural and remote communities, older adults and individuals who are marginally housed). The paper also noted that not all digital-health technologies are designed with underserved communities in mind, which may further marginalize them or result in their needs not being met. WIHV also prepared a report based on an evaluation of virtual care in the COVID-19 era in Ontario, and found that despite the many positive experiences and outcomes associated with the rapid expansion of virtual care during the pandemic, strategies to ensure equitable access were not always developed by clinics and hospital sites – and this meant virtual care was not always accessible for certain populations, including older adults.(20)

Box 4: Equity considerations

A problem may disproportionately affect some groups in society. The benefits, harms and costs of approach elements to address the problem may vary across groups. Implementation considerations may also vary across groups.

One way to identify groups warranting particular attention is to use “PROGRESS,” which is an acronym formed by the first letters of the following eight ways that can be used to describe groups†:

- place of residence (e.g., rural and remote populations)
- race/ethnicity/culture (e.g., First Nations and Inuit populations, immigrant populations and linguistic minority populations)
- occupation or labour-market experiences more generally (e.g., those in “precarious work” arrangements)
- gender
- religion
- educational level (e.g., health literacy)
- socio-economic status (e.g., economically disadvantaged populations)
- social capital/social exclusion.

The evidence brief strives to address all Ontarians, but (where possible) it also gives particular attention to Ontarians who face barriers accessing and using digital technologies (e.g., older adults, those living in rural and remote communities).

Many other groups warrant serious consideration as well, and a similar approach could be adopted for any of them.

† The PROGRESS framework was developed by Tim Evans and Hilary Brown (Evans T, Brown H. Road traffic crashes: operationalizing equity in the context of health sector reform. *Injury Control and Safety Promotion* 2003;10(1-2): 11–12). It is being tested by the Cochrane Collaboration Health Equity Field as a means of evaluating the impact of interventions on health equity.

From an equity perspective, these issues are important to identify and plan for as part of a broader transition to more technology-enabled, compassionate healthcare. There are efforts in Ontario to promote digital inclusion, equity and access across all government services through the Ontario Digital Service Action Plan.⁽¹⁷⁾ The plan emphasizes the need to create a digitally inclusive Ontario, where all people can access and benefit from digital technologies in their lives, but there is a need to ‘bake in’ inclusion and access from the beginning of policy and program design.⁽¹⁷⁾ The Digital First for Health Strategy is also an important government-led initiative with the intention of establishing strong digital capabilities that enable system integration, information sharing throughout the system, and easier ways into the care system through online appointment booking and virtual care.⁽²¹⁾

FOUR ELEMENTS OF A POTENTIALLY COMPREHENSIVE APPROACH TO PLANNING NOW FOR TECHNOLOGY-ENABLED HEALTHCARE

Many approaches could be selected as a starting point for deliberations about an approach for planning now for the future of technology-enabled healthcare in Ontario. To promote discussion about the pros and cons of potentially viable approaches, we have selected four elements of a larger, more comprehensive approach to planning for the future of technology-enabled healthcare. The four elements were developed and refined through consultation with the steering committee and key informants who we interviewed during the development of this evidence brief. The elements are:

- 1) defining the role of health-system stakeholders (including government) in enabling compassionate, technology-enabled healthcare
- 2) planning for a future health system where clinical encounters in all sectors and settings are less constrained by the geographical location of providers and patients
- 3) planning for a future health system with more digitally supported care
- 4) engaging in HHR planning processes that align the workforce to health-system needs.

The elements could be pursued separately or simultaneously, or components could be drawn from each element to create a new (fifth) element. They are presented separately to foster deliberations about their respective components, the relative importance or priority of each, their interconnectedness and potential of or need for sequencing, and their feasibility.

The principal focus in this section is on what is known about these elements based on findings from evidence syntheses (with our approach to mobilizing these syntheses outlined in Box 5). We present the findings from evidence syntheses along with an appraisal of whether their methodological quality (using the AMSTAR tool) is high (scores of 8 or higher out of a possible 11), medium (scores of 4-7) or low (scores less than 4) (see the appendix for more details about the quality-appraisal process). We also highlight whether they were conducted recently, which we define as the search being conducted within the last five years. In the next section, the focus turns to the barriers to adopting and implementing these elements, and to possible implementation strategies to address the barriers.

Those interested in a deeper dive into cross-jurisdictional insights about a narrower set of technological innovations (e.g., telehealth, telemedicine or virtual care) may find the following three reports helpful:

- 1) [the state of virtual care in Canada as of wave three of the COVID-19 pandemic \(released by Health Canada in 2021\)](#), which highlights the extensive progress made in rolling out virtual care across Canada during the pandemic, and outlines

Box 5: Mobilizing research evidence about approach elements for addressing the problem

The research evidence about approach elements for addressing the problem was sought primarily from Health Systems Evidence (www.healthsystemevidence.org), which is a continuously updated database containing more than 9,400 evidence syntheses and more than 2,800 economic evaluations of delivery, financial and governance arrangements within health systems. The evidence syntheses and economic evaluations were identified by searching the database for documents addressing features of each of the approach elements.

The authors' conclusions were extracted and used to create a 'declarative title' for each identified evidence synthesis included in Appendices 1-4. Some reviews contained no studies despite an exhaustive search (i.e., they were 'empty' reviews), while others concluded that there was substantial uncertainty about the approach element based on the identified studies. Where relevant, caveats were introduced about these authors' conclusions based on assessments of the reviews' quality, the local applicability of the reviews' findings, equity considerations, and relevance to the issue. (See the appendices for a complete description of these assessments.)

Being aware of what is not known can be as important as being aware of what is known. When faced with an empty review, substantial uncertainty, or concerns about quality and local applicability or lack of attention to equity considerations, primary research could be commissioned, or an approach element could be pursued and a monitoring and evaluation plan designed as part of its implementation. When faced with a review that was published many years ago, an updating of the review could be commissioned if time allows.

No additional research evidence was sought beyond what was included in the evidence syntheses. Those interested in pursuing a particular approach element may want to search for a more detailed description of the approach element or for additional research evidence about the approach element. We include hyperlinks to our search strategies for each approach element in the appendix to help facilitate this.

- recommendations for building on this progress into the future (10)
- 2) [the COVID-19 pandemic and the future of telemedicine \(released by the OECD in 2023\)](#), which compares and contrasts international experiences (including in Canadian jurisdictions) with rolling out telemedicine during the pandemic, with implications for the future (3)
 - 3) [empowering the health workforce to make the most of the digital revolution \(released by the OECD in 2021\)](#), which compares and contrasts international experiences (again including in Canadian jurisdictions) with widespread adoption of digital-health technologies, with a particular focus on how to support adoption and uptake among the health workforce.(2)

These reports provide case studies of success in moving towards technology-enabled healthcare, with the third report in particular providing insights into the system-wide transformations undertaken in Denmark (leading the adoption of telehealth) and Estonia (introducing an integrated electronic medical record system).

Below, we outline in greater detail the four approach elements, as well as what is known about them from the best-available evidence syntheses. We also highlight important equity related observations about the elements, including insights from the evidence syntheses identified, as well as initiatives in Ontario that are important considerations in how we think about addressing inequities in the province in the context of technology-enabled healthcare.

Element 1 – Defining the role of health-system stakeholders (including government) in enabling compassionate, technology-enabled healthcare

This element focuses on clearly establishing what role key health-system stakeholders – including leaders in government – should be planning to do to ensure all Ontarians can benefit from compassionate, technology-enabled healthcare in the short, medium and long term. It includes clarifying:

- 1) the legal and regulatory frameworks needed to enable compassionate, technology-enabled healthcare (e.g., including how the private sector is engaged and the rules in place governing private digital-health service providers, as well as how digital assets and data are governed)
- 2) the approaches to system financing, organizational funding, and provider remuneration needed for technology-enabled healthcare, as well as the approach for integrating emerging digital-health services into public and private insurance plans
- 3) who is responsible for supporting the development of technological innovations that are ‘fit for purpose’ and in the early identification and adaptation of existing innovations that can be leveraged
- 4) the necessary investments in infrastructure needed to support the digital inclusion of all Ontarians (e.g., telecommunications infrastructure to support internet access for everyone, including those in rural and remote areas, as well as efforts to promote digital literacy).

One particularly important consideration in this element is the extent to which government takes a ‘hands on’ approach to driving changes toward technology-enabled healthcare, versus setting up the rules of the game (e.g., through legal instruments and regulation) that allow private actors (e.g., insurance companies, digital-health companies) and healthcare providers to take action within the parameters of these rules.

We identified 12 evidence syntheses that addressed this element. In Appendix 1, full details about each of the syntheses and their findings are provided, with the following themes emerging when considering all of the findings together:

- there is little synthesized evidence specifically about policies and regulations that can affect access to digital technologies, or that specify specific roles for particular health-system stakeholders (including government’s role) over the short, medium and long term
- there is some evidence about the ways that government policymakers can enable the adoption of innovations to support technology-enabled healthcare, which found:
 - providing strategic direction for digital health requires the establishment of regulation and standards (which can include the adaptation of international approaches) and incentives to promote compliance among stakeholders

- innovations in technology-enabled healthcare may increase challenges and concerns about their potential impacts on key aspects of the health system (e.g., workload and workforce, equity, implementation and integration with existing services)
- key facilitators for planning, development, and uptake of new innovations include using analytical and deliberative approaches (e.g., rapid-learning and improvement cycles, stakeholder analyses to identify key supports for integration at multiple levels) providing tools to support those responsible for adopting and implementing new technologies (e.g., to identify innovation readiness and implementation considerations), as well as financial incentives and supports (e.g., covering up-front costs).

Element 2 – Planning for a future health system where clinical encounters in all sectors and settings are less constrained by the geographical location of providers and patients

This element focuses on planning for a future technology-enabled health system where clinical encounters in primary care, in specialist consultations and in rural and remote care can happen, regardless of where patients and providers are located. This would include:

- 1) clarifying the care models required, which includes determining:
 - which services are going to be provided virtually and which are not
 - the role of traditional ‘brick and mortar’ providers who will increasingly move to a mix of virtual and in-person services
 - the roles played by digital-health only companies that compete with ‘brick and mortar’ (or hybrid) providers
- 2) adjusting system-level arrangements that enable the above, including:
 - establishing an appropriate payment model
 - developing an approach for defining the payment amount
 - establishing an approach for defining appropriate referral networks and for ensuring continuity of care
 - establishing an approach to ensuring equitable access and quality of care.

In addition to these within-province considerations, the movement towards virtual models of care may also increasingly require planning and adjustments to health-system arrangements given the possibility of:

- Ontarians receiving care from providers based in other provinces or territories, or based in other countries
- Ontario-based providers providing care to patients in other provinces or territories, or based in other countries.

We identified 11 evidence syntheses that addressed this element. In Appendix 2, full details about each of the syntheses and their findings are provided, with the following themes emerging when considering all of the findings together:

- digital care appears to improve clinical encounters in different settings such as maternal healthcare and health promotion among rural older adults
- there are limited evidence syntheses about care models and the impact of digital care on existing workloads and on the workforce at the provider and system levels
- there are limited syntheses on establishing appropriate payment models, referral networks to ensure continuity of care, and an approach to ensuring the quality of care
- there is some evidence and guidance to suggest that the use of digital care-enhanced referral coordination and mobile clinical decision support systems may improve the quality and continuity of care
- key facilitators to plan for more clinical encounters include financial supports (e.g., reimbursement policies), tools to support adoption and implementation (e.g., technology infrastructure, technology education, culturally competent digital care), provider- and system-level support (e.g., leadership, buy-in), and standardization (e.g., use of technology, data sharing).

Element 3 – Planning for a future health system with more digitally supported care

This element includes the specific planning efforts needed to prepare Ontario’s health system for a future in which care is increasingly supported by digital-health technology. It includes considerations for all traditional health-system stakeholders (e.g., patients, families and caregivers, healthcare workers, health-system leaders) as well as those stakeholders who will increasingly be seen as ‘key’ to the system (e.g., private telecommunications companies and digital-only health providers). Key sub-elements of this element include:

- 1) clarifying digital-support models, which may range from:
 - optimizing the use of online self-monitoring, self-management and support for patients
 - optimizing the use of clinical-decision support and clinical-prediction tools for healthcare workers (and hence more precision medicine and precision health and social care by providers)
 - optimizing the use of predictive analytics for system leaders
- 2) adjusting system-level arrangements that enable the above:
 - clarifying the roles of, and accountability attributed to, private companies who provide required technology services for patient online self-monitoring and self-management (e.g., telecommunications providers)
 - ensuring equitable access to the technologies (e.g., mobile devices) and technology services (e.g., internet service) required by patients to engage in online self-monitoring and self-management through adjustments to provincial and territorial insurance plans
 - investing in the required information and communication technology infrastructure that enables healthcare workers and patients to make use of clinical decision-support and clinical-prediction tools, as well as in the required implementation supports that promote the appropriate use of these tools (including any necessary ‘change-management’ efforts targeting patients and providers)
 - creating strong evidence-support systems that ensure system leaders have access to the best-available evidence (including predictive analytics alongside other forms of evidence) when they need it, and in formats they can use.

We identified 22 evidence syntheses that addressed this element. In Appendix 3, full details about each of the syntheses and their findings are provided, with the following themes emerging when considering all of the findings together:

- digital care tends to improve the overall timeliness, availability, quality and comprehensiveness of patient care, while also contributing positively to:
 - enhanced patient safety
 - independent living and self-management
 - increased self-help behaviour
 - stronger referral coordination
 - improved interdisciplinary team-based care, clinical decision-making, clinical documentation and administrative efficiency
- key facilitators that can support the uptake and success of digitally supported care include:
 - personalization
 - interface optimization, interoperability and efforts to ensure collaborative and coordinated care
 - public engagement and patient recruitment
 - accounting for and adjusting to workplace environment, practice complexity and workflow.

Element 4 – Engaging in HHR planning processes that align the workforce to health-system needs

This element is required to ensure the healthcare workforce is optimized for new models of care (element 2) and associated digital supports (element 3) that will be established as part of planning for the future of technology-enabled healthcare work in Ontario. It builds on an assumption that the health-system features Ontarians want as part of their health system can be agreed upon by key stakeholders at all levels, and that these features are rooted in a population-health management approach (see Figure 1). Specific sub-elements include:

- 1) clarifying altered levels of demand for certain types of workers, which may range from:
 - fewer of some types of healthcare workers (e.g., radiologists who can focus on digital images that have already been reviewed using AI algorithms, booking clerks and scribes)
 - more of other types (e.g., digital-health support workers)
- 2) adjusting system-level arrangements that enable the above:
 - shifting from ‘stock-flow’ to population needs-based workforce planning models that are iteratively adjusted to reflect innovations in technology-enabled healthcare, as well as new types of healthcare workers required for care delivery
 - supporting self-regulation for new types of healthcare worker that are playing increasingly significant roles in care delivery, and adjusting scopes of practice among others as their role in care delivery evolves
 - reviewing and adjusting health professional education curricula to ensure that health workers are trained in ways that reflect shifts towards technology-enabled healthcare work.

We identified two evidence syntheses that addressed this element, which are described in full detail in Appendix 4. In summary, we found that:

- there was no synthesized evidence that provided insight on altered levels of demand for health human resources in response to technology-enabled healthcare
- areas of focus when using technology to mitigate health human resources restraints should include enhancing digital referral coordination and mobile clinical support systems, as well as creating standards for digital care
- at the system level, health workforce planning models in Canada have shifted to using a population health needs-based component that considers demographic and epidemiological variables of the population, in addition to the level of service and productivity in the healthcare system.

Additional equity-related observations about the four approach elements

Several evidence syntheses identified issues that are relevant to the equity groups prioritized in this brief, in particular:

- one focused on the importance of technology-enabled healthcare as a way to overcome health human resource challenges, particularly in underserved areas (22)
- several raised the need to ensure technology-enabled healthcare is introduced in ways that don’t exacerbate inequities and that are attuned to the needs of equity-deserving groups more generally (23-27)
- one identified telehealth as a useful tool for promoting health among older adults in rural areas.(28)

Additional details about reviews focused on particular dimensions of equity can be found in the Appendix.

While the insights from evidence syntheses are helpful reminders about the importance of planning for the future of technology-enabled healthcare in a way that is sensitive to equity concerns, it is also important to acknowledge that the Government of Ontario has developed a plan for digital inclusion through an equity lens, which is outlined in the Ontario Digital Service Action Plan.(17) The plan states that Ontario is working to achieve digital inclusion through the following steps:

- 1) designing programs and services to be inclusive and accessible from the start

- 2) closing connection gaps in rural and remote communities, and making high-quality, affordable internet available in public places
- 3) developing essential digital skills and literacy from childhood to later life
- 4) enabling the growth of the civic technology movement to empower people in using technology to address local problems in their communities.(17)

Taken together, if these steps are implemented successfully, they will help to mitigate some of the equity concerns related to the prioritized groups outlined earlier in this brief.

IMPLEMENTATION CONSIDERATIONS

A number of barriers might hinder implementation of the four elements of a potentially comprehensive approach to optimizing practice based on data, evidence and guidelines, which needs to be factored into any decision about whether and how to pursue any given element (Table 5). While potential barriers exist at the levels of providers, organizations and systems (if not patients/citizens, who are unlikely to be aware of or particularly interested in the specifics of these approach elements), perhaps the biggest barrier lies in two areas:

- 1) politicization of the health system (e.g., senior elected politicians set the vision for the health system) without governance structures that enable the planning and execution of long-term and complex change, which makes it very difficult to plan beyond the four-year election cycle
- 2) a lack of fora for health-system leaders involved in ‘small p’ politics (e.g. leaders of health authorities/organizations providing strategic direction and oversight for care delivery, leaders of health workplaces and practices, and leaders of organizations focused on specific categories of health workers) to broker agreement around the features of the future health systems we want, while acknowledging that there will be winners and losers and some level of risk tolerance will be required.

Table 5: Potential barriers to implementing the elements

Levels	Provisional / Draft responses			
	Element 1 – Defining the role of health-system stakeholders (including government) in enabling compassionate, technology-enabled healthcare	Element 2 – Planning for a future health system where clinical encounters in all sectors and settings are less constrained by the geographical location of providers and patients	Element 3 – Planning for a future health system with more digitally supported care	Element 4 – Engaging in HHR planning processes that align the workforce to health-system needs
Patient/individual	None identified (government-level enablers not particularly visible to patients)	- Some patients may prefer to see providers in person and in their own community - Some patients may adjust to models of care that are heavily reliant on digital technologies	- Some patients may perceive the emphasis on supporting self-monitoring and management as a signal that providers and organizational/system leaders are shifting the burden of care onto them - Some patients may not welcome a larger role for the private sector (e.g., technology companies)	None identified (patients are not likely to be aware of or particularly concerned with the approaches taken to plan for HHR)

Care provider	Providers (and the associations representing them) likely support government's role if it protects (or doesn't immediately threaten) their professional interests	- Some care providers may prefer to provide care in person and in their own community - Some care providers may perceive their remote-based colleagues as competing for patients (particularly if areas of specialty or scopes of practice overlap)	- Some care providers may perceive digital decision and prediction tools (based on algorithms and AI programs) as infringing on their professional autonomy - Some care providers may face a professional 'identity' crisis if their roles in the system start to drift from their vision of their profession	Some care providers may resist approaches to HHR planning that prioritize the role of new types of providers or that prioritize the role expansion of existing types of providers
Organization	- Public and not-for-profit organizations may oppose any new government roles perceived as them 'offloading' additional responsibility onto them without commensurate funding increases - Private, for-profit organizations may oppose any new government roles that are perceived as restricting access to markets	- Organizations may not be willing to invest in the necessary infrastructure required to enable locally based care providers to care for patients outside of their traditional 'catchment' areas - Organizations may find it difficult to adjust how they plan for and maintain 'brick and mortar' institutions as more digital and remote-based care comes online	Organizations may have yet to establish a culture, as well as the necessary structures and processes, that are required to support evidence-informed decision-making	Organizations may not be able to nimbly adapt to new HHR planning models that prioritize the integration of new types of care providers
System	Governments may not have the capacity to take on additional roles in areas for which they have not built up the administrative capacity	Significant changes to governance, financial and delivery arrangements may not be politically or technically feasible unless they are proactively planned for and introduced incrementally	Enabling a greater role (and integration of) for for-profit, private-sector technology companies in the delivery of publicly financed healthcare services may require significant changes to existing policy frameworks	System leaders involved in HHR planning are not likely to have access to high-quality, comprehensive datasets that would enable them to understand patient needs in a shifting care landscape, as well as the supply and distribution of a broader range of healthcare providers

There are also a number of facilitators to consider. Some of these have been covered in Table 1, which outlined some of the lessons learned about the factors driving two successful system-transformation initiatives in Ontario (e.g., legislated authority, resources and support from government, strong leadership and ability to broker relationships). Others that are more specifically related to the four elements included in this evidence brief are included in Table 6 below, as well as the ‘windows of opportunity’ that exist for implementing the elements.

Table 6: Potential windows of opportunity for implementing the elements

Type	Element 1 – Defining the role of health-system stakeholders (including government) in enabling compassionate, technology-enabled healthcare	Element 2 – Planning for a future health system where clinical encounters in all sectors and settings are less constrained by the geographical location of providers and patients	Element 3 – Planning for a future health system with more digitally supported care	Element 4 – Engaging in HHR planning processes that align the workforce to health-system needs
General	- Many patients and healthcare providers are already embracing technology as a way to improve access to care, with the COVID-19 pandemic accelerating progress in many areas - Many technological innovations have already established themselves in health as useful tools for patients and healthcare provider, (e.g., wearable devices that support self-monitoring and self-management) - Ontario Health Teams are currently being implemented across the province, providing many new ways in for innovations in areas like digital health, particularly through the Digital First for Health Strategy - New agreements with the federal government may open the door to new investments in technology (e.g., digital health and data)			
Option-specific	There is an interest among senior decision-makers for considering new roles for both government and organizations responsible for care delivery (e.g., recently the introduction of private, for-profit care centres), in ways that signal there is flexibility in the way stakeholders are involved in efforts to transform the system	There are already many projects that leverage technology to provide care to patients in remote and rural areas of the province, and agencies such as the Ontario Telemedicine Network (now part of Ontario Health) that have a mandate to connect and coordinate care in the provinces through digital technologies	Ontario is a hub for both established technology companies as well as innovative technology ‘start-ups,’ which could help to facilitate co-created solutions that are tailored to provincial needs and context	Decision-makers in Ontario are focused on identifying solutions to the ongoing HHR challenges in the province, which may open the door to new approaches for planning

REFERENCES

1. Protti D. Missed connections: The adoption of information technology in Canadian healthcare. Toronto, Canada: C.D. Howe Institute; 2015.
2. Dietrich-Socha K. Empowering the health workforce to make the most of the digital revolution. Paris: OECD Publishing; 2021.
3. OECD. The COVID-19 pandemic and the future of telemedicine. Paris, France: OECD Publishing; 2023.
4. Rapid-Improvement Support and Exchange. Population-health management collaborative summary (1 March 2021). Hamilton, Canada McMaster Health Forum; 2021.
5. Health System Performance Network. OHT cQIP indicators and population segmentation (presentation). Toronto, Canada: HSPN; 2022 February 2022.
6. Wang J, Vahid S, Eberg M, et al. Clearing the surgical backlog caused by COVID-19 in Ontario: a time series modelling study. *Canadian Medical Association Journal* 2020;192(44): E1347-E1356.
7. Jin YP, Canizares M, El-Defrawy S, Buys YM. Backlog in ophthalmic surgeries associated with the COVID-19 pandemic in Ontario 2020. *Canadian Journal of Ophthalmology* 2022.
8. Saunders NR, Kurdyak P, Stukel TA, et al. Utilization of Physician-Based Mental Health Care Services Among Children and Adolescents Before and During the COVID-19 Pandemic in Ontario, Canada. *Journal of the American Medical Association Pediatrics* 2022;176(4): e216298.
9. Kronfli C. COVID-19 policy brief: Realizing the full potential of virtual care in oOntario. Toronto, Canada Ontario Chamber of Commerce; 2020.
10. Falk W. The state of virtual care in Canada as of wave three of the COVID-19 pandemic: An early diagnostic and policy recommendations Ottawa, Canada: Health Canada; 2021 June 29, 2021.
11. Ministry of Health. Virtual care 1: Comprehensive and limited virtual care services. Toronto, Canada: Ontario Ministry of Health and Ontario Medical Association; 2022 November 24, 2022.
12. Virtual Care Task Force. Virtual care: Recommendations for scaling up virtual medical services: Canadian Medical Association, College of Family Physicians of Canada, and the Royal College of Physicians and Surgeons of Canada; 2020 February 2020.
13. Canadian Partnership Against Cancer. Virtual care in Canada: Environmental scan. Toronto, Canada: Canadian Partnership Against Cancer; 2019 2019.
14. Sinclair D, Rochon M, Leatt P. Riding the Third Rail: The Story of Ontario's Health Services Restructuring Commission, 1996-2000. Montreal, Canada: Institute for Research on Public Policy; 2005 August 15, 2005.
15. Thompson LJ, Martin MT. Integration of cancer services in Ontario: The story of getting it done. *Health Education Quarterly* 2004;7(3): 42-8, 2.
16. Statistics Canada. Canadian Internet Use Survey, 2020. Canada S, editor. Ottawa, Canada: Statistics Canada 2021 June 22, 2021.
17. Ontario Digital Service. Digital Action Plan 2018. Toronto, Canada: Government of Ontario; 2018 2018.
18. Statistics Canada. Canadian Internet Use Survey, 2018. Canada S, editor. Ottawa, Canada: Statistics Canada; 2019 October 29, 2019.

19. Shaw J, Chandra S, Gordon D, et al. Digital health technologies for more equitable health systems: A discussion paper. Toronto, Canada: Women's College Hospital Institute for Health Systems Solutions and Virtual Care (WIHV); 2019.
20. Centre for Digital Health and Evaluation. Virtual care in the COVID-19 era evaluation: Summary report. Toronto, Canada: Women's College Hospital Institute for Health System Solutions and Virtual Care; 2022 2022.
21. Government of Ontario. Ontario expanding digital and virtual health care: Giving patients more options part of province's plan to end hallway health care. Toronto, Canada: Government of Ontario; 2019 November 13, 2019.
22. Lehoux P, Roncarolo F, Silva H, Boivin A, Denis J, Hebert R. What health system challenges should responsible innovation in health address? Insights from an international scoping review. *International Journal of Health Policy and Management* 2019;8(2): 63-75.
23. Rodgers M, Raine G, Thomas S, Harden M, Eastwood A. Informing NHS policy in 'digital-first primary care': A rapid evidence synthesis. *Health Services and Delivery Research* 2019;7(41).
24. Kruse C, Bouffard S, Dougherty M, Parro J. Telemedicine use in rural Native American communities in the era of the ACA: A systematic literature review. *Journal of Medical Systems* 2016;40(6): 145.
25. Meurk C, Leung J, Hall W, Head B, Whiteford H. Establishing and governing e- mental health care in Australia: A systematic review of challenges and a call For policy-focussed research. *Journal of Medical Internet Research* 2016;18(1): e10.
26. O'Connor S, Hanlon P, O'Donnell C, Garcia S, Glanville J, Mair F. Understanding factors affecting patient and public engagement and recruitment to digital health interventions: A systematic review of qualitative studies. *BioMed Central Medical Informatics and Decision Making* 2016;16(1): 120.
27. Thompson M, Reilly J, Valdez R. Work system barriers to patient, provider, and caregiver use of personal health records: A systematic review. *Applied Ergonomics* 2016;54: 218-42.
28. Rush K, Singh S, Seaton C, et al. Telehealth use for enhancing the health of rural older adults: A systematic mixed studies review. *Gerontologist* 2022;62(10): e564-e577.
29. Frost M, Tran J, Khatun F, Friberg I, Rodriguez D. What does it take to be an effective national steward of digital health integration for health systems strengthening in low- and middle-income countries? *Global Health: Science and Practice* 2018;6(Suppl 1): S18-S28.
30. Hassanaly P, Dufour J. Analysis of the regulatory, legal, and medical conditions for the prescription of mobile health applications in the United States, the European Union, and France. *Journal of Medical Devices: Evidence and Research* 2021;14: 389-409.
31. Sabet S, Heard A, Brown A. Science, technology, innovation and partnerships for development: An evidence gap map 2017. 108 p.
32. Ross J, Stevenson F, Lau R, Murray E. Factors that influence the implementation of e-health: A systematic review of systematic reviews (an update). *Journal of Implementation Science* 2016;11(1): 146.
33. Franco-Trigo L, Fernandez-Llimos F, Martinez-Martinez F, Benrimoj S, Sabater-Hernandez D. Stakeholder analysis in health innovation planning processes: A systematic scoping review. *Health Policy* 2020;124(10): 1083-1099.
34. Turner S, D'Lima D, Hudson E, et al. Evidence use in decision-making on introducing innovations: A systematic scoping review with stakeholder feedback. *Journal of Implementation Science* 2017;12(1): 145.
35. Waddell K, Wilson MG. Rapid synthesis: Exploring models for health workforce planning. Hamilton; 2019.

36. Tursunbayeva A, Pagliari C, Bunduchi R, Franco M. Human resource information systems in health care: Protocol for a systematic review. *Journal of Medical Internet Research Research Protocols* 2015;4(4): e135.
37. Gupta A, Thorpe C, Bhattacharyya O, Zwarenstein M. Promoting development and uptake of health innovations: The Nose to Tail Tool. *F1000 Research* 2016;5: 361.
38. Lavis J, Gauvin F, Mattison C, Moat K, Waddell K, Reid R. Rapid synthesis: Creating rapid-learning health systems in Canada. Hamilton, Canada: McMaster Health Forum; 2018 2018. 36 p.
39. Silva C, Lopes R, de Goes Bay OJ, et al. Digital health opportunities to improve primary health care in the context of COVID-19: Scoping review. *Journal of Medical Internet Research Human Factors* 2022;9(2): e35380.
40. Goldstein K, Zullig L, Dedert E, et al. Telehealth interventions designed for women: An evidence map. *Journal of General Internal Medicine* 2018;33(12): 2191-2200.
41. Queiros A, Alvarelhao J, Cerqueira M, Silva A, Santos M, Rocha N. Remote care technology: A systematic overview. *Studies in Health Technology & Informatics* 2017;242: 111-118.
42. Vegesna A, Tran M, Angelaccio M, Arcona S. Remote patient monitoring via non-invasive digital technologies: A systematic review. *Telemedicine Journal and e-Health* 2017;23(1): 3-17.
43. Ekman B. Cost analysis of a digital health care model in Sweden. *Pharmacoeconomics Open* 2018;2(3): 347-354.
44. Orton M, Agarwal S, Muhoza P, Vasudevan L, Vu A. Strengthening delivery of health services using digital devices. *Global Health: Science and Practice* 2018;6(Suppl 1): S61-S71.
45. Keasberry J, Scott I, Sullivan C, Staib A, Ashby R. Going digital: A narrative overview of the clinical and organisational impacts of eHealth technologies in hospital practice. *Australian Health Review* 2017;41(6): 646-664.
46. Rogers M, Lemmen K, Kramer R, Mann J, Chopra V. Internet-delivered health interventions that work: Systematic review of meta-analyses and evaluation of website availability. *Journal of Medical Internet Research* 2017;19(3): e90.
47. Thomas E, Taylor M, Banbury A, et al. Factors influencing the effectiveness of remote patient monitoring interventions: A realist review. *British Medical Journal Open* 2021;11(8): e051844.
48. Voruganti T, Grunfeld E, Makuwaza T, Bender J. Web-based tools for text-based patient-provider communication in chronic conditions: Scoping review. *Journal of Medical Internet Research* 2017;19(10): e366.
49. Stokke R. The personal emergency response system as a technology innovation in primary health care services: An integrative review. *Journal of Medical Internet Research* 2016;18(7): e187.
50. Simblett S, Greer B, Matcham F, et al. Barriers to and Facilitators of Engagement With Remote Measurement Technology for Managing Health: Systematic Review and Content Analysis of Findings. *Journal of Medical Internet Research* 2018;20(7): e10480.
51. Kim M, Coiera E, Magrabi F. Problems with health information technology and their effects on care delivery and patient outcomes: A systematic review *Journal of the American Medical Informatics Association* 2017;24(2): 246-250.
52. Shuwandy M, Zaidan B, Zaidan A, Albahri A. Sensor-based mHealth authentication for real-time remote healthcare monitoring system: A multilayer systematic review. *Journal of Medical Systems* 2019;43(2): 33.
53. Agarwal S, Glenton C, Tamrat T, et al. Decision-support tools via mobile devices to improve quality of care in primary healthcare settings. *Cochrane Database of Systematic Reviews* 2021;7(7): CD012944.

54. Goncalves-Bradley D, AR JM, Ricci-Cabello I, et al. Mobile technologies to support healthcare provider to healthcare provider communication and management of care. *Cochrane Database of Systematic Reviews* 2020;8(8): CD012927.
55. Konttila J, Siira H, Kyngas H, et al. Healthcare professionals' competence in digitalisation: A systematic review. *Journal of Clinical Nursing* 2019;28(5-6): 745-761.
56. Ajami S. Use of speech-to-text technology for documentation by healthcare providers. *National Medical Journal of India* 2016;29(3): 148-152.
57. Kilsdonk E, Peute L, Jaspers M. Factors influencing implementation success of guideline-based clinical decision support systems: A systematic review and gaps analysis. *International Journal of Medical Informatics* 2017;98: 56-64.
58. De Angelis G, Davies B, King J, et al. Information and communication technologies for the dissemination of clinical practice guidelines to health professionals: A systematic review. *Journal of Medical Internet Research Medical Education* 2016;2(2): e16.
59. Zhao J, Song B, Anand E, et al. Barriers, facilitators, and solutions to optimal patient portal and personal health record use: A systematic review of the literature. *American Medical Informatics Association Annual Symposium proceedings* 2017;2017: 1913-1922.
60. Eden R, Burton-Jones A, Scott I, Staib A, Sullivan C. Effects of eHealth on hospital practice: Synthesis of the current literature. *Australian Health Review* 2018;42(5): 568-578.
61. Weigel F, Switaj T, Hamilton J. Leveraging health information technology to improve quality in federal healthcare. *United States Army Medical Department journal* 2015;15(4): 68-74.

APPENDICES (see separate document)



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