Evaluation Of E-Health Implementation In The Healthcare System: A Canadian Perspective

L S Park, T Tolsma, T Gao, J Singh, A Mardon

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Abstract

The COVID-19 pandemic has promoted the development of E-health to support the virtual healthcare provision, which offers an improved quality of and access to health in anticipation of the virtual, digital post-COVID society. E-health can be described as an emerging field of health using new digital and medical technologies to assist the deliverance of healthcare. Implementation of E-health poses advantages to public health and individual clinical care by achieving individualized precision medicine, greater access to healthcare, digitalization of medical records, and accurate diagnosis. This paper evaluates the advantages of E-health and the current status of E-health implementation and development in Canada. Then, the future direction and limitations of E-health in clinical practice are discussed.

INTRODUCTION

Amid the SARS-CoV-2 (COVID-19) pandemic, quarantine, social isolation, and contactless measures have been implemented at all levels of governments.1 In Korea, the term un-tact has been coined to describe the contactless post-pandemic society. The COVID-19 pandemic has accelerated the digitalization of healthcare globally,1 forcing health institutions to reconsider the traditional patient-clinician relationships in anticipation of the contactless and virtual, post-COVID era. Limitations in physical infrastructure, supplies, and human resources evidently poses a challenge to the traditional healthcare system. In order to ensure the continued provision of essential healthcare services, governments and colleges have taken unprecedented response measures, using “brand new digital or medical technologies involving genomics, big data, wearables, mobile applications, and artificial intelligence”,2 to assist in the deliverance of healthcare known as E-health. E-health provides an alternative to in-person doctor-patient appointments and individualized practice of medicine2 while minimizing physical contact. Therefore, investigation into its benefits and limitations would offer an improved healthcare implementation for the contact-free, post-pandemic future.

This paper reviews previous literature to discuss the evolution and improvements of digital health and the current status of digital health in Canadian healthcare settings. In addition, this paper evaluates future technological advancements in healthcare, well-suited for the contactless society. Finally, potential limitations of digital healthcare are discussed. This paper will particularly take a Canadian perspective although many of the points can be generalized.

ADVANTAGES OF E-HEALTH

E-health is an application of IT (Information Technology) and communication in the healthcare sector. This application includes self-assessment for patients, online screening and testing as well as telemedicine, a real-time virtual clinical communication and conferencing.[1] While the definition of E-health varies across governments, health organizations, and academia, it is under the umbrella of healthcare, while encompassing Mobile Health and Medical Artificial Intelligence (AI), overlapping with medicine.[2]

Self-Health Assessment Tool

During the COVID-19 pandemic, provinces in Canada have adapted E-health self-assessment tools, which helps citizens determine their eligibility for testing, guide them to the nearby health centre, and provides safety advice.[1] For example, during the COVID-19 pandemic, Canadian provincial websites provided self-assessment tools, which contained questionnaires that evaluated symptoms and travel history. Expanding this E-health assessment tool in the post-

COVID society, the privatized sharing of laboratory test results as well as personal medical records in hospitals for patients through E-health could encourage patients to adopt greater health autonomy to make health decisions.[1]

Accessible, Individualized Healthcare

Previous research indicates that within the current healthcare system, patients do not receive the care they want and require.[3] In support of this literature in Canada, the Canadian Institute for Health Information reports that only 62% of Canadians are satisfied with clinical experience.[4] An E-health platform such as Maple, which focuses on virtual clinical consultations, diagnosis, and treatment may fill this missing gap in patient experience by allowing shorter waiting time, personalized healthcare, and increased number of doctor-patient consultations.[5] In addition, from a Canadian perspective, one of the challenges of Medicare (healthcare system in Canada) is its limitation on reaching geographically-isolated and extreme climatic regions in Canada such as Nunavut.[6] However, E-health and medical technology could facilitate sharing of medical information and advice as well as bring appropriate medical support to the patients, thereby increasing health accessibility to geographically-isolated patients as well.[6]

Outbreak control and Public Health

As demonstrated during the COVID-19 pandemic, digital contact tracing technology has played a significant role in many countries in controlling the transmission of COVID-19.[7] The use of digital contact tracing has allowed governing bodies to identify and trace the potential active patients and advise appropriate measures. An exemplary use of digital tracing technology can be found in South Korea, whose conjunctive use of geolocation data, transaction and public transit history, and security cameras allowed efficient identification of potential contacts.[8] It has therefore been revealed that, while the issue of privacy and cyber-attacks remain technologically unresolved, E-health is a significant advantage that can be used in future pandemics and in seasons of public health adversity to control its transmission.

Clinical Advantages

There are over 20 medical AI technologies that are officially approved for use by the Food and Drug Administration (FDA) and majority of them are Picture Archiving and Communication Systems (PACS).[2] AI interventions assist with Computer-Aided Diagnosis (CAD) of radiology images.[2] Recent studies indicate that AI technology could interpret radiology images at a comparable competence as that of a physician and would further prevent misdiagnosis considering that average radiologists still have a 3%-5% error rate.[9]

The development of E-health therefore allows for patients' active engagement in their health and a more individualized care, all without physical contact, which is suited for the anticipated post-COVID-19 era.

CURRENT STATUS IN CANADA

Use of AI and machine learning in the healthcare field is a relatively new practice in Canada. Thus, medical AI is not yet fully implemented as Canadian medical AI regulations are not as established as the United States, for example, whose FDA has begun the pilot testing for the Pre-Cert regulatory program back in 2017.[9] However, medical machine learning has potential to grow and is slowly making progress in Canada. In fact, previous literature discusses the ease of implementation of E-health in Canada due to the integrated and interconnected nature of the Canadian healthcare system that would allow for an efficient collection of anonymized medical data, which is necessary for the proper functions of AI tools in clinical settings.[9] Furthermore, recently in 2020, the Hospital for Sick Children in Toronto has begun developing CHARTwatch, an AI technology which collects and analyzes real-time and medical history records to alert 24 to 48 hours in advance of the patient's risk of adversity.[10]

In Canada, digitalization of patient data has actively been in use. Many Ontarian hospitals and healthcare institutions, such as Halton Healthcare in the Greater Toronto Area, have adopted Meditech's (Medical Information Technology, Inc., Westwood, MA, USA.) electronic health record software. Meditech compiles a patient's previous medical record, lab results or medications for efficient, quick, and well-informed decision-making by clinicians.[6]

Telemedicine, which is relatively safe and low-risk for use by private doctors, has also been slow to progress in Canada compared to the United States. In 2016, Kaiser Permanente (Kaiser Permanente, Oakland, CA, USA), the United States' largest healthcare company, conducted 52% of 110 million patient visits on a virtual platform. Further data suggested that there was no increase in misdiagnoses and even a decrease in malpractice claims.[5] Despite such advantages, Canada has been slow to adapt to telemedicine due to fear and concern surrounding data and privacy, and its potential

to negate the universality principle of Canadian healthcare system.[5] Currently, in light of the pandemic, telemedicine and the real-time virtual care system has slowly grown in Canada. Particularly in Alberta, the integration of virtual meeting app, Zoom (Zoom Video Communications, Inc., San Jose, CA, USA) with online referrals and clinical communications, enabled triaging, documentation, and electronic consultations while avoiding physical contact.[1]

During the COVID-19 pandemic, Canada has experienced an increased use of E-health. For example, recent literatures show that the use of virtual platforms, using clinician-patient video conferencing and visits have increased from 1000 per day in February to 14 000 by mid-May.[11] In Alberta, Edmonton, Virtual Hospital was established during the pandemic to deliver acute medical care for patients with chronic and complex diseases at home, using home monitoring, virtual health assessments, and a virtual communication network between family and specialist doctors.[1]

Finally, during the pandemic, Canada's COVID Alert app was designed and implemented for wide use across Canada. This decentralized system of digital contact technology alerts app-holders if a Bluetooth signal of an active COVID-19 patient has been detected within the 2-metre boundary for more than 15 minutes.[12] Since its launch in July 2020, it has now gained over 5 million users.[12] This therefore demonstrates a positive shift in the use of, and in the public sentiment towards online medical technologies and E-health by Canadians to autonomously avoid physical contact and to prevent the viral transmission.

FUTURE DIRECTION

One of the prospects of future E-health is its mental health intervention, ranging from text-based information to more sophisticated interactive activities and therapies, that could be used for anxiety and depression management among children and adolescents.[13] However, a recent systematic review, which included an ongoing study in The Hospital for Sick Children in Toronto, suggests that the data on mental health advantages of E-health interventions are not yet sufficient nor indicate that E-health interventions are significantly better than traditional comparators.[13] However, given the growing access to technology and interest for E-health, there is a possibility for its wide implementation as a mental health intervention method in near future.

Patient health data collection is an integral part of E-health. Improved collection of patient-generated health data (PGHD) in every-day life, not limited to clinical settings,[2] should be E-health's future direction. In fact, there are many wearable mobile devices already in the market, that collect the user's health data, such as name, gender, age, height, weight, activity, and blood pressure.[14] Active use and collection of PGHD through mobile technologies will facilitate an improved transfer of information among clinicians as well as management of health conditions.[2] However, such a future direction for PGHD must be assisted by adequate consideration and a proper solution to the issue of privacy and cyber-security.

DISCUSSION

While the wide applications of E-health are promising, in order for E-health to serve as an alternative method of healthcare provision, technologies must be reassessed and its implementation should be guided by sufficient consideration of its challenges and limitations.

Privacy and Ethics

Progress in the development of E-health allows for a more accurate analysis, diagnosis, and suggestions for treatment plans for the patients via AI technology. Hence, the legal framework behind accountability for misdiagnosis caused by AI assistance should be reconsidered before its adaptation, which is not fully addressed in the current civil codes.[15] In addition, with personal clinical data collection being an integral criterion for E-health, the dilemma between protecting and improving health, and protecting privacy[16] must first be addressed prior to its implementation. For example, Canada's digital COVID tracker, instead of a centralized system wherein personal data is collected, relied on a decentralized system, powered by Bluetooth without collection of data.[12] The issue of privacy could further have an adverse effect on patient experiences, who might withdraw from seeking clinical help due to fear of being scrutinized.[9]

Financial Costs

For active implementation of medical AI infrastructure in hospitals, the establishment of hardware and software poses financial challenges. For instance, Icometrix, one of the medical AI softwares has a subscription fee of €5,000 and another AI hardware, DGX, that possess 4 Deep Learning GPUs (Graphic Processing Units) could cost €40,000 each,[17] which is equivalent to about $62 000 CAD. Hence, wide-spread implementation of private medical AI technology in hospitals would pose a significant financial burden on both

the government and regional healthcare organizations in Canada on top of the national multi-million funding towards medical AI development.[9] Since not all healthcare organizations are equally prepared to adopt E-health in Canada,[1] the cost associated with its hardware, software, and development presents hurdles for its nation-wide implementation in the near future.

Effect on Clinicians

As medical AI develops, clinicians may become overly reliant on the uses of AI and lose their role and expertise in critical, independent decision-making.[18] Therefore, the extent of its utilization and application must also be considered prior to its implementation lest it interferes with the professional opinions of clinicians rather than being utilized as an additional assistance in diagnosis and treatment. Previous literatures also argue that with the growing influence of AI technology and digital informatics, medical students and clinicians would require further education in health informatics and data as well.[9]

Effect on Patients

One of the potential limitations of E-health would be the disruption of the traditional patient-physician relationship, and the fear in patients that their personal data will be collected and studied.[9] This fear could introduce biases in a patient's responses. In addition, although sharing health information and personal medical history allow patients to become actively engaged in their own health, it could adversely promote excessive involvement and encourage patients to self-diagnose. Self-diagnosis is not only accurate to about 58%, but also it interferes with professional, clinical diagnosis to receive unnecessary healthcare, thereby increasing healthcare spending.[19] Further, while having accessible health information via E-health could provide accurate, algorithm-based clinical advice,[9] its 'black box' mechanism could reduce independence and freedom of patients, preventing them from making informed health decisions.[9] The accessibility of E-health for the elderly population (ages >65) in Canada must also be considered given that only 60% of this age group own a smartphone and a mere 20% regularly use the internet.[20] This age group could possibly have a reduced access to healthcare due to E-health.

CONCLUSION

E-health has demonstrated its advantages in the modern healthcare system through the digitalization of clinical data and handling pandemic outbreaks. Given its virtual platform through which healthcare is administered, the future of E-health promises a virtual, yet efficient healthcare provision, suitable for a contactless post-COVID-19 society. Despite being in its primary stages in Canada, the current advantages demonstrated by E-health anticipates its potential to provide precision medicine and improve future management of human diseases in a virtual, digitalized society. However, to successfully implement E-health, the issues of protection of personal data, financial costs associated, as well as adverse effects on clinicians and patients must be adequately considered. Future studies and health policies should consider these challenges of implementing E-health with the purpose of mitigating its limitations while maintaining or improving the quality of healthcare through E-health.

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Author Information

Louis S. Park
Antarctic Institute of Canada, Edmonton, AB; McMaster University, Hamilton, ON
Canada

Theoren Tolsma
Antarctic Institute of Canada, Edmonton, AB; Institute for Christian Studies, Toronto, ON
Canada

Tian Jian Gao
Antarctic Institute of Canada, Edmonton, AB; Western University, London, ON
Canada

Jasrita Singh
Antarctic Institute of Canada, Edmonton, AB; McMaster University, Hamilton, ON
Canada

Austin Mardon
Antarctic Institute of Canada, Edmonton, AB; University of Alberta, Edmonton, AB
Canada