Managing Pandemics with Health Informatics – Successes, Challenges, and Lessons for telehealth / Managing the pandemic using health informatics tools: international case studies

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Abstract

## Introduction

Emergence of COVID19 pandemic ushered in a paradigm shift in medical care and public health. When the COVID-19 pandemic began to spread worldwide in early 2021, given its infectiousness and potential to rapidly transmit through healthcare providers, countries worldwide looked for ways to deliver healthcare services while maintaining the norms of social isolation and separation in the space of clinician-client encounters. As a result, the traditional face-to-face encounters either needed to be supplanted with technological solutions or alternatives were sought. Hence, aadoption of virtual care such as through telehealth became commonplace worldwide. Even though telehealth and other virtual care tools existed pre-COVID, the need for public health practices such as physical distancing accelerated the pace of adoption of telehealth. Digital health innovations were rapidly implemented and scaled up to provide solutions for the management of COVID-19 as well as the management and follow-up of non-COVID diseases adversely affected. Digital solutions were used for disease surveillance, patient screening, triage of admissions, diagnosis, monitoring, contact tracing, patient follow-up, supply chain management, staff training as well as research reducing the burden for the overburdened healthcare staff. The challenges of COVID-19 pandemic and the resultant disruption of health services delivery due to lockdowns in many countries have generated interest in the practice of telemedicine across the globe and have changed practices and policies. Many countries have introduced new regulatory frameworks or revised existing frameworks to leverage telemedicine to overcome these challenges (citation needed).

Telemedicine is a powerful tool for health professionals and healthcare delivery systems to extend care but there are several challenges that reliance on technology alone could pose in the long-term sustainability and scale up of such approaches. For example, human-centred design approaches and local care delivery practices, barriers and enablers are at risk of not being considered (citation??). Besides, implementing new technologies in a pandemic adds to the existing complexities around change management, capacity building, and prioritization of care. A notable challenge in implementing health information technology (HIT) are unintended consequences post implementation. Various UICs including community, patient safety, information retrieval, individual-collaborative interchanges, and workflow issues have been described (Ash, Berg, & Coiera, 2004; Harrison, Koppel & Bar-Lev, 2007; Borycki, 2013; Gogia et al., 2016; Kuziemsky et al., 2016). [CK1] UICs remind us that HIT implementation is not without risk and expedited implementation of HIT such as telehealth in response to the COVID-19 pandemic could present an increased risk. However, at the same time we want to use COVID-19 as an opportunity to learn how we might increase our capacity for telehealth delivery while also accounting for UICs such as privacy and security, ethical and legal concerns, and social issues (Kaplan, 2020[CK2] ). Regardless of whether HIT adoption occurs over years or weeks such as during COVID-19, it is still a complex adoption process and we must account for implementation factors such as workflow, organizational and social, and ethical and legal concerns.

High performing health systems may be more resilient in responding to COVID-19 (Legido-Qugley). Roughly, a high performing system is one in which all aspects of a health system have been accounted for in COVID-19 response strategy. Systems thinking refers to While medical informatics and more specifically telehealth, is the focus of our working group, we recognize that HIT is only one component of a health system and it must be aligned with other system components including human resources, financial, and governance (Champion et al., 2019).

While COVID-19 has identified many opportunities for telehealth, it has also identified challenges that the medical informatics community must overcome as part of developing a sustainable telehealth system for critical response. Health systems refer to a system of systems that includes technology, data, organization, financial, human resource and policy components. A good reference is the World Health Organization’s definition and model of health systems (https://www.who.int/topics/health\_systems/en/). Systems thinking is an approach used to understand the interaction of system components to enable us to design policy and HIT to support health system objectives (Adam[CK3] & de Savigny, 2012; Chang, Ogbuoji, Atun, & Verguet, 2017). Relevant to the work in this paper is that the design and evaluation of telehealth tools to support care delivery in a critical response such as COVID-19 requires us to Telehealth is a classic example of a health system in that it consists of a number of interrelated parts that must work in unison for telehealth to effectively contribute to healthcare delivery. (Champion[CK4] et al., 2019).

[CK1]I’ll fill these references in later on

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In this paper, we describe the international experiences of implementing telemedicine/ telehealth in the context of the ongoing COVID-19 pandemic. These experiences comprehensively outline the practices from across the globe. The exemplars outlined by the members of the IMIA – telehealth working group from their direct involvement in the design, implementation and evaluation of these efforts, providing a global overview, while focusing on context, local health systems capacity, implementation considerations, gleaning from the deep technical expertise of the working group and sharing key lessons to inform policy across the world. The objective of this paper is to compare telehealth responses to COVID-19 across several countries so we can identify what has worked well but also what we can learn in order to better enable telehealth capacity for critical response such as during a global pandemic.

## Methods

The objective of this paper was to identify key learning points relevant to the practice of telemedicine, based on field experience of practitioners involved from the projects related to the application of telemedicine and information technology in delivering and ensuring seamless delivery of care for patients and clients across the world. This would then help to generate a theoretical framework and assimilate key learning points. Therefore, all members of the Telehealth Working Group of the International Medical Informatics Association were invited to provide their inputs and reflections on their best practices and current contributions and praxis of the telemedicine or delivery of care. As many of the news and reports are based on an on the ground understanding references are relatively sparse ach member also wrote a short section on their “pros and cons” of telemedicine during COVID in each of their countries and then the group as a whole reviewed at common opportunities and issues. Responses from all authors were collected in the form of a text document and the authors were assigned random codes to deidentify them (R1, R2, …, RN)

The contents of individual contributions were analysed to identify emergent themes. These experiences, tools, and insights were thematically analysed and classified for thematic commonalities. We used existing health systems strengthening framework (ref) and telehealth implementation guidelines(ref) to undertake the analysis around relevance, acceptability and health systems embeddedness.

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## Results

We obtained total of 14 text responses and reflections from eight countries. We analysed data from practitioners in India, Sri Lanka, Brazil, Colombia, Canada, New Zealand, The United States, and The United Kingdom. Collectively, these represented the major hotspots of Covid19 and in case of New Zealand, provided a snapshot of the arrangements for a health system that effectively mitigated the impact of COVID19 and were able to eliminate the infection. The themes were derived from the text that are presented in the Appendix. The emergent themes were as follows:

Covid19 resulted in extraordinary enactment of laws or government initiatives to allow telemedicine to emerge business as usual. – India, Brazil, and New Zealand enacted new laws or legalised the practice of telemedicine in lieu of face to face clinical encounters. In some parts of the world, such mandates were achieved in a rapid pace, for example in New Zealand.

Establishment of new mechanisms of dissemintation. – India established clinical practice guidelines. New Zealand

Emergence of technology platforms and technology vendors. –

Use of mobile platforms. –

Transformation in the outlook of using Telemedicine. –

Telemedicine moves beyond traditional care. --

Mobilisation of volunteers or CAM to deliver healthcare. –

Training and orientation or education of providers. --

**Appendix**

**(SBG (R1), India and (R2), India)**

In India, the COVID-19 pandemic disrupted delivery of routine health services as strict lockdowns were implemented in 5 phases and lasted several months. Associated travel restrictions and redeployment of the healthcare workforce for COVID19 required a refocused public health response. The Government of India issued an advisory for those with chronic conditions to avoid visits to healthcare facilities for non-emergency consultations, resulting in significant challenges to those with chronic conditions and multiple morbidities. These disruptions led to the accelerated release of the Telemedicine Practice Guidelines 2020 (TPG) which provides a legal framework for delivery of health care remotely through telemedicine services by the Medical Council of India which caters to practitioners of modern Medicine. Similar guidelines were also created for adoption by the Dental as well as followers of traditional medicine of which Ayurveda is the most well known. Teh latter is important as the Covid epidemic has resulted in an increased demand for Ayurvedic products, so knowledge of when and how to use is important.

The TPG has been an attempt to create a legal framework of Telemedicine. *This was required* as it was perceived to be Illegal in the past. The Karnataka State Medical council had banned teleconsultations and the Indian Medical Association - the largest community of doctors worldwide used to advice their members to not provide care support without a physical visit.

Several state governments introduced telemedicine services through the public health systems while others engaged with private providers to offer services through public private partnerships. Some states established toll free numbers through which citizens could seek information about COVID19, report symptoms, book tests as well as seek medical consultations for routine health conditions. Given the teledensity in urban and rural areas of India, teletriage for those with suspected symptoms of COVID 19 is increasingly being adopted by several state governments. A volunteer based network of health focused innovators came together on a common technology platform as Project StepOne, they offered an Interactive Voice Response System based triage and established toll-free number for COVID response on behalf of state governments. This platform also offered home based remote monitoring for mild cases and facilitated early referrals and hospital admissions for those requiring high dependency care. Over 500000 individuals with confirmed COVID-19 have been managed by Project StepOne. ***There has been a sharp*** rise in the number of telemedicine apps.

A number of organizations came together to create a registry of Telemedicine vendors ([www.telemedregistry.in](http://www.telemedregistry.in)) in India which currently includes 130 vendors listing their products in the very first phase. This number is expected to rise to 200 by the second phase. Simultaneous efforts are underway to register telehealth devices.

Despite the proliferation of these Apps which served more as appointment systems and with a payment gateway, they have hardly made a dent into actual remote care delivery, published figures regarding usage are sparse. Most teleconsultations are still largely through WhatsApp and Telephone with emails coming a distant 3rd.

The reason behind the same is overriding familiarity of patients and their families with WhatsApp. India is now the second largest consumer of mobile phones with over 40% of them being smart mobiles. This figure by itself would place penetration of mobile internet higher than any other country except China. India has the worlds’ largest user base of WhatsApp. This also means that for now, the ones who posses mobile phones and are more technically savvy are reaping higher benefits. There are apps and projects afoot to engage rural level health workers or even the more tech savvy community persons to work as intermediaries looking after proper information delivery from the patient to the remote clinicians as well as vice versa.

In India, several health start-ups offered video consultations, primarily as a triage tool providing medical advice and guidance on referral. However much of these video consultations and referrals are external to the public health system whereas 70% of healthcare in India is provided by the private sector. In a fragmented health system, video consultations have served as the first line of contact between a person with suspected covid-19 and the health system. Moreover, video consultation platforms could be mandated to trigger notifications on potential cases that need further evaluation and confirmatory testing for covid-19. Such an approach would help strengthen the national disease surveillance network.

Its use for teleconsult was largely frowned upon but has been demand driven by patients as well as forced upon by the clinicains who are themselves vary of facing the patients directly. The concept of Telehealth has shifted from remote care to a “I would rather not see a patient physically”.Side by side a higher sales of Tele-stethoscopes and other remote clinical and observational devices has been reported

This same user demand concomitant with the need by the clinicians has allowed penetration of to almost all specialities. Previously it had been restricted to radiology, pathology, dermatology, ophthalmology, cardiology and wound care etc as these were almost entirely depended on sharing of images or needed chronic care support

Regarding tele-education - online meetings have replaced physical conferences almost completely.Sadly there is a somewhat over proliferation with terms like infodemic being floated. This related to the high amount of user fatigue. Almost everybody can go online calling himself or herself a knowledge expert. With little to distinguish high level meetings with those arranged by start ups, Whether Online meetings will replace physical meetings is hard to judge but telecare is definitely here to stay.

**(R3:, India)**

**Catalytic impact on the virtual care ecosystem in India**

**Practice guidelines**

The release of telemedicine practice guidelines by the Government of India in March 2020 though originally intended for the practice of virtual consultations by registered medical practitioners belonging to the allopathy system of medicine also lead to the development of practice guidelines by councils for alternate system of medicine like Ayurveda, Siddha, Unani and Homoeopathy within a fortnight. A recent addition was the release of tele-practice guidelines by the Indian Speech and Hearing Association.

**Capacity building**

The release of telemedicine practice guidelines also brought about the need for orientation and training of registered medical practitioners in the country on the do’s and dont’s in accordance to the regulatory expectations in the country. The Telemedicine Society of India in partnership with the Digital Health India Association pooled a team of volunteer resource persons who designed an online “Train to Practice Telemedicine Certificate Course” and began delivering it within ten days of the release of the telemedicine practice guidelines. This online course delivered as a webinar consisted of four modules of 20 - 30 minutes duration each was followed by questions and answers apart from pre-course and post-course quiz for the participants. The learning modules focussed on the following:

##### Introduction to Telemedicine

##### Introduction to Tele-triage

##### Legal aspects of the Telemedicine Practice Guidelines

##### Setting up your telemedicine practice – A DIY approach

and those scoring 80% or above in the online assessment were eligible for a course completion certificate. This was a non-accredited course and given the busy schedules of medical practitioners was scheduled on the weekends.

* Scope, exclusions and seven key elements of telemedicine practice guidelines in India
* Gov initiatives
  + National Teleconsultation Centre (CoNTec) (Doctor-to-doctor)
  + eSanjeevaniOPD: National Teleconsultation Service (Patient-to-doctor)
* Other initiatives
  + HIS integrated cloudy-telephony helplines - implementation experience from three States
* Voices from the field - telemedicine practitioners from four specialties
* National Digital Health Mission and telemedicine

References:

Telemedicine Practice Guidelines: Enabling Registered Medical Practitioners to Provide Healthcare Using Telemedicine

<https://www.mohfw.gov.in/pdf/Telemedicine.pdf>

Frequently Asked Questions [FAQs] on Telemedicine Practice Guidelines

<https://tsitn.org/wp-content/uploads/2020/04/Final_FAQ-TELEMEDICINE.pdf>

Telemedicine Guidelines for Ayurveda, Siddha & Unani Practitioners

<https://tsi.org.in/wp-content/uploads/2020/04/CCIM-Telemedicine-Guidelines-for-Ayurveda-Siddha-Unani.pdf>

Telemedicine Practice Guidelines: Enabling Registered Homoeopathic Practitioners to Provide Healthcare Using Telemedicine

<https://tsi.org.in/wp-content/uploads/2020/04/Telemedicine-Practice-Guidelines-by-Central-Council-for-Homoeopathy.pdf>

Invitation to conduct Proof of Concept (PoC) for ‘Telemedicine Building Block’ under National Digital Health Mission

<https://ndhm.gov.in/home/notice>

Insurance Regulatory and Development Authority of India (IRDAI) Guidelines on Telemedicine

<https://www.irdai.gov.in/ADMINCMS/cms/frmGuidelines_Layout.aspx?page=PageNo4155>

**(R4, Brazil)**

Once pandemics numbers start to decrease and healthcare professionals return to provide care face-to-face on an ambulatory level, strategies to maintain offering telehealth consultations on healthcare services regular schedules might be advised to institutional leaders at risk of returning to previous models strongly directed to local care, almost exclusively.

PROS

* Brazilian telemedicine law has been promulgated and it is valid as long as the pandemic takes.
* Healthcare professionals, not only physicians, have embraced remote care and a lot of fear of using technology has been surpassed.
* Digital platforms have been improving to accommodate professionals' needs to provide remote care.
* Patients and professionals have been able to interact in a safer environment considering contaminating clinical status of the patient.
* Self-care algorithms have been adopted as an acceptable resource of health care by patients, healthcare providers and policy makers.
* Telemedicine business models have been evolving from a patient-healthcare provider model (person to person), to an institutional level, including, but not limited to, hospitals, pharmacies, clinical analysis laboratory, etc

CONS

* Patients and healthcare professionals are not yet fully aware of privacy risks and data protection best practices when using digital environments.
* Telemedicine software solutions still need significant improvements to support a fast and easy user experience to patients and healthcare providers.
* Not enough training opportunities to healthcare providers about how to best provide remote care, including etiquette and semiology maneuvers.

(R5 and R6, Brazil)

[bulletpoints to guide the writing process]

Facts from Brazil

* Legal authorization of telemedicine by a Federal Law [April 15th 2020] - Several practices have been permitted even remote consultations and prescriptions, complying to some requirements to provide security to the process and safety for the patients;
* In order to avoid healthcare services overload by COVID-19 infections, local elective procedures and care have been temporarily suspended, leaving a considerable population of patients with reduced care, especially from non urgent conditions [chronic diseases, oncologic conditions...]
* Lockdown practices increased demand for remote healthcare services, which have been enabled in some weeks, providing remote medical orientations, consultations and telemonitoring for several diseases;
* Regional approaches for providing remote care have been implemented by hospitals, clinics and even startups. NUTES-UFPE implemented a remote monitoring center for patients with flu-like symptoms [possible covid cases] and mental health issues related to pandemic context. This service was, on the first moment, composed by volunteers and after some weeks, we receive a grant from the Brazilian Ministry of Education, to scale the care and to improve the range of services and their availability
* CTC - NUTES case report

**(R7, Sri Lanka)**

Sri Lanka is an island covering 65,610 km² with a population of 22 million. The doctor-patient ratio in 2017 was 1:671 (doi: 10.4038/cmj.v62i4.8573). Eventhough on average, Sri Lankans are within 4.8 kilometres from a free government-sponsored allopathic Western-medicine health care facility (<http://documents1.worldbank.org/curated/en/423511468307190661/pdf/899540WP0Box380th0Care0in0Sri0Lanka.pdf>) there can be challenges on availability of types of healthcare delivered on each facility.

Traditionally, the general public prefer face to face consultations compared to consultations through telecommunications. Even though the word Telehealth was introduced to the world in 1970s, it became famous in Sri Lanka with the initiation of health education hotlines in 2011.(<https://bit.ly/33GxYl0>). However, the Telehealth concepts were highlighted by only a few who had interest in it.

Patients get attracted to Telehealth due to lifestyle reasons as well as geographic barriers. For example, rural populations have difficulty in reaching some specialist care services. On the other hand, the busy urban population has difficulties in finding time to follow up chronic diseases although specialist care institutes are within city limits. In late 2018 there were around 20 major Telehealth services in Sri Lanka. (https://apami2020.org/program\_schedule.pdf#page=2)

However, during the COVID pandemic, the general public was unable to visit a health care facility even if it was next door. Alternative methods were needed urgently for screening patients as well as for the follow-up of chronic diseases who need long term care.

This vacuum resulted in mushrooming of Telehealth service vendors. On the positive side, major telehealth providers joined hands with the government sector to provide services. The "MyHealth Sri Lanka" application (<http://mdiit.gov.lk/index.php/en/digital-news/item/78-the-mobile-app-myhealth-sri-lanka>) was made to empower citizens with correct knowledge for correct decision making. This digital health application by the government sector, delivers services free of charge and was launched in April 2020 as a solution to the pandemic situation. Other than its several functionalities, application included a platform to collaborate with private partners in providing Telehealth services. Also many doctors joined the service and provided services free of charge. Meanwhile, there were various local inventions for remote monitoring which can assist the delivery of telehealth services.

Main obstacle in expansion of Telehealth was the lack of guidelines and medical legislation related to this. However, as a solution for the urgent need, Health Information Unit of the Ministry of Health, Sri Lanka made a set of guidelines to assist these voluntary participating doctors using this new platform. Currently, The National eHealth Guidelines and Standards (NeGS) are being updated to include Telehealth services. Main challenge is to make a proper system to regularize internet based prescriptions which is a main modality in the clinical part of Telehealth which is called Telemedicine.

**(R8, New Zealand)**

The first case of Covid-19 in New Zealand (NZ) was diagnosed on 28 February 2020 from an overseas flight that arrived two days earlier (MoH, 2020a). Overall though, New Zealand has been less affected by Covid-19 than much of the world in part due to being a small island-based population able to close its borders to overseas travel but also due to several initiatives introduced early in the pandemic, especially the very clear daily messages on television from the NZ Government about the pandemic status, availability of individual and business assistance, and that the country was ‘a team of 5-million’.

These initiatives included, but are not limited to:

1. A 4-level Alert system was introduced on 21 March 2020 by the NZ Government to manage the risk of Covid-10. Alert Level 1 is the least restrictive, known as ‘prepare’ and Alert Level 4 the most restrictive, known as ‘lockdown’ (New Zealand Government, 2020a). NZ entered Alert Level 3 on 23 March with a 48 hour notice that it would enter level 4 on 25 March. NZ stayed in Alert Levels until 27 April. NZ stayed in Alert Level 1 until 12 August when Auckland (the largest city in NZ) had a community outbreak and moved back into Alert Level 3 until 23 September (New Zealand Government, 2020b). Barring the occasional community case and overseas cases identified in mandatory isolation facilities, New Zealand has remained essentially free of community transmission and hence healthcare runs ‘as normal’.
2. The Ministry of Health set up a detailed public information website that used zero-data to access and introduced the NZ COVID Tracer App, a digital diary using QR codes scannable on mobile phones (MoH, 2020b). Thus providing additional information for contact tracing to the enhanced digital contact tracing system.
3. Emergency and essential services including healthcare remained up and running during Alert Levels 3 and 4 but with the majority of healthcare delivered by telehealth. Healthcare services thus had 48 hours to switch service delivery from in-person to telehealth, and this was over a weekend! GPs were asked to switch 70% of their consultations to telehealth (NZ Herald, 2020). Secondary care providers (hospital based care) started to run telehealth consultations in their outpatient departments. This target was attained but has dropped back to pre-Covid levels as NZ has been in Alert Levels 1 and 2.
4. Telehealth service delivery was supported by a change to medication prescribing with the rapid introduction of electronic prescribing due to work done by the Ministry of Health, the Medical Council of New Zealand and the NZ Telehealth Leadership Group, which determined new rules for electronic prescribing using NZePS with a manual signature exempt temporary waiver from the NZ Government (NZ Telehealth, 2020a).
5. Both Health Informatics New Zealand and the NZ Telehealth Forum & Resource Centre ran webinars for health providers on telehealth consultations (HiNZ, 2020; NZ Telehealth, 2020b) and the NZ Telehealth Forum & Resource Centre provided information for both health providers and consumers on how to run telehealth consultations ( NZ Telehealth, 2020b). The Royal New Zealand College of General Practitioners (RNZCGP) and other professional colleges provided regular updates to health care providers (RNZCGP, 2020)

In summary, NZ responded rapidly to the arrival of Covid-19 in the country with a switch to telehealth consultations and well run telehealth information and training sources enabling health providers to continue to provide healthcare despite the pandemic.

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(R9, United States):

AZCOVIDTXT: Winning the Battle Against COVID-19 One Text at A Time

The COVID-19 outbreak has caused widespread confusion. People need help in taking proper precautions, distinguishing between COVID-19 versus other respiratory ailments, and handling financial, nutritional and other effects of the pandemic. Under-served populations in particular are badly affected. At the same time, public health authorities urgently need a means to accurately estimate the numbers of people suffering from upper-respiratory symptoms, the numbers of those that seek testing, and those that are positive for COVID-19. Some location information would also be very useful for epidemiological purposes. *A method for addressing these health information gaps that is easy to use, can reach everybody, and can be rapidly set up is urgently needed.*

*AZCOVIDTXT* is a powerful bilingual (English and Spanish) system to help the citizens of Arizona, especially the more vulnerable and underserved populations, successfully cope with this pandemic. This unique platform, developed at the University of Arizona, launched in early April 2020 after just three weeks of development by programmers and University of Arizona faculty and staff including Sriram Iyengar, Nirav Merchant, Kacey Ernst, Maliaca Oxnam, Kacey Ernst, Steve Rains, Mary Margaret Sprinkle, Sarah Freylersythe, and Tracy Crane. Hagan Franks of the University of Arizona’s Data Science Institute led the programming team. A complete list is at https://azcovidtxt.org/about-the-team/.

AzCovidTxt is designed to be easy to use, and low-touch, requiring no installation by the participants. Participants receive (1) SMS (text) messages 3 to 4 times a week with useful information to help them successfully cope with the many effects of the pandemic, and (2) a tailored health and wellness survey once a week. The survey enables participants to anonymously provide information on the wellness of household members and also about the multiple challenges they are facing. *AZCOVIDTXT* does not collect personally identifiable information and does not attempt to geolocate or track participants. Among other valuable benefits, the data collected populates a rich knowledge-base to enable insights into the spread of the disease, the needs of the community, and to inform decision-makers for effective mitigation strategies.

Data contributed by participants is summarized at the zip code level and combined with county and regional level data sets. The results are visible on the https://AZCOVIDTXT.org website and map. The *AZCOVIDTXT* Community Forum provides pointers for additional resources in addition to information for common questions and topics related to the COVID outbreak. This online forum is managed by students from the College of Public Health, Nursing and Medicine including Paulina Colombo and Jules Barbati, who provide weekly updates supervised by AZCOVIDTZT team faculty. The team is currently identifying other applications of the underlying principles and design of AzCovidTxt.

*Figure 2: Screenshot from AzCovidTxt, November 22, 2020*

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R10, India,, Sankara Nethralaya

India has the requisite national core capacities stipulated in the International Health Regulations to manage public health emergencies. The Integrated Disease Surveillance Program (IDSP), which is a nation-wide surveillance system for epidemic prone diseases has been activated by the Ministry of health and family welfare towards COVID response, and is being further strengthened with substantive digital inputs.

Government of India launched online data pool of critical human resource for combating and containing COVID19. The dashboard contains state-wise and district-wise availability of the large pool of human resources for various activities to fight COVID.

Training of healthcare professionals through online modules on iGOT (integrated Govt online Training platform ) has been emphasized .More than 25 lakh officers have registered themselves for an online training module for capacity-building to effectively fight against the coronavirus pandemic .

Indian council of medical research (ICMR ) has been involved in various areas of work ever since the inception of COVID-19 in the country. Its core areas of work are diagnostic kits evaluation/other claims, data collection and analysis, procurement, distribution and regional depots, high-level public health committee [National Task Force (NTF)], NTF research groups, other research studies and policy group on AYUSH and Guidance for the country to lead the research effort on a digital platform.

Ministry of Health & Family Welfare, Govt. of India is implementing an eHealth project including Telemedicine on National Medical College Network (NMCN) for interlinking the Medical Colleges across the country with the purpose of e-Education and National Rural Telemedicine Network for e-Healthcare delivery. One national resource centre (NRC) and seven regional resource centres (RRC ) and connected/linked to other medical colleges .Update on Covid -19 are shared on a digital platform and more than 5000 telemedicine sessions have been conducted .

The setting up of the National Telemedicine Taskforce by the Health Ministry of India, in 2005, paved way for the success of various projects .Both in healthcare delivery and technology, a major role in this was played by NASA and ISRO in implementing it for disease screening and disaster management services.

R11, Colombia

**Shifting in the continuum of care when crisis strikes**

Before there was a process to register and enable providers (registro especial de prestadores). There were 7 identified escenarios and a series of proposed standarized procedures for each one.

Scenarios are: home/community, prehospital, ER, outpatient, inpatient, intensive care, diagnostic technologies.

Telemedicine was conceived as two providers (one remote and one reference station connected) interchanging information.

These procedures were agnostic of technology.

When COVID stroke, Colombia issued an exception law, where all face to face and elective procedures were suspended.

decreto 538,

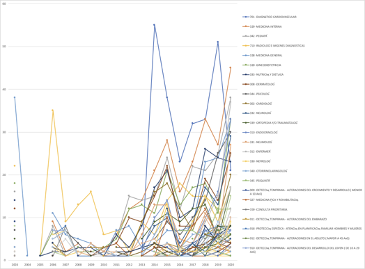
The law facilitated telemedicine and telehealth services that required direct interaction with patients.(https://www.minsalud.gov.co/Ministerio/Institucional/Procesos%20y%20procedimientos/PSSS04.pdf)

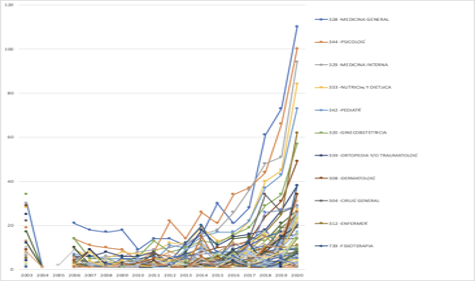
Se resalta que la Resolución 521 de 2020 “Por la cual se adopta el procedimiento para la atención ambulatoria de población en aislamiento preventivo obligatorio con énfasis en población con 70 años o más condiciones crónicas de base o inmunosupresión por enfermedad o tratamiento durante la emergencia sanitaria por COVID 19”, establece como medios para la atención en salud para cada uno de los grupos poblacionales los telefónicos, los virtuales y la telesalud. Adicionalmente, la Resolución 536 de 2020 “Por la cual se adopta el plan de acción para la prestación de servicios de salud durante las etapas de contención y mitigación de la pandemia por SARS cov.2 (COVID.19)”, establece como responsabilidad de las DTS, las EAPB y los prestadores de servicios de salud, el fortalecimiento y uso de la modalidad de telemedicina como una medida para fortalecer el aislamiento social, garantizar el acceso, mitigar las posibles saturaciones de la capacidad instalada e insuficiencia de talento humano en salud de los prestadores de servicios de salud, proteger grupos de mayor riesgo, y prevenir la transmisión del virus. Finalmente encontramos que, en el Decreto Legislativo 358 de 2020 “Por el cual se adoptan medidas en el sector salud, para contener y mitigar la pandemia de COVID-19 y garantizar la prestación de los servicios de salud, en el marco del Estado de Emergencia Económica, Social y Ecológica”, para facilitar la implementación de modelos de atención que incluyan la telesalud y la prestación de los servicios en la modalidad de telemedicina se determinan algunas medidas temporales, permitiendo la autorización transitoria para la prestación de servicios de salud por la secretaría de salud departamental o distrital a través del REPS , entre otros, para: i) Adecuar temporalmente un lugar no destinado a la prestación de servicios de salud, dentro o fuera de sus instalaciones. ii) Prestar servicios en modalidades o complejidades diferentes a las habilitadas dentro de las cuales puede estar la telemedicina iii) Prestar servicios de salud no habilitados. En este decreto también se establecen condiciones temporales para la implementación de plataformas tecnológicas para la telesalud.

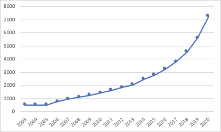
La teleorientación es una actividad de telesalud que no requiere habilitación ni autorización transitoria. Los pacientes que solo requieren información general sobre covid-19 deben dirigirse a la línea telefónica que tenga determinada la entidad (ETS, EAPB o prestador) para la orientación telefónica o a un verificador de síntomas en línea si está disponible La prescripción de medicamentos solo puede realizarse si existe una atención en la modalidad de telemedicina de forma sincrónica, sin perjuicio de la continuidad de formulación de medicamentos en pacientes crónicos que requieran sus tratamientos previamente establecidos. La atención con video llamada proporciona información visual del estado del paciente con indicios para el diagnóstico y la orientación terapéutica, se recomienda para pacientes con mayor sintomatología o signos de alarma, con comorbilidades, para aquellos con circunstancias sociales que influyan en el curso de la enfermedad, pacientes ansiosos o con problemas de audición.

Toda atención en la modalidad de telemedicina debe estar registrada en historia clínica del paciente. T

Analysing the National registry of providers we can see the explosion of new enabled registered services. There is a high concentration in "reference" services.

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**R12UK)**

In England the COVID-19 pandemic has resulted in policies and implementations to address the challenges in delivering care differently with a further shift to community care, maintaining access and introducing new ways of working to reduce the possibility of overwhelming the health service and reducing morbidity and mortality including protecting people most vulnerable to the virus. A significant impact of physical distancing is the reduction in face to face interactions of citizens with the healthcare service. In England general practice has moved form 90% of face to face consultations to 85% remote consultations mainly using telephone, video consultation or texting. All NHS secondary care providers have access to video consultation technology.

The covid-19 pandemic has resulted in rapid, safe and effective scaling of digital delivery due to the organisational and digital infrastructure already in place. NHS England and NHS Improvement (NHSEI)provide a national direction on service improvement and transformation, governance and accountability, standards of best practice, and quality of data and information. NHSX (nhsx.nhs.uk) is responsible for driving digital transformation and leading policy implementation and change. The Digital Technology Assessment Criteria for health and social care, (beta-DTAC) validates the suitability and function of digital health technologies (https://www.nhsx.nhs.uk/key-tools-and-info/designing-and-building-products-and-services) and the Evidence Standards Framework for digital health technologies describes the level of evidence needed to demonstrate effectiveness and value for digital technologies. (https://www.nice.org.uk/about/what-we-do/our-programmes/evidence-standards-framework-for-digital-health-technologies).

Engaging healthcare professionals and the population regularly during the pandemic was essential in providing uniform trusted information. Communication directly with healthcare professionals is via a central web-based cascading alerting system for issuing health messages and other safety critical information and guidance. Communication with the population is through a government website. NHS 111 is a health advice and signposting online and telephone service and also has a dedicated coronavirus service.

A Digital First Primary Care approach supports patients to use online tools to access all primary care services, such as receiving advice, booking and cancelling appointments, having a consultation with a healthcare professional, receiving a referral and obtaining a prescription. (https://www.england.nhs.uk/gp/digital-first-primary-care). The following are examples of digital technologies which are scaling during the pandemic to enable safe and effective healthcare. 1) Patients can be triaged before contacting the GP service through completing a questionnaire based online web-based form. 2) Remote clinical examination of chest (digital stethoscopes), ears, throats and skin. Remote assessment supported using easy to use devices such as ECG tracings, pulse oximetry and blood pressure monitors. 3) General practitioners telephone access to specialist advice using a technology that automatically loops to the next specialist until the call is answered. 4) New ways of delivering care remotely for chronic conditions. Home based pulmonary rehabilitation (PR) supported with apps using video or virtual reality technologies. Disease monitoring by sending structured data questionnaires via SMS text messages. 5) Digital apps and tools empowering people to take control of their health such as the NHS app, NHS website and NHS apps library (https://www.nhsx.nhs.uk/key-tools-and-info/apps-and-tools-patient-care). 6) An integrated care record combines data from local systems to create a single care record presented through a browser based viewer which can be directly embedded into an organisations electronic patient record system to support patient care. Standardised interoperable solutions will be essential for effective healthcare delivery. 7) Volunteers have been engaged supporting over 2 million people at risk such as delivering food and medicines, driving patients to appointments and phone calls for the isolated. They are managed through a dedicated mobile app. 8) Text messaging is used to communicate with patients for a range of reasons including booking appointments, self-help web links, attaching documents/images and flu/covid-19 campaigns.

Although the system works well there are still challenges. 1) Integration and connectivity of technology in health and care organisations. 2) The integrated care record is being implemented and has to scale across the system further. 3) Significant funding and resources have been made available during the pandemic and if this reduces new innovations and scaling of current proven technologies will have less impact. 4) Educational resources and training in digital technologies for professionals and the population is essential to ensure tools are used effectively and promote empowerment and self-management. 5) People who are not digitally connected need an approach to gain the benefits of digital inclusion to enable high quality care.

## R13,Canada)

In Canada, universal access to healthcare services is mandated Federally under the Canada Health Act but actual healthcare delivery is the reasonability of each Province or Territory. That alignment alone provides challenges as even if a federal informatics infrastructure existed there is no guarantee that individual provinces would adapt it. The Federal-Provincial jurisdictional issue also means that progress in telehealth delivery is varied across the provinces and territories. However, while overall telehealth capacity has been ramping up in Canada, it is still described as lagging behind other jurisdictions[CK1] ().

Canada faced a number of challenges in ramping up telehealth capacity to respond to COVID-19. One such challenge is a lack of a national medical license as physicians are licensed in a specific province or territory. This presents challenges if telehealth needs to be provided to a patient in a different province or territory where the physician is licensed. The ability of a physician to provide telehealth in a different province varies across the provinces and territories[CK2] []. For example, the provinces of Ontario, Nova Scotia, and Newfoundland and Labrador do not require an out of province physician to obtain provincial licensure to practice telemedicine. Other provinces (e.g. Alberta) do not require an out of province physician to obtain a licence but they are only able to provide emergency or temporary telehealth services[CK3] [].

Another challenge in responding to the COVID-19 pandemic was that telehealth services were not covered under provincial funding models. One benefit of COVID-19 was that the rapid shift to virtual care required adapting physician fee schedules, including new billing codes and updated practice guidelines. While each province and territory implemented their own billing code for virtual care, there were many similarities across Canada[CK4] . By the end of March 2020, all provinces and territories had some version of a billing code to support virtual care. A final challenge is that the transition to virtual care is very much a work in progress. Some clinical tasks transition better to virtual care. Care management and monitoring for patients with chronic or complex conditions has transitioned better to virtual care than diagnostic tasks that may require physical exam procedures as part of the diagnosis.

[CK1][Telemedicine on the rise but lagging in Canada | CMAJ News](https://cmajnews.com/2018/09/06/telemedicine-on-the-rise-but-lagging-in-canada-cmaj-109-5634/)

[CK2]*Inter-jurisdictional Medical Licensing to Support Telemedicine.* Ottawa: CADTH; 2020 Aug. (CADTH Policy Brief).

[CK3]*Inter-jurisdictional Medical Licensing to Support Telemedicine.* Ottawa: CADTH; 2020 Aug. (CADTH Policy Brief).

[CK4]Canadian Institute for Health Information. Physician billing codes in response to COVID-19. 2020;<https://www.cihi.ca/en/physician-billing-codes-in-response-to-covid-19>

## R14, Canada)

Case study in British Columbia, Canada

As the Western most of all 10 provinces and territories in Canada, British Columbia has a population of 5.1 million occupying 945,000 km2 of land mass. Delivering equitable and high quality care with this distribution of population is challenging in normal times, and magnified even more during the COVID-19 pandemic. Since March 2020, the BC Ministry of Health, in association with a group of health organizations including the Rural Coordination Centre of British Columbia, First Nations Health Authority, BC Emergency Medicine Network, Doctors of BC, Provincial Health Services Authority, and Providence Healthcare, set up a network of virtual care to support clinicians-to-clinicians and clinicians-to-patients telehealth services, collectively named as Real Time Virtual Support (RTVS) services. [kh1, kh2]. These virtual care services span across the entire province, providing citizens and indigenous community members access to teleconsultations via telephone and videoconferencing, and also community physicians and nurses with access to peers and specialists consultations enabled by technologies. The clinician-to-clinician pathways include: emergency medicine (Rural Urgent Doctors in-aid or **RUDi**), intensive care (Rural Outreach Support or **ROSe**), pediatrics (Child Health Advice in Real-time Electronically or **CHARLiE**), maternal and newborn care (Maternal and Babies Advice Line or **MaBAL**). The clinician-to-patient pathways include: HealthlinkBC 8-1-1 virtual physicians (HealthlinkBC Emergency iDoctors in-assistance or **HEiDi**), and First Nations **Virtual Doctors of the Day**.[kh2] Our 6 month evaluation as of end of September demonstrated involvement of over 140 physicians in this network, providing a total of over 14,000 consultations in all parts of BC. [kh3]

This deployment of not simply one line of telehealth but a network of services presents excellent opportunities for scale up and spread of services, and insights for future improvement. This publicly funded network provides a comprehensive safety net for vulnerable patients and health providers needing real time, urgent support with clinicians and colleagues in aid. Also, this network that provides just-in-time services is grounded on referring patients back to their own primary care physicians or healthcare teams for ongoing, continuity of care. In the case of those who don’t have family doctors, this virtual care network helps the patients to be attached to a new family doctor or primary care clinic. Integration of these new virtual care pathways to existing referral services in communities and regions is an important and ongoing priority so as to ensure smooth handover between services and harmonization of patient care pathways, reducing confusion and optimizing timely care for our citizens.

[kh1]: <https://rccbc.ca/rtvs/>

[kh2]: <https://www.bcemergencynetwork.ca/real-time-support/>

[kh3]: Unpublished data.

## Discussion

As evidence continue to emerge in how countries have addressed the issue of covid19 pandemic, relatively sparse evidence has emerged on the role of using telehealth and telemedicine in organising the aspects of care that was necessary during this pandemic. Several common themes emerged from this study of the eclectic examples of in-country experiences and strategies in organising and harnessing the power of distance based technologies in addressing the pandemic on the one hand, and maintaining a continuum of care on the other.

This paper has described the international experiences of telehealth usage in response to the COVID-19 pandemic. We have created a virtual world. It is important that we do not lose the connections that were built but it is equally important that the IMIA community provide guidance for telehealth usage to safely increase its usage. We also need to remember that we are not here to solve telehealth implementation to solve COVID-19. Rather, we are here to make recommendations on how we can better enable telehealth delivery to support critical response such as during a global pandemic.

The key outcome from this paper is that telehealth capacity must be in place prior to a pandemic.