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Editorial

Digital healthcare: The only solution for better healthcare during COVID-19 pandemic?

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A B S T R A C T

The huge impact of the COVID-19 pandemic on global healthcare systems has prompted search for novel tools to stem the tide. Attention has turned to the digital health community to provide possible health solutions in this time of unprecedented medical crisis to mitigate the impact of this pandemic. ***The paper shall focus on how digital solutions can impact healthcare during this pandemic.***

1. Tracking the high-risk subsets likely to be infected with COVID-19

Surveillance Systems for suspected patient tracking:

- ***Digital DHIS2 based solutions*** can help capture information on high risk passengers entering the country from at-risk countries to facilitate active COVID-19 surveillance. Various Governments across the world are now engaging with agencies to develop such systems to record demographics, symptoms of COVID-19 disease, data of contacts at all ports of entry to later link confirmed cases with contacts, and even create lab requests and monitors patient outcomes. Relevant information can then be passed on to health officers in their respective geographic areas. These systems can help accelerate detection, reporting, active surveillance and rapid response for COVID-19 cases, and can be installed as a ***standalone COVID-19 package*** or can be ***integrated into a country's existing disease surveillance systems.*** This innovation in digital healthcare is the brainchild of Ministry of Health Sri Lanka's pioneering design of DHIS2 tracker for COVID-19 cases (***Sri Lanka nCoV Surveillance system***).[1] On the same lines, Singapore government has launched the app trace-together on March 20, 2020. TraceTogether detect other users of the app who are in close proximity, and can then be used to identify close contacts based on the proximity and duration of an encounter between the two users (https://www.tracetogether.gov.sg/).
- ***Creation of international and national dashboards*** that integrate information from the WHO and CDC to track the COVID-19 statistics in real time: These dashboards include information on cases according to each country and region, displayed in maps and charts with live geospatial updates to keep constant track of cases. Display of live data at a glance can help capture events ahead of time which is vital in times of the COVID-19 pandemic.
- The Chinese government has released a new *app to help the general public find out if they have been exposed*. Users can avail of the app through platforms like WeChat, Alipay and QQ, and by registering their phone numbers, name and ID, find out if they have come in close contact to confirmed or suspected case. On the same lines https://www.coronatracker.in/has been launched in India.
- ***Using drones for surveillance*:** To ensure that public is following safety guidelines, the Chinese government is now using drones with loudspeaker capabilities that can zero in on defaulters who aren't following recommendations and issue instructions to correct behavioral patterns. The drones are also being used for spraying disinfectants on affected areas like bus and train stations.

2. Telehealth systems and their applications in the COVID-19 pandemic

Creation of telemedicine services both for COVID-19 screening and managing non-COVID-19 cases: On March 2, 2020, the American College of Cardiology and American College of Physicians issued a joint statement and urged policymakers to understand the vital role digital and telehealth services can play in the COVID-19 pandemic. With self-quarantine and social distancing assuming importance in limiting community spread, virtual care can allow HCW's to maintain continuity of care to patients remotely. The following steps are being taken globally in this regard.

- ***Creation of virtual chatbots and webbots for COVID-19 patients*** so that HCW's can assess and interact with patients via virtual visits and not risk exposure. Telemedicine teams in West are helping train physicians to rapidly screen COVID-19 cases (using questionnaires) and if needed triage them to designated areas to avoid in-hospital clustering and minimizing exposure.
- Curtailing, limiting or deferring elective visits and elective surgeries ***by delivering follow up care by virtual visits.*** This helps

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triage many patients at home and divert several stable patients away from the hospitals who would otherwise incur risk of unnecessary exposure.

- o ***Development of robotic telemedicine carts*** (Vici, by InTouch Health), equipped with cameras, interactive screens and basic medical equipment which can be sent into quarantined patient areas to assess patients, thus limiting HCW exposure and risk.
- o ***Tele or electronic intensive care units (e-ICU)***: These can allow HCW's to remotely monitor upto 60–100 patients in ICUs across multiple hospitals. In the USA, more than 300 hospitals in 34 states are taking advantage of such eICU services using two-way cameras, video monitors, microphones and smart alarms connected by high speed data lines.
- o Web technology can also help ***bring visitors into patient rooms using vICU and iPads,*** thus further reducing visitors load to hospitals.

Government support **for telehealth**: Gaps in legislation and the lack of clearly defined rules for telehealth practices posed uncertainties not only for patients but for doctors as well. Previous barriers to virtual care in USA including location constraints and proper reimbursement to providers limited the availability of these services to patients. The US government has recently approved legislation providing emergency funding to waive off some of the financial and healthcare coverage difficulties in relation to telehealth statutes and telehealth restrictions. This can potentially increase the penetration of virtual care to more patients in the times of COVID-19 pandemic.

- o Furthermore, the Health Insurance Portability and Accountability Act (HIPAA) Security Requirement of the U.S. Department of Health has declared that it will not impose penalties for non-compliance with HIPAA rules for the "*good faith provision of telehealth during the COVID-19 nationwide public health emergency*," allowing use of tools like FaceTime, Google Hangout, Zoom, Skype etc. to connect with patients.
- o Under the revised US legislation, telehealth services shall not be limited to patients with COVID-19, allowing it to be used as an option to also manage non COVID-19 patients remotely.
- o A new US FDA policy has approved devices including clinical electronic thermometers, ECGs, cardiac monitors, ECG software for over-the-counter use, pulse oximetry, noninvasive blood pressure monitors, respiratory rate/breathing frequency monitors, and electronic stethoscopes.[2] These non-invasive monitoring devices have the potential to be connected to a wireless network through Bluetooth, Wi-Fi, or cellular connection to transmit a patient's measurements directly to HCW's eliminating unnecessary patient contact. Some of these devices also have the potential to apply algorithms to transform a patient's physiological parameters into novel indices or alarms that can expedite emergency diagnosis if and when required.
- o As per new Indian guidelines,[3] a Registered Medical Practitioner is entitled to provide telemedicine consultation to patients from any part of India while upholding the same professional and ethical norms and standards as applicable to traditional in-person care, within the intrinsic limitations of telemedicine. All practitioners are also encouraged to get familiar with these guidelines by online programs developed and made available by the Board of Governors. Recommended tools for carrying out technology-based patient consultation include mobile or landline phones (connected over LAN, WAN, Internet etc), chat programs like WhatsApp, Facebook Messenger etc. or Mobile App or internet based digital platforms for telemedicine or data transmission systems like Skype/email/fax etc. The guidelines also state that in all cases of emergency, the patient must be advised for an in-person interaction with an RMP at the earliest. If an alternative care is not present, tele-consultation might be provided if it is the only way to provide timely care. Practitioners should exercise their professional judgment to decide whether a telemedicine consultation is appropriate in a given situation or an in-person consultation is needed.

3. Offering diagnostic support

Stand-alone diagnostic booths that can perform off-site testing for COVID-19 to minimize exposure to healthcare workers and conserve use of PPE. Initially conceptualized in South Korea as ***"drive-thru" testing stations***, medical staff in PPE starting taking samples from people in automobiles without them having to exit, thus obviating direct contact and exposure. Subsequently ***"walk-through"*** testing booths (roughly the size of a telephone booth) have been developed, where up to 10 people can be screened per hour. Labeled as the "Safe Assessment and Fast Evaluation Technical booth of Yangji Hospital, or 'SAFETY', the booth allows complete separation between patients and HCW's. Instead of replacing all PPE's for each staff manning the booth in multiple shifts, only the booth is periodically disinfected, taking only a few minutes to do so.

4. Using artificial intelligence (AI) for diagnostics

- o AI-powered temperature screening solution using iThermo: Developed by Integrated Health Information Systems (IHiS), Singapore, in partnership with AI startup KroniKa, it obviates the need for manual temperature checks. These AI tools also factor in distance analysis and compensation (as temperature measurements reduce with distance).
- o Diagnostic and quantitative CT image analysis of COVID-19 cases through AI based algorithms: The Intelligent Evaluation System of Chest CT launched in Shanghai can not only reliably quantify the infection but also the cumulative pneumonia load by quantitative and omics analysis of image features like morphology, range and density of the lesion.

Use of wearables for providing COVID-19 related information and tracking of physiological parameters:

Using wearable devices to track resting-heart-rate, sleep-duration and temperature has in the past helped create timely and accurate models of population-level influenza trends. Therefore, expedited development and use of digital epidemiology tools to identify patterns predicting onset, progression, and recovery of COVID-19 cases is an attractive option. Those in home quarantine can use such solutions to monitor and transmit parameters like temperature, heart rate and if needed oxygen saturation to HCW's without in-person hospital visit. Few recently launched apps in this regard include:

- o **Apple health check app** which serves as an information and screening portal, developed in collaboration with Apple, the CDC, the White House Coronavirus Task Force and FEMA. Users can log on, answer questions about symptoms and exposure and are directed about what steps to follow.
- o **Siri give me guidance:** This is a recent update of Siri which provides simple voice prompt based symptom-related guidance and, in selected cases, relevant telehealth-app links for information pertaining to COVID-19.
- o **Alexa daily check:** "My Day for Seniors" on Alexa specifically focuses on the elderly population, who can be screened virtually for possible COVID-19 symptoms by responding to daily

questionnaires. Downstream communication for suspected COVID-19 cases is then transmitted back to HCW's.

- Other providers like Orbita, GetWellNetwork, MobileSmith, MeMD, Ro, Everlywell, Bright. md's and Phreesia are also providing these resources incorporating latest COVID-19 guidelines and updates.

Initiation of studies using wearables: The Scripps Research Translational Institute, has started the DETECT (Digital Engagement & Tracking for Early Control & Treatment) Study which uses devices like Fitbit, Apple Watch, Garmin among others for tracking heart-rate, activity and sleep data and matching it with symptom reports submitted by participants.[4] The UC San Francisco's TemPredict Study is a similar project involving the Oura Ring users to submit device collected physiological data along with daily symptom surveys.[5]

5. Public dissemination of information related to COVID-19 infection

Developing free interactive chat services that can help the general public learn about important issues related to COVID-19. Users can ask questions and get connected to appropriate health-care services delivering automated informational responses to frequently asked questions about COVID-19. In the present context, this can help disseminate information pertaining to hygiene practices on a wider scale and help spread public awareness about COVI 19. One such platform, *askNivi*, launched in 2017 in Kenya and mid-2019 in India is an AI based consumer engagement portal that was initially tasked with reproductive health counseling, and is now being expanded to include COVID-19 related conversations, on its twitter handle https://twitter.com/asknivi?. Similarly, in the USA, the birth control app Natural Cycles has now developed a new symptom tracker with built-in functionality to address the COVID1-9 crisis. Apps are also being made available to those in home quarantine to connect with healthcare workers who can help monitor and if needed, report symptoms. The Global Digital Health Network in its first virtual COVID-19 special convention on March 12, 2020 showcased other such mobile based tools (eg. CommCare, Safiri Smart and Praekelt.org) that support mass communication for disease notifications and can provide tech-based solutions in COVID-19 response activities.[6] In South Korea, information is being shared with the public via an interactive website viz. Corona Map.[7] ***Aarogya Setu*** is a mobile application developed by the Government of India to connect essential health services with the public to apprise them of risks, best practices and relevant advisories pertaining to the containment of COVID-19.[8]

6. Integrating the rapidly evolving treatment protocols into clinical decision making tools

Building rapid data integration and analytical platforms for clinical decision making can help synthesize fragmented data into comprehensive bias-free analysis, providing fast, on-demand insightful solutions which are not possible manually. Developing such clinical decision support systems can help transform offline, static, data-driven guidelines (which are evolving almost daily) into interactive, online up-to-date algorithms for rapid execution. Placing patient demographics and reports into the systems can help generate point-of-care decision making tools. These software analytics can be used to improve healthcare response in terms of epidemic surveillance, geospatial analysis, cluster outbreak reporting and development of accurate therapeutic algorithms in response to the global pandemic challenge. One such system, Zenysis, is already collaborating with governments in Africa and Asia to set up dedicated Emergency Operations Centers and Virtual control rooms to monitor and coordinate responses to the COVID-19 pandemic.[9]

7. Administrative support to health care workers (HCW's) using digital tools

Digital technology systems to connect administrative authorities with HCW's: Such tools can help set up interactive two-way communication between HCW's even in remote areas with their respective administrative portals or ministries for real-time information exchange, data management and resource management solutions. An example is ***mHero,*** a mobile phone-based communication system, created by IntraHealth International and UNICEF in 2014 in Liberia for an Ebola outbreak. It operates on basic talk-and-text pattern and no smartphone or tablet is mandatory and at present it is being used to update HCW's regarding COVID-19.[10] Utilization of an existing digital health technology system and expanding and adapting it to evolving healthcare needs, ***highlights the fact that government sponsorship, oversight and co-ownership of digital health systems is critical for managing such pandemics***.

8. Ongoing education tools for HCW's: virtual meetings, a glimpse of the future of medical education

As all major meetings get cancelled and conference calendars get disrupted due to the COVID-19 pandemic, we as HCW's are in danger of losing out on interactive learning and keeping up with academic progress and the latest advances in our respective fields. In these times, there is an urgent need to explore digital platforms to encourage off-site remote knowledge sharing by webinars and non face-to-face meetings. The COVID-19 pandemic could very well reflect the *shift from the more traditional face-to-face in-person learning for HCW's to an all-pervasive virtual education and collaboration.*

9. Judicious use of social media platforms

To curb fake news and avoid panic triggers, Facebook has announced that it is working with third-party sources to verify and check facts to avoid spread of misinformation on media platforms. In addition, it is collaborating with researchers to provide anonymized mobility data to create population-density and forecasting models. Governments need to work with search engines and other social media platforms to prevent spurious claims getting amplified and help encourage only scientifically robust sources of information.

10. Conclusions

The COVID-19 pandemic poses enormous challenges to the global healthcare community. Digital health systems are well suited to provide novel solutions to this public health emergency. These include development of robust surveillance systems, telehealth, novel diagnostic and clinical decision making tools, wider penetration of wearables for tracking of physiological parameters and development of interactive chat services for public dissemination of COVID-19 related information.

Medical fraternity is likely to face major structural changes which may transform our workflow and communication portals, with telemedicine emerging as the most viable option ensuring safety of HCW's and patients. Healthcare systems that make timely investments in telemedicine would be well equipped to ensure that

patients are able to receive effective and safe medical care in the context of the current pandemic. *Cardiology with its track record of remote monitoring of vitals, wearable ECG and implantable device data can set a precedent for other specialties to follow.*

Conflict of interest

No conflict of interest to declare.

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