

# **ICP Monogram on Digital Technology in Clinical Medicine**



**Dean, Indian College of Physicians**

**Dr. Alaka Deshpande**

**Editor in Chief**

**Dr. Shriram V Kulkarni**

**Associate Editors**

**Dr. Sagar Sinha**

**Dr. Alok Modi**

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Unit 6 & 7, Ground Floor, Turf Estate, Off Dr. E. Moses Road, Near Mahalaxmi Station (West), Mumbai 400011.

**Editor-in-chief**

Dr. S V Kulkarni

144 LBS Nagar, Khopoli, Raigad 410203

Maharashtra, India

Mobile: +91-9422493926

Email: svk1955@rediffmail.com

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## Author Index

**Dr. Alok Modi** MD (Med.), FISH (India), FACP (USA), PGDL (UK)  
Medical Director, Dr Modi's KEVALYA HOSPITAL, Thane  
Email: [alpalok@gmail.com](mailto:alpalok@gmail.com)

**Dr. Amol Annadate**  
Consultant Pediatrician, Anant Multispecialty Hospital, Vaijapur  
<http://amolannadate.com/about/>

**Chethana C**  
Registered Dietician  
PhD Scholar, Clinical Nutrition, MGM School of Biomedical Sciences, Navi Mumbai  
Email: [mgmchms@mgmsonpm.edu.in](mailto:mgmchms@mgmsonpm.edu.in)

**Dr. Darpan Kaur** MD (Psych.)  
Professor, Psychiatry, MGM Medical College, MGMIHS, Navi Mumbai  
Email: [kaur.darpan@gmail.com](mailto:kaur.darpan@gmail.com)

**Dr. Dipak Kulkarni** MD (Dermat.)  
Consultant Dermatologist, Alok Clinic, Panvel  
Email: [alokclinic@gmail.com](mailto:alokclinic@gmail.com)

**Dr. Dev Taneja** MS (Surg.), MBA (NUS)  
Director, CarePoint Hospital, Navi Mumbai  
Assistant Professor, Surgery, MGM Medical College, MGMIHS, Navi Mumbai  
Email: [drdevtaneja@gmail.com](mailto:drdevtaneja@gmail.com)

**Dr. Laxman G. Jessani** DNB (Med.), CCEBDM, MNAMS, FNB (Infectious Diseases),  
FRSPH (UK)  
Consultant, Infectious Diseases Physician, Apollo Hospital, Navi Mumbai  
Associate Professor, Apollo Hospitals Educational and Research Foundation  
Email: [laxmanj27@gmail.com](mailto:laxmanj27@gmail.com)

**Dr. Minakshi Dhar**

**Dr. Pragnesh Vachharajani**  
Founder, Hitcon (<https://hitconhealthtech.blogspot.com/>)  
Email: [info.hitcon@gmail.com](mailto:info.hitcon@gmail.com)

**Dr. Prasad Chapukar** BDS  
Consulting Dental Surgeon, Kharghar, Navi Mumbai  
Email: [smilematters23@gmail.com](mailto:smilematters23@gmail.com)

**Dr. Priyanka Jadhav** MD (Med.)  
Associate Professor, General Medicine, DY Patil School of Medicine, Navi Mumbai  
Email: [drpriyankabjadhav@gmail.com](mailto:drpriyankabjadhav@gmail.com)

**Dr. Pushkar Khair**

Consulting Physician, Pune  
Email: pkhair@ethosh.com

**Dr. Rajani Mullerpatan PhD, MSc (PT)**

Prof-Director  
MGM School of Physiotherapy & MGM Center of Human Movement Science  
MGMIHS, Navi Mumbai  
Email: rajani.kanade@googlemail.com

**Dr. S. V. Kulkarni MD (Med.), FICP, FACP, FGSI, FDI, FACM**

Director: Diaabetter, Center for Diabetes, Thyroid, Obesity & Adolescent Research,  
Navi Mumbai  
Senior Physician, General Medicine, MGM Medical College, MGMIHS, Navi Mumbai  
Email: svk1955@rediffmail.com

**Dr. Sagar Sinha MD (Med.), DNB (Med.), FNB (Crit. Care), EDIC**

Head, Critical Care Unit & Associate Professor, Emergency Medicine  
MGM Medical College, MGMIHS, Navi Mumbai  
Email: drsagarsinha@gmail.com

**Dr. Sangita Choudhary Bsc. Nursing, MHA, PhD in Hospital Administration**

PhD Scholar, MGM Medical College Kamothe, Navi Mumbai  
Email: csangeeta18@gmail.com

**Dr. Santosh Bhide MS (Ophthal.), DNB (Ophthal.), FAICO**

Consultant Ophthalmologist, Pune

**Sayali Sunil Devlalkar**

Software Engineer, Navi Mumbai

**Dr. Suranjana Basak MD (Med.), DNB (Med.), PGDADCCE (RCP, UK)**

Consultant Physician, Reliance Hospital, Navi Mumbai  
Email: suranjana\_basak@hotmail.com

**Dr. Suresh Shinde MD (Med.), MNAMS, FISE, FICN**

Consultant Physician, Pune  
Email: acmepune@yahoo.com

**Dr. Tanvi Kulkarni MD (Path.)**

Consultant Pathologist, Jeevan Laboratory & Director, Digital Pathology, Morphle  
Labs, Kolhapur

**Dr. Varsha Reddy Jayar MD (Geriatric)**

Geriatric Physician, Sri Devraj Urs College, Kolar  
Email: varsha.jayar@googlemail.com

## Preface

In the very early years clinical medicine used only the power of observation, percussion, auscultation and analysis of symptoms. From the days of Laennec, the attitude towards technology has made quite a big change. We evolved from the stethoscope, aided by X-rays, Ultrasound, Clinical biochemistry & immunology, Imaging with CT, MRI & Nuclear Medicine to Genomic analysis; to raise the standards of clinical medicine. The real pick up of technology was seen in last 60 years.

The revolution of digital technology & data science in all the fields of our daily use have inspired the medical profession immensely too. As the speed of computing increased, as the data started becoming cheaper or/and faster and as the cost of the hardware started coming down, more and more medical professionals adopted different aspects of digital technology.

Why we are publishing this monogram? In Indian Medical literature there is hardly any compiled book on use of “Digital Technology in clinical medicine”. This is an ever expanding and very fast developing science almost every month there are some new additions which are humanly impossible to catch up. We started our journey in APICON 2009 of Kolkata in form a workshop & continued it every year. We wish to continue this journey as an annual edition of “Digital Technology in clinical medicine”, for the coming years too. There are many academic, technology minded & enthusiastic medicos who are ready to join our group and contribute to this novel concept. Many of the text books on

Data Sciences, cloud computing and electronic health records which are available in the Western literature however they do not satisfy our needs

Digital Medical Technology is galloping at a fantastic pace. This year 2023, only addition of two new champions like ChatGPT and Google muse will be making radical transformation in which way handle scientific information or create our presentations. The list of this is endless, our aim is to have something which is a sort of a basic book and it will help us to ignite the passion of writing communicating and thinking in the young generation is the only purpose with which we have prepared this monograph.

Your comments suggestions and constructive criticism is always welcome. We thank you all for joining our digital journey.

Editorial team

**Dr. Shriram V Kulkarni**

MD (Med.), FICP, FACP, FCSI, FDI, FACM

Email: svk1955@rediffmail.com, Mobile: +91-9422493936

Course Coordinator (ICP-API Digital Medicine Course)

Editor in Chief (ICP Monogram on Digital Medicine)

*Associate Editors:*

**1. Dr. Sagar Sinha**

MD (Med.), DNB (Med.), FNB (Crit. Care), EDIC

Email: drsagarsinha@gmail.com, Mobile: +91-9372277267

**2. Dr. Alok Modi**

MD (Med.), FISH, FACP (USA), PGDL (UK)

Email: alpalok@gmail.com, Mobile: +91- 9920123411



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## **1. Technology: Need of the hour for Physicians**

*Sagar Sinha, Priyanka Jadhav*

Medical devices and apps are already invaluable tools for HCPs, and as their features and uses expand, they are expected to become even more widely incorporated into nearly every aspect of clinical practice. Many HCPs remain reluctant to adopt their use in clinical practice. They provide the HCP with many advantages; they are currently being used without a thorough understanding of their associated risks and benefits. Rigorous evaluation, validation, and the development of best-practice standards for medical apps are greatly needed to ensure a fundamental level of quality and safety when these tools are used.

With the implementation of such measures, the main determinant of an app's value may ultimately be its ability to provide meaningful, accurate, and timely information and guidance to the end user in order to serve the vital purpose of improving patient outcomes.

The aim is for complete cross-integration across vertical and horizontal domains of healthcare.

Besides patient-care at pre-hospital level, arrival to Emergency Room/OPD, admission and hospitalisation, tools are available right up to discharge and follow-up of the patient. The COVID-19 pandemic has taught us invariably that technology was a significant tool across this spectrum.

Better diagnosis, risk-stratification and optimisation of patient therapeutics will only result in the best care of the patient.

Besides this, the educational/academic domains have exploded and across medical education (undergraduate to CMEs for super-specialists) are now technology-heavy. Digital communication platforms have allowed us to connect better and are now accepted as a standard.

Research is an area which needs to develop to simple-solutions for a practicing physician. Despite current data-gathering apps/platforms doing a significant amount, however the interface sometimes (and user attitude) has not been able to allow for conversions of these data troves into publications from India.

With availability of fancier peripheral enhancements (hardware) and extremely AI-based software solutions (like ChatGPT), there is scope for improved productivity and over time, will be cost-friendly to physicians and affordable, accessible and applicable to every aspect of a physician's professional and personal life.

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## 2. Apps: Development, Utility, Selection & Innovations

*S. V. Kulkarni, Sagar Sinha*

### **Introduction**

An APP or a shortform of Application is a very powerful computer software meant to be used on a mobile technology on all platforms of operability.

*While using or selecting an app we need to follow certain basic principles:*

#### **1. Differentiate between a Medical & Healthcare Apps:**

Healthcare apps are very generalised & not academically up to-date or accurate, many times a prank. Apart from the table few more attributes are important.

#### **2. Safety:**

- Play store protection & data security is an important component of any digital component.
- Google Play Protect checks your apps and devices for harmful behaviour, runs a safety check on apps from the Google Play Store before you download them and confirms device for potentially harmful apps from other sources/malware besides deactivates or remove harmful apps from your device.
- Also warns you about detected apps that violate unwanted software policy by hiding or misrepresenting important information.

*How to Verify your device certification status?*

Open the Google Play Store app, At the top right, tap the profile icon, Tap **Settings**, Under About, check if your device is Play Protect certified.

There is a constant changing scenario in developmental world of apps. The developers have many methods in how to increase app visibility by leveraging seasonality (seasonal trends) and special events to drive more downloads with their advanced techniques:

1. By seizing on the changing user behaviour with the advanced app store optimization techniques including unique creatives, in-app experiences & in-app event cards, utilizing custom product pages, product page optimization & creative optimization.
2. ASO - Apple Search Ads relationship

The industry has grown to receive funding over USD 20 billion a year (20x-growth in 10-years).

### **Assessment of App**

1. Store: Play Store, App store, Windows Market
2. Last Updated
3. Publisher
4. Visibility Score\*
5. Category Ranking History
6. Review Breakdown Positive-Neutral-Negative
7. Ad Intelligence on 0 Networks
8. ASO Keywords
9. Downloads
10. Revenue-optional visibility

\*The visibility score indicates the app's overall discoverability inside the app stores. Every app gets a grade out of 100, based on keyword rankings, category rankings and review/rating performance. A higher visibility score means better discoverability.

### **How to buy-use & recommend apps?**

1. Created by- Person-his CV
  2. Center-location-institute
  3. Credibility-past track.
  4. Consumed by-how many users
  5. Criticized by-reviews-For & against.
  6. Category- Medical Vs. Healthcare, fitness apps.
  7. Cost-Buy from approved dealers-vendors.
  8. Made In India Apps
- eg. Acid Base Balance by Dr. Satish Deopujari from Nagpur

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<https://appinventiv.com/blog/mobile-apps-transforming-healthcare-industry/amp/>

### 3. Precision medicine and digital twins in management of medical disorders

*S. V. Kulkarni, Suranjana Basak, Varsha Reddy Jayar*

#### **Introduction**

The American National Research Council's *Toward Precision Medicine* [1] adopted the definition of precision medicine from the President's Council of Advisors on Science and Technology in 2008 as: "The tailoring of medical treatment to the individual characteristics of each patient- to classify individuals into subpopulations that differ in their susceptibility to a particular disease or their response to a specific treatment. Preventative or therapeutic interventions can then be concentrated on those who will benefit, sparing expense and side effects for those who will not". Precision medicine, the ability to accurately measure specific predictors of patient outcomes is implemented in personalized clinical care.

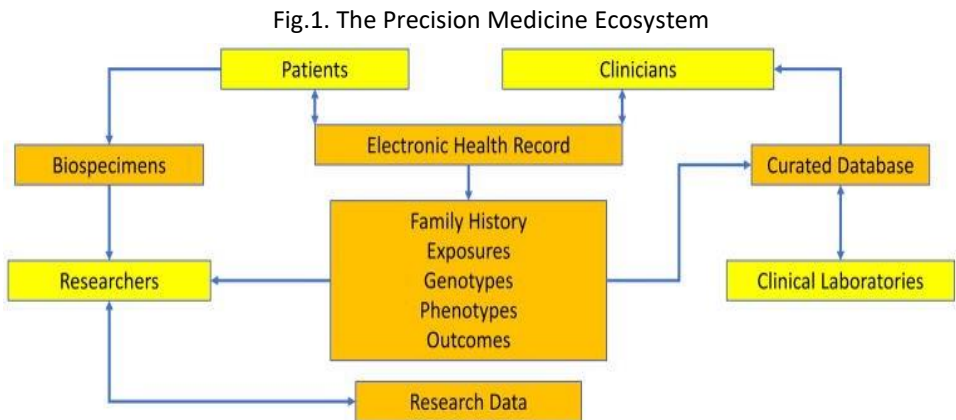
Despite great strides in biomedical advances during the past century, a large number of patients do not respond to drug treatment. According to a report from the US Food and Drug Administration (FDA), medication is deemed ineffective for 38–75% of patients with common diseases [2]. This results in patient suffering and increased healthcare costs. These problems reflect the complexity of common diseases, which may involve altered interactions between thousands of genes that differ between patients with the same diagnosis. There is a wide gap between this complexity and modern health care, in which diagnostics often relies on a small number of biomarkers of limited sensitivity or specificity. Digital and genomic medicine may bridge this gap by monitoring,



processing, and integrating vast amounts of data from wearable digital devices, genomics, imaging, and electronic medical records [3].

### **Components of Precision Medicine**

Precision medicine describes a model for health care delivery that relies heavily on data, analytics, and information. This model goes beyond genomics and has vast implications for in health care. Precision medicine – and the ecosystem that supports it must embrace patient centered-ness and engagement, digital health, genomics and other molecular technologies, data sharing and data science to be successful.



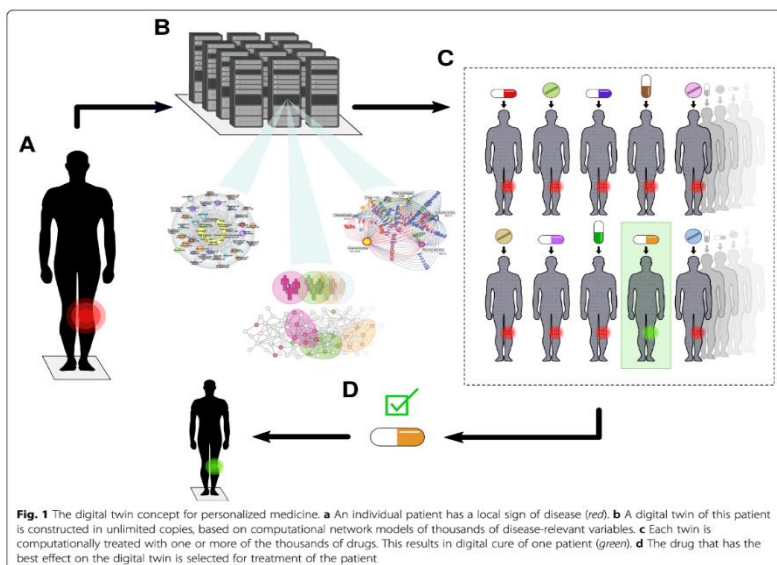
A precision medicine ecosystem ideally links patients, providers, clinical laboratories and researchers (Fig.1) [4]. With the advent of EMRs and robust IT systems supporting both research and health care delivery, patients (and research participants) who agree to provide biospecimens and share their clinical and research data are at the epicenter of contributions to the research enterprise. Researchers

generate new findings from the data derived from samples linked to digital phenotypes, family history and environmental exposures all captured as part of clinical care. Clinicians utilize a growing knowledge base curated from clinical laboratories [5][6].

### **Applications of Digital Twin concept to personalize medicine**

Digital twins are a concept from engineering which has been applied to complex systems such as airplanes or even cities [7]. The digital twin concept can be translated to patients in order to improve diagnostics and treatment. This is the general aim of the DigiTwin consortium, which includes academic, clinical and industrial partners from 32 countries for specific problems will also require national initiatives [8].

Fig.2 The Digital Twin concept for personalized medicine



### **1-Virtual Organs**

Scientists have been working on virtual hearts that can be customised to individual patients and updated to understand the progression of diseases over time and the response to treatment. Philip Heart Model simulates a virtual heart, starting with the company's ultrasound equipment. Siemens Healthineers have been working on digital twin of heart to simulate cardiac catheter interventions. Dassault Systèmes 'Living Brain Project' is guiding epilepsy treatment and tracking the progression of neurodegenerative diseases using AI while working on virtual brain modelling.

### **2-Genomic Medicine**

Swedish researchers have been mapping mice RNA into digital twins to predict effects of treatment used in Rheumatoid Arthritis. Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) was originally discovered by yogurt engineers Philippe Horvath and Rodolphe Barrangou of Danisco (DuPont) in their study of the sequences of the bacterial genome that protect against invading viruses [9]. In 2012, RNA biologists Jennifer Doudna and Emmanuelle Charpentier used their knowledge of CRISPR to reprogram DNA using an enzyme called CRISPR-associated protein 9 (Cas9), which is described as programmable "molecular scissors" that can rewrite the genetic code [10].

### **3-Personalized health information and treatment**

Health based apps capture health data into digital twins. It works with manually entered data such as health histories, mood tracker, symptom tracker, automatic tracks from fitness devices. The digital twin can provide basic front line information and interactions with doctors to address severe conditions. It helps in optimising drug dosage for various ailments such as the Empa research centre in Switzerland for

chronic pain. In addition, patient reports about the effectiveness of different dosages calibrate digital twin accuracy. Most approaches to digital twins build on existing equipment to capture the appropriate data while Q Bio's new Gemini Digital Twin platform starts with a whole-body scan. The company claims to capture a whole-body scan in 15 minutes without radiation using advanced computational physics models that are more precise than conventional MRI for many diagnoses. This helps in developing integrations to improve these models using data from genetics, chemistry, anatomy, lifestyle and medical history.

#### **4-Medical Diagnostics**

The GE Healthcare Command Centre has the prime aim to virtualize hospitals and test the impact of various decisions on changes in overall organizational performance. There are various models for evaluating changes in medical diagnostics, radiological scans, operational strategy, capacities, staffing and care delivery models to objectively determine which actions to take.

#### **5-Improved Surgical Outcomes**

Digital twins can help surgeons by using simulations to improve patient safety. It can improve the ability to plan and execute less invasive surgeries using catheters to install unique implants. Preliminary results from Ansys has shown a dramatic reduction in the need for follow up surgery.

#### **6-Quick Treatment Initiation**

Organizations in US have been working on reducing the time taken to treat stroke patients. Early treatment is critical but it requires the coordination of several elements to process smoothly. Digital twins could provide the enabling infrastructure for organising the details for crafting these

new types of arrangements. They can make it easier for customer service agents to understand and communicate with patients and caregivers. For example, a large insurance provider used TigerGraph database to integrate data from over 200 sources to create a full longitudinal health history of every member. The study said that it reduced call handling time by 10% and over \$100million estimated savings.

### **7-Medical Devices and Innovation**

The U.S. FDA has launched a significant program to drive the adoption of various types of digital approaches. Regulators in the U.S. and Europe are also identifying frameworks for including modeling and simulation as sources of evidence in new drug and device approvals. The FDA is creating the regulatory framework to allow companies to certify and sell software as a medical device. The core idea is to generate a patient-specific digital twin from different data sources, including lab tests, ultrasound, imaging devices, and genetic tests. In addition, digital twins can also help optimize the software in medical devices such as pacemakers, automated insulin pumps, and novel brain treatments. Siemens worked with several vaccine manufacturers to design and test various vaccine production line configurations. New mRNA vaccines are fragile and must be precisely combined using microfluidic production lines that precisely combine nanoscale-sized particles. Digital twins allowed them to design and validate the manufacturing devices, scale these processes, and accelerate its launch from 1 year down to 5 months.

### **8-Geriatric Medicine**

Frailty, falls and lack of fitness are the true enemies of geriatric population. Assessment models based on DT and IoT inputs are being used for preventive care interventions. A

Wearable-as-a-Service™ that perpetually monitors and analyses users' 24-7 heart activity. In the case of a life-threatening emergency, 100Plus will instantly alert the user, their loved ones, and emergency responders in real-time, helping ensure immediate care delivery and potentially saving the user's life. If seniors do not want to use wearables due to allergy, thin skin quality, then a video based non wearable option is Binah.ai. which is a series of non-invasive, video-based health and wellness monitoring solutions. It gives an unparalleled advantage in health analytics as its technology transforms any device equipped with a simple camera into a medical-grade healthcare gadget. Dementia patients are keen to know their risk anticipated, Infinity BiologiX and Cytos Collaborate to Provide New Genetic Test to Predict the Risk of Cognitive Decline Due to Alzheimer's Disease, can use Serum or saliva, *genoSCORE* test to assess patients before symptoms arise, and prior to invasive *cerebrospinal fluid* (CSF) testing or expensive scanning techniques.[11]

### **9-Digital Twinning**

Very recent work by Shamama, Parmesh & Dr. Shashank Joshi et al [12] has shown a great role of digital twinning in metabolic disorders. It does not involve too much cost & helps the patient to almost have a fine look in his own metabolism, interplay of food exercise, stress on our daily metabolic parameters.

### **Conclusion**

The clinical implementation of digital twins will require solving a wide range of technical, medical, ethical, and theoretical challenges. The costs and complexity will be comparable to those of projects such as the Human Genome Project (HGP), but may lead not only to greatly improved

health care and understanding of disease mechanisms but also to completely new research directions. Another potential similarity to HGP could be the potential to inspire technical developments, leading to a decrease in both the costs and the difficulties involved in clinically implementing digital twins. Given the importance of the medical problem, the potential of digital twins' merits concerted research efforts on a scale similar to those involved in the HGP.

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## 4. Rheumatology in the era of smartphones: A practical primer

*S. V. Kulkarni, Sagar Sinha, Sayali Sunil Devlalkar*

### **Introduction**

Digital technology has made significant changes in the quality of healthcare management. Smartphones, which are often the end-user products designed to deliver these services have made deep inroads and have become an essential aspect of our daily lives. Every aspect of healthcare starting from the infrastructure, training, education, disease management, patient counselling, follow-up and research has some 'app' available to take care of its needs. The goal of this review is to cover the various practical aspects of smartphones pertaining to Rheumatology, whether one is a general physician, consulting physician, specialist, techno-savvy patient or an administrator. Rheumatology is an exciting evolving field of medicine. The advent of biological drugs in the past decade has heralded in a new era in this field but unfortunately in our country, majority of the population doesn't have access to even the basic aspects.

A recent paper by Grainger et al. identified 721 and 216 apps in the Google Play store and iTunes store respectively. Their review found a lack of high-quality apps for longitudinal assessment of RA disease activity and suggested that Current apps fall into two categories: simple calculators primarily for rheumatologists and data tracking tools for people with RA. [1]

The authors wish to emphasize to the target audience that the apps chosen for this review are just for representation purposes only without any recommendation of one over the

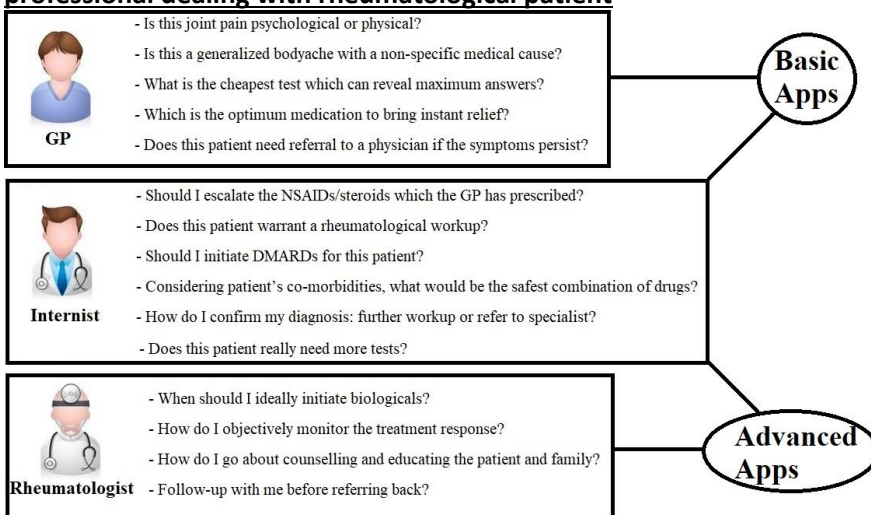


other. The idea is to orient and acquaint the users to the options available. The final decision of using apps should be determined after thorough personal research, by need and functionality of the app factoring in the cost as well.

All the images below are from the Google Play store from the official app descriptions.

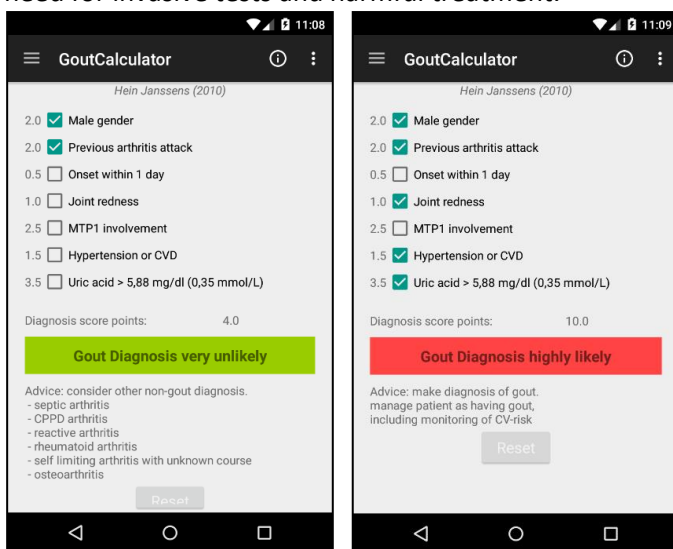
## **Rheumatology apps for medical professionals**

### **Questions which may be asked by the type of medical professional dealing with rheumatological patient**

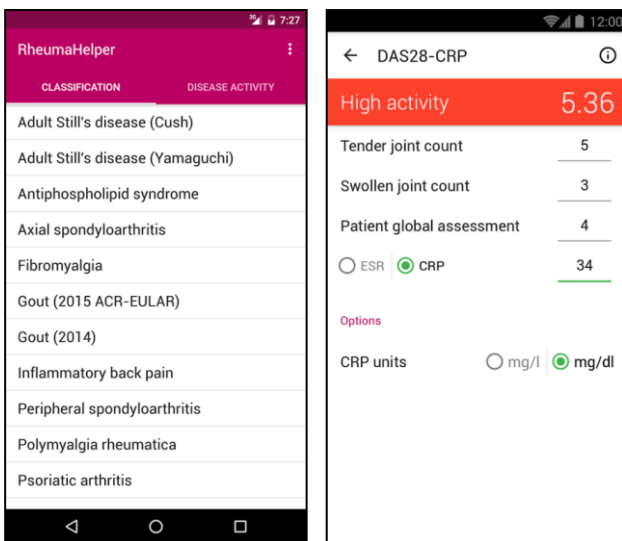


There may be different questions in the minds of the practitioners; with some overlapping ones considering their respective training, expertise and experience. Needless to say, the questions arise due to the simple fact that all of them want to deliver the best possible care to the patient. The limitations in knowledge or experience or exposure can be easily bridged by some of the apps discussed below...

**1-Gout Diagnosis Calculator:** Diagnosis is rarely made via the gold standard technique of synovial aspiration and polarized light microscopy. Vast majority of diagnoses are clinical. A primary care and rheumatologist team derived and published a clinical decision rule in 2010. This app brings that decision rule to primary care physicians, rheumatologists, and acute care clinicians everywhere. With just a few clicks about a case, you can see what the gout diagnosis calculator suggests about the patient's chances of having or not having gout. For a GP, potential use of this app may eliminate the further need for invasive tests and harmful treatment.



**2-RheumaHelper** is a mobile rheumatology assistant. It provides a complete toolbox of disease activity calculators and classification criteria the informed rheumatologist can reference during day-to-day work.



### **Rheumatology apps for techno-savvy patients**

There have been large validated studies proving m-health applications in disease management pertaining to the patient- education, self-management, counselling etc. Azevedo et al. covered the future perspectives of smartphone applications for rheumatic diseases self-management. [2]

### **Example 1: Patient-Physician interaction in clinic**

- If you are willing to spend 5 minutes a day, I could suggest a medical application to help you objectively be involved with your treatment...


- There's an app for it (describing it)

- It helps me that you are involved with your condition and that treatment extends beyond simple pharmacology and involves education and counselling. We are in this together!

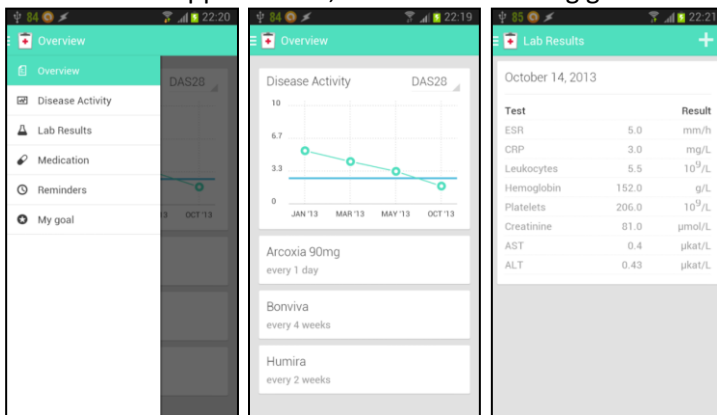
- Well doctor I have understood all the medical aspects of this arthritis condition but I wanted some more clarification, especially with regards to how can I be involved with my treatment

- Tell me more



- How is it helpful to you?



**3-RA Helper:** simple, intuitive assistant for RA patients, helping track disease activity, medication, appointments and lab results. Features include track disease scores (DAS28, SDAI, CDAI), visualize progress, medication-related, reminders for appointment, lab data and setting goals.

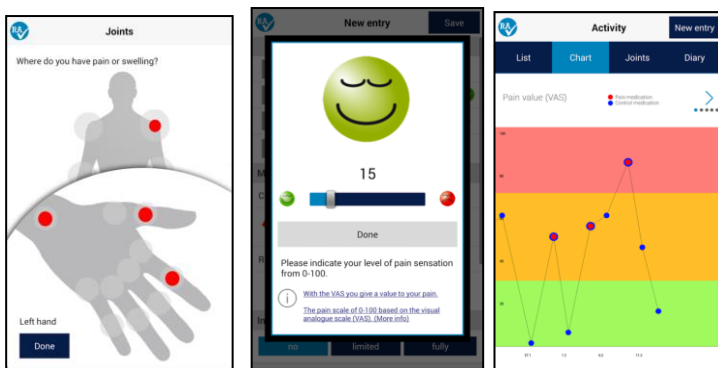


### **Example 2: Patient-Physician interaction over phone**

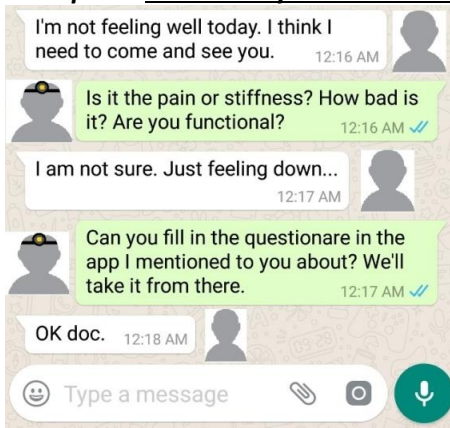
<p>- Sorry to hear that. I could schedule you in for Monday. But tell me more about the last 2 weeks...</p> <p>- What kind of data?</p> <p>- So it contains objective and subjective information about your physical symptoms and signs?</p> <p>- I am glad you did that. Perhaps when you are here you can show it to me. It will help me decide the future course for the treatment.</p> <p>- OK!</p>	<p>- Doc, I am in a lot of pain. I'm abroad right now. The stiffness is back and I have been very uncomfortable for the past 2 weeks. I have been taking painkillers however no relief. I get back this weekend. Can I see you first thing on Monday?</p> <p>- I am slightly better now. I have been travelling but no real physical exertion. Someone recommended a great app which I downloaded. I've been feeding in data for the past 10 days.</p> <p>- My pain scale, scores, medications... sort of like a log-book.</p> <p>- Precisely.</p> <p>- Sounds great! In fact, I can email you a copy of that right now.</p>
	

**4-RheumaTrack® RA** is a personal digital patient diary with the following functions:

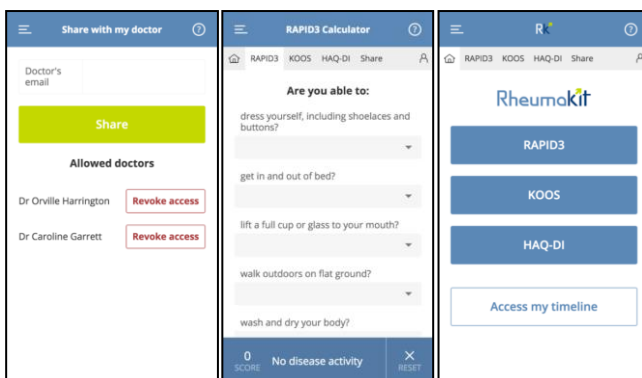
- Protocol for pain- according to visual analog scale (VAS) and pain localization
- Individual medication planner and scheduler
- Lucid illustration of the pain diary, documentation of morning stiffness
- Documentation of sports activities, infection times and inability to work
- Reminder function for pain value recording, medication intake, checks & doctor's visits
- Functional and intuitive user guidance, extensive statistical evaluation
- Code lock against undesired access, export of data
- Export function: All of the data recorded can be backed up as a CSV file or as a formatted PDF file.



### **Example 3: Patient-Physician interaction over WhatsApp**



**5-RheumaKit** allows patients to monitor their health status, feed their clinician with relevant information. Conditions covered: RA, spondyloarthritis, psoriatic arthritis, Gout, SLE, osteoarthritis, etc. Benefits: reduce visit frequency and optimise treatment



## **Conclusion**

This is the era of evidence-based medicine which is increasingly becoming patient-centric. The practitioner and the patient both need to evolve, especially in the field of rheumatology to serve a country of over a billion. M-Health is the simplest key to unlock this future!

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2. Azevedo AR, de Sousa HM, Monteiro JA, Lima AR. Future perspectives of smartphone applications for rheumatic diseases self-management. Rheumatology international. 2015 Mar 1;35(3):4

## ***Further Readings/Apps:***

RheumaBuddy, ASAS App, RheumaGuide, Rheumatology Connect, ACR Convergence 2022, Arthritis Tracker, Cliexa-RA, My Pain Diary, Guidelines And Criteria, Rheumatology Secrets, PainScale, RA Monitor, Sworkit, Pain Relief Hypnosis, Reachout, MyHealthBoost App (NHS approved): NHS Fife Rheumatology Service

## 5. Using Digital Technology in Teleophthalmology

*Santosh Bhide*

### **Introduction**

One of the earliest and most famous uses of hospital-based telemedicine was in the late 1950s and early 1960s, when a closed-circuit television link was established between the Nebraska Psychiatric Institute and Norfolk State Hospital for psychiatric consultations.[1]

Tele-ophthalmology exists since many years, but its application has been challenging because of its need for standardized and high-definition digital images.[2]

Teleophthalmology is a branch of telemedicine that delivers eye care through digital medical equipment and telecommunications technology.

According to recent statistics population of India is 140 billion. Number of trained ophthalmologists available in India is very low compared to population. Due to this in India, the ophthalmologist to patient ratio is as low as - 1:10,000. 70% of our population lives in rural India where availability of eye care professionals is limited. Certain areas in our country are inaccessible due to geographical challenges.

Teleophthalmology is of great help for this population. Super speciality eye care is available at their door step. There is no need for travelling by the patient or accompanying person there by significantly reducing financial burden on the patient



## **Advantages of Teleophthalmology**

### **1. Wide coverage of population in remote areas**

Consultation can be provided in remote areas. Preliminary examination is done by trained technician and data is transferred to base hospital. Video conferencing between treating doctor in base hospital and trained optometrist/ ophthalmic technician is done

### **2. Helps in avoiding unnecessary Referrals**

Selection of patients who need treatment is possible due to tele consultation. This can significantly reduce burden on the health care system

### **3. Timely management of emergency situations**

Consultation and subsequent management of patients needing emergency treatment is possible due to telemedicine

### **4. Cost effective**

Teleophthalmology saves cost, time and efforts of patients in conditions where in person consultation is not mandatory. It also reduces financial burden on patient as there is no need to travel and patient's daily earning is not compromised leading to better compliance to treatment and follow up

### **5. Expert opinion**

Additional expert opinion from another ophthalmologist or from consultant of other speciality is possible

### **6. Protection from infection**

In covid pandemic situation, teleconsultation helped in avoiding physical contact with the patient thereby protecting both doctor and patient from spread of covid infection

## **Challenges in Teleophthalmology**

### **1. Lack of awareness**

Both patient and doctors are not fully aware of technology and ease of application of technology

### **2. Issues of reliability and accuracy of results**

Patient and doctor both have concerns about quality of image. Due to this accuracy in reporting may be challenging. Availability of better equipment is the solution

### **3. High cost of equipment**

Investment in equipment and maintenance of the same is a big concern in starting teleophthalmology practice. Regular upgradation of hard ware and software is necessary leading to burden on finances

### **4. Concerns over quality of image**

With a poor-quality fundus image, grading becomes difficult

### **5. Availability of Trained and Dedicated staff**

Trained staff may not be available. Success of any project depends on dedicated, trained onsite staff. Managing human resources is always a big challenge

### **6. Issues related to Government policy**

- Medico legal concerns: There is a fear in the minds of doctors regarding medico legal issues related to teleconsultation

- Privacy and security concerns

### **7. Training of Doctors, para clinical staff and technicians**

Training and accreditation of everyone involved should be an ongoing process

### **8. Availability of high-speed internet**

In remote areas, availability of internet can cause difficulty in using digital technology

### **Guidelines**

Indian Telemedicine practice guidelines are included in Appendix 5 of Indian Medical Council (Professional Conduct, Etiquette and Ethics Regulation, 2002). New guidelines in association with NITI Aayog were released on 25<sup>th</sup> March 2020.[3]

## **Teleophthalmology in various ocular conditions**

### **1. Screening of diabetic retinopathy**

Remote retinal imaging in diabetics is most widely accepted modality for screening of large number of patients. Fundus images are captured on retinal camera are shared with ophthalmologists in hospital. Multiple studies have reported that sensitivity (62.5% to 98.2%) and specificity (76.6% to 98.7%) for diagnosing DR using tele-ophthalmology was comparable to traditional clinical examinations.

In rural India, a cost-utility analysis was performed for DR screening using tele-ophthalmology. Patient and provider costs of DR screening via tele-ophthalmology and DR therapy were estimated through interviews with patients and hospital administrators. Findings indicated that the cost per quality-adjusted life-year (QALY) for tele-ophthalmology was cost-effective (\$1320 per QALY) compared to no screening.[4]

**2. Screening for Retinopathy of Prematurity- Karnataka Internet Assisted Diagnosis of Retinopathy of Prematurity (KIDROP)** program is a well-structured tele-ROP tool in rural Southern India. Retinal imaging is performed by trained technicians who grade images and transfer them to experts with specially designed software to generate ROP report. The accredited technician determines on site whether the baby needs follow-up/treatment/discharge based on the triage algorithm created by experts. The rural multicentre study (2011–2015) demonstrated successful screening of 7,106 preterm infants (20,214 examination) from 36 rural NICUs in South India. The study reported that no infant in the study region developed unscreened stage 4 or 5 ROP.[5]

### 3. Others:

Glaucoma, ARMD, adnexal and orbital diseases, in lid conjunctiva and corneal diseases, in ocular emergency situations, in post-operative check up

#### Summary

Prevention of permanent blindness in population who has no access to primary eye care is possible by extensive use of tele ophthalmology. Due to less time consumption and convenience, it is now accepted in rural, semi urban and urban areas. It has also improved compliance for follow up

Lack of awareness in public and doctors and reluctance n accepting new technology is the barrier for extensive usage of this technology

With availability of high-speed internet, 5 G network and high-end equipment at low cost; Tele ophthalmology will be of great help in screening and treating our huge population

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## **6. Webinars- Boon or Bane? How to make best out of it... Avoiding WFS!**

*Minakshi Dhar, S. V. Kulkarni*

### **Introduction**

The term “webinar” is derived from an amalgamation of two words, “web” and “seminar.” The term “webinar” was first introduced by Korb in 1998. However, the pandemic of COVID in 2020, and the imposition of lockdown throughout the world, made it one of the most common modes of digital interactions in the medical fraternity. It revolutionized the way of sharing knowledge and boosted e-learning. A webinar is different from an introductory webcast; it is interactive and allows two-way communication between the speaker and participants.[1]

Webinars comprised a major avenue for education during COVID-19 pandemic, with initial general satisfaction among physicians. However, this paradigm shift was sudden and lacked proper regulations. Despite initial satisfaction, the majority of physicians felt overwhelmed with the number and frequency of webinars. Physicians’ satisfaction is crucial in planning future educational activities, and considering that this current crisis will most likely have long lasting effects, webinars should be viewed as complementing traditional in-person methods, rather than replacement.[2]

Participants’ perspective and the advantages and the disadvantages of a webinar and provides suggestions for the conduct of an ideal webinar with maximum active participation. [3]

### **The benefits of hosting a webinar**

- 1. Location independence:** Cost Reduction
- 2. Scalability:** Webinars let you speak directly to hundreds, if not thousands
- 3. Variety:** Offer plenty of freedom to play with the format to keep your audience engaged. The different interactive elements you can use in webinars include slides, polls, chats, drawing tools, and Q&A sessions.
- 4. Real-time feedback:** Those viewing the webinar can type in questions and comments while your presentation is underway.
- 5. Audience attention:** Viewers typically pay close attention to live webinars
- 6. Trust:** Webinars give your academic a human face that helps forge stronger bonds with your audience.
- 7. Leads:** Webinars can be an incredible source of new leads for best practices

### **Our Practical Experiences**

After lockdowns and community quarantines were implemented in many parts of the globe, suddenly everything became digital, including the traditional face-to-face conferences, trainings, class room teachings. So we entered the ubiquitous world of webinars! Usage of the webinar has gradually increased during the COVID-19 pandemic, with webinars providing an effective tool to engage with stakeholders, amid a dearth in physical events. If you look at your social media feed today, especially LinkedIn, chances are that you would find multiple webinar announcements and live streams.

All this led to a 'new pandemic' called WFS: ***Webinar Fatigue Syndrome.***

This has led to overfeeding & A New Pandemic, Albeit Non-Lethal, Webinar fatigue is a **new term** used to describe an overall *FEELING OF TIREDNESS* or *LACK OF ENERGY* towards WEBINARS.

**A brief touch on this new clinical entity...**

*What is Webinar Fatigue Syndrome?*

*Are you a victim of Webinar Fatigue?*

*How to overcome this as a PATIENT (participant)?*

*How to treat it as a DOCTOR (organizer)?*

**Our simple & practical experience is this...**

After extensive research and keeping pace with the modern boom of knowledge, diagnostic criteria have been established for WFS

1. Reaction time to any external stimulus increases
2. Constant rubbing of eyes
3. Constant fight with the spouse
4. Less indulgence with friends and family members.
5. Lethargy

**Modified CRUB-19 Criteria**

**C** – Constant Irritation

**U** – Urge to ignore invitations

**R** – React to any invitation even before looking at the topic

**B** – Thinking of Boycotting the Webinars

**Why Does It Occur?**

- You blink less frequently when staring at a screen.
- Your body aches from sitting in the same position for an extended period.
- Your brain assumes the stillness means you want to sleep, thus you fall asleep
- Results demonstrate that evening exposure to an LE-eBook phase-delays the circadian clock, acutely suppresses

melatonin, and has important implications for understanding the impact of such technologies on sleep, performance, health, and safety.

### **How to Avoid it is a Participant?**

*Which one to attend? How many can I attend?*

1. The solution lies in **PRIORITISATION**
2. Avoid **MULTITASKING**

### **Why should we avoid multitasking**

1. **Damage our brain:** cognitive overload, dulls brain, retards our response time.
2. **Makes us less productive:** more time and energy are spent on switching tasks reducing productivity
3. **Makes you dumb:** repeated multitasking adversely affects your alertness and even intelligence
  - Do you realize that all of us are doing multitasking? Texting while walking, sending emails during meetings, chatting on the phone while cooking dinner and making telephone calls while driving or walking on road?
  - In today's society, doing just one thing at a time seems downright luxurious, wasteful, and is considered out of fashion. We think, as amazing multitaskers, we are great achievers! Wow!
4. **Makes us less productive:** Research shows that multitasking does not make us half as efficient as we like to believe. Guy Winch, author of Emotional First Aid states, 'what we call multitasking is actually task switching.
5. **Weaken your memory:** when you are juggling between two different activities, you cannot be paying proper attention to any one of them. So, whatever you are doing or learning, you will not be able to recollect it properly later.
6. **Makes you prone to errors:** According to Weinschenk, 'you make more errors when you switch than if you do one



task at a time'. E.g., Sending wrong msg to wrong people...

**7. Kills Your Creativity:** While multitasking, your attention hops from one problem to another. This makes you lose focus and concentration at the tasks at hand. It is quite possible to work on a few similar tasks at one time, when it comes to serious problem-solving, it's a big challenge. The concentration suffers affecting your creative instincts.

**8. Multitasking Causes Anxiety.** A major disadvantage of multitasking is that feeling of anxiety which is the result of frequent loss of concentration. The symptoms of interrupted work can range from psychological to even physical.

**9. Waste of Time:** Contrary to the common belief, multitasking takes away a lot of time in attention-switching. The time spent on the reset is far greater than the usual perceived time-saving. That is the simple tragedy.

**10. Multitasking lowers the quality of your work:** When you multitask, your work suffers, for sure. Research shows that multitasking reduces performance and makes project completion much longer.

### **Tips for Prioritization**

1. Attend the ones that contribute to your goals
2. Mark them as must attend Keep adequate time for revision of notes and marking your action points. A webinar attended and not converted into action points is of little use.
3. Allot time for self-development in a day/week. Cater for family time, sleep, exercise, entertainment, etc to live quality, balanced life.
4. Could attend, should attend: Write time against each
5. In self-development time allot time for books, articles, TV debates and webinars.

Discipline yourself to watch webinars within these guidelines and avoid webinar fatigue.

Due to the latest turn in the world of virtual events and the dissatisfaction experienced by virtual attendees, leaves event organizers in quite a tricky spot because live events still aren't a viable option in most places.

But due to the virtual events, we got a glimpse of how truly convenient and advantageous virtual events can be. They still have a lot of potential, provided your event is one that gives attendees an actual experience, not just five back-to-back webinars. So, organizers need to plan the sessions in such a way so that attendees don't suffer from WFS.

We all know content will always reign. That's just the way it is. And one way to keep your event interesting is by giving your attendees content in a variety of formats. The content doesn't have to be limited to your sessions either.

### **1. Allocate points for each activity**

- Answering polls, asking questions, interacting with sponsors and attendees—and list the top scorers on a virtual leader board
- Plan a virtual bingo to facilitate networking amongst attendees
- Host quizzes related to a particular session, Kahoot –Screen shots

### **2. Live polling**

- This was pretty popular even with live events. For one thing, attendees get to be an active part in the session and helps the speaker take the session in a direction attendee most prefer. Poll anywhere

### **3. Questions**

- Can a session ever be complete without that designated question and answer time? That's why you need a platform that allows attendees to submit their questions to the

speaker(s).

#### **4. Real-time chat facilities**

- Remember those side conversations at live events? At virtual events, they happen in the chat rooms. Your attendees can start discussions, ask the organizers questions, or even give their opinion on the topic discussed. All of this gives them something to do other than simply staring at the screen while also making them feel involved.

#### **How to host?**

It's better to host your virtual event in bits and pieces, even if it's just three hours every day for a few days. While attendees have no problem staying at a live event throughout a day or even over a period of days, that's not the case with virtual events. They can't sit in front of the computer the whole day.

That's why it's important to spread your event over a few days or even keep the sessions spare with more breaks than usual.

Every event organizer wants to make it a life time experience for attendees. When we say "experience," we mean the attendees take an active role in the event—they experience something as opposed to being passive spectators. So how do you make them experience your virtual event? You give them something to remember, something to cherish. This you can do by making the event more diverse and inclusive. This is because, at inclusive events, attendees feel like they belong, which in turn makes it a positive experience.

#### **Who doesn't love a good surprise?**

When you tell attendees that there's some good news for them and that'll be announced sometime during the event, they're more likely to tune in and stay tuned in. You may not have a big surprise for them, that's okay.

### **Do something unexpected!**

You can give them a digital gift card to buy lunch and take part in the virtual lunch hour. Or host a virtual after-party once the event is over. You could have an impromptu soapbox session and invite members of the audience to speak.

We are sure with above tips you can make a fantastic webinar at the same time avoid WFS.

*'Happy Webinarring'!!!*

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## 7. Digital Technology in Infectious Diseases

*Laxman Jessani*

### **Introduction**

Smartphones and tablets are now being increasingly used by Infectious Diseases (ID) Physicians in outpatient and in-hospital settings to access information on the go. A study done by Epocrates application (app) found 90% of physicians access drug information via a mobile app, and 40% use a mobile app once or twice a day. Mobile apps provide point-of-care access to medical information from the pocket to the patient. For example, reliable paperback publications like the Sanford Guide to Antibiotics or the Johns Hopkins Antibiotic Guide have been used for decades by ID specialists; now the app version with regular updates of both guides provides the same reliable information that clinicians have depended since long.

In essence, the early apps were nothing more than a book chapter on an electronic device. They were limited in their ability to search for needed information and were difficult to navigate. Now, most devices are in constant connection with the Internet and are much more dynamic, with the ability to access PubMed or other medical databases in real time. This allows physicians to have access at the point of care to the latest studies or clinical guidelines in order to enhance clinical decision making.

A study by Bogosh et al demonstrated how a mobile phone transformed into a microscope could diagnose soil-transmitted helminth infections in children on Pemba Island,

Tanzania, where medical resources are limited [1]. Busy ID clinicians need content on antimicrobial dosing, travel advice, immunization schedules, infection control guidelines, influenza surveillance, and disease-specific management.

**Table 1** provides a summary of few selected apps grouped into various categories such as Antimicrobial References, Infection Prevention/Control and Clinical References.

**TABLE 1:** List of most commonly used ID apps

App	Description
Infection Control Pocketbook	Disease and pathogen-specific isolation precautions adapted from CDC guidelines
Lexi-Drugs	Comprehensive drug database with international brands, new FDA warnings
Sanford Guide to Abx	Clinical conditions and anti-infective drug information. Can install content on 3 devices
Epocrates Rx	Easy to navigate drug information and drug interactions. John Bartlett, MD, provides up-to-date scientific news and reviews abstracts.
Johns Hopkins Abx Guidea	Comprehensive easy to use antimicrobial guide. Allows voice search on iPhone
Uptodate	Provides evidenced-based recommendations of current clinical information for adults and kids
Medscape	From WebMD, features drug information, diseases, calculators, and free CME and ACPE credit. Easy to navigate

**ID apps guide in following:**

1. Simplify decision making during making therapeutic decisions
2. Calculating antibiotic choice or dose modification in renal failure
3. Checking drug interactions in the vast list of drugs for the sick patient
4. Prevents prescribing and medication errors
5. Monitoring drug-drug interactions and ideal dosing in critical situations

**1-Epocrates**

Epocrates (<http://www.epocrates.com>) was founded in 1998 as a drug reference app for the Palm OS handheld devices. Since then, 4 products have been developed that can be operated on most mobile platforms. The iOS platform now provides clinical articles that are hand-picked and commented upon by experts in that particular field. According to Manhattan Research's 2011 data, this is currently the most popular mobile medical app and is used by as many as 50% of US physicians.

Browse Content Infectious Disease vancomycin... vancomycin HCl

Infectious Disease by System >

Infectious Disease by Bug >

Infectious Disease by Bug Class >

Infectious Disease by Drug >

Infectious Disease by Drug Class >

**Special Note**  
[use guidelines]  
Info: refer to [www.CDC.gov](http://www.CDC.gov) for recommendations on appropriate use and preventing/controlling spread of vancomycin resistance

**infections, severe bacterial**  
[<50 kg]  
Dose: 500 mg IV q12h; Start: 10-15 mg/kg IV q12-24h in elderly pts; Alt: 10-15 mg/kg IV q12h; Info: pts w/ high clearance may require 10 mg/kg IV q8h; dose, duration varies w/ infxn type, severity

[50-69 kg]  
Dose: 750 mg IV q12h; Start: 10-15 mg/kg IV q12-24h in elderly pts; Alt: 10-15 mg/kg IV q12h; Info: pts w/ high clearance may require 10 mg/kg IV q8h; dose, duration

Home Interactions Pill ID Tools More Home Interactions Pill ID Tools More

Endocarditis,... >2 months post-op Sepsis/Shock hospitalized

Empiric Specific Info Notes Empiric Specific Info Notes

**\*\*Early surgical consultation advised.\*\***

**Viridans streptococci**  
1. [penicillin G](#) 18-24 million units IV 24h div q4h x6wks (if PCN MIC <0.1 mcg/ml) [and] [gentamicin](#) 1 mg/kg IV q8h x2wks  
2. [ceph\\_3\\_4](#) [and] [gentamicin](#) 1 mg/kg IV q8h x2wks  
3. [vancomycin](#) 15 mg/kg IV q12h x6wks

**Streptococcus bovis**  
1. [penicillin G](#) 18-24 million units IV 24h div q4h x6wks (if PCN MIC <0.1 mcg/ml) [and] [gentamicin](#) 1 mg/kg IV q8h x2wks  
2. [ceph\\_3](#) [and] [gentamicin](#) 1 mg/kg IV q8h x2wks

**Acinetobacter**  
1. [imipenem/cilastatin](#) 500 mg IV q6h x14d  
2. [meropenem](#) 1 g IV q8h x14d

**Clostridium**  
1. [metronidazole](#) 500 mg IV q8h x14d  
2. [beta-lactam/beta-lactamase inhibitor treatment](#)  
3. [clindamycin](#) 600 mg IV q8h

**Bacteroides**  
1. [metronidazole](#) 500 mg IV q8h x14d  
2. [beta-lactam/beta-lactamase inhibitor](#)  
3. [clindamycin](#) 600 mg IV q8h

**Propionibacterium**

Home Interactions Pill ID Tools More Home Interactions Pill ID Tools More

This product is intended for nearly all healthcare professionals. The breadth of information makes it ideal for trainees, primary care providers, and even allied healthcare providers who need point-of-care drug information. When clinical information regarding bite infections was evaluated,



there was a concise monograph with images, epidemiology, and management recommendations, although the depth of ID information would not likely augment the clinical knowledge of most attending ID physicians. The drug interaction tool (Interaction Check) is excellent and can have a positive impact on patients if demonstrated in real time when discussing medications and potential interactions. Interaction Check is easy to use, customizable, and thorough, especially the interactions with herbal medications.

The inclusion of the basics of antibiotic dosing, introductory material on pharmacokinetics, drug interactions, and medication pricing make this a very practical tool for an ID physician. A useful feature is the ability to link to a drug monograph from a disease state monograph, such as linking directly to amoxicillin-clavulanate from the section on human bite wounds. Again, this app is not intended to provide the ID physician with guidance for therapies, and it is limited in scope with regard to pathogens or any medical management other than pharmacologic therapies. This app is very easy to use and fairly stable, although occasionally sluggish in its responsiveness. Although it offers a wealth of medical information, simply utilizing the basic drug monographs and interactions would make Epocrates a valuable addition to the ID physician's arsenal of information.

### **2-John Hopkins ABX Guide**

- The Johns Hopkins ABX Guide

(<http://www.hopkinsguides.com>) is 1 of a set of 3 guides available from Johns Hopkins Medicine. The diabetes and HIV

guides are discounted when 2 or 3 guides are bundled into 1 integrated app. Much of the content from the HIV and ABX guides appears to overlap. The ABX Guide is formatted like a general ID reference text. It is very easy to use, well referenced, and up-to-date. The ABX guide is available for iOS, Android, Windows Phone, Blackberry, and mobile Web browsers.

The image displays two screenshots of the Johns Hopkins ABX Guide mobile application. The top screenshot shows the 'Vancomycin' page. The left sidebar contains a table of contents with categories: All Topics, Antibiotics, Diagnosis, Management, Pathogens, Vaccines, and Brand Names. The main content area is titled 'Vancomycin' and includes sections for 'INDICATIONS' (FDA and NON-FDA APPROVED USES) and 'FORMS'. The bottom screenshot shows the 'Acinetobacter baumannii' page. The left sidebar contains a table of contents with categories: Endocarditis and Acinetobacter baumannii. The main content area is titled 'Acinetobacter baumannii' and includes sections for 'PATHOGENS' and 'MICROBIOLOGY'. The application interface includes a top navigation bar with the Johns Hopkins logo and 'ABX Guide' text, and a bottom navigation bar with icons for home, search, and other functions.

**Vancomycin**

**INDICATIONS**

**FDA**

- Bone and joint infections
- Pneumonia
- Septicemia
- **Endocarditis** treatment and prophylaxis (in PCN allergic pts)
- Oral vancomycin: antibiotic-associated pseudomembranous colitis caused by *C. difficile* and enterocolitis caused by *S. aureus* (including MRSA)

**NON-FDA APPROVED USES**

- Hardware-associated infections

**FORMS**

---

**Acinetobacter baumannii**

**PATHOGENS**

- Frequency (based on 1779 cases 2000-03):
  - » *S. aureus*: 32%
  - » Viridans streptococci: 18%
  - » *Enterococcus*: 11%
  - » Coagulase-negative staphylococcus: 11%
  - » *Streptococcus bovis*: 7%
  - » *Streptococcus* (other): 5%
  - » HACEK organisms: 2% [*Haemophilus parainfluenzae*, *Haemophilus aphrophilus*, *Actinobacillus actinomycetemcomitans*, *Cardiobacterium hominis*, *Eikenella corrodens*, *Klebsiella*]

**MICROBIOLOGY**

- Aerobic gram-neg coccobacilli or rods, often mistaken for *Neisseria* or *Moraxella* on Gram stain.
- Common in environment (water, soil) and hospital (catheters, lotions, ventilation equipment).
- Grows on standard agar media.
- *A. baumannii* is the major species of *Acinetobacter*. Others occasional human pathogens include *A. calcoaceticus*, *A. Iwoffii*, *A. junii*, *A. johnsonii* and *A. baylyi*.
- *A. baumannii* is low grade pathogen affecting compromised hosts

### 3-Sanford Guide

The 2022 *Sanford Guide to Antimicrobial Therapy* (<http://www.sanfordguide.com>) is the latest edition, and over the past several years has expanded to various electronic and mobile platforms. The makers of Sanford Guide now also provide separate guides on HIV infection and AIDS therapy as well as on hepatitis, although these do not link to the antimicrobial guide. The Sanford Guide app and Sanford Guide Web edition are updated on an ongoing basis.

The screenshot displays the Sanford Guide mobile application interface. On the left is a yellow navigation menu with the following options: Disease / Condition, Drug Information, Bacterial Organism, Therapeutic Adjuncts, and Tables / Tools. The main content area is split into two columns. The left column shows the 'Endocarditis, Overview' article with an 'Overview' sub-header and a list of diagnostic criteria. The right column shows the 'Acinetobacter baumannii' article with a 'Clinical Setting' sub-header and a list of clinical characteristics.

**熱病 SANFORD GUIDE**  
**ANTIMICROBIAL THERAPY**

- Disease / Condition >
- Drug Information >
- Bacterial Organism >
- Therapeutic Adjuncts >
- Tables / Tools >

### Vancomycin

#### Vancomycin, Vancocin

**Usage**

- Vancomycin is a glycopeptide antibiotic most often used (in parenteral form) in empiric or initial therapy of proven or suspected MRSA or MRSE infections. The oral form of Vancomycin is the preferred therapy for *C. difficile* colitis.
- Initial doses are based on **actual body weight**, including obese patients.
- Subsequent Vancomycin doses should be adjusted based on measured trough serum levels.
- In retrospective study of patients

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Back **Endocarditis** Home

### Endocarditis, Overview

#### Endocarditis, overview

**Overview**

- Endocarditis diagnostic criteria include:
  - Evidence of continuous bacteremia (multiple positive blood cultures)
  - New murmur (worsening of old murmur) of valvular insufficiency
  - Definite emboli
  - Echocardiographic (transthoracic or transesophageal) evidence of valvular vegetations.
- Refs.: [European Heart Journal 30:2369, 2009](#); [Circulation](#)

Back **Acinetobacter ba...** Home

### Acinetobacter baumannii

#### Acinetobacter baumannii

**Clinical Setting**

- Positive culture for *Acinetobacter baumannii*. A gram negative aerobic bacterium. Nosocomial, opportunistic pathogen and frequent cause of ventilator-associated pneumonia.
- Regimens are determined by susceptibility of the identified organism.
- There may be resistance to multiple classes of antimicrobials, including: Imipenem, Meropenem,

#### 4-Medscape

Medscape (<http://www.medscape.com>) was originally founded in 1995 as a free online resource for healthcare professionals to provide a medical reference for clinical decision support, news, and continuing medical education. There is no detailed spectrum of activity listed for different antibiotics, and references provided do not typically include IDSA guidelines. Overall, the Medscape app is an up-to-date, free resource that can serve residents and non-ID physicians while still providing some helpful information to ID practitioners that can be supplemented with a more focused ID reference.

The screenshot displays the Medscape app interface. At the top, the Medscape logo is visible. Below it, there is a search bar and a navigation menu with categories: Hospitals Pay Physicians in Medicare Bundled Payment Model, Drugs, OTCs & Herbals, Diseases & Conditions, Procedures & Protocols, and Interaction Checker. The main content area is split into two columns. The left column shows search results for 'Infective Endocar...' with a 'Back' button. The right column shows search results for 'Acinetobacter' with a 'Save' button. Below the search results, there are two sections: 'Etiology' and 'Epidemiology'. The 'Etiology' section discusses the different types of IE and lists underlying causes like Rheumatic valvular disease and Congenital heart disease. The 'Epidemiology' section discusses the frequency of Acinetobacter infections and their mortality/morbidity.

**vancomycin**

**Adult Dosing & Uses**

**Dosing Forms & Strengths**

**capsules**  
125mg  
250mg

**injectable solution**  
5mg/mL

**powder for injection**  
500mg  
1g

**Pseudomembranous**

**Medicine**

**Medscape** from WebMD

**Reference** Interactions News Education More

**Back** **Infective Endocar...** **Save** **Back** **Acinetobacter** **Save**

**Etiology**

The different types of IE have varying causes and involve different pathogens.

**Native valve endocarditis**

The following are the main underlying causes of NVE:

- Rheumatic valvular disease (30% of NVE) - Primarily involves the mitral valve followed by the aortic valve
- Congenital heart disease (15% of NVE) - Underlying etiologies include a patent ductus arteriosus, ventricular septal defect, tetralogy of Fallot, or any native or surgical high-flow lesion.

**Epidemiology**

**Frequency**

**International**

*Acinetobacter* commonly colonizes patients in the intensive care setting. *Acinetobacter* colonization is particularly common in patients who are intubated and in those who have multiple intravenous lines or monitoring devices, surgical drains, or indwelling urinary catheters. *Acinetobacter* infections are uncommon and occur almost exclusively in hospitalized patients.

**Mortality/Morbidity**

Although *Acinetobacter* is primarily a

**Reference** Interactions News Education More **Reference** Interactions News Education More

Although infectious diseases apps provide point-of-care access to resources and clinical decision support tools, even the most well-designed app is of no value to ID HCPs if the content is inaccurate, outdated, or too difficult to navigate and if there is no clinical co-relation.

### **Conclusion**

Electronic references for mobile devices have made medical information available to the clinician in real time at the bedside. Many apps are available for the different mobile platforms, each with its own strengths, weakness, and intended audiences. No single app will meet all of the needs of an ID physician, although the Hopkins ABX Guide and the Sanford Guide provide the most comprehensive amount of clinical material. Each app delivers content in a unique way and would meet divergent needs, from those of the experienced clinician to those of the trainee. The ability to rapidly access trusted medical knowledge at the point of care can help all healthcare providers who treat infections to have access to the most current recommendations and literature that are available.

### **References**

1. Bogoch II, Andrews JR, Speich B, et al. Mobile phone microscopy for the diagnosis of soil-transmitted helminth infections: a proof-of-concept study. *Am J Trop Med Hyg* 2013; 88:626–29

## 8. Judicious use of social media for Medical Professionals

*Amol Annadate*

### **Why social media? Are we using its full potentials?**

Social media provides physicians with tools to share information, to debate health care policy and practice issues, to promote health behaviours, to engage with the public, and to educate and interact with patients, caregivers, students, and colleagues.

In today's age when dissemination of genuine medical information is need of the day, social media is a free, self-run, self-operated, automated media.

The uniqueness of this media is that response is quantifiable and it is an interactive platform. Also, soft promotion in medical practice is needed which can be decently achieved through social media.

Social Media platforms that can be used

1. Facebook page / account
2. Twitter handle
3. Instagram
4. Whatsapp
5. Youtube channel
6. Linkedn
7. Wesite
8. Telegram
9. Moj
10. Blogs
11. SnapChat, ShareChat

### **Handle with care**

- Social media is a double edged sword. If media is like speaking on a closed platform, social media is like a speech on crossroads. Since each and every word spoken on written on social media is open for judgment and scrutiny, it has to be highly strategized.
- It is a platform where you don't have control on your audience and anyone can shout back. Since you are constantly judged on social media and unlike media there is no editor you have to be your own editor.
- It is always difficult to edit your own self so this a skill that needs to be acquired for a graceful social media presence. Also, the virtual praise on social media is a honey trap and can hinder creativity and divert one from the target.

### **Care Bundles**

#### **1. Time management**

Promptness is the key. One should mark daily time zone to be devoted for social media daily. Having a social media manager is a good idea.

#### **2. Facebook page vs account**

Having a Facebook page is always better than a personal account as page gives a professional touch. Personal account can be continued for personal updates.

#### **3. Content Strategy**

- Usually content is written very reflex and not strategically.
- Content is the soul of your social media message. It should not be self-centred but it should be experience centred and something that educates the reader.
- Become very personal and try sharing personal details is not a very good strategy. It must be general expression of opinion than one's own.

**4. Comment management** and keeping the fans and followers engaged is equally important. Do not invite

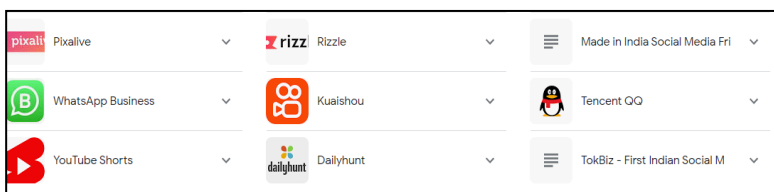
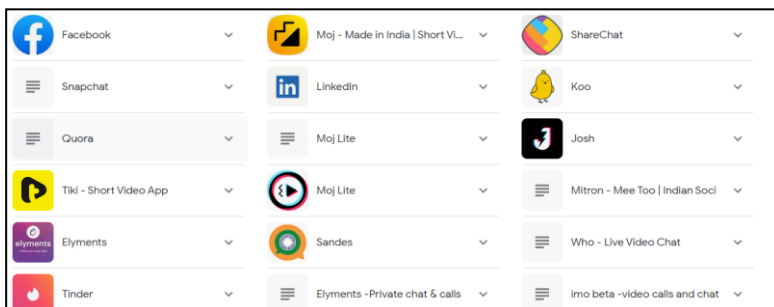
controversies by unnecessary comments on religious or such things without relevance to your profile. Rather than speaking about ourselves we should speak about incidents, events with social references.

- If we have a story to tell which can create excitement, inspiration or give a moral. Think before writing why people should read the content. Don't divert the content from the pre decided social media targets and image

### **Top benefits of social media in healthcare**

1. General Awareness and Medical Information
2. Raising Awareness of serious issues
3. Public Health Surveillance
4. Extensive reach for the Practitioner
5. Peer Support in case of crisis and medicolegal situations

*Word of Caution: Stay Secure*





## 9. Taking digital technology to the masses: Hitcon my views and experiences.

*Pragnesh Vachharajani*

### Introduction

Technology in healthcare is the future and current need. It is high time that healthcare professionals adapt technology to the fullest and start taking benefits of it, organize their practices, deliver quality care and grow their practices. Apart from being the need of the hour, it is going to become mandatory for future generations of healthcare professionals.

Keeping this in mind and taking digital technology to a grassroot level of medical practice, a group of doctors called Management Medicos attempted a novel thing called

**“HITCON”**: HEALTHTECH CONFERENCE FOR DOCTORS.

First time starting HITCON in 2016 with one event in Ahmedabad to 2022, 8 events done so far in various cities of Gujarat and One event virtually. These are basically one- or two-day events which are attended by doctors and hospital staff. The entire event is organized keeping in mind the most basic needs of healthcare professions to empower, encourage them to use and adapt technology. At the same time new advanced developments and news in the field across the world are shared by eminent faculties across India.

HITCON now has become a platform which connects healthcare with technology. Tech companies participate in Hitcon to reach out to the target audience and display their

products and solutions. More and more healthcare professionals are attending Hitcon now and till date about 10,000 plus have attended and updated them in the field of technology. They are adopting current technology proactively, not only that they are suggesting a lot of changes, modification in the present practice.

Including a concept like hackathon in which will encourage the young Entrepreneur to be an important part in medical Digital Technology.

It has helped many start-ups and industries which need a platform to connect with the healthcare industry and have critical feedback and inputs from the end user.

Along with the event, knowledge related to starting a start-up or doing innovation is also discussed to ignite new talent among doctors to take up innovation and develop some required products. Training & support is not available easily and with the help of Hitcon it is made possible via various workshops and webinars.

Now this journey has become more inclusive with the Hitcon main event, Hittalks-single speaker talks, Hitcon Master Class (single speciality workshops) and webinars. Such practical activities which can be replicated and will be helpful in any state or country. A collaboration with organizations of doctors will make this more inclusive and reach a bigger audience in future.

And once you have reached a certain target and number of users the cost of the equipment, app or software will come down which is the biggest factor in preventing the use of it.

## 10. Tele Pathology

*Tanvee Kulkarni*

**Telepathology (TP)** is a rapidly growing field that utilizes modern technology to remotely diagnose and consult on pathology cases. This technology allows pathologists to remotely access and analyze digital images of tissue samples, eliminating the need for physical transport of specimens.

**Primary benefits** of telepathology is improved access to pathology services in remote or underserved areas. Instead of having to travel long distances to receive a pathology consultation, physicians in these areas can simply send digital images of tissue samples to a remote pathologist for analysis. This can greatly improve patient outcomes and reduce healthcare costs.

**Ability to collaborate** on difficult or rare cases. Pathologists can share digital images and consult with colleagues from around the world to arrive at a diagnosis. This can greatly improve the accuracy and speed of diagnoses, especially for rare or complex cases.

**Potential to improve the efficiency** of pathology services. By eliminating the need to physically transport specimens, telepathology can save time and reduce the risk of specimen degradation. This can lead to faster turnaround times for pathology results, which can improve patient care and reduce healthcare costs.

**Types of telepathology systems** 1whole slide imaging (WSI) systems, 2virtual microscopy, and 3telemicroscopy.

**WSI systems** involve scanning an entire glass slide of tissue and creating a digital image that can be viewed remotely.

**Virtual microscopy** involves creating a digital slide library that can be accessed remotely. **Telemicroscopy** involves remotely accessing a microscope via a video link.

**Challenges** that need to be addressed. is ensuring the1 **quality and accuracy** of digital images. Pathologists need to be able to trust the digital images they are viewing, and there must be2 standards in place to ensure that digital **images are of high quality and accurately represent** the tissue samples.3

**Data security.** Digital images of tissue samples contain sensitive patient information, and it is crucial that these images are protected from unauthorized access. Needs robust security measures to be in place to protect patient data from hacking and other forms of cybercrime.

In conclusion, TP is a rapidly growing field that has the potential to greatly improve patient care and reduce healthcare costs. However, challenges such as ensuring image quality and data security need to be addressed to ensure that telepathology is safe and effective. With the right approach, telepathology has the potential to revolutionize the field of pathology and make expert diagnoses and consultations more accessible to patients around the world.

### **Telepathology TP Author's version**

Telepathology also called Digital Pathology is the practice of remote pathology using advanced image capturing instruments and telecommunication links to enable the electronic transmission of digital pathology Images.

**Types of Telepathology:**

1. Static Telepathology
2. Dynamic Telepathology
3. Whole slide Imaging

**Static Telepathology:** It is the easiest type, wherein a photograph of a microscopic image is taken using a camera of a mobile phone or a camera installed on a microscope and this image is shared using email or WhatsApp to another pathologist for diagnosis or second opinion.

**Dynamic Telepathology:** In this type the slide is viewed by a pathologist from a distance using microscope attached camera and videoconferencing softwares and reporting is done in real time.

**Whole Slide Imaging:** Advent of Whole slide scanners, high speed internet, advances in cloud storage technology has revolutionised the field of Telepathology. Now instead using microscope mounted camera, the entire slide is scanned using Whole slide scanners. Once scanned the slide is digitalised and can be viewed on a computer screen. Once digitalised the slide scan can be uploaded to the cloud and can be viewed and reported seamlessly from any part of the world, provided a good internet is available.

**Telepathology** can be used for remotely rendering primary diagnoses, second opinion consultations, quality assurance, education, and research purposes.

## 11. Future of Technology ChatGPT: Optimizing Language Models for Dialogue.

### *The Brilliance and-or Weirdness*

*S. V. Kulkarni*

#### **Introduction**

A model called ChatGPT (**Generative Pre-trained Transformer**) which interacts in a conversational way. The dialogue format makes it possible for ChatGPT to answer follow up questions, admit its mistakes, challenge incorrect premises, and reject inappropriate requests.

ChatGPT is a sibling model to InstructGPT, uses using Reinforcement Learning from Human Feedback (RLHF) which is trained to follow an instruction in a prompt and provide a detailed response.

This is a very innovative app and if it used for good reason and purpose, it gives fantastic results with its impressive technology. Answers to medical questions are still raw. But, as the knowledge-base (repertoire of database of answers-to-questions) increases this technology will be useful.

We should be updated on such and similar technologies, and get tech savvy. ChatGPT is still a chat. No charts, algorithms, no sophisticated replies in yet.

Here is a ChatGPT answer to my question - very generic, but still OK:

**QUESTION: A patient has hypertension 160/90 mm Hg. He also has an ulcer in his foot, with uncontrolled diabetes. How do I treat this condition?**

*CHATGTP ANSWER:*

*Treatment for hypertension in a patient with an ulcer on their foot and uncontrolled diabetes is a complex issue, and it would require a multidisciplinary approach.*

**Blood pressure control:** The first step in treating hypertension in this patient would be to control their blood pressure. This can be done through lifestyle changes such as diet and exercise, as well as medication if necessary. The target blood pressure for this patient would be less than 130/80 mm Hg.

**Diabetes management:** Tight control of blood glucose is important in the management of diabetes in order to prevent further complications such as foot ulcer. Medications, such as metformin, insulin, or a combination of both, may be prescribed to help control blood sugar levels. It's also important for the patient to monitor their blood sugar levels regularly and adjust their treatment plan as needed.

**Ulcer treatment:** The wound should be cleaned and dressed regularly to prevent infection and promote healing. The patient should avoid putting weight on the affected foot and should keep the wound elevated as much as possible. A specialist in wound care should be consulted to help manage the ulcer.

**Lifestyle changes:** A healthy diet low in salt, cholesterol, and saturated fat and regular physical activity are important to manage hypertension and diabetes, and to prevent complications.

**Medications:** A combination of medications may be prescribed to control hypertension, diabetes, and other related conditions. These may include ACE inhibitors, ARBs, diuretics, and beta-blockers for hypertension, and antibiotics if there is an infection in the ulcer.

It's important to note that the treatment plan should be **tailored to the individual** based on their specific needs and goals, and it's always best to work with a healthcare professional to create a personalized treatment plan.

### What is important?

- It gives an answer as an Individualised Management, does not support or advertise any product or tall false claims.

### Another Medical Question Example

The screenshot displays a user interface for a medical question-and-answer system. It features a dark background with white text and orange accents. The interface shows a question, a detailed answer, a follow-up question, and an error message.

**Question:** What is sarcopenic obesity

**Answer:** Sarcopenic obesity is a condition characterized by the co-existence of both sarcopenia (age-related loss of muscle mass and strength) and obesity (excess body fat). Individuals with sarcopenic obesity typically have a higher body mass index (BMI) due to an increase in fat mass, but also have lower muscle mass and strength compared to those with a similar BMI who do not have sarcopenic obesity. This condition can lead to an increased risk of disability, falls, and other health problems.

**Follow-up Question:** How can I treat sarcopenic obesity?

**Buttons:** Save & Submit, Cancel

**Error Message:** An error occurred. If this issue persists please contact us through our help center at [help.openai.com](https://help.openai.com).

**Footer:** There was an error generating a response. Regenerate response



Examples	Capabilities	Limitations
"Explain quantum computing in simple terms"	Remembers what user said earlier in the conversation	May occasionally generate incorrect information
"Got any creative ideas for a 10 year old's birthday?"	Allows user to provide follow-up corrections	May occasionally produce harmful instructions or biased content
"How do I make an HTTP request in Javascript?"	Trained to decline inappropriate requests	Limited knowledge of world and events after 2021

ChatGPT was launched as a prototype on November 30, 2022, and quickly garnered attention for its detailed responses and articulate answers across many domains of knowledge.

Its uneven factual accuracy was identified as a significant drawback.

Following the release of ChatGPT, OpenAI was reportedly valued at \$29 billion.

There are many controversies in its Reception, criticism, credibility and social, ethical and intellectual property issues.

It is still experimental & not accepted or recommended in educational & research institutions globally anywhere.

## 12. Digitalization a boon to hospital industry

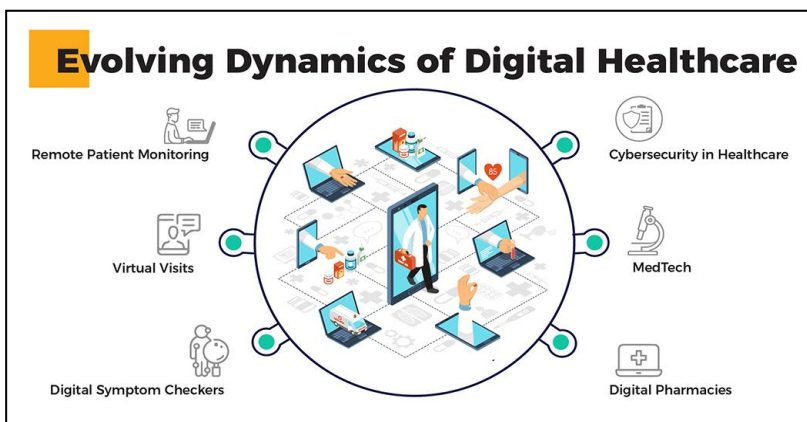
*Sangita Choudhary*

### **Introduction**

In the most recent memory, no event has ever tested the healthcare industry like the 2020 pandemic, and like any other test, it has left 'n' number of questions in its wake – it has changed the stakeholders' perspectives on some key aspects and functions, specifically within the digital transformation framework. The COVID-19 pandemic accelerated the convergence of several trends in the health care industry, particularly consumers prioritizing convenience and access to care. Leading health systems view digital transformation as a way to become more consumer-friendly while simultaneously changing their operations, culture, and use of technology. Over the past two decades, many hospitals have adopted to digital technologies in their health systems. Digitalization from installing Electronic Health Records (EHR), Telemedicine, Online Lab testing, Advanced medical devices, Artificial intelligence, Virtual Reality and Big Data. The healthcare industry is on a mission to create an ecosystem of patients, doctors, hospitals, health devices, insurance, and patient care service providers. Through the online platforms, patients can now access apps-based on their smartphones; and utilizing the rise of immersive technologies that are adding value to virtual consultations.

The App based updates and communications that are allowing in-patients, their families to stay abreast on updates, have one on one communication with doctors, nursing staff, and hospital administration seamlessly. With the digital healthcare services patients can keep detailed and automatically updated medical records for themselves,

making their medical history easily accessible. The “digitalisation of healthcare” will contribute to relieving medical service provision from routine tasks (Smart Contract Function) and improving the precision of diagnosis and therapy (precision medicine, theragnostic, big data). Additionally, it will support promotion of the application of Point-of-Care Testing Technologies (POCT) in all areas of the health system (primary care, emergency care, acute treatment, rehabilitation).



## 13. The Metaverse and its applications in Medical Education and Healthcare

*Pushkar Khair*

### **Introduction**

Information technology has proved its benefit to the healthcare world to a great extent. It has significantly helped easier access to information and facilitated interaction for the exchange of knowledge. This has in turn helped providers to care for patients better. Today we stand on the brink of the next chapter in the evolution of this technology which is being termed the Metaverse.

The Metaverse being built on the next generation web 3.0 technology can provide an immersive and near-real experience around any medical information.

The Metaverse which is poised to help consume information in an experiential way has potential applications in medical learning, clinical care, patient education, and medical innovations.

Any technology is meaningful for the healthcare world only if it can address one question effectively. “Is it going to help me care for patients better and improve their lives?”.

The article is a glimpse into the art of the possibility of what the Metaverse as a technology platform has in its story for the healthcare world. While the possibilities are not limited to the ones expressed in the article, it is the beginning of an exciting journey of innovation in information technology which is not going to leave the healthcare world untouched.

## **The evolution of Information Technology in Healthcare**

The decade of the 90s saw the dawn of the era of information technology. In the initial days, the computer was seemingly a possession of a rare few. Today smartphones with ever-evolving operating systems and computing abilities have become an extended part of the human body.

In the journey of evolution of information technology, the year 2022 saw a lot of buzz starting around the word Metaverse. Technology terms like web 3.0, blockchain and NFTs (Non-Fungible Tokens) started doing rounds over the internet. As any new concept would have it, the Metaverse became a point of opinion, discussion, excitement as well as scepticism.

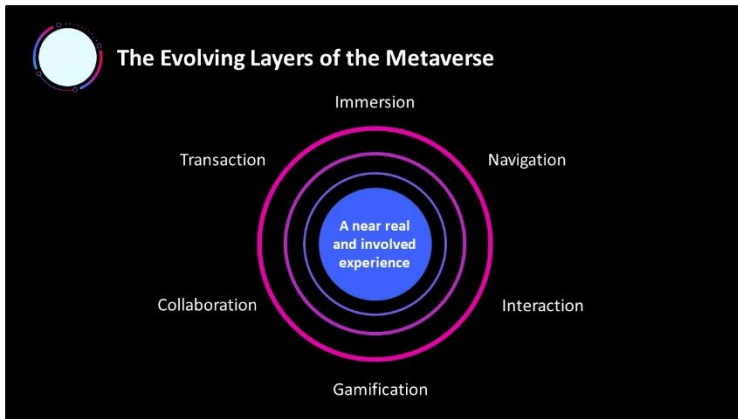
While healthcare has always been lagging in the adoption of the latest in information technology, it would be a good practice to be prepared to know how the Metaverse is going to touch the way we learn medicine and care for patients.

To see where and why we are at the brink of the technology evolution today, it would be worthwhile looking back at how the journey has progressed. With the introduction of the internet, the world was first exposed to web 1.0, which enabled the availability of information 'online' that could be accessed through searches and clicks. This soon followed the web 2.0 technology which allowed us to also interact with each other. Initially through emails and eventually through real-time synchronous chats and even more, through video calls. This shrunk the world of communication and access significantly from what it was. Web 3.0 is the next technology in its gestation and its birth would see the enablement of the next level of digital experience which we call today, the

Metaverse equipped with the functionalities of artificial intelligence, machine, and deep learning.[1]

### **The Metaverse**

The word Meta has a peculiar meaning, it means attached, yet detached through an independent existence. With the term Metaverse, we mean a digital universe which is a virtual replica of our physical universe where a 'created' reality can be experienced. Here the word 'experience' is of primary importance. The kind of experience that web 3.0 technology has to offer is the one that involves more of the human senses giving a near-real and involved experience. This is due to the ability to navigate in 3-dimensional space, immerse in situations and environments and interact with digital assets and avatars very much alike in the real world.[2]



While virtual reality, augmented reality, and extended reality have been in use for a while now, the ability to collaborate on one virtual space from different locations, socialize, interact, and experience are the additional capabilities that are being facilitated through the Metaverse.

While virtual reality headsets can provide the best immersive experience, it might take a while before the devices could be universally available and accessible. A similar though not as immersive experience is now possible on the interface of computer screens and mobile phones.

Having understood what the Metaverse is and the technology that has the potential to enable it, we as medical professionals would want to see if it is meaningful for our lives. The healthcare world has always seen technology as an enabler. An enabler to learn better and care for patients better. How then the Metaverse would act as an enabler in our forthcoming lives?

### **Metaverse in Medical Learning**

With the ability to navigate and immerse in situations and environments, the Metaverse opens possibilities to understand science better. Due to the engagement of more senses than while reading a chapter or watching a video, the Metaverse can take you on a journey in the most intricate parts of the human body to understand the pathogenesis of a disease process and the way therapy acts to correct it. With access to very accurate human body structures, understanding the human anatomy can be now made accessible to every medical student, without the need for physical human cadavers. Today, where the top medical Universities and their infrastructure remain inaccessible to most of the world, a digital twin of these Universities could democratize quality medical education and improve healthcare across the globe.

Learning through experiencing patient cases and being involved in the management of multiple case scenarios is what helps create good healthcare providers. While, today, it

can be limited by the exposure that one gets in the health care institutions where they work, the Metaverse can create unlimited clinical scenarios which one could experience with no limitations of time, space, and travel and be better equipped to anticipate and care for the patients in the real world better. Having experience managing a case in the virtual world can help create a better recall in the real world, where time is of the essence.



Interventional training and training on medical procedures, today, are under a lot of stress due to the running costs and availability of training personnel as well as the physical infrastructure needed to hold such training. So is true for learning to operate newer devices in patient diagnostics and therapy. The Metaverse is an enabler to provide standardized, scalable, and instant feedback-oriented training experiences which have the potential to reduce the constraints of time, space, availability, and travel. This is possible through the creation of the digital twin of the training environment with standardized messages delivered through digital meta-trainers.



Due to the multi-sensory experience in the Metaverse, the 3 key aspects in learning viz. the cognitive, the affective, and the psychomotor, are effectively addressed, thus making medical learning complete and holistic.



### **The Metaverse in Clinical Care**

As the Metaverse, which is the attached digital universe to our physical universe, it is possible to have a digital twin of a human which accurately represents the physical one in the real world. Having a digital twin with more objective data

information can enable healthcare providers to get the complete information to treat them. Consider a person who needs delicate surgery. Having a digital twin of such a patient created using the demographic data, vital and laboratory data as well as image data from the CT or MRI examination, could enable a surgeon to practice the procedure layer by layer to anticipate what can go wrong, thus making the real surgery safer and more accurate.

Having the digital replicas of the physical patients also can enable the creation of clinical trial environments which would enable more accountable and efficient trials on medical devices and newer drug molecules, thus helping them reach deserving patients faster in the real world.

With the availability of Centres of Excellence in the digital universe, patients across the globe can get access to the most accurate and updated medical opinions so that quality healthcare could be democratized.



## **The Metaverse in Patient education**

Today, as healthcare providers struggle to give that personal time to each patient they care for, there is a need to address all the questions and concerns that patients have about their disease state. It could be a medical condition needing pharmacotherapy or a disease state needing surgical intervention. For the patient, it is a very personal and agonizing situation. Patients need to be better informed so that they can take better care of themselves. The Metaverse offers possibilities to create patient journeys which they could navigate through to know what to expect in their recovery plan. It gives us the opportunity to create situations in day-to-day lives to help the patients learn the right actions to be taken in those situations that they can identify in their real lives. Being able to empathize with patients and giving them information in a form they can easily understand through experience can help reduce a significant amount of time stress that healthcare providers face today.



## **The Metaverse in Medical Innovations**

Over the last decade, we have seen rapid development in medical technology devices. These have showcased great examples of how lives can be saved and made better through the right amalgamation of digital data and patient interventions. The rapidity with which developments are happening arises the need for medical device companies to do early prototyping of workflows and device interactions. The Metaverse, through its ability to create digital twins of the device workflows, can enable the research scientists to do early prototyping and usability testing in the virtual space to get early feedback on improvement of the experience with the device, so that the road to actual patient care can be significantly reduced.



## **Conclusion**

As these are the early twilight hours for the Metaverse, which has started to shine gradually at the Horizon, the above possibilities are just a glimpse into the art of the possible. It is always going to be us, healthcare providers, deciding how best to make use of the technology. For any new technology to be desirable, feasible, and viable over a long period of time, it must address one common question. "Is it really going to help me care for lives better?" If yes, the healthcare world would embrace the Metaverse with open hands.

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*Images courtesy Ethosh Digital ([www.ethosh.com](http://www.ethosh.com))*

## 14. A Physician's Dream Clinic with Digital-Assist Devices

*Suresh N Shinde*

Before the era of technology revolution, primary physicians were using stethoscope, sphygmomanometer, and other tools of clinical examination to arrive at a clinical diagnosis in



their chambers. Last few years many digital devices have been introduced, which are based on dry chemistry. These 'Point-of-care' devices give fast and accurate results and that to at very nominal cost. Using such devices in the clinic has increased the diagnostic capabilities of a physician, enabling him to quickly arrive at a correct diagnosis. Applying this 'single window concept' to the clinic has not only helped physicians but also the patients. Using such digital devices increases efficiency, productivity, patient turnaround time and above all, the patient satisfaction. No wonder that such a modern clinic is a choice of many patients.

**Electronic Medical Record:** Recording patient history, writing clinical notes and writing a prescription was a tiresome job, especially if OPD was very heavy. It used to take a lot of time,



huge stationery, filing and occupied lot of space. Retrieval of papers was also time consuming. Long prescriptions were invariably associated with mistakes with drug names, doses, and incompatibilities. Patient

appointments was yet another problem for the receptionists. Receipt writing and accounting used to be time consuming too. All these problems are easily done away by using a EMR system. It addresses all the above issues, adds to efficiency, and saves a lot of time. It generates elegant, readable, accurate and impressive prescriptions, which are mandatory today by the national medical council. Most of these EMR systems are storing the data in encrypted form and store in the cloud as well as in clinic computer. This data is medicolegally important and can be accessed from anywhere anytime.

### Upgrade your Instruments !

**Newer Stethoscopes:** Many new stethoscopes have appeared in the market. These digital stethoscopes have retained their old phenotypic identity but have many advanced features. They can amplify the sounds, apply various frequency filters.



You can record and see the phonogram of the sounds and murmurs. You can share it with the patient. It is an excellent tool for teaching at bedside with its Bluetooth capability. It has a wi-fi version which was found to be useful during covid epidemic as the data could be obtained without a physical contact with the patient.

**Blood Pressure Apparatus:** The original mercury and aneroid sphygmomanometers have fallen into disrepute and are largely replaced by better electronic oscillometric instruments which have many more features, and are equally accurate, portable, durable and economical too.



A tubeless version with bluetooth is very useful for home-monitoring blood pressure. However, one must have all the three sizes of arm-cuffs for accurate measurements. These instruments usually require recalibration after two years.

**Ambulatory blood pressure monitoring** is a concept which



enables one to record his blood pressure many times a day and record the trend. Such trends can be very useful in diagnosing ‘white-coat hypertension’, which may otherwise be erroneously labelled as

hypertensive. It can also be useful to diagnose ‘non-dippers’



who are at more risk and require additional therapy. Ambulatory blood pressure monitoring instruments with software are available online for about twenty thousand rupees. This device can be used as a clinic-

service but a dedicated clinic staff needs to be trained in using it correctly. It is very useful in monitoring blood pressure during pregnancy, and refractory/labile hypertension. **Non-invasive BP monitor** instrument is also available along with pulse oximeter and free software for just thirteen thousand rupees.

This ‘Low-cost Nurse’ be used for monitoring vitals in hospital, during surgery, in ambulance or even at home. It is very useful if you are doing scopies or other small procedures.



**ECG instrument:** Though, senior physicians in remote areas are still using old galvanometer-based machines, modern micro-processor based interpretive ECG machines have become a norm today. These are small, damping free, standardized machines give good tracings. The measurement of various ECG component parameters is very useful and saves time. The ECG callipers of olden times have become obsolete. The interpretation quality of low-end machines is very poor and physicians should use them only as a guide before deciding the final ECG diagnosis. Since, the thermal paper tracing of ECG fades away, it is a good idea to make a xerox copy. One can use a colour printer to make a nice colour-xerox.



**A ECG machine in your pocket:** Such small machines are available from rupees five thousand up. Every physician must carry one in his/her pocket. It can prove very important in any emergency to make a diagnosis of asystole, atrial fibrillation, ventricular tachycardia or even hyper/hypokalemia and decide on CPR.



One can use during treadmill exercise at home too. It is a boon for elderly patients at home to monitor their ECG as they can instantly share a PDF version of the ECG with their physician or use for video tele-consult. A six-channel version is also available.

**Clinical Examination Instruments:**

**Peak Flow Meter & Spirometer:** Peak flow meters are very handy devices for assessing basic respiratory function. They are simple non-digital spring-based devices available for few hundred rupees. They require use of single-use disposable mouth piece for each patient. However, digital spirometers are very useful as they give much more information, more indexes of respiratory function. A multicoloured digital display is very attractive. This is priced around twenty-two thousand rupees. It is useful to monitor asthma and COPD cases.



**A Vibrometer:** This instrument generates different intensities of various frequencies of vibration and enables you to assess vibration sense. You can get a printed formatted report. Useful for diabetologists. Cost Rs 30,000.

**A Digital Otoscope:** Useful tiny device, which when wirelessly paired to your phone, enables you to see the ear-drum and take a picture or video. Cost Rs 1800

**Vascular Doppler:** Useful instrument to detect peripheral pulses using a 8 MHZ probe. Additional probes available. Useful for diabetologist and podiatrists. Cost Rs 20,000.

**Karada Scan Body Fat Analyzer:** This instrument is a bio-impedance based multi-segmental body composition analyzer. Gives detailed information regarding nine body-metrices including subcutaneous fat, visceral fat, lean body mass, body age, muscle mass and resting metabolism.

**Ophthalmoscope:** This Welch-Allyn pan-ophthalmoscope is an excellent add-on to the physician's basket as it gives 20 times bigger image than usual ophthalmoscope. It is very convenient and can be used in non-dilated pupil. It can be connected to a smart phone and a formatted report of fundus pictures can be



printed. Though it costs around seventy five thousand, it is still economical as compared to fundus cameras. The best robotic fully automatic fundus camera with minimal interpretation costs around seven lakh rupees. A simple device using 20D lens costs thirty-five thousand but requires dilated pupils and a lot of expertise in image acquisition. A pocket ophthalmoscope can be used for studying the fundus with dilated pupils but requires more time.

**Urine Analyzer:** This small device is very useful addition to the clinic's POC laboratory. This Urit-31 uses a strip with fourteen parameters which includes 'urine albumen-creatinine ratio'. The strip costs thirty-five rupees each but gives fast and accurate results using a small thermal wi-fi printer. Very cost-effective device indeed! Instrument with printer costs Rs 45,000.



**Glucometer:** Glucometers are becoming cheaper and cheaper. Now a good basic meter is available for Rs 600. The strips with carbon electrodes would cost Rs 8 with lancet. If you buy bulk, then meters are available free. Meter cost varies with included additional features as memories, phone connectivity, app pairing etc. These meters are basically targeted at patients. In my clinic, we use multiple pricking device pens with single use lancets. These pens are available for Rs 50 but can be used repeatedly and save time in busy clinic.



**FREESTYLE BLOOD KETONE STRIPS:** This meter uses strips to measure ketones in finger prick or venous blood. Costs Rs 5,000 and strips Rs 140 each. The results are very accurate and useful in guiding the therapy. Though useful in physician clinic, can also be used in hospital to monitor diabetic ketoacidosis. We can monitor effectiveness of 'keto-diet' using this strips and are also useful in obesity clinics.



**Hemoglobinometer:** We used Sahli's hemoglobinometer in our undergraduate years. It was visual colour matching test. This meter uses small plastic strips on a finger-prick blood sample and gives accurate results in seconds. While visual assessment of anaemia is very fallacious, this device really helps. Strip costs Rs 35. Battery powered and print-out is possible.



**CONTINUOUS GLUCOSE MONITORING:** While FreeStyle Libre Pro device is for professionals, freestyle libre is for patients. It has a small coin-sized 'state-of-the-art' sensor which is applied to the arm with a special applicator. This small chip-based miniature computer analyses and records interstitial glucose every fifteen minutes for 14 days. It offers graphical analysis of the glucose trends, and guides on the 'Time-in-range', which is new parameter of glucose control addressing the glucose variability factor. Very useful patient education tool as the patient understands the type of food and its effect on blood glucose. Requires a reader costing Rs 5,000. The sensor costs Rs 2500 each.



**HbA1c ANALYZER:** Glycosylated hemoglobin has become very important parameter in diabetes control. Though the gold standard HPLC based test requires a good laboratory setup, comparable results are obtained with POC devices. Many such brands are available. The one I use is a Swedish make and is a cartridge-based test. This device costs Rs 35,000 and the cartridge Rs 175 each. Test is done on finger prick sample and



gives result in five minutes. The device needs daily and monthly check and comparable to HPLC. Device can be connected to printer to get a printed result.

### Some More devices:

**YOUR OWN PRINTING PRESS!:** I use a Canon G-7070 all-in-one, Wi-Fi enabled, ink tank printer with four colour inks. This work-horse printer performs multiple printing jobs like printing prescriptions, Lab-reports, PDFs, Photos etc. It can make elegant photo copies of ECG tracings which lasts for years without fading. The printing cost is very minimal and maintenance is minimal. This printer costs around Rs 24,000.



**YOUR PERSONAL ACCOUNTANT!:** This tiny device can store all the financial inflow data of your clinic for years. It costs Rs 10,000 up. It has a small chip, battery and a 3" thermal printer. We have to define and feed your item-wise rate menu to this device. You can generate item wise receipts in seconds. It can print total or item wise collection at the end of the day/month/year. Very useful for 'cash flow analyses.



**Learning in waiting hall:** You can make use of audio-visual material to health educate your patients while they are awaiting their turn in your clinic's waiting hall. Many companies come out with such material. You can procure various documentaries, lectures to run in the waiting



hall TV. YouTube is a best source for such previewed and approved material. If you have the resources and time, you can create your own teaching and instructional videos. Imagination and creativity have no limits!

Finally, using digital devices in your clinic will make you work, not harder but smarter!

## **15. Digital Technology in Hospital Administration; A Strategic Choice**

*Dev Taneja*

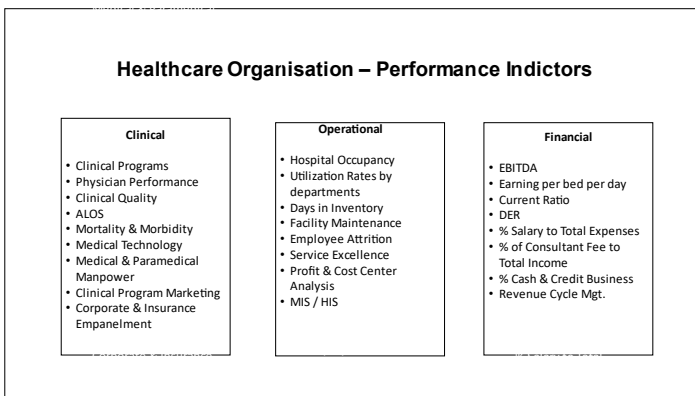
### **What Is the Role of Digital Technology in Healthcare Administration?**

Technology touches every aspect of your life. It has played a huge role in healthcare over the years, paving the way for innovative medicines and procedures. Now, technology is revolutionizing healthcare information technology. The transition from a paper records system to a digital one in a complex industry is not easy. After all, privacy and patient access must both be protected

Healthcare usually conjures images of doctors and nurses working with patients. As vital as they are to the system, they rely on healthcare administrators to keep their clinics, hospitals and practices running. Healthcare administrators are the people responsible for the day-to-day operations of health organizations. They are the people who keep the lights on, create the schedules and maintain cash flows. Traditionally, healthcare administration has involved its fair share of paperwork, and that remains true. However, new software and technology have changed how healthcare administrators keep track of everyday tasks.

Like medicos' basic interest in the wellbeing of his/her patient, the Top management is guided by its aims and daily vital operational charts of clinical, operational & financial performance indicators.

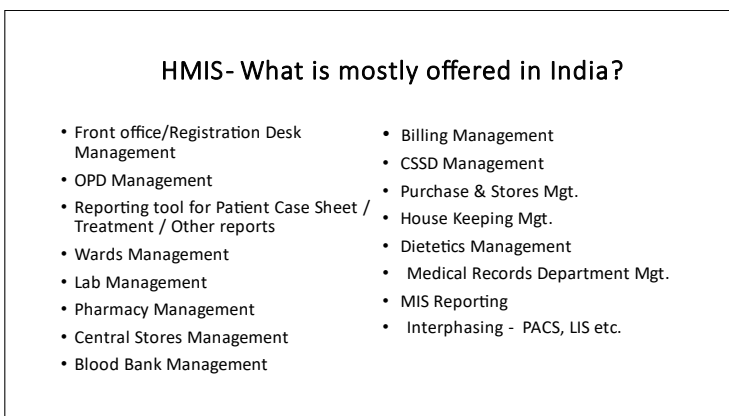




### Hospital Management Aims

1. Improve the quality, cost effectiveness, and efficiency of the hospital services
2. Increase patient / customer satisfaction
3. Reduce medical errors and promote patient safety

### What is currently offered in HMIS software in India?



In India, we are mostly using Transaction reporting system. The potential of using Clinical Information Systems to improve Clinical Care, Clinical Quality & Clinical Outcomes is

still not being appreciated and the healthcare community needs to understand its importance. Further, HMIS applications in Chronic Disease Management are rudimentary in India at present.

### **What is missing in India?**

1. Clinical Information Systems
2. Clinical Decision Support Systems
3. Chronic Disease Management Systems

### **Importance of Electronic Medical Record (EMR) & Personal Health Record (PHR)**

EMR addresses one of the greatest inefficiencies of the healthcare i.e., the immobility of healthcare records. Timely availability of the patient data can greatly help in coordination of care, clinical decision-making process and significant reduction of medical errors.

In India now, under Ayushman Bharat Health Mission, now Ayushman Bharat Health Account (ABHA) Numbers can be created for patients and healthcare providers free of cost.

### **IT Enabled Chronic Disease Management (CDM) System**

The medical community must appreciate that CDM means that the patient cannot be cured of his/her disease. As Clinicians, we can, at best help the patient to maintain near normal health status of his/her ailment by use of medications and advocating Life Style changes. IT enabled use of patient's health data by the Care Team Stakeholders can significantly improve CDM outcomes. Already, the projections for incidence of diseases like Diabetes Mellitus, Hypertension, COPD etc. are alarming for India. What is sorely missing is Coordinated Care of the CDM patients and a Team approach to manage CDM for better health outcomes

## **Clinical Decision Support Tools**

The basic input for this is the use of standardized Clinical Protocols nationally.

In India also, now, ICMR has also come out with Standard Treatment Workflows (STW) for India for various clinical specialties. Sooner than later, these clinical treatment workflows or protocols will be made mandatory in India like NABH. Few STWs are now available for Cardiology, ENT, Nephrology, Neurology, OBG, Paediatrics, Psychiatry, Pulmonology & Urology at present.

Clinical decision support (CDS) provides timely information, usually at the point of care, to help informed decisions about a patient's care and CDSS involves six levels of decision making: *alerting, interpreting, critiquing, assisting, diagnosing and managing*

Top leading companies offering CDSS include IBM Watson Health, Hearst, Cerner Corporation, Wolters Kluwer Health, Philips Healthcare, Elsevier B.V, NextGen Healthcare etc.

## **Future of IT in Health in India**

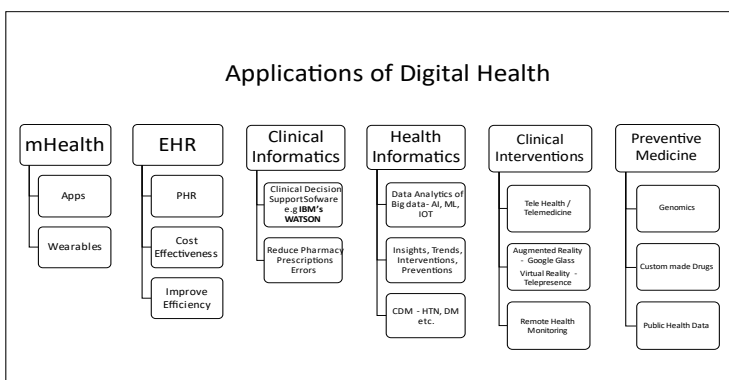
The November 2019 NITI AAYOG report Health System for New India's Building Blocks describes "**Reimaging India's Digital Health Landscape**" wiring the Indian Health Sector.

The NITI AAYOG report has already set a blueprint for using IT to improve Health System for India in the 21<sup>st</sup> Century.

The national thrust for rapid digitation of India, introduction of 5G Technology, with plans under considerations for having a dedicated Satellite exclusively for Public Health are the tools that will improve the healthcare access through telemedicine, efficiency, productivity & improved clinical

outcomes in India. Indian Health universities also must now introduce interdisciplinary Digital Health Modules courses for various streams of students at the earliest, as India will need an army of Health IT professionals down the line. IIM, Raipur has already started enrollment for Certified Digital Health Professional (CDHP), a Post Graduate Certificate Program in Digital Health.

A **National Health Information Exchange (NHIE)** in future can bring all stakeholders; patients, providers, payors & Public Health Applications on a single platform.



### Health IT Standards

India, still does not have defined Indian Health IT Standards of its own. The various USA Healthcare IT Standards for exchange of data amongst systems, patient data privacy etc. are SNOWMED & LOINC for Clinical data, HL 7 for exchanging data between systems, HIPPA / HITECH for privacy of personal health information, Standards for devices and software - FDA certifications.

## **Challenges of Implementation of Digital Technology for Hospital Administration**

The healthcare systems of tomorrow may never be “paperless” but progress is being made despite legendary reluctance of physicians to accept changes in the way we practice. The transformation process of building electronically integrated systems that manage patients with “seamless” care has already gained traction across the globe and India can ill afford to be left behind.

1. In India, the level of Health IT Applications is directly proportional to the IT literacy & IT understanding of the Top management & promoters. There is over emphasis on purchase cost of IT hardware & mostly poor understanding of HMIS software capabilities, due to this, hospitals are reluctant to commit higher costs for good HMIS software. Right Software implementation is the core for enhancing organization capabilities. The result is that more than 90 percent of HMIS software’s in India provide low end solutions, as it is too expensive to build & maintain upper end Health IT solutions for them.
2. The other major problem is near absence of use of HMIS Application Consultants for assisting in choosing & guiding implementations of HMIS software in the hospitals. This entails mapping hospital’s Standard Operating Protocols (SOP) and at times using business process re-engineering. In India, typically majority of the hospitals do not employ people with understanding of this important operations management aspect and as a result, there is very poor customization of the standard HMIS product installations, which in turn leads to frustrations for operating teams once the software goes live. Once the HMIS vendor has installed his product with minimal customization as per hospital

needs, future customizations will incur additional costs, which are otherwise preventable.

### **Conclusion**

Indian Healthcare providers must treat IT in Health as a Strategic Resource for an organization like vital human resources and finance. There must do an informed strategic spending on Health IT. The upsides of using Digital Technology in hospital administration are immense and are cost effective in the long run. What we are seeing in India is just the 'Tip of Iceberg' in the potential of Health IT applications.

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## 16. Role of technology in Rehabilitation

*Rajani Mullerpatan*

### **Introduction**

Digital technology has a wide scope in Physiotherapy evaluation and management. Its application in consultative, diagnostic, preventive and therapeutic services includes diagnosis, surveillance, care, guidance, support and counselling and offering Physiotherapy information

The current advancement in technology for rehabilitation include virtual reality technique, robotic-therapy

The concept of empowerment is being emphasised more and more in rehabilitation as the end result of all therapeutic modalities. The emphasis has shifted from deficits and dependency to assets and independence. Advanced technologies can play a significant role in this process. Because they save expenses and increase the number of patients served by each carer, technological solutions may be advantageous. Additionally, they offer accessibility to rehabilitation treatments for people who are dealing with physical, monetary, and/or attitude hurdles.

They help clinicians evaluate quantitatively the patient's performance and progress while providing consistent training, especially for extended periods of time. This results in an increase in therapy access and a health-care cost reduction.

### **Robotics**

- Robots can help patients with neurological disorders such as stroke, spinal cord injuries in restoration of lower extremity function. Lower extremity rehabilitation robots are broadly

divided into two categories: i) exoskeleton robots & ii) end-effector robots. Exoskeleton robots can be further divided into-a) treadmill-based and b) leg orthoses. End-effector robots can be divided into-a)footplate-based and b)platform-based. The four major types of robots vary in-driving modes, control strategies and training modes.

- In this sense, Robotics has met this demand with a wide range of assistive products. Andago G-EO System, HARMONY helps therapists educate patients how to walk again and promotes the development of new neuroplasticity pathways to replace those that have been disrupted by sickness or injury. This aids in patients' motor rehabilitation and makes rehabilitative exercises fun, challenging, and engaging.

#### **Tele-rehabilitation including Virtual reality training:**

- Tele-rehabilitation makes use of various rehabilitation services via telecommunication technologies. It includes physiotherapy, occupational therapy, speech-language therapy and implementation of virtual reality, tele-robotic therapy and video-games. It also includes videoconferencing tools, webcams, video catalogue of exercises, telephonic evaluation and management services, etc. Physiotherapy interventions are delivered via tele-rehabilitation in addition to consultation with physiotherapist and monitoring treatment outcome without patient's physical presence.

- Video games and virtual reality (VR) are computer-based applications that imitate actual items and activities in enticing settings might encourage patients to progress as planned. Since VR offers physicians the opportunity to regulate and grade tasks to push the user while presenting them with an enriched environment to promote high user engagement, it has been successfully employed for rehabilitation treatments.



- Gait rehabilitation in neurological patients with severe impairments uses robotics and VR. Patients can play video games and provide auditory and visual feedback while carrying out the exercises advised by their physiotherapist using specific VR devices.
- It offers information on the patient's range of motion, frequency of successful exercises, and number of repetitions finished, quantitatively assessing the patient's progress. The data is acquired from the physically performed tasks (e.g., balance, rotation, exertion, timing, or abduction).

### **Challenges and Limitations**

Feedback of digital technology in physiotherapy: clients (individuals requiring ankle-foot orthoses) and clinicians were satisfied with tele-rehabilitation via low-band-width videoconferencing and reported confidence in videoconferencing assessment. However, in earlier trials, participants reported poor quality video-streaming and difficulties in communication due to poor quality speaker phones. Limitations of tele-physiotherapy services are – virtual communication with physiotherapists can make the experience of treatment impersonal. In cities, patients may not have adequate space at home for exercise.

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## 17. Digital Technology in Dermatology

*Dipak Kulkarni*

The computerization and the digital technology have revolutionized the field of medicine, and more so for dermatology, as:

1. In a typical dermatology OPD, patient turnover is high and most follow up patients are visiting after a long interval of a few weeks. Thus, retrieval of old records, especially the images, is crucial.
2. Being a visual science, the before and after images speak more than the written words about the progress or resolution of a dermatosis. The creation, storage and comparison of the images is easier due to digital technology.
3. The ability of the dermatologists to do visual diagnosis, the lesser risk involved in prescribing dermatological treatment online and the paucity of dermatologists in remote areas, makes dermatology an ideal branch for telemedicine practice as well as a chain-of-clinics model. The digital technology is handy in both the situations.
4. Many dermatological drugs are associated with unfamiliar and verbose instructions about their consumption or application. To type them in the vernacular language is eased due to computerization.
5. Computerization is vital in research, information retrieval about rare dermatoses as well as dermatology training.
6. Due to common ignorance about many dermatoses in society, the digital media and websites of the clinics can be great tools for patient education.

7. Use of artificial intelligence (AI) could be an interesting tool for diagnosing dermatoses, even without formal training, which will enhance the reach of these services beyond the dermatologists.

I started using a DOS based program, way back in 1996. But computer use became user-friendly after the advent of multimedia computers after Windows 95 platform. The present software which I am using has a storage of around 280 thousand patients on my online storage, the data which I can retrieve from any of my clinics seamlessly. The software helps me in many aspects like online bookings, waiting patient management, digital medical records and retrieval, image storage, patient education, accounting and taxation and academics. The same software is being used by more than 300 dermatologists in India.

## 18. Nutrition-Wellness Digitalised

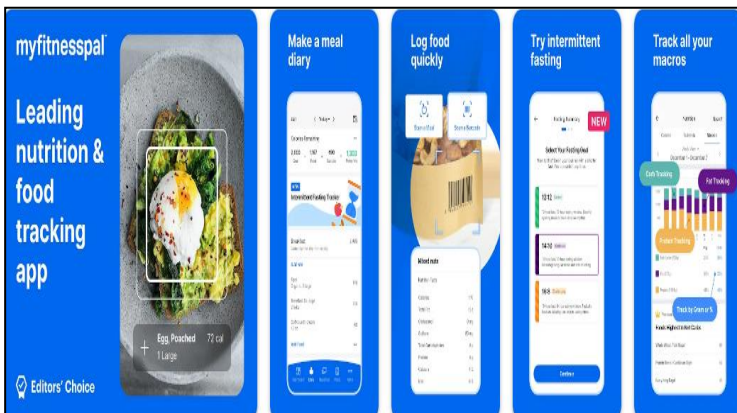
*Chethana C*

Digital healthcare delivers affordable, easily accessible and sustainable healthcare services to people using digital technologies and various applications. Covid-19 pandemic has made the world realise the importance of good health and there was a parallel surge in the digital healthcare utilisation. Digital healthcare includes services of healthcare professionals like doctors, nurses, pharmacology, physiotherapists, Nutritionists and Dietitians.

Wellness industry has boomed in the recent era making use of digital technologies. Multifarious apps focusing on nutrition and diet are available in the digital market for the customers. The services are being provided with the assistance of nutritionists, health coaches and artificial intelligence.

These apps guide the users in tracking their daily diet and physical activity, helps in knowing the nutritive value of the foods they eat, helps in their weight loss journey, assists in better management of the dietary habits and lifestyle of people with Diabetes, obesity, PCOD, hypertension and many more. Although these apps are handy and at one's disposal, these technologies do have some downside aspects like authenticity of the information provided in the concept of the nutritional value of food and the service provider, reliability of the information and guidelines, cost effectiveness, inconsistency of the customers in following the regime leading to unavailing results.

There is a need for individualistic approach in the management of health, wellbeing and nutritional status which requires master professional guidance who can steadfast the users for enduring results. For this reason, the users must inquire about the choices available related to their end usage goals. This is workable when the Digital healthcare systems is backed up by sound knowledge, authentic and authorised source of information and healthcare practices specific for the end user benefit and amplified technology usage.



## 19. Digital Technology in Psychiatry

*Darpan Kaur*

### **Introduction**

Technology is rapidly changing the practice of medicine and we are now in a new world of Digital Psychiatry. Despite advances in the field of Psychiatry and Psychological Sciences, universal access to mental health care continues to remain a significant unmet need. It is postulated that varied economic, geographic, cultural factors as well limited manpower and resources affect access to mental health care. Technology can help bridge this gap in mental health care. Digital Technologies are disrupting every modern industry and have entered the Health Care Sector with a significant focus during the COVID-19 Pandemic. Technological innovations are paving new Horizons in Psychiatry which include digital consultations, tele counselling, mobile applications-based care, tele-mentoring and tele-education of mental health care providers.

**Digital Psychiatry for Diagnosis, Treatment, Assessment, Psychotherapy and Community Care:** The Digital revolution is impacting all fields of science, medicine, and psychiatry changing regimes and methods of knowledge production. It is highlighted that the Brain is the place where biological, psychological, social, and spiritual mechanisms meet each other and interact. There is scope of Digitalization and artificial intelligence to herald an era of new procedures for psychiatry. Machine learning techniques combined with big data should enable algorithmized diagnostics, prediction and therapy that are superior to clinical observation and interaction in terms of accuracy and efficiency. Digital Medicine System (DMS) provides an opportunity to

objectively assess and report patient medication adherence. It includes a wearable sensor that receives a data signal from a medication tablet with an embedded ingestible sensor after ingestion of the medication and transmits that data to the patient's mobile device to display health care information for the patient and treatment team. Digital interventions have gained momentum in terms of behavioral health. AI techniques can in future help Psychiatry to re-define mental illnesses more objectively than currently done in the DSM-5 and identify illnesses at an earlier or prodromal stage when interventions may be more effective, and personalize treatments based on an individual's unique characteristics.

Artificial intelligence (AI) has increasing clinical relevance for therapeutic applications in mental health services with innovations ranging from 'virtual psychotherapists' to social robots in dementia care and autism disorder, to robots for sexual disorders, artificially intelligent virtual and robotic agents. It is important that for responsible clinical implementation, ethical and social implications of the increasing use of embodied AI in mental health need to be identified and addressed. Artificial intelligence (AI) can be a transformative technology for clinical medicine, however the current technology maturity of AI is low. Many varied diverse factors such as technical problems of data quality, dataset shift, black-box opacity, validation and regulatory challenges, and human factors such as a lack of education in AI, workflow changes, automation bias, and deskilling can contribute to the low technological maturity. Methodological safe, sound and ethical approaches are recommended in AI to augment the decisions making in Psychiatry. Treatments in psychiatry have been rapidly changing over the last century. Although the evidence for many technology-based interventions or mobile applications is currently still insufficient, such

advances in technology can play a larger role in the way that patient receives mental health interventions in the future, leading to easier access to them and improved outcomes. Digital platforms currently allow people to self-monitor and self-manage in a way that face-to-face/paper-based methods of assessment have up until now not allowed. Digital mental health interventions can be effective for improving depression, anxiety, and psychological well-being among college students in the community for mental health care. However, it is recommended that more rigorous studies are needed to ascertain the effective elements of these interventions. Patients residing in regional, rural and remote communities experience perennial difficulties accessing mental health treatments in a timely manner, Digital psychotherapy as an alternative treatment delivery method provides an opportunity to address this healthcare gap and to avoid the challenges related to workforce maldistribution.

## **Conclusion**

Technological innovations open up interesting arenas and future perspectives for the improvement of mental health. Digital Psychiatry is a promising and growing way to deliver mental health services yet remains underutilized and under realised to its full inherent potential. 40 Further systematic real-world outcome based multiple collaborative research and effective translation into clinical care in this fascinating arena of Digital Technology in Psychiatry is highly needed.

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## 20. Digital Dentistry

*Prasad Chapukar*

### **Introduction**

Digital dentistry is the future dentistry refers to the use of dental technologies or devices that incorporates digital or computer-controlled components to carry out dental procedures rather than using mechanical or electrical tools. The use of digital dentistry can make carrying out dental procedures more efficient than using mechanical tools, both for restorative as diagnostic purposes. Used as a way to facilitate dental treatments and propose new ways to meet rising patient demands. The 'father' of digital dentistry is the French professor François Duret, who invented dental CAD/CAM in 1971.

Some of the technologies used in digital dentistry include:

1. Intraoral cameras and scanners
2. CAD/CAM
3. Computer-aided implant dentistry — including design and fabrication of surgical guides & crown manufacturing
4. 3D Printing (e.g. to print physical models of digital images taken with intra-oral scans, make appliances, temporaries, surgical guides)
5. Digital radiography/CT/MRI
6. Cone beam computed tomography (CBCT)
7. Electric and surgical/implant handpieces
8. Photography (extraoral and intraoral)
9. Practice and patient record management software — including digital patient education e.g. Thalamus Patient Education
10. Shade matching
11. Diagnodent

## **Virtual and Augmented Reality**

### **1. Intra-Oral Cameras**

X-rays have been extremely valuable for many years in assessments of oral health. However, at times the image produced can show limited information because it is only a 2D image. Intra-oral cameras (IOCs) allow an operator to see a clear image of the inside of the mouth. Similar to the size of a dental mirror IOCs have a tiny camera that is able to detect more on the 3D surface of a tooth than a 2D x-ray image is able to show. Examples include specific locations and sizes of cavities, cracked teeth, excessive erosion, abrasion and many more.

Conventional dental impressions are made by placing an impression material loaded on an impression tray over the dental arches. As it sets a negative imprint of the soft and hard tissues in the mouth. Digital intra-oral impressions made using intra-oral cameras are able to recreate the positive impression of a patient's dentition and other structures into a digital format on a computer almost instantly

### **2. Colour Matching**

Traditionally dentists will use a physical shade guide in the dental surgery as they compare the patient's teeth to the shades in the guide, all done while the patient is in the chair. Newer computer matching techniques allow for a more superior than matching methods currently used. There are always differences in perception when it comes to the human eye and observation. Now used in some dental surgeries it can improve dental-laboratory communication.

### **3. CAD/CAM used with intra-oral scanning**

Two studies have shown that a significantly smaller marginal fit was observed when compared to traditional methods of

casting, a more accurate marginal and internal fit. Direct digitized impressions were taken straight from the patients mouths and indirect digitized impression taken from already made impressions. The digitized impressions were then used to create CAD/CAM milled all-ceramic crowns. Between the direct and indirect, the direct digital impression technique was statistically more accurate, they showed significantly better inter-proximal contact. The entire process proved to be more time efficient for both the dentist and patient in comparison with conventional methods or taking impressions with silicone impressions and sending them to a lab.

### **Use of Dental Technology in other areas**

1. Diagnosis of Caries
2. Occlusion and TMJ Analysis
3. Digital Orthodontics
4. Quantitative light-induced fluorescence

### **Conclusion**

As digital dentistry continues to adapt and becomes more common, the approach to incorporating the topic of digital dentistry in learning outcomes during dental training must also change. As we enter 'the digital age of dental education', future practitioners need to be exposed to new digital procedures in the curriculum and teaching.

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## 21. Digitalizing Diabetes Clinics

*S. V. Kulkarni, Alok Modi*

### **Introduction**

Digitalizing a diabetes center is the only way to move forward in the coming years.

*Questions arise...*

What are new approaches for digitalizing diabetes clinics?

How do I start? & How do I Progress?

Why do we need to jump to the digital bandwagon?

Many advantages to have a digital approach to caring for our patient:

1. Today's clinician is moving forward with hi tech glucometers, CGM (Continuous glucose monitoring devices)
2. AI to determine progress of patient, increasing Compliance, reducing cost.
3. AI also helps to control hypoglycemia and glycemic variability which could be intraday variability and inter-day variability these are not possible to control with any other modality of management.

In this article we will see how moving ahead with times and getting AI into our practice helps improve patient care.

Basic approaches include:

1. Overcoming inertia  
- shifting from conventional paper-pen-chart model to digitalize the health records
2. Adopt HER friendly to you and staff
3. Advise the patient towards a step-wise increment in his Diabetes care
4. Understand the situation and aim to overcome limiting factors (hardware/software/compliance etc.)

### ***Case-example using a smart glucometer with an APP***

A very innovative way for our patients and care provide us an opportunity to adopt digital technology, e.g., asking them to visit to the website of the glucometer manufacturer like Accucheck. ***Accu-Chek mySugr App***

It has got all the options and even a senior citizen also can use it by increasing the font size. Ask patient to download the app to keep the track of blood sugar in a graphical format. it has been trusted by more than a million people & has no bugs & certified by Play Protect about safety.

Many features and lot of benefits to the patient:

- quick easy login of blood glucose, meals and track activities
- creates clear smart blood glucose level graphs which determine progress of glycaemic control.

The conventional method uses hunt and peck mental technology which does not give you any idea of the flow of glycaemic control. Also, these graphs help you correlate hypoglycaemias and hyperglycaemias with food, type of food, carb counting, caloric counting and duration between hypoglycaemia and the medication/insulin etc taken, time of taking medicines etc. So rational decisions can be taken about using SR preparation, second generation basal insulins, replacing or even reducing potent sulphonylureas. All this is not possible with the paper recording methods. See here is where AI makes a big difference in the outcome of glycaemic control and hence CVOT benefit, in fact by even reducing medications on the long run.

There is always motivating feedback to keep the patient going on a good track and achieving normal glucose levels including a personalised login screen which can be shared with a caregiver and it is compatible with Apple and Android devices.

With a smart diabetes companion that's there for the patient anytime, anywhere and for free, one can face the challenges of diabetes with confidence. Sync with the Accu-Chek Instant blood glucose meter to track blood glucose results wirelessly on one's Apple or Android mobile device.

The mySugr Pro is available in India and free for all Accu-Chek Instant blood glucose meter users.

### **Summarising Benefits and Features**

1. Quick and easy logging of meals, diet, medications, carbohydrates, blood glucose levels and more
2. Personalized logging screen—add, remove and reorder fields
3. Smart, clear blood glucose graphs
4. Estimated A1C level at a glance
5. Daily, weekly and monthly analysis
6. Exciting challenges to achieve personal therapy goals
7. Motivating feedback to keep you going
8. Secure tracker data backup
9. Insightful data analysis

### *Additional tech specifications and Data transfer:*

Accu-Chek Instant blood glucose meter communicates via Bluetooth wireless technology. Other Accu-Chek blood glucose meters require manual data entry.

### **Conclusion**

These allow the HCP to be in real time in touch with the sugars of the patient which again is not possible if there is no digitalization of technology. This approach is the simplest way to start a digitalizing journey with active patient participation and will lead to improved outcomes and care.

## 22. CGMS: A Practical Primer

*Alok Modi*

### **Introduction**

Glucose monitoring so far has been approached by doing tests in the laboratories or by doing a fingerstick through a glucometer. In the former method. It is a venous blood with its analysed. In the later method it is a capillary blood which is analysed. Whereas when you talk of CGM or continuous glucose monitoring, it is a tissue sample which is directly analysed. First, I'll provide a brief overview of the subject and its importance in diabetes management. Then, I'll discuss the different types of continuous glucose monitoring systems, their features, and how they work.

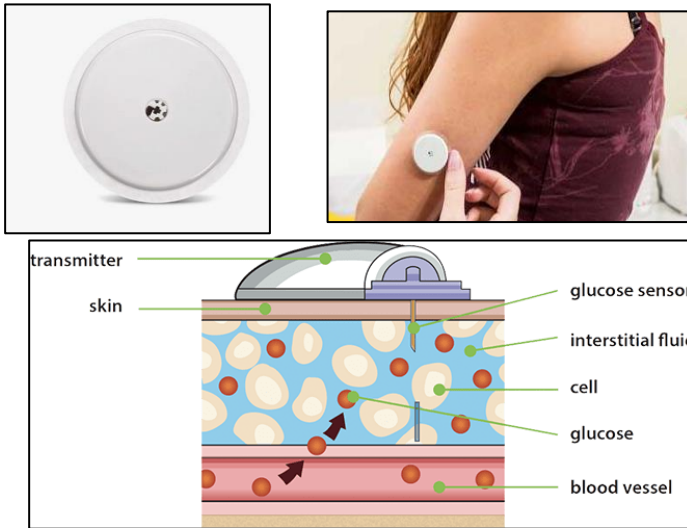
### **Advantages**

Now, what are the advantages of continuous glucose monitoring? Where does the score the form of systems? The typical problem by doing HBA 1C or by the conventional methods you do not get an idea about the fluctuations of blood glucose. This is what we call in medical parlance as glycaemic variability. In twenty-four hours also you don't get an idea about the low blood sugar or hypoglycaemia which can occur for a short span of time or can occur 3 to 4 times or even multiple times in a day and we don't come to know how long the hypoglycaemia has prolonged. We all know that hypoglycaemia is more dangerous than hyperglycaemia and the complication data of hypoglycaemia is much higher than hyperglycaemia.

To begin with , continuous glucose monitoring (CGM) is a technology that can be used to track a person's glucose levels in real-time.



This system consists of a small sensor that is inserted under the skin and continuously measures glucose levels in the interstitial fluid. This information is then sent to a receiver, which can be used to monitor and alert the user of changes in glucose levels.



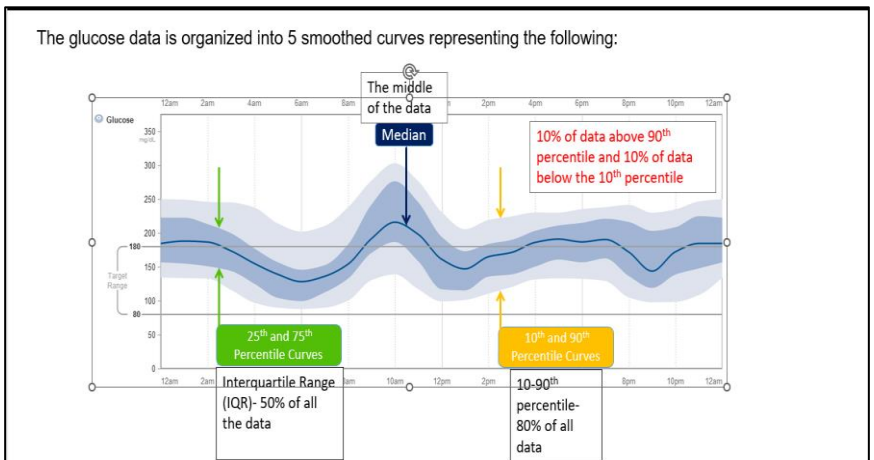
CGM is an important tool in managing diabetes, as it allows the user to be more aware of their glucose levels and react accordingly. This technology can help the user anticipate and prevent hypoglycemia (low blood sugar) and hyperglycemia (high blood sugar). It can also help the user identify patterns in their blood sugar and make necessary adjustments to their diet, activity, and medication as needed.

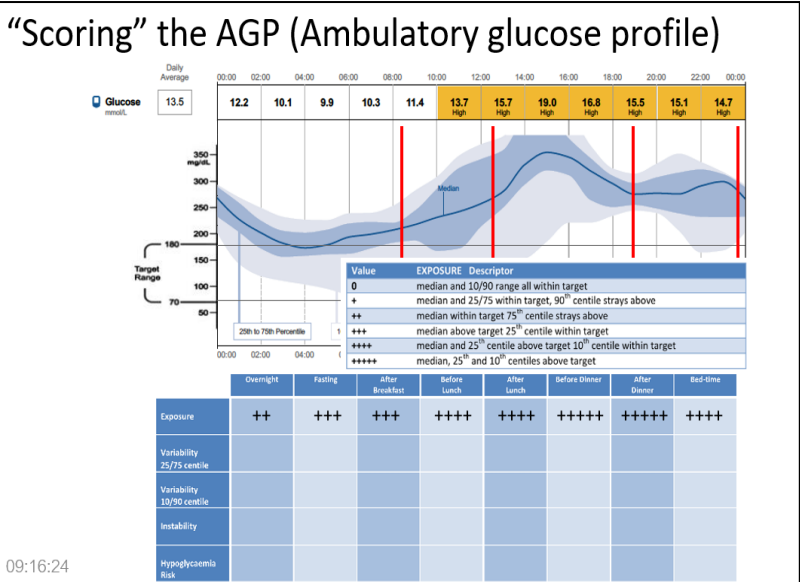
There are several types of CGM systems available, with varying features and capabilities. Traditional CGM systems, such as the Dexcom G5 and the Abbott Freestyle Libre, require the user to manually scan the sensor with a receiver.

The two things that a CGM helps tremendously are:

1. Glycaemic variability
2. Hypoglycaemia

Because Libre pro measures sugars every 15 mins over 14 days you get around 1344 readings which are sent analysed for their trends, percentiles and mean by software, this kind of analysis is not possible with any glucometer or lab readings or Hba1c. And we all know that glycaemic variability is the 4<sup>th</sup> dimension in the pathogenesis of diabetes complications. Hypoglycaemia and glycaemic variability are more dangerous than uncontrolled glycemia in management of diabetes, whether it is type 1 or type 2.





- People with diabetes having the same HbA1c values can still experience different fluctuations in BG levels.....**Glycemic variability.**

**A1c = 7.8**

**A1c = 7.8**

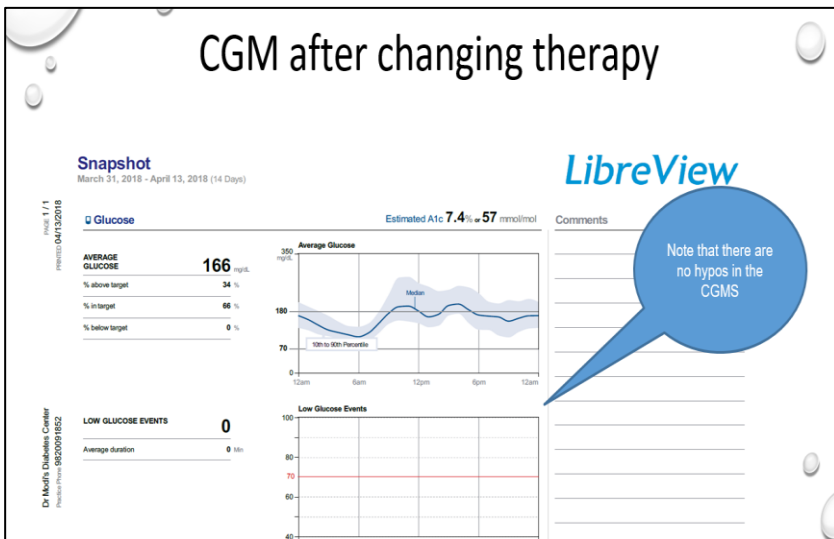
- These **Glycemic** fluctuations have more deleterious effects on Endothelial function & Oxidative stress, compared to constant high blood glucose, thereby leading to CV complications<sup>1,2,3</sup>

Focusing on HbA1c alone may not reveal the complete spectrum of risk for people with diabetes<sup>4,5,6</sup>

Let me illustrate this with examples in my own practice:

**Case-1**

Vice president of a leading pharma company, 47 year old male presented with diabetes more than 10 years and Hba1C 7.8. Has been on glargine basal insulin 36 units once a day, prandial insulin which was actrapid insulin 24 units before lunch 20 units before dinner. 2 grams per day metformin and glimepiride of 3 milligrams per day. Was experiencing a lot of hypoglycaemic episodes and weight gain of 3kilos before coming to me for second opinion. I did his CGM, put him of GLP1A, cut down on his prandial insulins and SU and his sugars stabilised. No hypoglycaemias and no weight gain. See his CGM after changing and reducing therapy in fact.



## Case-2

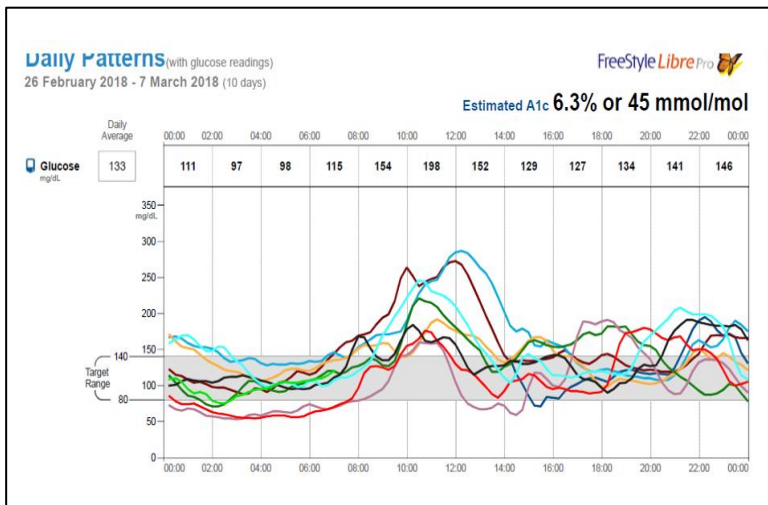
70year old lady doing well on glimepiride 2 mg once daily, Metformin 1.5 gm at bedtime, degludec insulin 14 u sc once daily. Gets F/PP done once a month.

Sugar values:

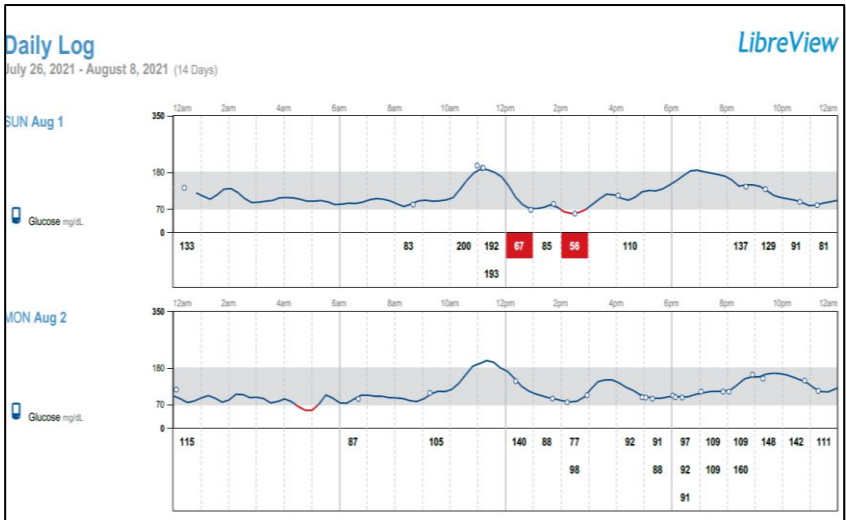
Date	Fasting	Post-prandial
21/1	114	187
16/2	122	162
20/3	104	156
18/4	112	152

Looks good, but see her CGM analysis

Her Hba1c was 7.2, 6.9, 7.1, 6.8 in the last 9 months or so. Started developing watering of eyes on reading and watching television, ophthalmologist found early fundal edema with mild retinopathy.



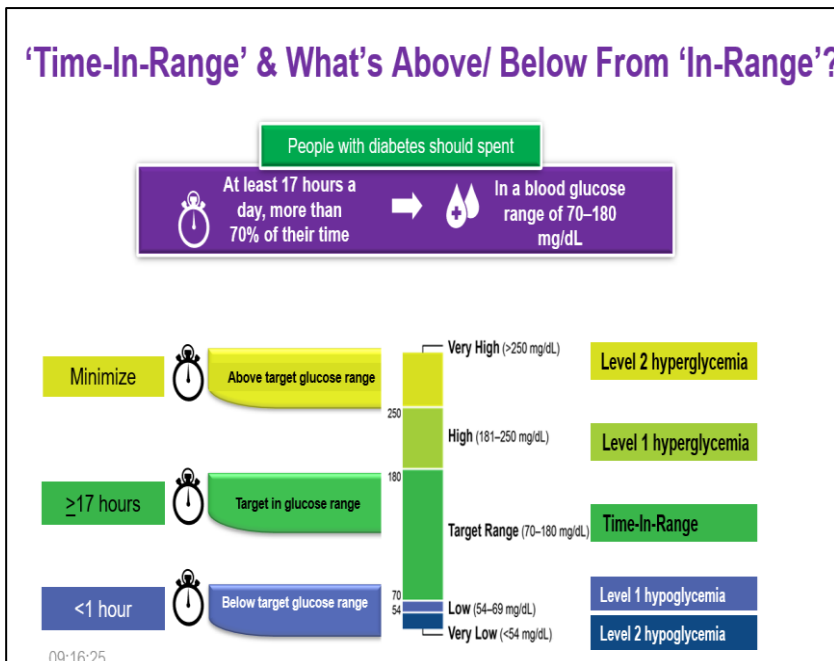
Her treatment changes and now see her CGM pattern after 3 years:



### Newer CGMS-Concepts

CGM brings in a new concept of TIR or time in range. It is now the gold standard of glycaemic metrics and included in the latest guidelines by ADA. Rather than look for HbA1c as an average of sugar in 3 months, we look at how much time patient stays in range in 24 hours as TIR (time in range) TAR (time above range) and TBR (time below range for hypoglycaemia). For all type 2 diabetics keeping TIR to at least 70% decreases risk of end organ Damage like MACE, retinopathy, nephropathy etc.

## 'Time-In-Range' & What's Above/ Below From 'In-Range'?



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The fourth industrial revolution or 'Digital technology' is a big umbrella for all the aspects of healthcare which we practice in our day-to-day life. Starting from administration, clinical evaluation, history, electronic health records documentation, laboratory evaluation and comparison, diagnostics, precise drug therapy, avoiding complications and interactions to rehabilitation, presentation - publication skills and research. In the COVID-era, telemedicine has taken a big leap all over the world. It is not possible for us to cover all the aspects of Digital Technology in Medicine but it is our sincere attempt to sensitize, include salient and important aspects of Digital Healthcare which will be useful to a practicing primary care physician.

Dr. Sagar Sinha is a young dynamic, dedicated intensive and emergency care physician from Navi Mumbai. After his MBBS graduation and a short stint abroad, he completed MD Medicine from D.Y. Patil Medical College, Nerul and then pursued his intensive care medicine training at Kokilaben Ambani Hospital, Mumbai. Currently, he heads the Critical Care Unit and is Associate Professor of Emergency Medicine at MGM Medical College, Navi Mumbai. He has impressive presentation skills right from his student days & been a major contributor for many papers and workshops on digital technology in medicine. Besides an AHA and Ventilator instructor, he is a good teacher, astute clinician and researcher of his own kind. His work in Disaster/trauma management on the busiest Mumbai Pune Expressway and highest stroke thrombolysis in the region deserves recognition.

Dr. S. V. Kulkarni is a primary care physician practicing in Raigad and Navi Mumbai since 1982. A bright academician of Miraj Medical College, he is very actively involved with newer digital & computer technology's applications in clinical medicine over 15 years and is considered as a prime activist, motivator & pioneer in this field. He has conducted many hands-on workshops, delivered several lectures and published papers on technology in medicine, including 2 grand rounds in USA. At present he is Associate Professor of Medicine in MGM Medical College, Navi Mumbai and has been host of many state level conferences and organising secretary of APCON 2007 Goa. His keen interest in telemedicine and the gadgets which are to be used during the process, has benefited to many clinicians during COVID times. As a course director of digital technology in clinical medicine course by ICP, he has reached to almost 5000 physicians all across the country and internationally, to know about the finer nuances of digital medicine technology. Presently he is president of Telemedicine Society of India Maharashtra state chapter, Faculty council member of Indian college of physicians and a prolific writer, gifted orator, most quested after speaker and keen researcher in this new evolving field of artificial intelligence and digital technology.