

IFMBE CED 2021 CE Competency & Leadership Webinars:

# Lessons learned & progress in Clinical Engineering practices as a result from COVID-19



September 1, 2021, 8-10 am ET

Moderation by: **Keiko Fukuta** (Japan), **Tom Judd** (USA), **Yadin David** (USA)

# Agenda

## LESSONS LEARNED AND PROGRESS IN CLINICAL ENGINEERING PRACTICES AS A RESULT FROM COVID-19

WEDNESDAY

SEPTEMBER 1<sup>ST</sup>, 2021

NEW YORK CITY TIME

8 - 10 AM ET

### MODERATION BY

KEIKO FUKUTA (JAPAN), TOM JUDD (USA), YADIN DAVID (USA)



### GLOBAL CLINICAL ENGINEERING COVID-19 DAY

YADIN DAVID, GLOBAL CLINICAL ENGINEERING ALLIANCE



### OXYGEN SYSTEMS AND CHALLENGES DURING COVID-19

ALEJANDRA VÉLEZ, WORLD HEALTH ORGANIZATION

TOM JUDD, IFMBE CLINICAL ENGINEERING DIVISION



### MEDICAL DEVICES DURING COVID-19

DAN CLARK, NOTTINGHAM UNIVERSITY HOSPITAL NHS

ROBERTO AYALA, CE & HTM CONSULTANT

JITENDAR SHARMA, AMTZ



### DECONTAMINATION & PERSONAL PROTECTIVE EQUIPMENT

ELLIOT SLOANE, GCEA HEALTH TECHNOLOGY FOUNDATION

LEANDRO PECCHIA, UNIVERSITY OF WARWICK



### TELEHEALTH DURING COVID-19

DR. MANISH KOHLI, FORMER HIMSS CHAIR

ROSSANA RIVAS, WHO COLLABORATING CENTER FOR HTM

ELLIOT SLOANE, GCEA HEALTH TECHNOLOGY FOUNDATION



### COVID-19 VACCINES

YADIN DAVID, GLOBAL CLINICAL ENGINEERING ALLIANCE

ROSSANA RIVAS, WHO COLLABORATING CENTER FOR HTM



### HTM INNOVATION

MLADEN POLUTA, WESTERN CAPE DEPARTMENT OF HEALTH

ZHENG KUN, HANGZHOU CHILDREN'S HOSPITAL



### WOMEN IN CLINICAL ENGINEERING

CARLA GALLEGOS, HEALION INC, USA

JENNIFER DEFRANCESCO, UNIVERSITY OF CINCINNATI HEALTH



**IFMBE CED 2021 CE Competency & Leadership Webinars:**

**Lessons learned & progress in practice for  
Clinical Engineers in the Time of COVID:**

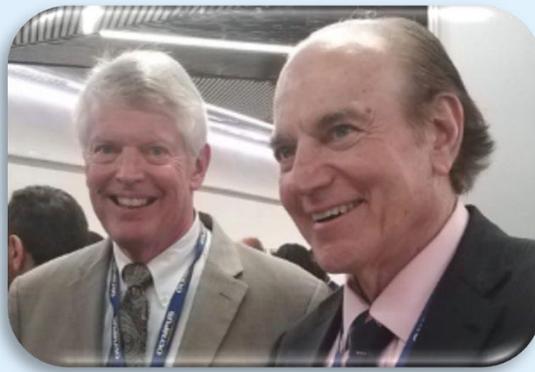
**Global Clinical Engineering COVID-19 Day**

**September 1, 2021**



**Yadin David, Interim President of Global Clinical Engineering Alliance, US**

# Speakers



Tom Judd & Yadin David  
**CED**



Adriana  
Velazquez, **WHO**



Elliot Sloane, **USA**



Li Bin,  
**China**



Umberto Nocco,  
**Italy**



Riad Farrah,  
**Lebanon**



Roberto Ayala,  
**Mexico**



Jitendar Sharma,  
**India**



Mladen Poluta & Ashenafi  
Hussein, **Africa**



Bruno Roma,  
**Brazil**



Claudio Meirovich,  
**Spain**



Doug Dreps,  
**USA**





What are the top three (3) **lessons** learned?

What are the top three (3) **challenges** you are facing?





## Isolation ward



## Medical equipment in isolation wards

On the second floor, the perimeter of the isolation ward is the patient corridor

The interior of the isolation ward on the second floor is designed as a doctor's corridor

# Challenges we are facing

1. *Machine availability* plus space inside the hospitals (e.g., ICU beds). The need for ventilators, monitoring systems, beds and pumps is been huge and new beds had to be set up in no time. We had a very high percentage of patients who, after a first access in ER or other wards since they seemed similar to patients affected with pneumonia, in a short time ended up in ICU, requiring space and beds in no time. The need for more beds is related to the need to keep positive patients isolated. If you don't have ICUs with boxes etc, one single infected patient will cause you to close the ICU to not infected patients. And at the beginning of the outbreak hospitals were still working on routine patients.
2. *Organizational issues*. We had to convert wards to host infected patients. This required a major rethinking of the ward distribution and the opportunity to discharge or move patient at risk, i.e. elderly patients. After this moving was over, the new ward had to be prepared with telemetry systems (or monitor connected to a central pc), CPAPS or easy-to-handle ventilators, pumps etc. Plus all the devices needed to protect clinicians.
3. *Device procurement*. This might be a typically Italian problem, due to the fact that we should acquire using bids (that usually require long time). This timing summed up to the actual availability of devices in such a big number. We experienced that only few producers have big stock, and even when we had guarantees by vendors, we ended up without the machines most of the times because they were diverted to other sites or markets.

# Riad Farah, Saint George Hospital UMC, Beirut Lebanon

**Minute 37** in YouTube: <https://www.youtube.com/watch?v=OEJkRMQHqYI>

## **Lessons learned:**

- Hospital leadership has had to adapt to a rapidly changing situation
- Importance of Emergency Preparedness and Training
- Just in time Hospital 'Stock' doesn't work in time of crisis

## **Challenges:**

- Need for a national plan, as one hospital cannot address all needs
- Need a national certification by WHO for designated COVID19 vendors
- Architectural readiness for the rapidly changing situation and needs

# Roberto Ayala, CENETEC, Mexico City, Mexico

<https://www.gob.mx/salud/cenetec>

**Minute 59:35** in YouTube: <https://www.youtube.com/watch?v=OEJkRMQHqYI>

## 1. Lessons learned:

- Lack of proper preparation for disasters in a healthcare setting.
- Poor coordination between health authorities and technical experts.
- Need of repositories for open source material on priority medical devices.

## 2. Challenges now facing:

- Indifference from Government and Ministry of Health on the role that an expert unit like CENETEC can offer.
- Lack of coordination between biomedical/clinical engineering community
- Lack of proper guidelines for validating open-source, low cost, home made ventilators.

# Doug Dreps, Mercy Health, St. Louis, Missouri, USA

<http://mercy.net>

Minute 63:30 (1:03:30) in YouTube: <https://www.youtube.com/watch?v=OEJkRMQHqYI>

## What are the top three lessons learned?

- Having leadership quickly assemble to have one voice for our Health System, including new policies dealing the challenges daily has been very important.
- Feeding data to system command center to look at availability of ventilators, beds, patient monitors and other medical devices. Training nurses to triage repairs for COVID19 related medical equipment.
- Knowing what areas in our hospitals could be easily converted to negative pressure rooms.

## What are the top three challenges you are facing?

- Realization that not only every state, but every country is trying to acquire COVID-19 testing, PPE, ventilators, supplies simultaneously. Most items are back ordered or not available.
- Keep up with the need to pop up new COVID patient ICU and Med Surg units as cases increase. Moving monitoring and coming up with new ways to deal with these units.
- Checking in the many ventilators we are receiving from colleges, veterinary clinics and others to get certified and put into our fleet.

# Brazil: Lucio Flavio Brito, Professor & CE Director

## Lessons Learned:

- The importance of having friends prepared to respond to a disaster. It is important to help colleagues to react in the best way; good communication skills can fill deficit of reliable info that helps those most in need to make decisions effectively
- The themes of CE focused on the control of nosocomial infections are extremely important and that, it is little practiced in my country in real terms. It is, therefore, an area to explore, with a great chance of success. I believe it will awaken, in some of the youngest, a taste for the paths that lead beyond routine, daily work.
- Despite everything, I am confident. In my country we have been working with infectious diseases since the death of one of our presidents. From then on, both infection control and tropical and traveler medicine gained more visibility, resources and stakeholders. We have dealt with AIDS and tuberculosis for many years and have had positive results in combating them. TB, whose transmission is, in a way, similar to the covid-19, taught us a lot how to fight them. There are really few of our colleagues working in this area. I discovered that we need to move forward and that the time is now, with speed.

## Challenges:

- It is a challenge to work in the best way to group people from cities, states and countries, from different associations, organizations. Finding more prepared groups of people where CE can contribute and make a difference and play their part. ...
- Acting to awaken people's notion of attitude, seems to be one of the great interesting challenges to think about and put into practice. To help, both young beginners and old guard practitioners, to practice the motto, "together we can do it better".
- Transform seemingly difficult “things” into “things” that are easy to understand and practice. When many people want to help, unprepared, the result may not be the best possible. ...The problem seems to be: how to make CE a practical thing for this moment? Something that ordinary people can see as well. See and perceive, through our attitudes, how we can and how we help. Despite the disaster that few of us can see, awaken the notion now, of preparing for future disasters, whatever they may be.



IFMBE Clinical Engineering Division (CED)



Together ...

**We overcame giant challenges –  
Let's hear how did we change?**

**Thank you!**



... We Can Make It Better ... Everywhere



**Alejandra Velez**  
**Technical Focal Point**  
September 1<sup>st</sup>., 2021.

# **OXYGEN SCALE UP INITIATIVE - LESSONS LEARNED – BIOMEDICAL ENGINEERS IN THE COUNTRIES**



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Home / Initiatives / Oxygen Access Scale Up



## Oxygen Access Scale Up

<https://www.who.int/initiatives/oxygen-access-scale-up>

1. Integrate the guidelines developed within different departments inside WHO: Medical Devices, Clinical Departments, Innovations.
2. Connect with partner's publicly available tools.
3. WHO Tools, specially about oxygen generator plants at scale.
4. Webinars and news!

WHO technical consultation  
on oxygen access scale-up  
for COVID-19



# Still we are asking ourselves...

- How many health interventions would improve the outcome if oxygen therapy was available?
- What is the costing treatment per intervention?
- How to increase equal distribution and access to medical devices for oxygen therapy?
- How to ensure international standards are applicable everywhere?
- How to bridge the gap between technical guidance and implementation?
- Are there enough guidance for LMIC?
- ...

# One of the things we better know now is when do we need biomedical engineers...



Along all the life cycle!

**Innovation + Availability + Accessibility +  
Appropriateness + Affordability**

# WHO holistic and "tiered" approach

Select + bundle and cost + unbundle solutions.



# What do WE see?... Holistic assessment at country level

Biomedical equipment:  
Infrastructure, management,  
procurement, donations, maintenance



Biomed Workforce and Workshop



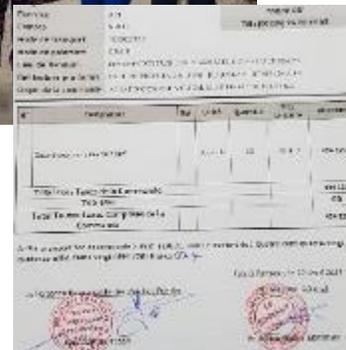
Cylinders management  
& maintenance



Contract with main  
supplier of PSA plants



Liquid oxygen suppliers:  
value chain and cost



Rational use of oxygen, oxygen  
therapy and pulse oximetry (overview)



Context: fuel black market



# PSA systems: **similar issues...**

## lack of maintenance → systems working at

# What do WE answer?... **Different solutions !!!**

Air compressors & air tanks



Oxygen tanks



Piping & power generator

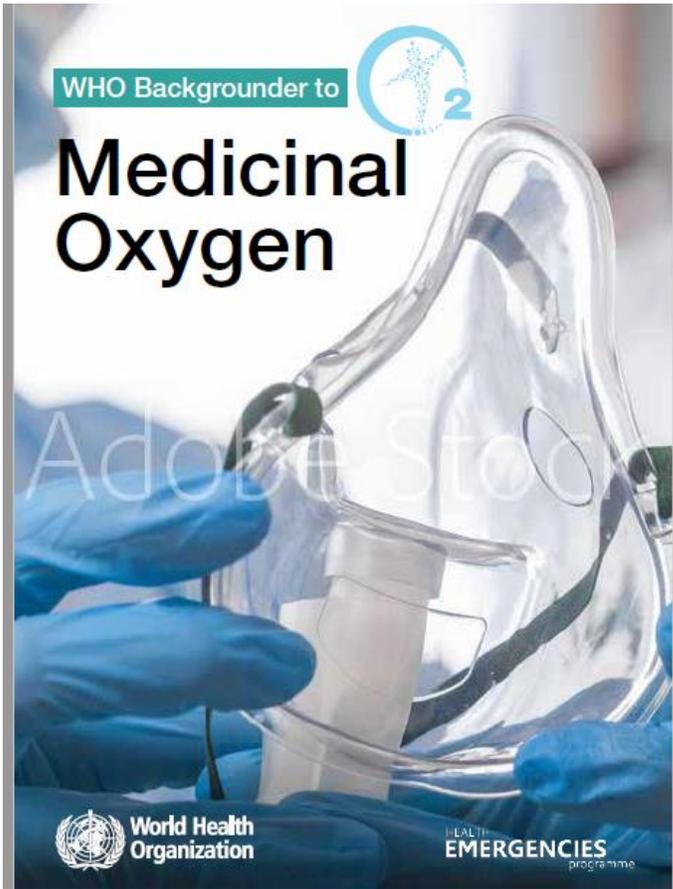
Booster compressor



Filling manifold and back up supply



# What we would need to adjust in Clinical Engineer



- Some ideas in terms of:
  - ✓ Education: use of new tools and models / expand.
  - ✓ Innovation: appropriateness / sustainable solutions.
  - ✓ Information: development of policy, guidelines, trainings / sharing trustable platforms.
  - ✓ Implications in process: from the decision making and along all the process.

**IFMBE CED 2021 CE Competency & Leadership Webinars:**  
**Lessons learned & progress in practice for**  
**Clinical Engineers in the Time of COVID:**  
**Reflections on Oxygen Experts and Implications for CEs**  
**September 1, 2021**



**Tom Judd, MS, CCE-E, CPHQ, CPHIMS, IFMBE CED Board Chair**

2021 CED  
WEBINAR SERIES  
PRESENTS:



# SYSTEMS RESPONSE FOR OXYGEN IN COVID-19 CLINICAL SETTINGS: CHALLENGES & SOLUTIONS

WEDNESDAY  
MAY 19<sup>TH</sup>, 2021 | GENEVA TIME  
2 PM CET | NEW YORK CITY TIME  
8 AM ET

MODERATION BY  
TOM JUDD (IFMBE CED) AND LEITH GREENSLADE (EVERY BREATH COUNTS)



WELCOME & INTRODUCTION  
ADRIANA VELAZQUEZ, WHO  
ROBERT MATIRU, UNITAID



WHO OXYGEN TOOLS & GUIDELINES  
ALEJANDRA VELEZ, WHO



OXYGEN NEEDS TRACKER  
ALEX ROTHKOPF, PATH



OXYGEN CLINICAL IMPACTS  
PAUL SONENTHAL, PARTNERS IN HEALTH-PIH



NGOs CLOSING THE OXYGEN GAP  
JASON HOUDEK, CLINTON HEALTH ACCESS INITIATIVE-CHAI



NGOs CLOSING THE OXYGEN GAP  
JIM ANSARA, BUILD HEALTH INTERNATIONAL-BHI



PANEL & Q&A

# Agenda

May 2021  
References  
significant:

<https://ced.ifmbe.org/2021-leadership-webinars/guruPrograms/18-2021-leadership-webinars/72-syst-resp-2.html>



IFMBE  
Clinical Engineering Division



2021 CED  
WEBINAR SERIES  
PRESENTS:



# SYSTEMS RESPONSE FOR OXYGEN IN COVID-19 CLINICAL SETTINGS: CHALLENGES & SOLUTIONS

THURSDAY  
20 MAY, 2021 | GENEVA TIME  
2 PM CET | NEW YORK CITY TIME  
8 AM ET

MODERATION BY  
CÉSAR BURGÍ VIEIRA (MD) AND ELLIOT SLOANE (PHD) (CED)



WELCOME & INTRODUCTION  
YADIN DAVID, GCEA  
ED WHITING, WELLCOME



USING WHO INVENTORY TOOL FOR MOH PAKISTAN  
TAZEEN BUKHARI, EBC-WHO



GAMBIA DEVELOPING OXYGEN TREATMENT CENTRES  
EBRIMA NYASSI, ESL-EBC



RWANDA BIOMEDICAL CENTRE COVID RESPONSE  
FRANCINE UMUTESI, EBC-RDC



MALAWI & OPEN O2 EXPERIENCE  
GRYCIAN MASSA, EBC-LILONGWE INSTITUTE



HAITI IMPLEMENTING BHI'S OXYGEN SOLUTION OXBOX  
STEVE MTEWA, EBC-BHI



PANEL & Q&A

# WHO Reflections

- WHO: COVID-19 Biomedical/Clinical Engineers to ensure technology is appropriate to well-being of patients (BME/CE scope of work: PPE, IVD, medical equipment, digital health)
  - Oxygen is an essential medicine, for COVID-19, pneumonia, surgery, trauma...
- WHO: Global Oxygen: the role of local CEs
  - Medical oxygen sources of good quality
  - Distribution / monitoring / regulation
  - Patient receiving appropriate care, that is safe and high quality
- WHO: Take home messages:
  - MOH, funding agencies need to include the local BME/CE and other engineers' perspectives to support delivery of medical oxygen.
  - Oxygen sources and delivery technologies are complex and should include: planning, needs assessment, regulations, supply, installation, maintenance and training for safe use.
  - Need to ensure good quality, availability, appropriateness, affordability to respond to local oxygen needs.
- WHO: Understanding the Oxygen Ecosystem
  - Equitable scale-up means quality oxygen reaching more patients, at the right time and in a more sustainable way.
  - Sustainable action requires implementation programs, resource allocation, local capacity building and, in some situations, cultural change.
  - Multidisciplinary stakeholder action is needed to develop strategic planning, tools, advocacy and technical support.

WHO: Clinical Engineers progress in times of COVID19

**Our scope of health technology management now includes PPE, Oxygen & IVD systems as well as medical devices and digital health.**

WHO: Global Oxygen: the role of local CEs

**CEs now have oxygen systems management responsibilities and need to step up.**

• WHO: Take home messages:

**CEs to seek out opportunities for funding support and use it wisely in ways we have done traditionally with medical devices.**

• WHO: Understanding the Oxygen Ecosystem

**Continue to work with clinicians in new ways to deliver best care. Join oxygen planning and delivery committees at local and country levels to help make a difference.**

# NGO Perspectives

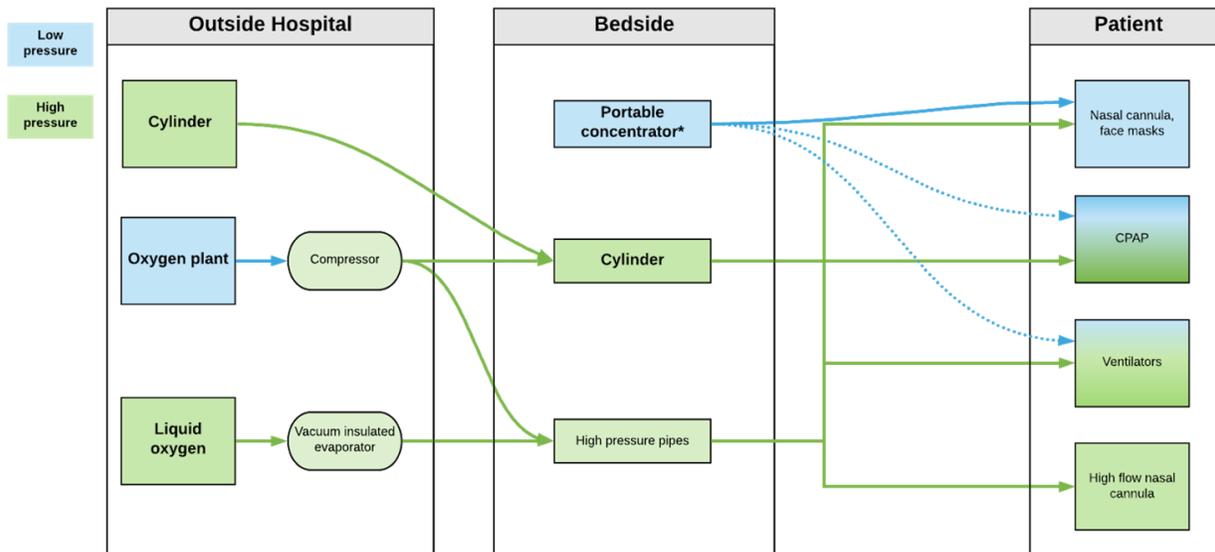
## Oxygen needs estimation method – daily

- WHO estimates for % COVID-19 cases requiring oxygen, and % severe and % critical cases
- WHO estimates for the daily oxygen needs of COVID-19 patients
- Note: need will rise or fall weekly as WHO confirmed COVID-19 cases rise or fall

## Oxygen cost estimation method – annual USD

- Income-level dependent investment gap
- Assumed oxygen device split (PSA plants, Liquid oxygen tanks, cylinders, concentrators)
- Blended set of cost metrics across representative geographies including (investment and operating cost) for each device
- Required daily oxygen need assumed over a year

## Clinical perspective – bedside & patient



## Oxygen needs estimation method – daily

**CEs to partner with clinicians & other planners to estimate needs**

## Oxygen cost estimation method – annual USD

**Work with WHO, as well as national and global CE societies and federations to better understand and give input into local and country-wide requirements**

## Clinical perspective – bedside & patient

**Help clinicians focus on bedside & patient while CEs focus mainly on Outside Hospital Oxygen sources and bedside tools, as well as assisting at the Patient's side as needed**

# NGO Perspectives 2

- **Oxygen ecosystem perspective**

- need trained CE-BME/other practitioner and clinical safety protocols to guarantee continuity and safe use.
- need clinical protocols implemented by trained healthcare workers with access to adequate supplies.
- need production plants, cylinders, piping, and portable concentrators to ensure a sufficient oxygen supply.
- This is how we ensure the success of short-term efforts while building long-term health system capacity:
  - With training, protocols, and ongoing mentoring

- **Equipment and Supplies**

- The right things, in the right quantity, at the right time
- Closely integrated clinical delivery and clinical operations team to ensure access to necessary supplies
- In-country and global supply chain management to support procurement

## Oxygen ecosystem perspective

**CEs need to understand Oxygen system training requirements as well as safety protocols; WHO, CED and GCEA can help.**

**CEs can help plan for and deploy the various Oxygen sources.**

**CEs can be a part of long-term mentoring of both CE practitioners and other clinical and allied health care workers.**

## Equipment and Supplies

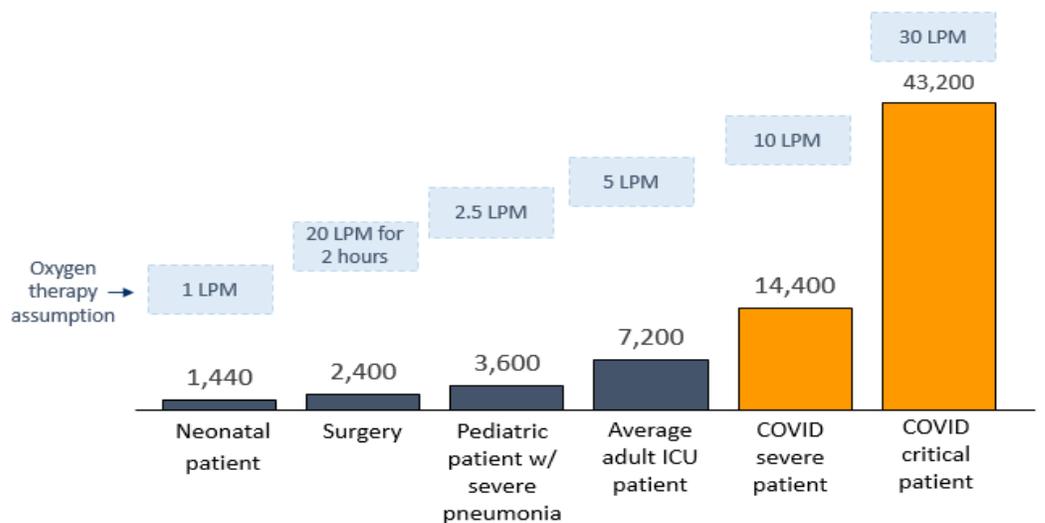
**This is the CE tradition, to work with local, national, and global partners / stakeholders to meet point of care requirements**

# NGO Perspectives 3

COVID-19 patients require **two to six times** more oxygen than an average ICU patient

**Total liters of oxygen required to treat a single patient for one day**

*(estimation based on average flow rate)*



**Increase in oxygen demand due to COVID-19**



**5x –  
10x**



**>6x**

**CEs can help health system planners meet equipment, system and supplies needs in a timely fashion across the patient acuity spectrum.**

**Indicative lead times for oxygen equipment; dependent on availability**



**Onsite bulk storage tanks**

**>4 weeks to ship**



**Concentrators**

**3 to 6 weeks to ship**



**PSA plants**

**4 to 12 weeks to ship**



**Piping systems**

**>3 weeks to install**

# NGO Perspectives 4

Oxygen Concentrator



PSA Plant



BHI/PIH PSA Support Team



## Build Health International Oxygen Guiding Principles in LMICs

1. LOX is highly efficient in resourced settings with excellent transportation infrastructure.
2. Portable Oxygen Concentrators do not produce good clinical outcomes in hospitals (for COVID19 - high end of acuity spectrum, but typically assist childhood pneumonia)
3. Wall mounted piped oxygen to every hospital bed must be the standard.
4. Site planning + stable electricity + temperature control + parts supply chain + tools + hands on training= a stable PSA plant with longevity. Take any one thing out = failure.
5. Successful oxygen infrastructure in LMIC's takes on the ground, technical knowhow and capacity. Policy, whitepapers, internet tools, and webinars, all help and have their place, but in the end, mechanics not academics, successfully install and maintain oxygen infrastructure.

**What can CED & GCEA do in response?  
Engaging the global network of Clinical and  
Biomedical Engineers and our Hospital  
Engineering partners in LMICs across the  
world? Ideas next page**



Together, we can make it better!  
Together, we are making it better!

# THANK YOU

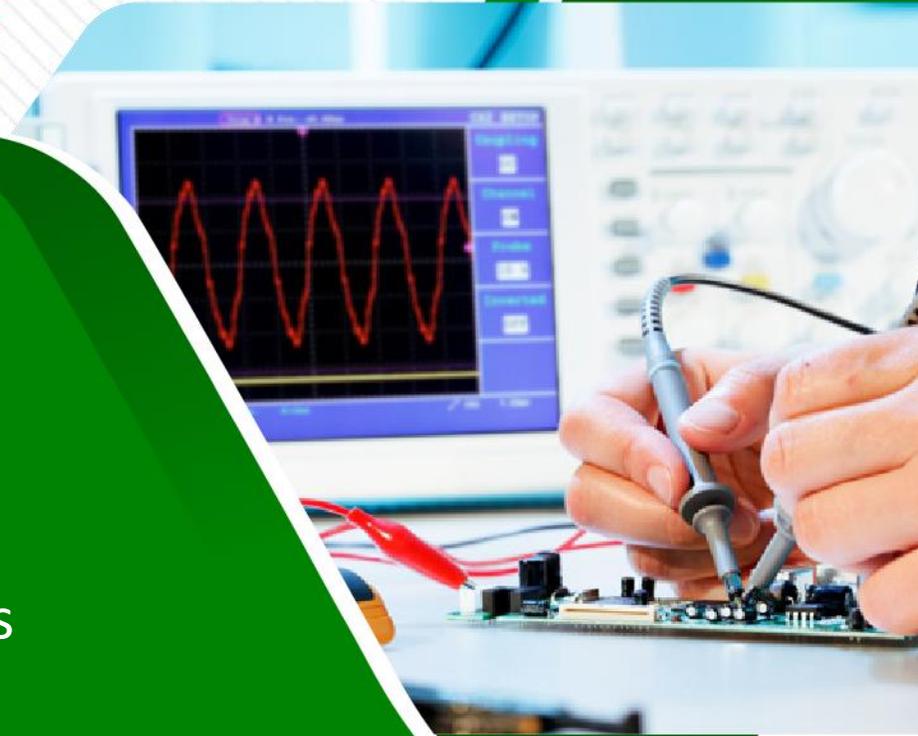
Tom Judd, MS, CCE-E, CPHQ, CPHIMS, FACCE, FAIMBE, FHIMSS  
IFMBE CED Board Chair, <https://ced.ifmbe.org/>  
<https://www.linkedin.com/in/tom-judd-169a181/>  
Judd.tom@gmail.com

**IFMBE CED 2021 CE Competency & Leadership Webinars:**

**Lessons learned & changes in practice for  
Clinical Engineers in the Time of COVID:**

**Supporting the Management of patients in their own homes**

**1st September 2021**



Professor **Dan Clark** OBE  
Clinical Engineering  
Nottingham University Hospitals NHS Trust, UK

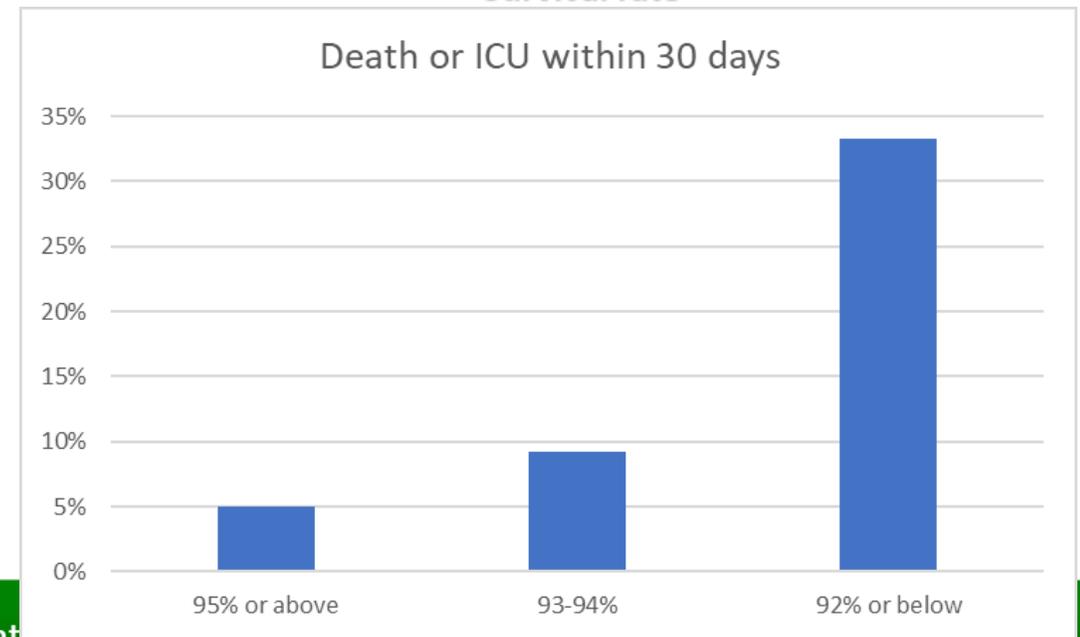
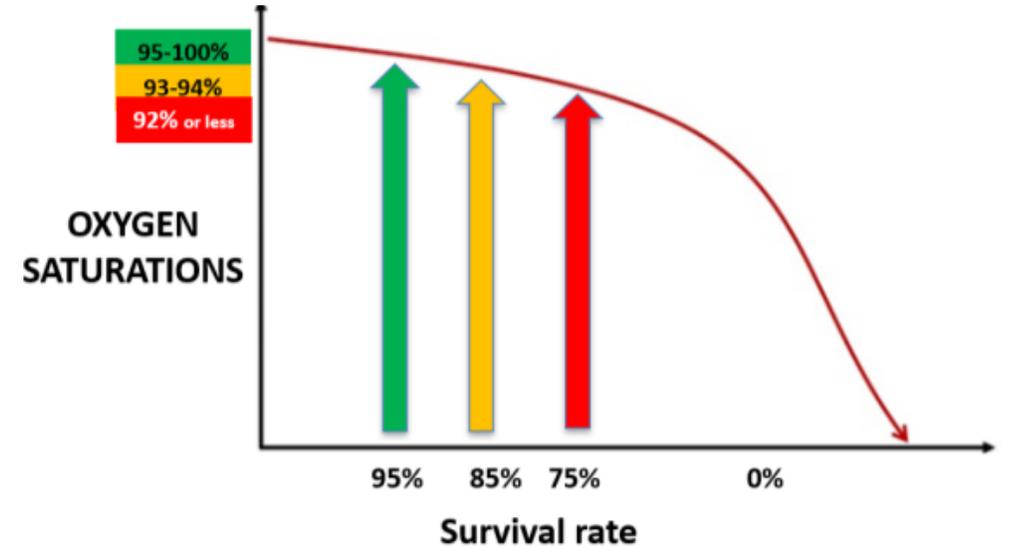
# Accelerating the trend: hospital > home care



- Historically, Clinical Engineering professionals are hospital-based
- But, the trend is to manage more patients in their own homes
- Covid has accelerated this trend

# An example: the NHS Oximetry@home project (1)

- **Silent hypoxia:** a characteristic of covid is that SpO2 levels of some suffers fall to dangerous levels without them suffering conspicuous breathing difficulties
- Delayed intervention has been shown to have significant detrimental outcomes
- Even patients with presenting oxygen saturations of 94-95%, values regarded as within this normal range, had a significantly ( $p=0.045$ ) higher 30 day mortality rate (5.3 %) than those presenting with oxygen saturations higher than 95% (30 day mortality rate 2.3%)<sup>1</sup>



(1) Validation of home oxygen saturations as a marker of clinical deterioration in patients with suspected COVID-19

**Matthew Inada-Kim**; Francis P. Chmiel, Michael J. Boniface, Helen Pocock, John J. M. Black; Charles D. Deakin

doi: <https://doi.org/10.1101/2020.11.06.20225938>

# An example: the NHS Oximetry@home project (2)

- **Home Oximetry:** clinically-led project to introduce oximetry as part of a range of tools to manage patients in their own homes.
- Appropriate (timely) admission and also used for support earlier discharge
- Cheap and cheerful oximeters with limitations and concerns for clinical engineering community
- Clinical engineering professionals had to adapt to support the project



**NHS**  
Salford  
Clinical Commissioning Group

**THIS PULSE OXIMETER  
COULD SAVE YOUR LIFE**

For some people COVID-19 can affect your oxygen level making it drop dangerously low. This could happen even when you're feeling well.

**If your GP offers you a referral for Oximetry @home programme, take it!**

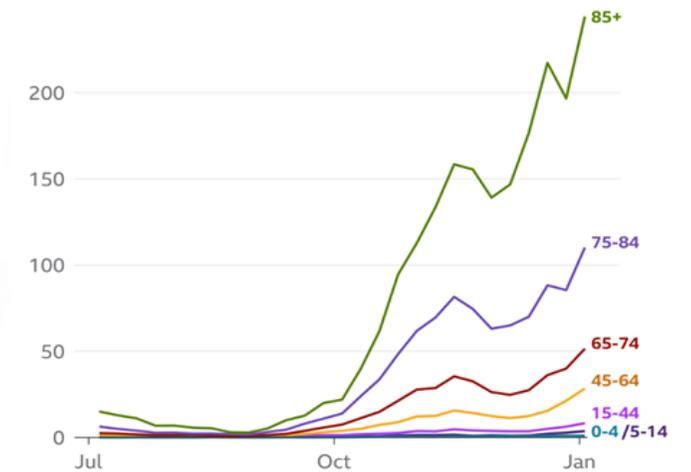
# Project Outcomes

- Project Outcomes
- Reduced admissions - in one city alone, over 1,000 admissions avoided in 3 month project period
- Reduced Length of Stay - Average inpatient LoS demonstrated to be reduced from average of 17 pre-project to under 10 with oximetry@home
- Supported early discharge

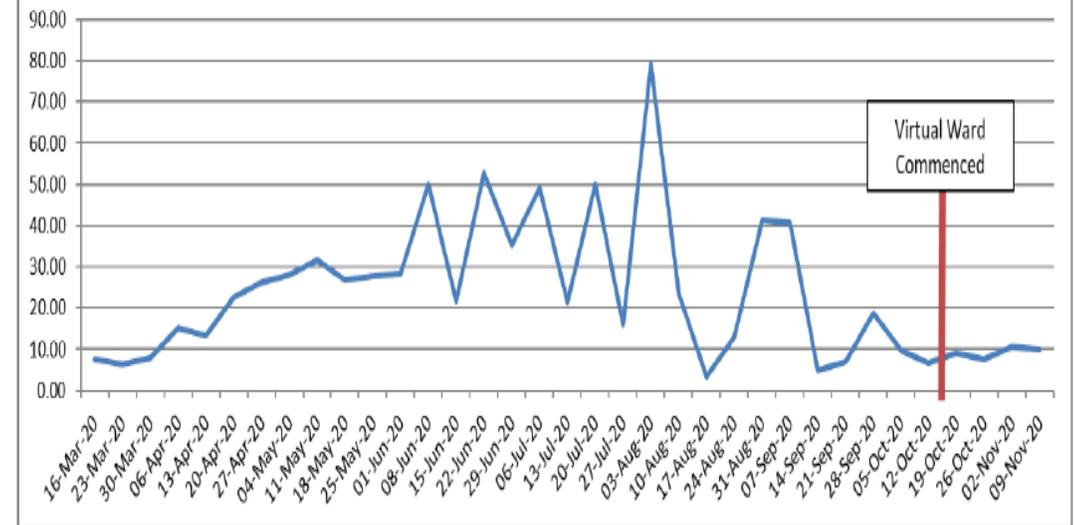
SUCCESS



Weekly hospital admission rate per 100,000 by age group



Royal Salford NHS Foundation Trust  
Average Total LOS of Covid-19 Spells by Week



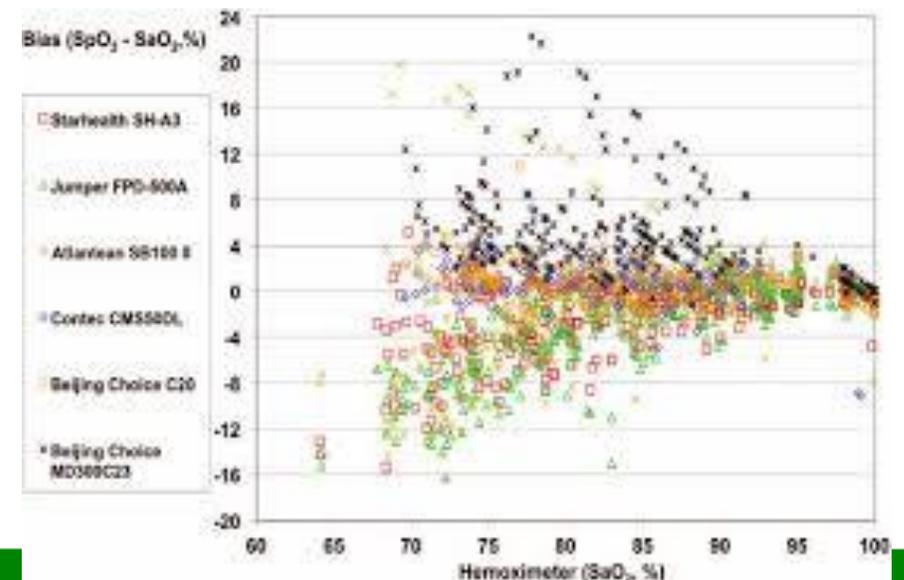
(2) Assessing the safety of home oximetry for covid-19: A multi-site retrospective observational study

Jonathan Clarke, Kelsey Flott, Roberto Crespo, Gianluca Fontana, Jonathan Benger, Ara Darziz, Sarah Elkin

doi: <https://doi.org/10.1101/2020.12.16.20248302>

# Challenges & Lessons for Clinical Engineering

- **Challenges for Clinical Engineering**
- High-tech versus low tech solutions
- Is 'good enough' now better than 'as good as possible' later?
- Managing remotely – where do the devices go, how can we track them, what happens when something goes wrong
- **Lessons for Clinical Engineering**
- Better to be involved and influencing, then watching from the sidelines
- It's only going to continue and accelerate



# THANK YOU!

**Contact:** Dan Clark  
daniel.clark@nuh.nhs.uk

**IFMBE CED 2021 CE Competency & Leadership Webinars:**  
**Lessons learned & changes in practice for**  
**Clinical Engineers in the Time of COVID:**  
**CE role in development of emergency use medical devices**  
**September 1, 2021**



**Roberto Ayala, BME CE, HTM CONSULTANT, MEXICO;**

# CE importance during pandemic

- CE professionals have had a key role during the pandemic, mainly in the front line for critical care units at healthcare institutions
- But another important role has been the contributions for locally produced, emergency use medical devices, specially those for respiratory therapy



# CE role in development of medical devices

- Critical care use ventilators has been the device with more demand and CE played a key role in the local development by:
  - Putting engineering knowledge and skills for the right development of devices,
  - Helping companies, academia, researchers and investors to identify needs, normative and the right tech specs,
  - Testing through right metrology practices



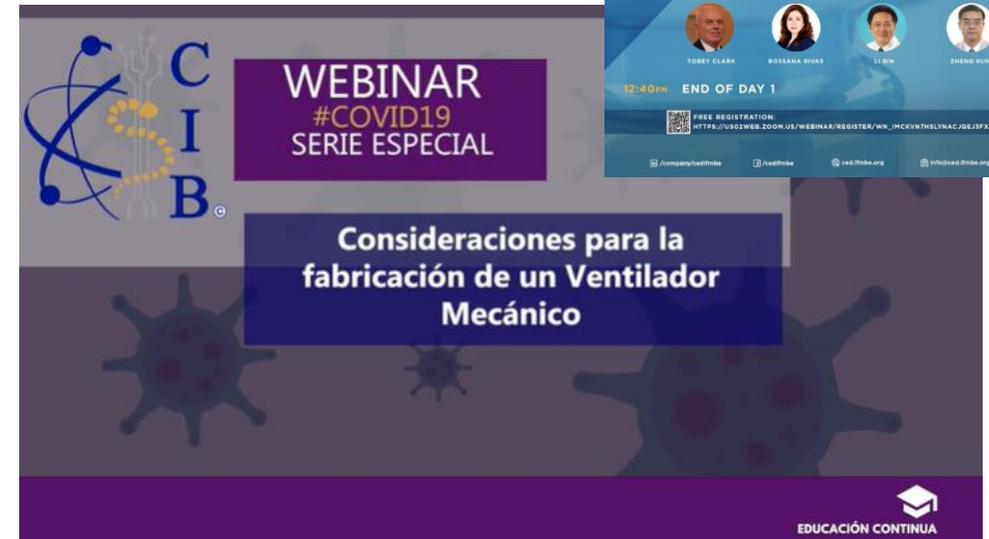
# CE role in supporting Health Regulation

- CE professional organizations and institutions have supported Health authorities and regulators by:
  - Identifying international standards, normative and best practices to establish local normative,
  - Develop tech specs for local production,
  - Support WHO/PAHO efforts for guidelines and relevant documentation



# CE role in training and education

- CE organizations, using the much recurrent web platforms, spread knowledge on best practices for manufacturing emergency use respiratory devices,
  - Webinars
  - Training courses
  - Calls with other health professionals
- IFMBE extraordinary webinars



# THANK YOU!

**Contact:** Roberto Ayala, HTM Consultant  
rap6701@gmail.com

**IFMBE CED 2021 CE Competency & Leadership Webinars:**

**Lessons learned & changes in practice for  
Clinical Engineers in the Time of COVID:**

**Medical Devices during COVID-19**

**September 1, 2021**



**Jitendar Sharma, AMTZ, India**



Medical Technology has become a sector that has survived the uncertainties of economic turbulence as well as showcased its life saving capacity for social good. AMTZ stands tall today by virtue of its servitude to the country in protecting the health of people by supplying affordable, accessible and good quality products across multiple states, hospitals in geographies. We remain committed to deliver independence from import dependency and make India a proud leader in medical technology development and production.

— DR JITENDRA SHARMA,  
MD & CEO, AMTZ

# Vizag's MedTech Zone - Saving Lives, Serving the Nation

The MedTech zone in Vizag, an established medical technology manufacturing ecosystem, has been contributing significantly to mitigate the pandemic

The Covid-19 pandemic had led to severe shortages of many essential goods and services. From N95 masks, diagnostic tests to medical oxygen and ventilators. The shortage of life-saving equipment and other essential supplies has flagged serious concerns about preventing the spread of coronavirus and impacts affected patients. While the crisis had placed these unparalleled demands, the pandemic has also provided means to strengthen the

healthcare industry with opportunities for innovation and cost efficiencies. There were individuals and organisations that have responded with resilience, rose to the occasion and matched the needs and beyond.

To tide over the crisis, the solution was a rapid escalation of manufacturing. This rapid escalation was to be made at a time when prominent economies around the globe had enforced total lockdown disrupting global production and supply-chain systems.

The MedTech zone in Vizag, an established medical technology manufacturing ecosystem, had all that it takes to make things happen and rose to the occasion. The Common Scientific Facilities (CSFs) & Common Manufacturing Facilities (CMFs) which include specialized laboratories, warehousing and testing centres that were pre-existing in the cam-

pus, was an added advantage for the mission AMTZ had committed to.

The key USPs of the campus are its Common Scientific Industrial Laboratories' such as the Center for Electromagnetic compatibility and safety testing, Center for Biomaterial Testing, Center for 3-D printing, Centers for Lasers, MRI coils, Gamma Irradiation, Moulding, and many other industrial service centers.

When the pandemic outbreak happened, there were no standard specifications for the essential products for the fight against the pandemic, and India was majority dependent on imports for ventilators, PPE Kits, N-95 Masks and so on. Today when the nation has emerged as the second-largest PPE manufacturer in the world and has grown self-sufficient in ventilators and N-95 masks, the role played by AMTZ is unique and

crucial.

AMTZ contributes by producing over a million diagnostic kits every day, which is a mammoth capacity. While container hospitals and mobile diagnostic labs are produced every week, this single campus can produce over 100 ventilators, 500 oxygen concentrators, 1 lakh N-95 masks, 5000 PPE kits and 10 lakhs RT PCR kits in just a day. However, the real strength of AMTZ is not just products for pandemic but a broader ambit of the healthcare value chain. For example, AMTZ also makes superconducting magnets for MRI and multiple other medical care products. Led by the Department of Biotechnology as part of Command Strategy, AMTZ aims to produce over 10,000 crores worth of medical equipment per annum. That's almost 25% of India's import dependency. Under the DBT AMTZ

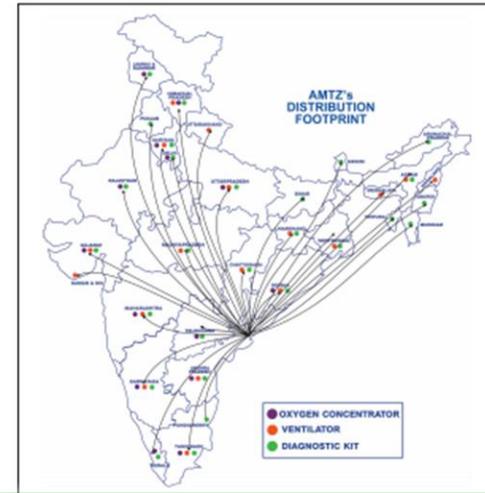


Command Center, over 10 crore RT PCR kits and thousands of ventilators are produced and supplied to states across India, and also to other countries dependent on Indian supplies.

Another initiative, a mobile diagnostic unit: I-Lab (Infectious disease diagnostic lab) with a biosafety facility capable of RT PCR, ELISA and 30 more tests was introduced to ensure ease of testing in rural areas. Ventilators and Oxygen concentrators were man-

ufactured round the clock in the zone to ensure the availability of these critical medical devices for treatment. Container hospitals were built in the zone to ensure the availability of beds during crucial times. Over 20 states in India have ventilators manufactured at AMTZ.

In the recent past, when access to oxygen emerged as one of the key challenges the country was facing, AMTZ introduced the pan India affordable oxygen concentrator rental program called O2Home. An app available on android and iOS platforms enables its users to rent oxygen concentrators on a per-day basis. AMTZ has partnered with Uber to ensure the last mile delivery of oxygen concentrators. Uber's extensive mobility network ensures oxygen support is delivered to every home swiftly and efficiently. The service is now available in 25 cities across India.



*Saving Lives*



*Serving Nation*



*Wishing you a Happy Independence Day*



CONTAINER HOSPITALS



MASKS & PPE KITS



RT-PCR KITS



MRI / SUPER CONDUCTING MAGNET



VENTILATORS



OXYGEN CONCENTRATORS



IR THERMOMETERS

GLUCOMETERS

PULSE OXIMETERS



DEFIBRILLATORS



RAPID RESPONSE MOBILE LABS

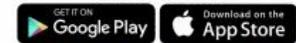
An Initiative by Supported by

Pan India **Affordable**  
**Oxygen Concentrator**  
Rental Program

Delivered to your Home by



Scan QR Code to



83416 22261

Visakhapatnam Lucknow Indore Jaipur Raipur Coimbatore Hyderabad Bhubaneswar Anantapur Bangalore Ahmedabad Patna Siliguri Hajipur Nagpur Guwahati Pune Varanasi Kottayam Aurangabad Puducherry Noida Kolkata Ludhiana Vadodara



<https://ced.ifmbe.org/>

[info@ced.ifmbe.org](mailto:info@ced.ifmbe.org)

# THANK YOU!

# The evolution of the PPE 'problem' during COVID-19

Applied Biomedical Signal Processing and Intelligent eHealth lab

**Davide Piaggio**, Teaching Fellow, Research Assistant

**Busola Oronti**, PhD student

**Prof Leandro Pecchia**

Treasurer, *IFMBE Clinical Engineering Division* (2018-21)

Secretary General, *IUPESM* (2018-2021)

Elected President, *EAMBES* (2019-23)

Innovation Manager, R&D Blueprint and COVID-19, *World Health Organization*, Avenue Appia 20, 1202 Genève, Switzerland

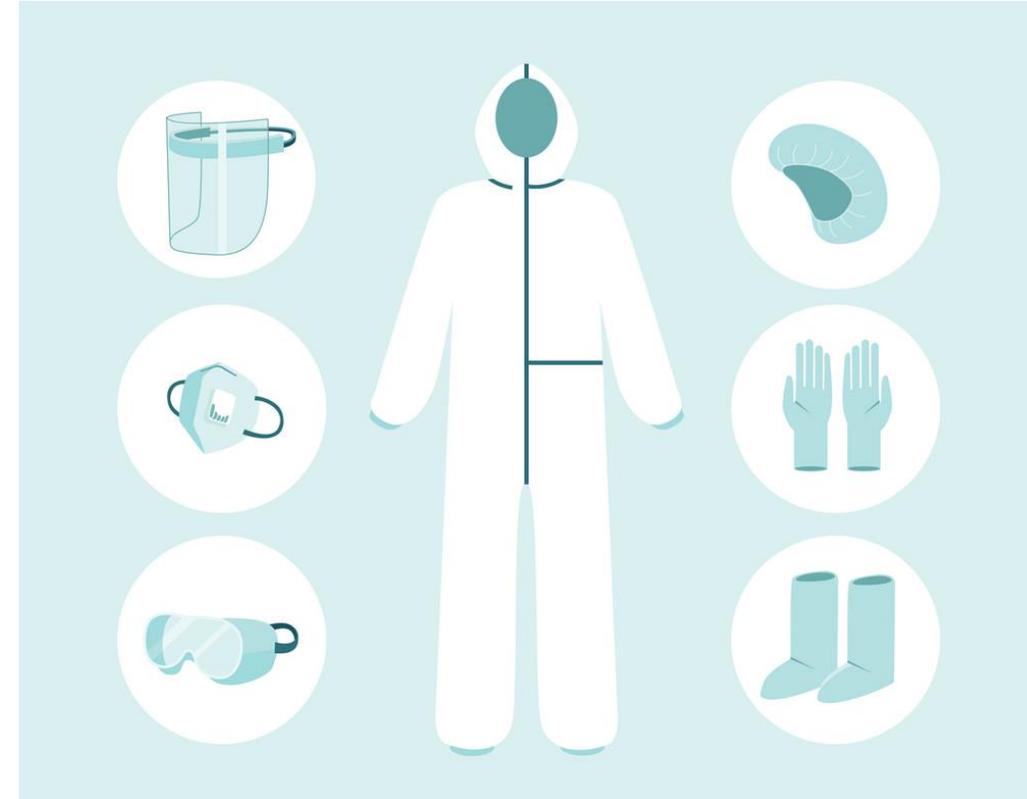


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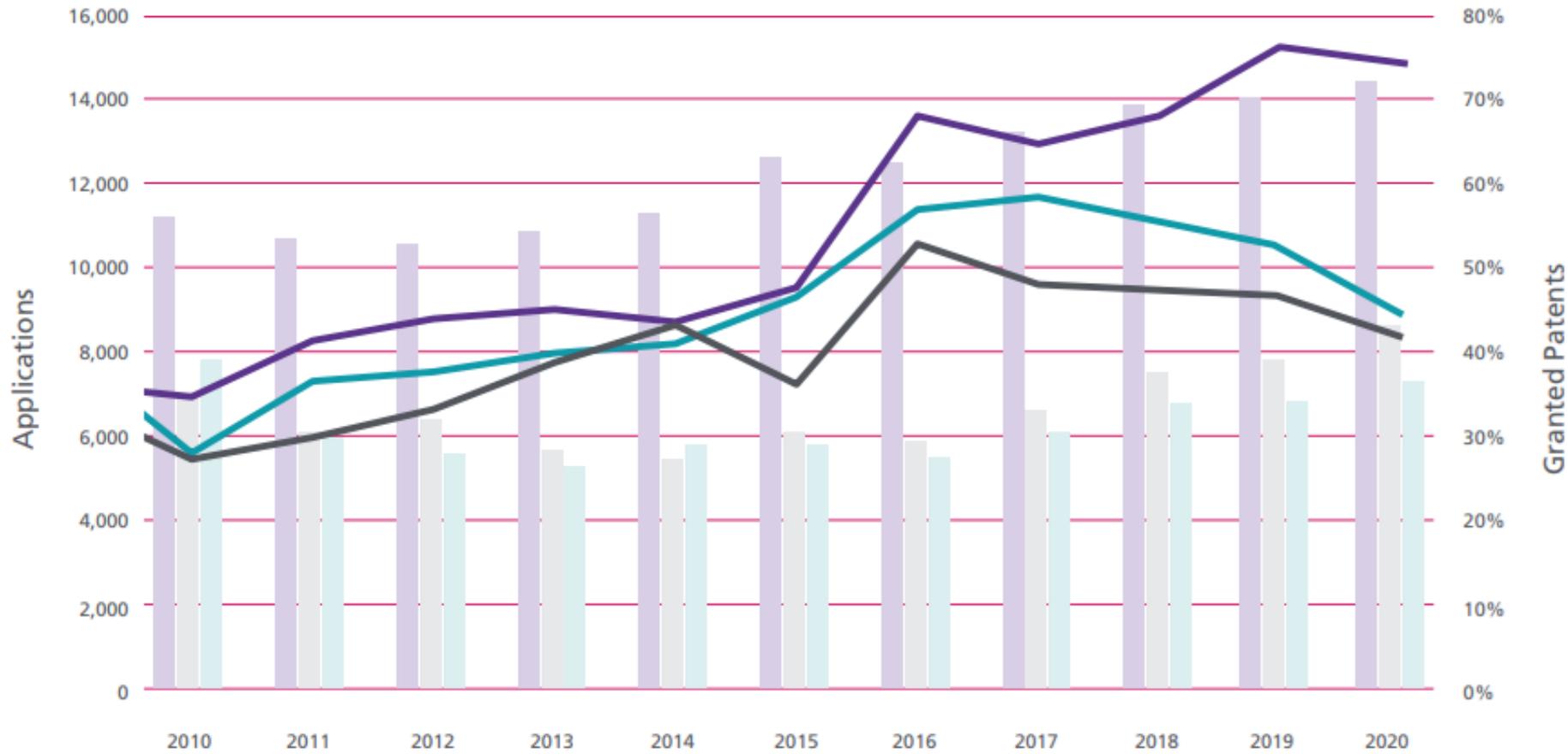
# Personal Protective Equipment (PPE)

According to the EU Regulation 2016/425, PPE is:

- equipment designed and manufactured to be worn or held by a person for protection against one or more risks to that person's health or safety;
- interchangeable components for equipment referred to in point (a) which are essential for its protective function;
- connexion systems for equipment referred to in point (a) that are not held or worn by a person, that are designed to connect that equipment to an external device or to a reliable anchorage point, that are not designed to be permanently fixed and that do not require fastening works before use;



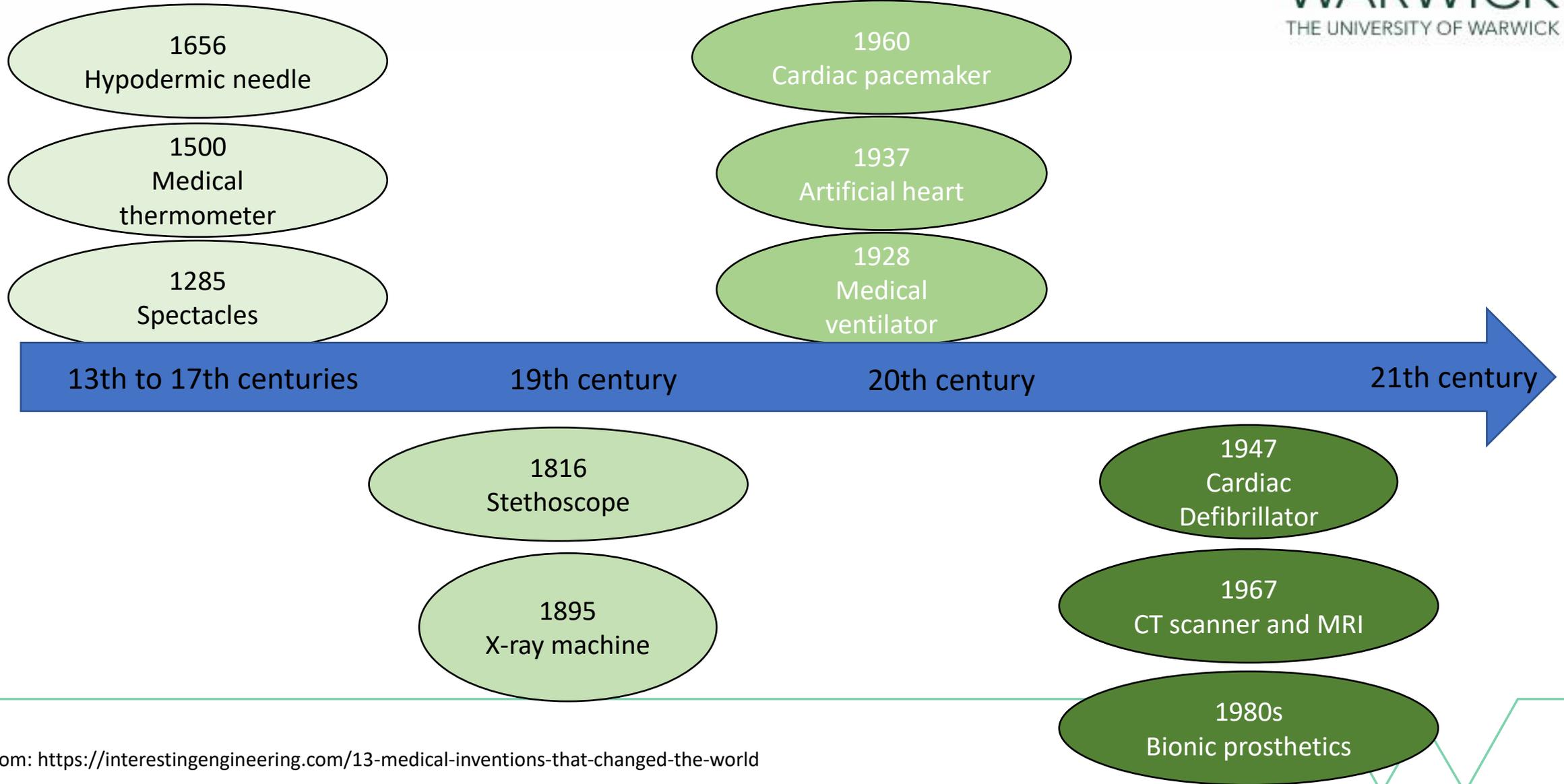
# Evolution of medical devices, drugs and vaccines



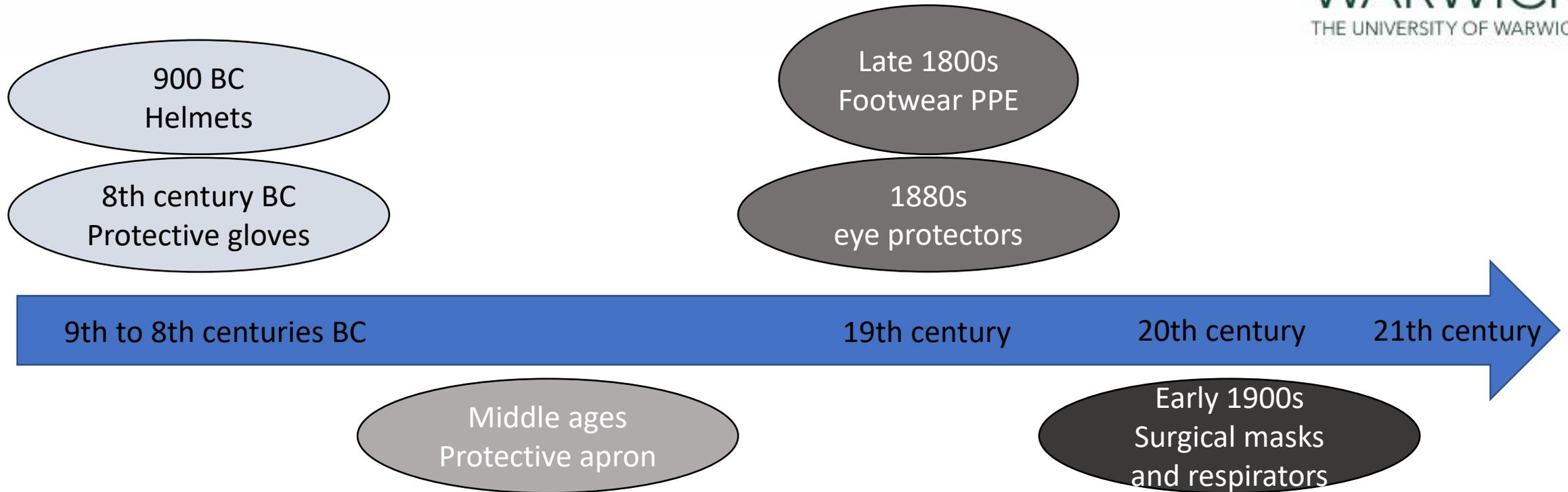
PPE?  
Missing from the main reports...

MedTech Applications    Pharma Applications    BioTech Applications  
MedTech Granted    Pharma Granted    BioTech Granted

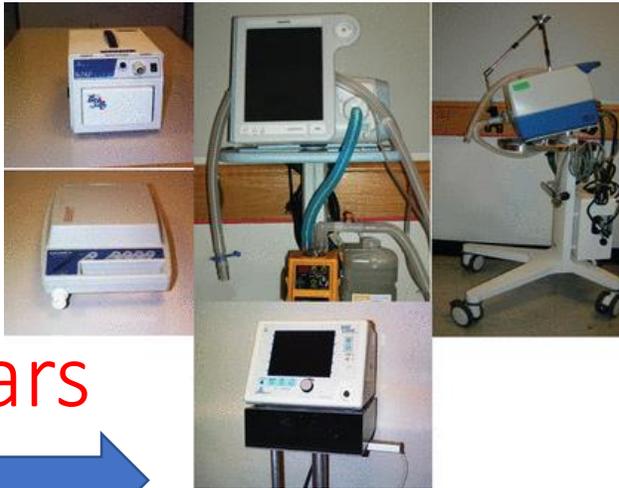
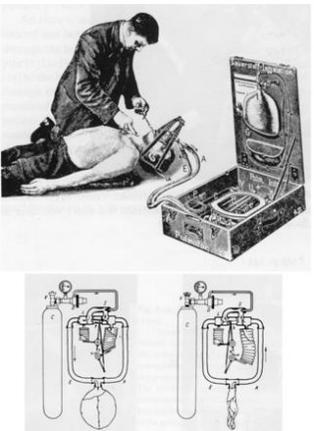
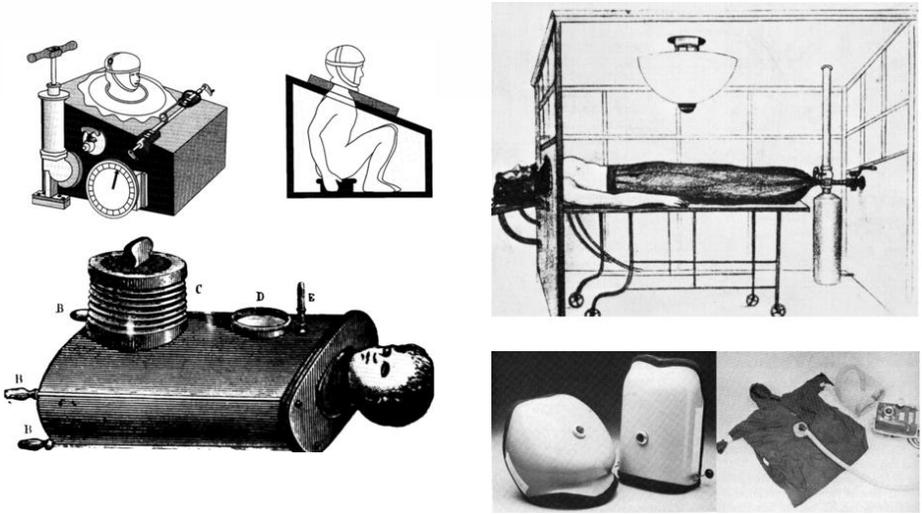
# Timeline top 10 most-impactful medical devices



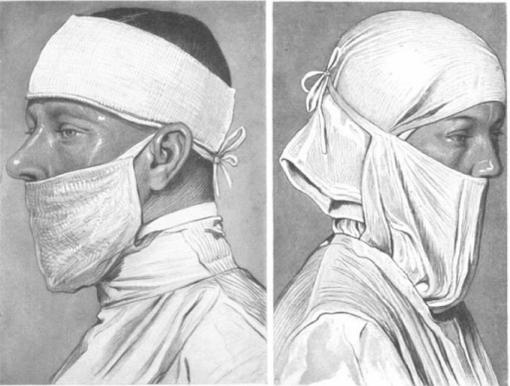
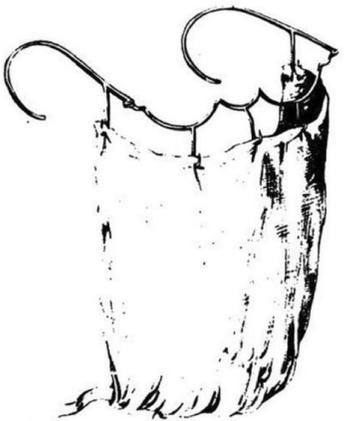
# Timeline of PPE



# Medical ventilator VS face mask



Time span <100 years



Time span 700 years



# COVID-19 and PPE

When COVID-19 pandemic started, the world discovered that PPE were not safe and effective as expected, especially not for global coverage: i.e., lay people are not skilled in PPE (appropriate use), unlike healthcare workers; using PPE during a pandemic can present risks (e.g., self-contamination, fit may reduce compliance...)



**PLEASE WEAR  
A PROPER FACE MASK**



# COVID-19 and PPE shortage

Every month, frontline health responders around the world need these supplies (and more) to protect themselves and others from #COVID19

- 89 million masks
- 30 million gowns
- 1.59 million goggles
- 76 million gloves
- 2.9 million liters hand sanitizer



#COVID19  
#coronavirus

## Grave Shortages of Protective Gear Flare Again as Covid Cases Surge

Five months into the pandemic, the U.S. still hasn't solved the problem. The dearth of supplies is affecting a broad array of health facilities, renewing pleas for White House intervention.



World Business Markets Breakingviews Video More

HEALTHCARE & PHARMA APRIL 22, 2020 / 6:14 PM / UPDATED A YEAR AGO

### In Britain's COVID-19 wards, doctors say they do not have enough gowns

By Alistair Smout

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### Shortage of personal protective equipment endangering health workers worldwide

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Health Coronavirus

## Coronavirus: The NHS workers wearing bin bags as protection

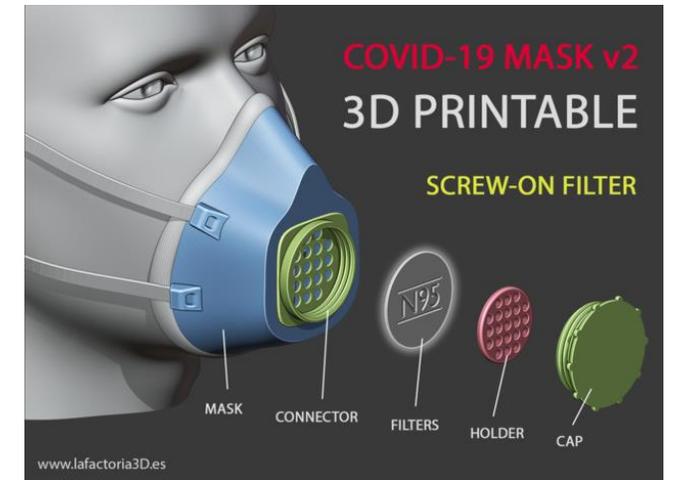
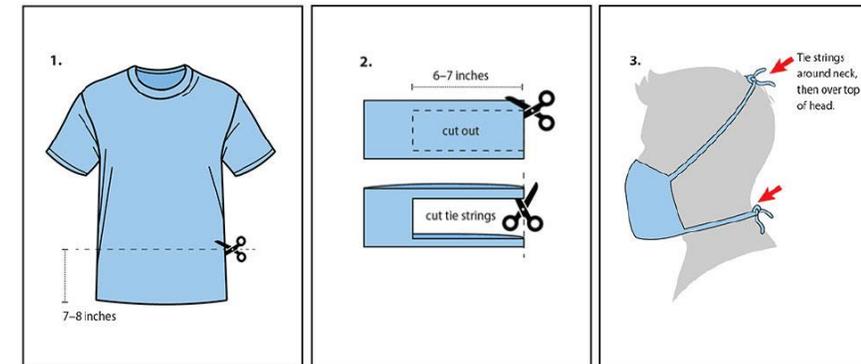
By Claire Press  
BBC News

5 April 2020



# PPE shortage, DIY solutions, and the inadequacy of the current regulatory frameworks

- PPE regulations and standards (e.g., EN166:2001 for face visors, EN 149:2001 + A1:2009 for filtering half masks) behind PPE are:
  - A) outdated, not ready for a situation of emergency due to a pandemic, and not universal.
  - B) too generic, and cover a wide spectrum of face visors or filtering half masks for different purposes → Some of the required tests result redundant and useless for some applications that are not heavy-industry related (e.g., bullet test, resistance to ignition test on visors....).
- Ordinary procedures for testing and certification have been questioned and empowered with fast-track pathways in order to speed-up the deployment of new solutions for COVID-19.
- Dangerous DIY solutions have flourished.



# WHO: Interim guidance



The WHO issued the guidelines on “Rational use of personal protective equipment for coronavirus disease (COVID-19) and considerations during severe shortages”.

- a. WHO recommends: contact and droplet precautions to be applied during care for patients with suspected, probable, and confirmed COVID-19. Additionally, airborne precautions are recommended to be applied during aerosol generating procedures.
- b. WHO does not recommend: PPE reuse (donning of a used PPE item without decontamination/ reprocessing), use of gloves in settings where they are not needed, wearing a medical mask over a respirator, or the use of non-medical masks as an alternative to medical masks or respirators.

# WHO: Interim guidance – decontamination/reprocessing of PPE



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Considerations for the feasibility of adopting PPE decontamination or reprocessing measures for health service settings should include:

- safe transport (where applicable) of potentially contaminated PPE items to facilities for reprocessing
- efficacy of the decontamination or reprocessing process to guarantee that any pathogens transmissible in health settings are effectively removed through disinfection or sterilization
- controls to ensure there is no residual toxicity (e.g. appropriate time allotted for off-gassing if a chemical disinfectant is used)
- pre- and post-reprocessing assessment of the functional integrity and shape of the PPE item
- capacity for performance testing following reprocessing for individual items and batches where applicable
- traceability of reprocessed PPE items to identify batches when investigating any subsequent quality control issues or infections resulting from inadequate reprocessing and remove affected lots from circulation.



# WHO: 4 evidence-supported methods for reprocessing respirators during severe shortages

Max 5x per respirator, if it maintains integrity (fitting, filtration performance, and breathability) (compare with US CDC).



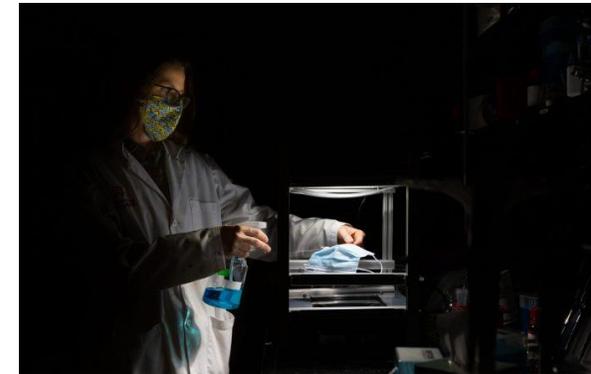
UV germicidal irradiation



Vaporised hydrogen peroxide



Dry heat



Methylene blue + Light

# WHO: 4 evidence-supported methods for reprocessing respirators during severe shortages

Face shields and goggles can be decontaminated by cleaning with soap/water to remove organic debris, followed by disinfection with Alcohol (70-90%).

Gowns (cotton/reusable material and without defect or heavy soiling) may be washed with a standard washing machine cycle 60C **OR** cleaned with soap and water, followed by disinfection by stirring in a drum containing a dilution of 0.05% sodium hypochlorite

# Conclusions

- In 1 year, PPE grew as medical devices in 10 years
- Still a lot remains to be done:
  - i. Catalysing PPE innovation
  - ii. Improving standards and quality
  - iii. Expanding and diversifying manufacturing capacity
  - iv. Strengthening procurement practices
  - v. Improving usage and disposal



Thank you!



## IFMBE CED 2021 CE Competency & Leadership Webinars:

Lessons learned & changes in practice for Clinical Engineers in the Time of COVID:

Telehealth advances ACCELERATED by the COVID-19 pandemic!

September 1, 2021



Elliot B. Sloane, PhD, CCE – Foundation for Living, Wellness, and Health and Villanova University

# Our IFMBE CED telehealth community dialog and activities, since ICEHTMC 3 in Rome, October, 2019

- **October 2019, ICEHTMC Keynote: “Telehealth Grand Challenge”**
  - Focus on advancing digital health standards to integrate personal health devices and data
- **January 2020, Pedro Galvan and Elliot Sloane assembled a CED Taskforce to begin addressing the Telehealth Grand Challenge.**
  - A taskforce team assembled a beautiful analysis of telehealth regulations and activities in Latin America
  - Pandemic in Feb/Mar 2021 put the taskforce on hold!
- **March '20 through summer/fall '20 “Surge 1,” virtually ALL nations whipped together ad-hoc phone and televideo patient consultation tools to expand patient/physician support without excessive virus spread**
  - Pedro Galvan and other nations developed AI tools to support MoH priority care
- **CED Webinar August 2020 – Global Digital Health Updates**
- **CED Webinar September 2020 - Telehealth's Emerging Impact**
- **CED Webinar December 2020 – Telehealth Innovations in the Middle East**
- **CED Webinar July 2021 – Cybersecurity Concerns for LMICs**

# MY, how COVID-9 has **supercharged** Telehealth!

- Pre-pandemic, most countries had little physician-patient telehealth.
- “Telemedicine,” involving physician-physician or hospital-hospital had a long history, e.g.:
  - Dr. Yadin David’s Texas Children’s Hospital global programs flourished in the 1990s
  - I witnessed the growth of India-USA Teleradiology in the early 1990s
    - These depended on high-tech, point-to-point telecommunications, and somewhat experimental or early Internet “eFax” type file (image) exchanges.
- **Physician-patient telehealth exploded organically *around the globe* almost as soon as the pandemic hit!**
  - Used free/ubiquitous televideo conferencing like Zoom, Facetime, etc!

# Telehealth innovations have transformed healthcare, **perhaps forever** (hopefully!)

- Physicians and patients of ALL ages taught themselves to use the tools.
- Governments relaxed restrictions to expand patient access and reduce in-hospital and in-office meetings in order to prevent virus spreading.
- New models of specialty medical care were invented “on the fly!”
  - New **Telemedical Care** including: telecardiology, teledentistry, teledermatology, teleneurology, telepsychology, telepsychiatry, telerehabilitation, telesurgical consultations, etc.
- UK innovated a **Pulse Oximetry at Home** program in late 2020
- In 2021, UK, US, and other countries have implemented **Virtual Hospital, Acute Care at Home, and Intensive Care at Home** programs to keep patients out of hospital pre- and post-COVID admissions.

# Innovations being developed and used NOW:

- Interoperability standards for remote medical device operation & remote patient monitoring, PLUS autonomous and semi-autonomous medical device subsystems!
  - e.g., see: [https://wiki.hl7.org/Devices\\_on\\_FHIR](https://wiki.hl7.org/Devices_on_FHIR), [https://wiki.ihe.net/index.php/DEV\\_SDPi\\_Profile](https://wiki.ihe.net/index.php/DEV_SDPi_Profile), & <https://secwww.jhuapl.edu/mdira>
- Wearable and mobile sensors, devices, and systems for point-of-care in the moment-of-care need.
  - See: [https://www.ihe.net/ihe\\_domains/devices/](https://www.ihe.net/ihe_domains/devices/)
- ML/AI tools to triage patients and recommend optimum clinical pathways
  - See the Hacking COVID-19 archives: <https://www.globalcea.org/hcu>

***Clinical Engineers will have a LARGE portfolio of home and remote care technologies to support, interwoven with ICT hardware and software!***

Together, we can make it better!  
Together, we are making it better!

# THANK YOU

**Elliot B. Sloane**, PhD, CCE, FACCE, FAIMBE, FHIMSS

Foundation for Living, Wellness, & Health &

Villanova University

[www.linkedin.com/in/ebsloane](http://www.linkedin.com/in/ebsloane)

[ebsloane@gmail.com](mailto:ebsloane@gmail.com), @flwh.org, @villanova.edu



## IFMBE CED 2021 CE Competency & Leadership Webinars:

Lessons learned & changes in practice for Clinical Engineers in the Time of COVID:

## Telehealth: Scope & Lessons learned globally in COVID-19

September 1, 2021



Rossana Rivas, PhD Candidate; Consultant, WHO Collaborating Center for Health Technology Management in US

# Telehealth Demand in COVID-19: the Top 50 Most Affected Countries

**Table 1.** Key COVID-19 and telehealth-related parameters for the top 50 countries most affected by the pandemic.

Rank	Country	COVID-19 cases <sup>a</sup> , n	COVID-19 deaths <sup>a</sup> , n	Total-RSVs <sup>b</sup>	ICT <sup>c</sup> adoption index
1	United States	2,877,238	129,643	96.6	74.35
2	Brazil	1,603,055	64,867	29.9	58.06
3	India	719,665	20,160	13.8	32.11
4	Russia	694,230	10,494	10.3 <sup>d</sup>	77.03
5	Peru	302,718	10,589	46.0	45.70
6	Chile	298,557	6384	74.7	63.13
7	United Kingdom	285,772	44,236	9.2	72.99
8	Mexico	256,848	30,639	6.9	55.03
9	Spain	251,789	28,388	6.9	78.21
10	Iran	243,051	11,731	4.6	50.85

**Increased demand for telehealth services across the 50 countries most affected by COVID-19.**

Reference: Wong MYZ et al., Telehealth Demand Trends During the COVID-19 Pandemic in the Top 50 Most Affected Countries: Infodemiological Evaluation JMIR Public Health Surveill 2021;7(2):e24445, doi: 10.2196/24445

Countries' telehealth-related internet searches from January 1 to July 7, 2020, presented as Relative Search Volumes (RSV; range 0-100). Daily COVID-19 cases and deaths from **WHO**.

ICT-Information & Communications Technology from the **World Economic Forum Report**.

# Telehealth: some facts

When the world urban and rural households are considered together, **43% of households do not have internet access at home**, and the majority of the offline population are mostly in **Africa (71.8%)** and **Asia and Pacific (51.6%)**.

International Telecommunication Union (ITU), 2021.



Reference: Zhai Y. A Call for Addressing Barriers to Telemedicine: Health Disparities during the COVID-19 Pandemic. *Psychother Psychosom.* 2021;90(1):64-66. doi: 10.1159/000509000. Epub 2020 Jun 4. PMID: 32498070; PMCID: PMC7316653.

# WHO Global Strategy on Digital Health 2020-2025

## STRATEGIC OBJECTIVE 1: PROMOTE GLOBAL COLLABORATION AND ADVANCE THE TRANSFER OF KNOWLEDGE ON DIGITAL HEALTH

Proposed Actions	Short-term (1-2 years)	Medium-term (2-4 years)	Long-term (4-6 years)
 <p><b>Global strategy on digital health 2020-2025</b></p>	<ul style="list-style-type: none"> <li>• Provide policy dialogue platform and technical support to countries to enable prioritization of digital health at national level.</li> <li>• Convene or participate in multistakeholder groups to support scaling up of digital health and innovation contextualized to public health priorities and needs including being prepared in times of emergency.</li> <li>• Participate in the multistakeholder digital inclusion coalition convened by the UN Secretary General.</li> <li>• Develop a knowledge repository of stakeholders and digital health solutions to support Member States.</li> <li>• Develop capacity-building methodologies, tools and training materials to help Member States to identify, systematize and share good practices and lessons learned on digital health.</li> </ul>	<ul style="list-style-type: none"> <li>• Gather, map and share globally digital health business cases and facilitate exchange of lessons learned between countries and portfolios.</li> <li>• Promote digital health collaborations and partnership models within and across organizations on the use of software global goods, open-standards, and common digital health architecture.</li> <li>• Provide policy dialogue platforms and technical support to countries to enable prioritization of digital health at regional and global levels.</li> <li>• Convene multistakeholder groups and explore new modes of cooperation to support the scaling up of digital health and innovation.</li> <li>• Review annually the global agenda for action to build the future of the digital health and information and communications technology workforce; and the digital capacity of the health workforce.</li> </ul>	<ul style="list-style-type: none"> <li>• Document and share digital health global repository of knowledge and propose interventions to enhance the impact of digital health technologies towards universal health coverage, Sustainable Development Goals and WHO's Thirteenth General Programme of Work, 2019-2023.</li> <li>• Define comparative metrics and develop benchmarking tools and assessment frameworks for digital health solutions, goods and innovations, and the health content specific to program areas and use cases.</li> <li>• Address and develop strategies to incorporate lessons learned and to mitigate shared challenges in ethics, legal frameworks and governance in digital health including data privacy and sharing and ensuring safety and protection of individuals within the digital health environment.</li> </ul>

Telemedicine: the delivery of health care services, where distance is a critical factor, by all healthcare professionals using information and communications technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and the continuing education of health care workers, with the aim of advancing the health of individuals and communities.

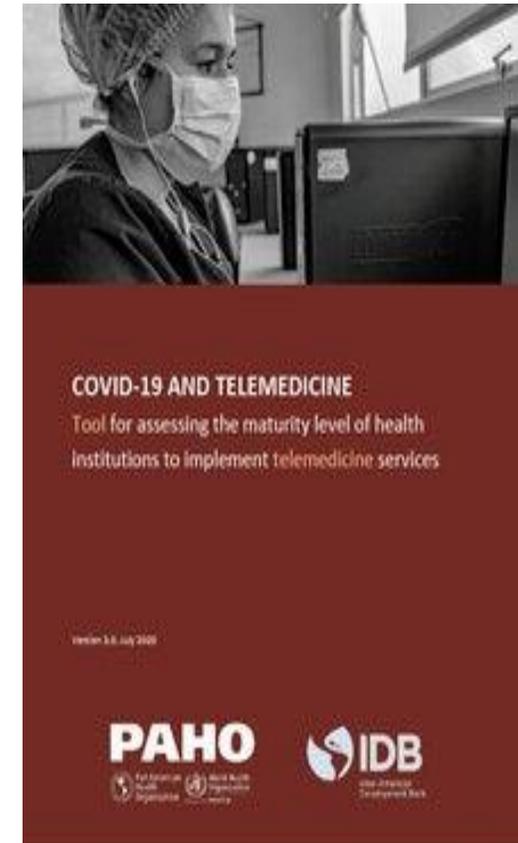
### References:

Global strategy on digital health 2020-2025. Geneva: WHO; 2021; Licence: CC BY-NC-SA 3.0 IGO

<https://www.who.int/health-topics/digital-health>

# Telehealth: Global lessons learned (1)

- A crowdsourcing exercise conducted from Telemedicine experts across the Americas obtained a “Tool for Assessing the maturity level of health institutions to implement Telemedicine services” (PAHO/WHO-IDB), it was designed for the Americas then disseminated throughout all continents.
- Crowdsourcing & Telemedicine’s lessons:
  - The value of collaboration, cocreation, and networking.
  - How to adapt on the fly, incorporating agility into scientific endeavors.
  - Novel partnerships, with flexible combinations of citizens, entrepreneurs, small businesses, corporations, academia, and governmental and nongovernmental organizations.



Reference: Bernardo, Theresa, et al. Collaborating in the time of COVID-19: The scope and scale of innovative responses to a global pandemic, JMIR Public Health and Surveillance, 2021, vol. 7, no 2, p. e25935.

# Telehealth: Global lessons learned (2)

- **Not every internet connection is stable and suitable for telemedicine through videoconference** because internet bandwidth varies depending on geographic locations and internet plans.
- **Lacking telemedicine training for clinicians before Covid-19** delayed the dispatch of telemedicine and affected the clinical experience.
- **Telemedicine may not be accessible to individuals with disabilities, some type of diseases and older adults.**



Reference: Zhai Y. A Call for Addressing Barriers to Telemedicine: Health Disparities during the COVID-19 Pandemic. Psychother Psychosom. 2021;90(1):64-66. doi: 10.1159/000509000. Epub 2020 Jun 4. PMID: 32498070; PMCID: PMC7316653.

# *Together, we can make it better!*

*Clinical Engineers have a growing opportunity for leading Telehealth projects, especially as personal and wearable health devices, health and wellness apps, and AI are added!*

## *Thanks*

Rossana Rivas, PhD Candidate; Consultant, WHO Collaborating Center for Health Technology Management  
in US

<https://www.linkedin.com/in/rossana-rivas-tarazona-a936aa3/>

## IFMBE CED 2021 CE Competency & Leadership Webinars:

Lessons learned & changes in practice for Clinical Engineers in the Time of COVID:

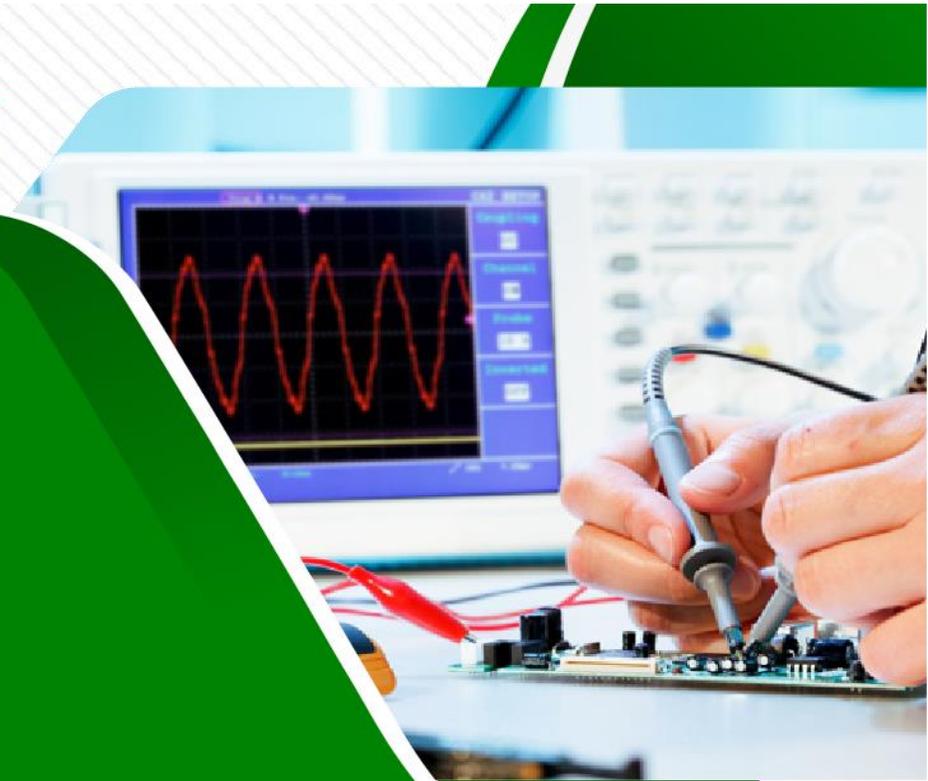
Future of Healthcare:

## Digitally Connected, Distributed Care

September 1, 2021

**Manish Kohli, MD, MPH, MBA, FHIMSS, FAAFP**

**Senior Advisor, Albright Stonebridge Group  
Past-Chairman of Board, HIMSS**



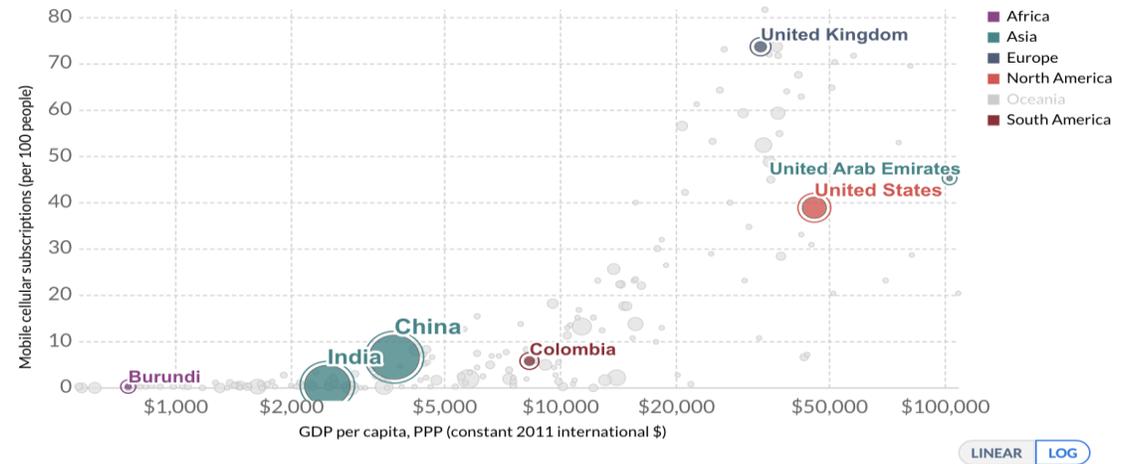
“More people have access to a mobile phone than to clean water, electricity or tooth brushes”

*Closing the gap in Health Equity through Technology, Alliance for Health Promotion in collaboration with the ITU, WHO and the Global Health Programme at the Graduate Institute, Geneva Nov. 16, 2015*

### Mobile phone subscriptions vs. GDP per capita, 2000

Number of mobile phone subscriptions, measured per 100 people versus gross domestic product (GDP) per capita, measured in 2011 international-\$.

Select countries Zoom to selection Average annual change Hide countries < 1 million people



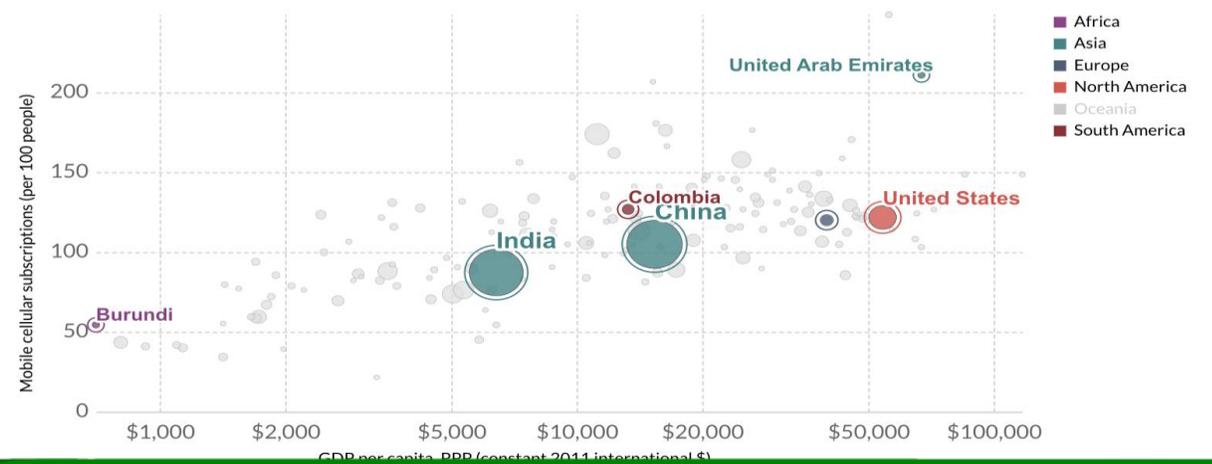
Source: World Bank, Our World In Data

CC BY

### Mobile phone subscriptions vs. GDP per capita, 2017

Number of mobile phone subscriptions, measured per 100 people versus gross domestic product (GDP) per capita, measured in 2011 international-\$.

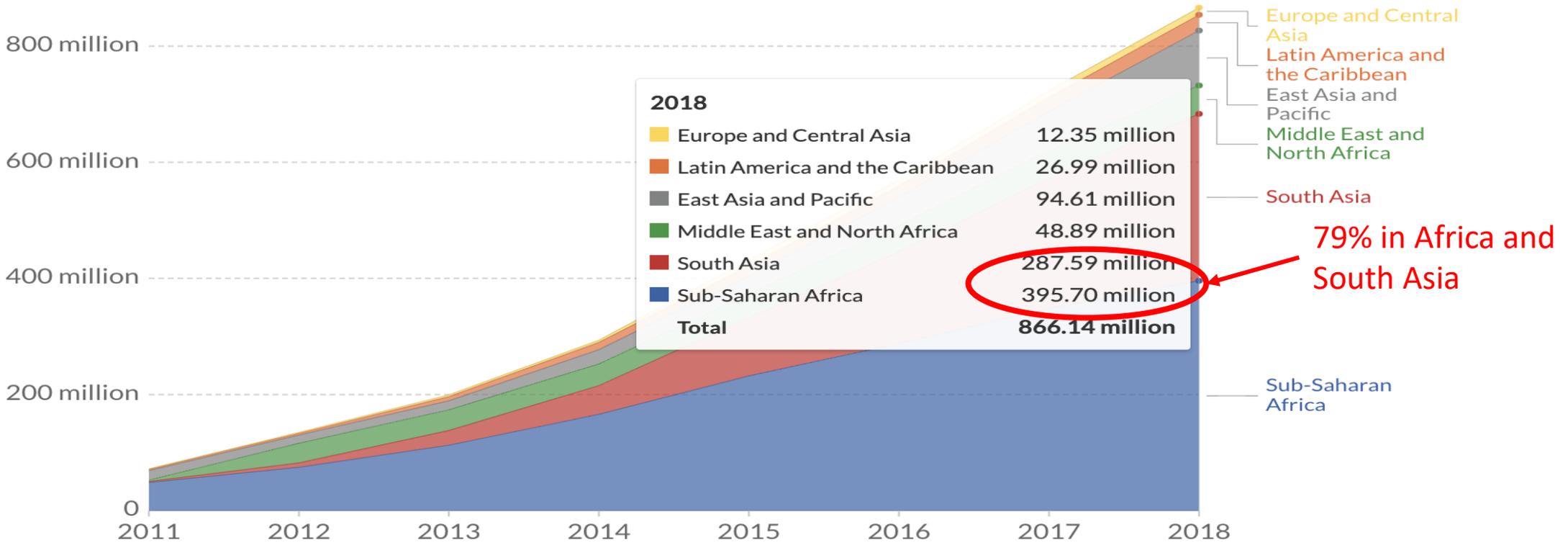
Select countries Zoom to selection Average annual change Hide countries < 1 million people



# Registered Mobile Money Accounts by Region, 2011 to 2018

The cumulative number of mobile money accounts at the end of the year by region. Mobile money services include transferring money and making payments using a mobile phone, without a formal account at a financial institution. North America is not shown since mobile money accounts are not utilised across this region.

Relative



Source: GSMA (2017). Global Mobile Money Database.

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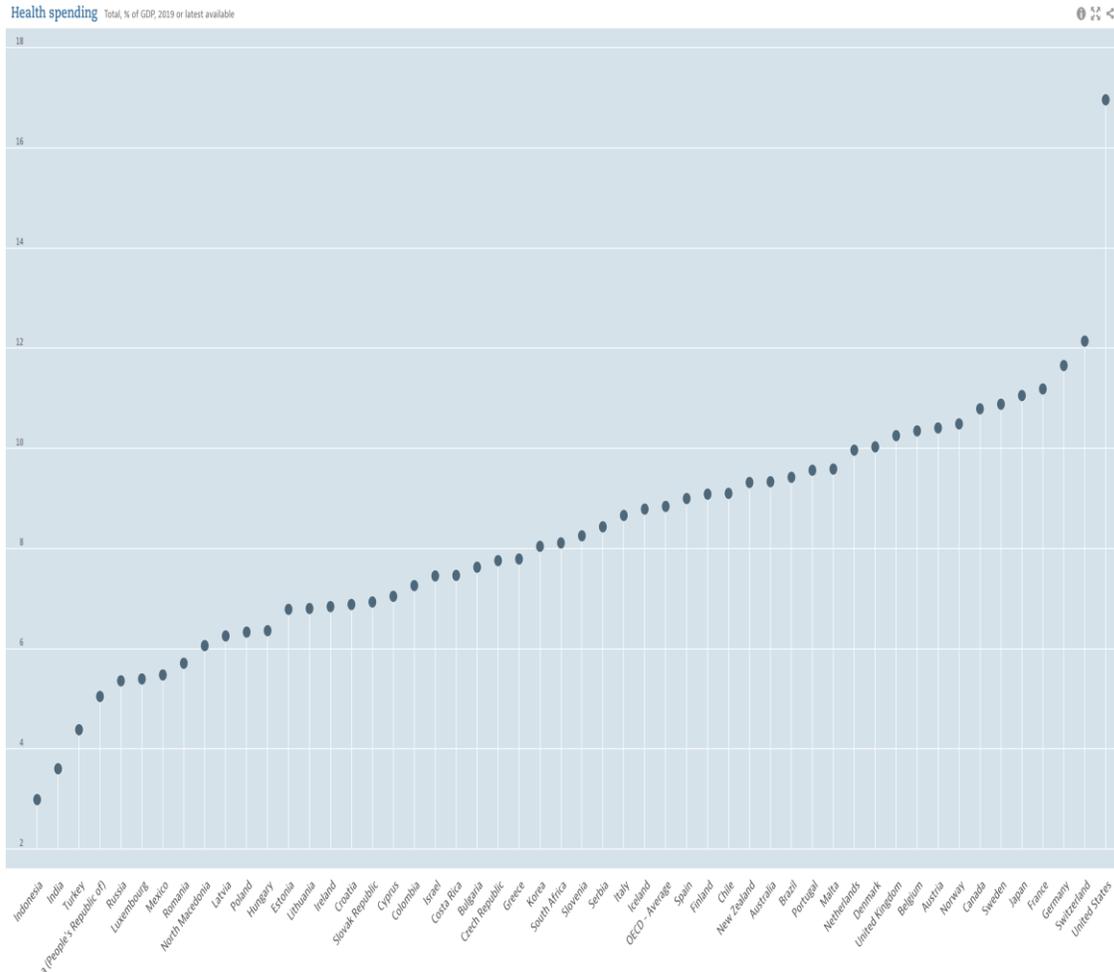
# Devices are getting smaller, more powerful and pervasive...

... generating more DATA

- Big Boxes
  - US, CT, MRI, LAB, Cardiology
- Small Boxes
  - 100x more in hospitals
  - A key to distributed care
    - Wearables and sensors
      - Remote monitoring
      - Remote diagnostics
      - Apps/Digital Therapeutics
    - Generate LOTS of data
- The global RPM market is expected to reach \$31.3 billion by the end of 2023, up from \$15.8 billion in 2017
- CAGR of 12%
- North America accounted for 35% of RPM market in 2016, and expected to dominate from 2016-2024

Cost: @10% of Global GDP (~\$8T)

## Workforce Shortages



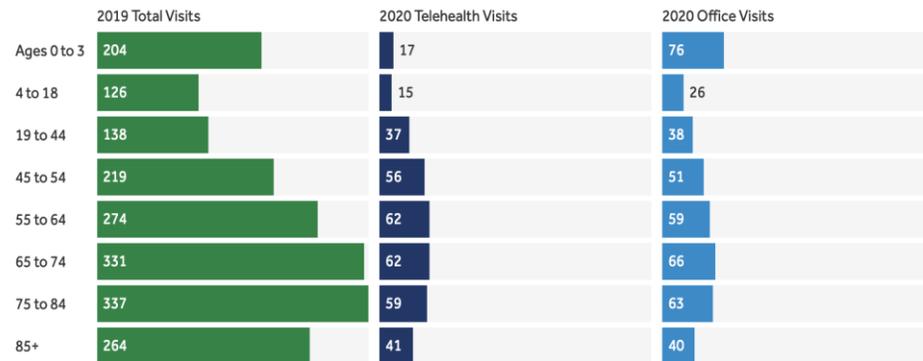
- Global shortage: 18M health professionals
- Upto **13M** of nurses will be needed to fill the global nurse shortage gap in the future
  - Existing deficits in nursing workforce plus retirement due to aging and burnout
  - 89% of these nurse shortages concentrated in LMIC
  - **76 countries** with less than 1 MD/1000
- **3 billion** people without access to a health professional

WHO, World Medical Association, ICN

# Covid-19 and Telehealth: A Tipping Point?

Telemedicine use increased sharply in the early weeks of the pandemic, but not enough to offset decreases in in-person office visits

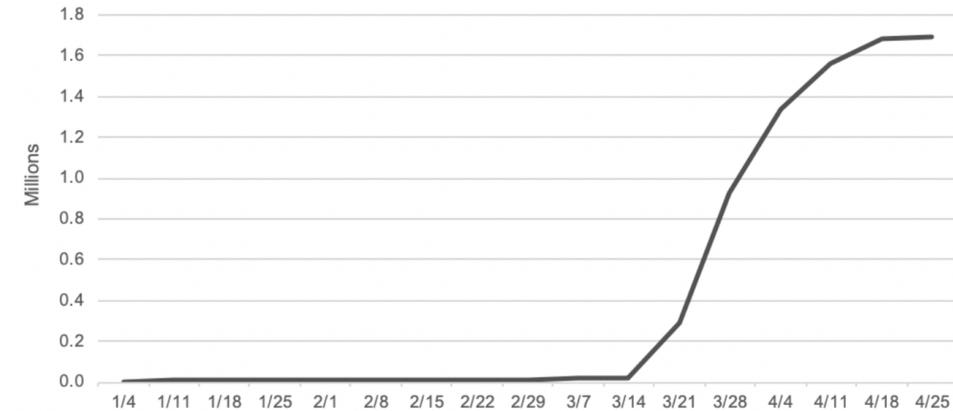
Visits per 1,000 patients from March 15 to April 14 in 2019 vs 2020, by patient age and type of visit



Source: Epic Health Research Network, "Expansion of Telehealth during COVID-19 Pandemic" • Get the data • PNG

Peterson-KFF  
Health System Tracker

Exhibit 1: Number of Medicare FFS beneficiaries receiving telemedicine per week



— Weekly Fee-for-Service Telemedicine Users

Source:

Internal CMS analysis of Medicare FFS claims data, March 17, 2020 through June 13, 2020 (using data processed through June 19, 2020) Notes: Telemedicine is defined to include services on the Medicare telehealth list including audio-only visits, as well as virtual check-ins and e-visits.

## 7 Telehealth Use Cases

### Provider-to-Provider Platforms

Use Case	Description	Timing	Video	Information transferred
1 eConsult	Templated communications, where primary care provider eConsults with specialist to share information and discuss patient care.	Asynchronous	No	Medical records and images
2 Virtual video consult	Distant specialist connects in real time to a provider/clinical setting to deliver a clinical service directly supporting the care of a patient (e.g., telestroke).	Synchronous	Yes	Medical records and images
3 eICU/TeleAcute	Remote covering clinicians use multiple modalities (video, monitor data) to follow a defined set of seriously ill patients.	Synchronous	Yes	Medical records, images and monitoring data

### Direct-to-Consumer Platforms

4 Second opinion	Patient-initiated electronic request for provider to give an opinion on a clinical case.	Asynchronous	No	Medical records and images
5 Remote-patient monitoring	Providers remotely monitor patients via connected/mHealth devices or PROs.	Synchronous	No	Monitoring data and patient-reported data
6 Video visit	Provider connects directly with patient via video to conduct equivalent of a visit.	Synchronous	Yes	None
7 eVisit	Provider connects with patient via email or secure messaging to provide clinical advice or support.	Asynchronous	No	Patient-reported data and images

Source: Manatt, 2019

<https://www.aha.org/>

## Specific Objectives Achieved by Telehealth

	Provider-to-Provider			Direct-to-Consumer				
	eConsult	Virtual consult	eICU	Second opinion	Remote monitor	Video visits	eVisits	
Objectives (illustrative)	Increase specialist access availability and capacity.	✓				✓	✓	
	Manage capacity and ambulatory space-use efficiency.	✓	✓			✓	✓	
	Improve patient/family experience and support consumerism strategies.				✓	✓	✓	✓
	Strengthen referrals and transitions of care between referring providers and long-term/post-acute care providers.	✓	✓					
	Improve central monitoring for early detection of decline, improved quality in ICU and other acute settings.			✓				
	Continue regional growth, extend brand and promote system-ness.	✓	✓					
	Enhance clinical relationships with partners and within specialty networks.	✓	✓	✓				
	Prepare for implementation/expansion of value-based payment models.	✓				✓	✓	✓

Source: Manatt, 2019

# National Emergency Tele-Critical Care Network project (NETCCN)

provides a user-friendly platform that supports rapid surges of critical-care capabilities “from anywhere to anywhere.”



Quinn, M. Army Telemedicine and Advanced Technology Research Center (TART)

Anywhere to anywhere tele-critical care support services for disaster environments

Solution set that provides specific mobile interfaces for patients, local caregivers and remote experts

Solution sets will be independent/agnostic from a specific electronic health record or proprietary systems

Delivering tele-critical care to Guam, Puerto Rico, Minnesota, North and South Dakota – at hospital, at home

Funded by US Army MRDC & and HHS ASPR

## The minimum capabilities of this system include:

1. Secure, mobile communications capabilities, including synchronous audio/video and asynchronous messaging
2. Capability for basic documentation in real-time as well as data collection and reporting.
3. A patient registration and cohorting system
4. A team organization and management tool including handoff features for change of shifts and transfers of care
5. Cloud-based information storage including ability for later offloading to EHRs, HIEs and other systems
6. HIPAA Compliant
7. Survey and Consent tools
8. A well-described clinical and staffing model that incorporates the technology in a simple, reliable manner for scaling during a disaster.

## **MISSION**

*Wings of Hope changes and saves lives through the power of aviation.*

## **VISION**

*We envision a world in which all people have access to the resources they need to create a better life.*



50+

Years serving humanity worldwide

160

Operations served since founding

48

Countries served since founding

2

Nobel Peace Prize Nominations

# Community Development Case Study

Patrulla Aérea Civil Colombiana



# We want to go even further

- Telehealth
- Remote Patient Monitoring
- Drone Program
- Data and Analytics
- Supply Chain and Logistics

# Key Trends in a Post Pandemic World

- Technology Architecture
- Digital Twins
- Empowerment
- Virtualization
- Sharing and Collaboration
- Dynamic, sustainable tech architecture
- Bring **data and intelligence** to scale
  - Model the physical world in digital format, risk free
- Innovating and problem solving from the front lines
- Tech democratization to augment skills gap
- Remote work capabilities, Telehealth and RPM, Robotic process automation
- Breakdown silos within and between organizations and partners

# Working together to leave healthcare better than we found it....





**Manish Kohli MD, FHIMSS, FAAFP**

[manish@beyondhorizonhealth.com](mailto:manish@beyondhorizonhealth.com)

[mkohli@albrightstonebridge.com](mailto:mkohli@albrightstonebridge.com)

**IFMBE CED 2021 CE Competency & Leadership Webinars:**

**Lessons learned & progress in practice for  
Clinical Engineers in the Time of COVID:**

**COVID19 Vaccines & Global Clinical Engineering**

**September 1, 2021**



**Yadin David, Interim President of Global Clinical Engineering Alliance, US**

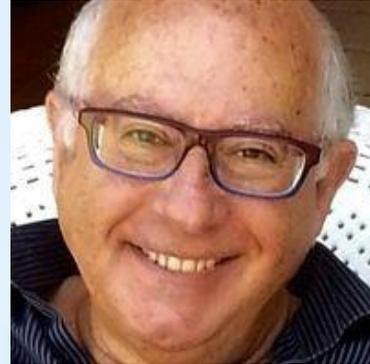
# Faculty



**Abigail:** *The road to building trust in COVID-19 vaccines:* IFPMA [vaccines confidence campaign](#)



**IFPMA:** *Partnered with IHF-International Hospital Federation* <https://www.ihf-fih.org/> for COVID-19 Response



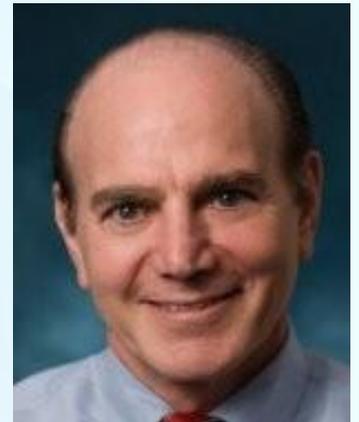
**Michael:** *COVID-19 Vaccine Production & Distribution in Israel*



**Nora Lucia:** *PAHO perspective: Vaccine Cold Chain Management & Distribution in Latin America & the Caribbean*



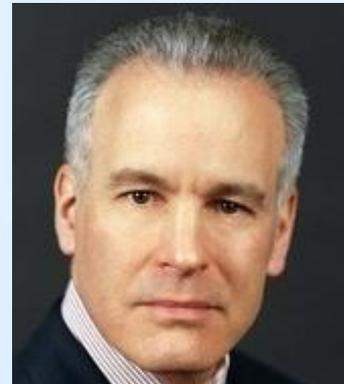
**Andrew:** *Clinicians, Engineers & Others Partnering Together*



**Yadin:** *How Can the Global CE Community Help?*



**Marcus & Jonathan:** *ECRI perspective: Vaccine Development & Distribution in the USA & Beyond*

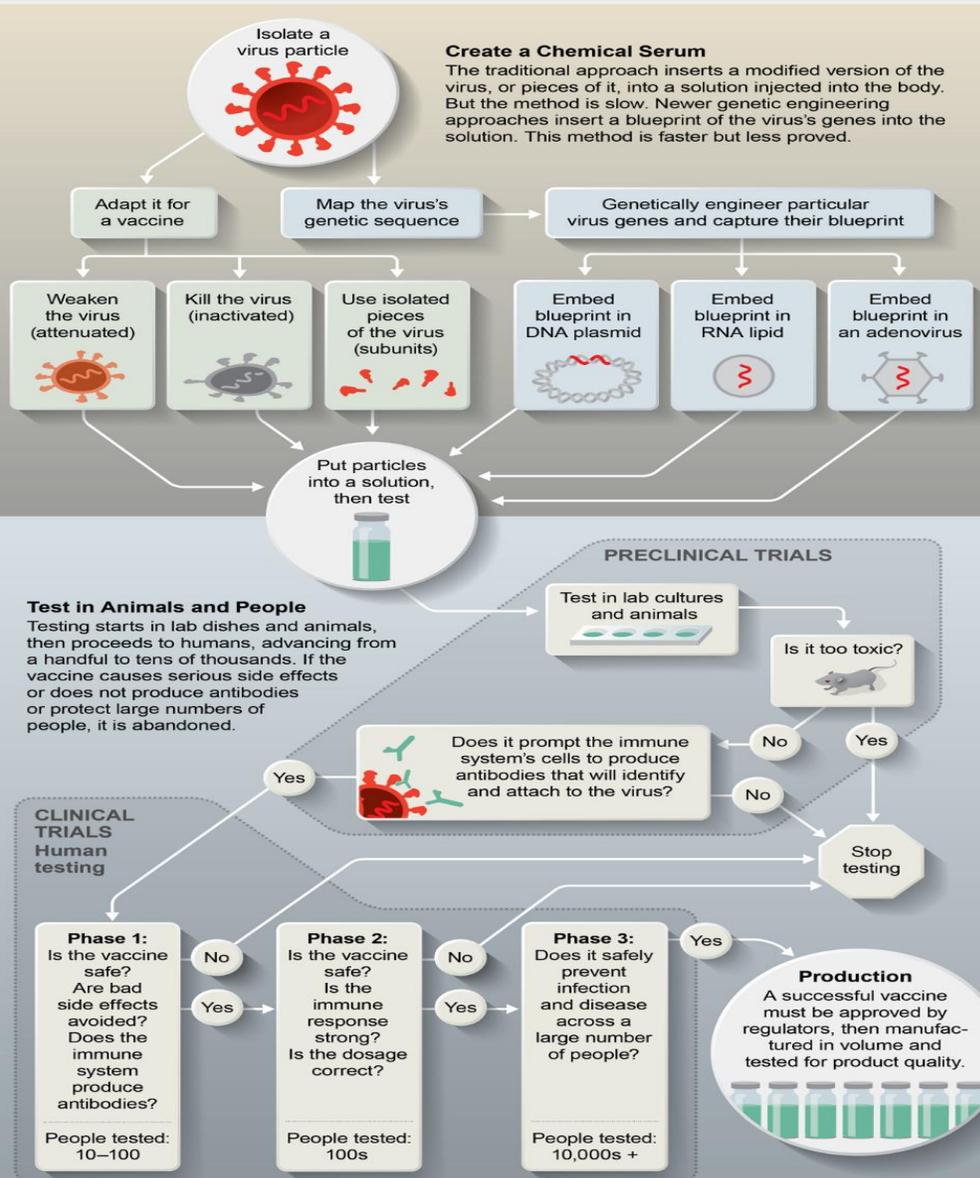


**Dan:** *Vaccine Regulation & Distribution in the UK*



# How to Develop a Virus Vaccine

A vaccine exposes the body to an altered, safe version of a disease-causing virus, prompting the immune system to produce antibodies—proteins that can stop the real pathogen from infecting cells. The immune system then remembers how to fight the invader. Scientists can use different methods to create a chemical vaccine formulation, which they then test for safety and efficacy.



## Graphics



[ifmbe.org/](http://ifmbe.org/)

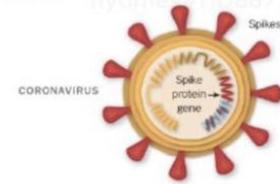
# How the Pfizer-BioNTech and Moderna Vaccines Work

By JONATHAN CORUM and CARL ZIMMER

The Food and Drug Administration has now authorized two vaccines for Covid-19, one made by Pfizer and BioNTech and the other by Moderna. The two vaccines have efficacy rates of 94 percent or more, and use the same strategy to train our immune systems to fight the coronavirus.

### A Piece of the Coronavirus

The coronavirus is studded with proteins that it uses to enter human cells. These so-called spike proteins make a tempting target for potential vaccines and treatments, and the Pfizer-BioNTech and Moderna vaccines are based on the virus's genetic instructions for building the spike protein.



### Messenger RNA Inside an Oily Shell

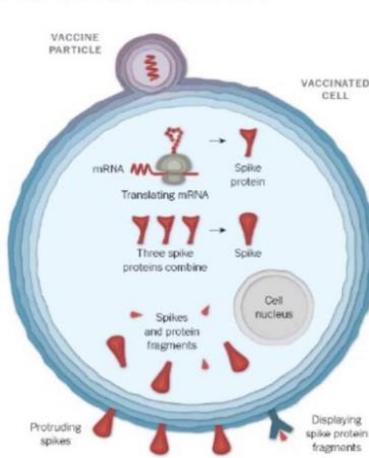
The two vaccines use messenger RNA, genetic material that our cells read to make proteins. The molecule — called mRNA for short — is fragile and would be chopped to pieces by our natural enzymes if it were injected directly into the body. To protect the mRNA, the vaccines wrap it in oily bubbles made of lipid nanoparticles.



Because of their fragility, the mRNA molecules would quickly fall apart at room temperature. Pfizer is building special containers with dry ice, thermal sensors and GPS trackers to ensure the vaccines can be transported at minus 94 degrees to stay viable. Moderna's vaccine will need to be refrigerated, and should be stable for up to six months when shipped and stored at minus 4 degrees.

### Entering a Cell

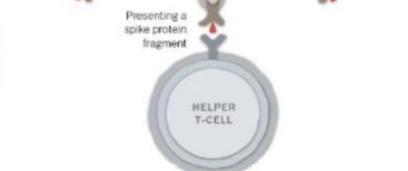
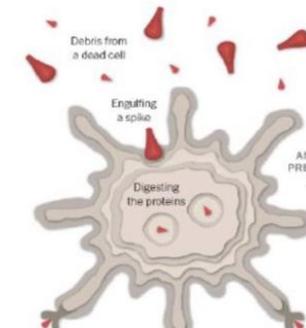
After injection, the vaccine particles bump into cells and fuse to them, releasing mRNA into the cell. The cell's molecules read its sequence and build spike proteins. The mRNA from the vaccine is eventually destroyed by the cell, leaving no permanent trace.



Some of the spike proteins form spikes that migrate to the surface of the cell and stick out their tips. The vaccinated cells also break up some of the proteins into fragments, which they present on their surface. These protruding spikes and spike protein fragments can then be recognized by the immune system.

### Spotting the Intruder

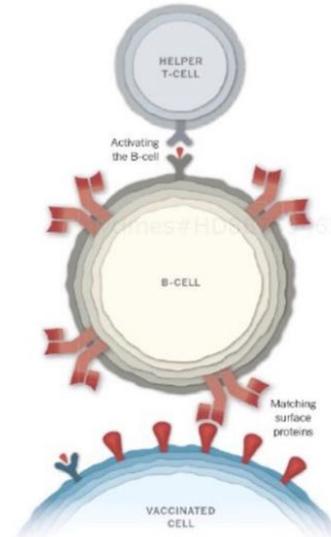
When a vaccinated cell dies, the debris contains many spike proteins and protein fragments, which can be taken up by a type of immune cell called an antigen-presenting cell.



The cell presents fragments of the spike protein on its surface. When other cells called helper T-cells detect these fragments, the helper T-cells can raise the alarm and help marshal other immune cells to fight the infection.

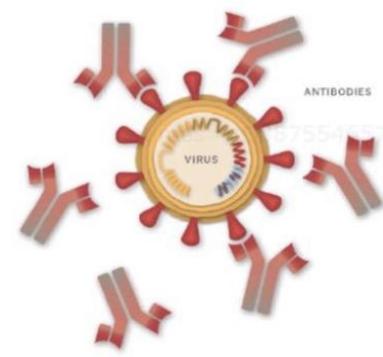
### Making Antibodies

Other immune cells called B-cells may bump into the spikes on the surface of vaccinated cells, or free-floating spike protein fragments. A few of the B-cells may be able to lock onto the spike proteins. If these B-cells are then activated by helper T-cells, they will start to proliferate and pour out antibodies that target the spike protein.



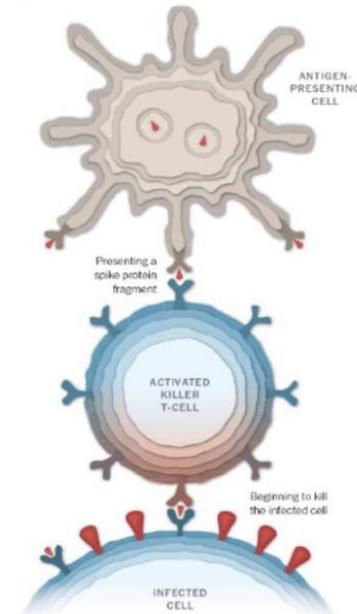
### Stopping the Virus

The antibodies can latch onto coronavirus spikes, mark the virus for destruction and prevent infection by blocking the spikes from attaching to other cells.



### Killing Infected Cells

The antigen-presenting cells can also activate another type of immune cell called a killer T-cell to seek out and destroy any coronavirus-infected cells that display the spike protein fragments on their surfaces.



### Remembering the Virus

The Pfizer-BioNTech vaccine requires two injections, given 21 days apart, to prime the immune system well enough to fight off the coronavirus. Moderna's vaccine also requires two injections, spaced 28 days apart. But because the vaccines are so new, researchers don't know how long their protection might last.

It's possible that in the months after vaccination, the number of antibodies and killer T-cells will drop. But the immune system also contains special cells called memory B-cells and memory T-cells that might retain information about the coronavirus for years or even decades.

# COVID-19 confidence

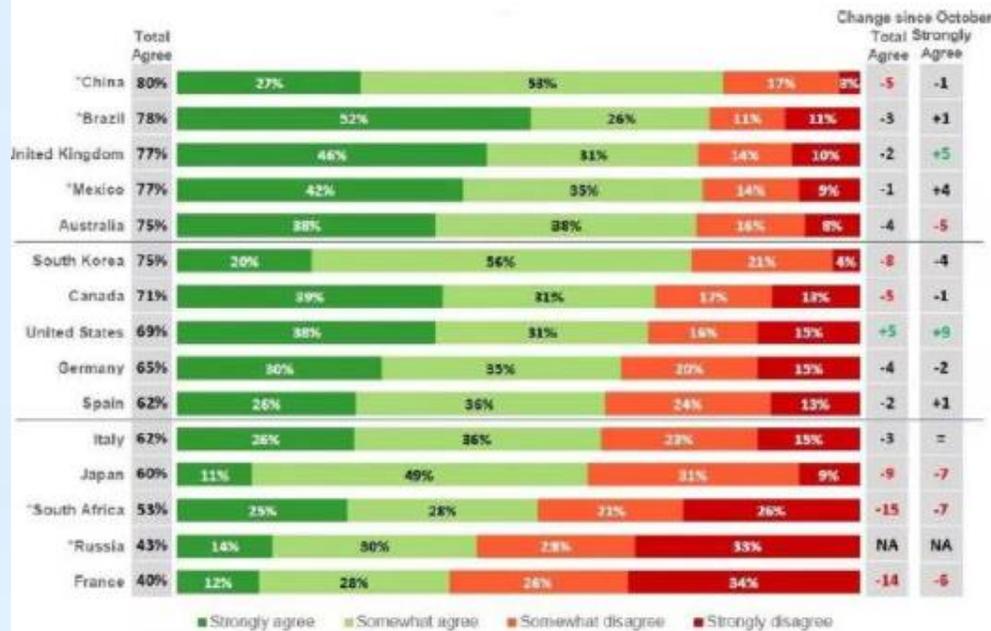


Image: World Economic Forum-IPSOS

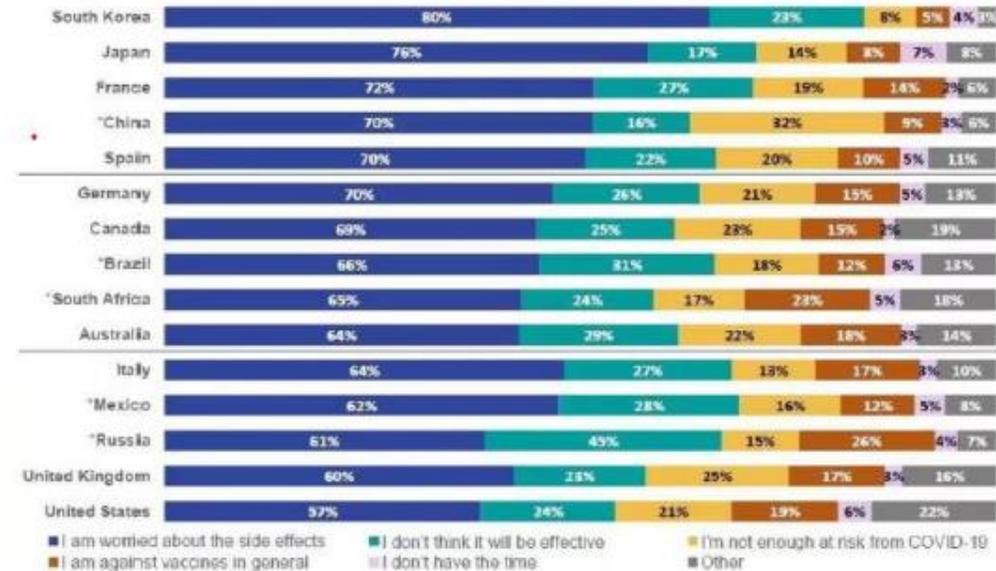


Image: World Economic Forum-IPSOS

1. **Genetic Engineering Could Make a COVID-19 Vaccine in Months Rather Than Years:** <https://www.scientificamerican.com/article/genetic-engineering-could-make-a-covid-19-vaccine-in-months-rather-than-years1/>
2. **The race for coronavirus vaccines: a graphical guide:** <https://www.nature.com/articles/d41586-020-01221-y>
3. **COVID-19 vaccine trial ethics once we have efficacious vaccines:** <https://science.sciencemag.org/content/370/6522/1277>
4. **A Nanomaterial Path Forward for COVID-19 Vaccine Development:** <https://ucsdnews.ucsd.edu/pressrelease/a-nanomaterial-path-forward-for-covid-19-vaccine-development>
5. **COVID-19 vaccine development and a potential nanomaterial path forward:** <https://www.nature.com/articles/s41565-020-0737-y>
6. **COVID-19 Vaccine Frontrunners and Their Nanotechnology Design:** <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7553041/>
7. **ECRI COVID19 Resource Center:** <https://www.ecri.org/coronavirus-covid-19-outbreak-preparedness-center/>
8. **ECRI Program December 16: COVID-19 Vaccine Distribution & Administration—Is Your Health System Prepared? Recording:** <https://www.ecri.org/video-covid-19-vaccine-distribution-and-administration?submissionGuid=be8caf64-6fc0-4aab-8c1d-247c2d1ffdcdb>; **Overview:** <https://www.ecri.org/landing-webcast-covid-19-vaccine-distribution-and-administration>
9. **ECRI Dry Ice for Storing Vaccines: How to Handle It Safely Hazard Report, December 9, 2020** [https://d84vr99712pyz.cloudfront.net/p/pdf/covid-19-resource-center/covid-19-clinical-care/covid-resource\\_dry-ice-safe-handling\\_alert.pdf](https://d84vr99712pyz.cloudfront.net/p/pdf/covid-19-resource-center/covid-19-clinical-care/covid-resource_dry-ice-safe-handling_alert.pdf)
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11. **The COVID-19 Vaccine Resource Page:** <https://www.onesourcedocs.com/covid-19-vaccine/>
12. **NEJM: (1) Dance of the Porcupines: A View into the Rapid Development of Covid-19 Vaccines from Around the World - Part 1, (2) Part 2; and (3) A Marathon, Not a Sprint: Covid-19 Vaccine Rollout in the UK:** [https://catalyst.nejm.org/doi/full/10.1056/CAT.21.0010?query=CON&cid=DM107557\\_Catalyst\\_Subscriber&bid=348615610](https://catalyst.nejm.org/doi/full/10.1056/CAT.21.0010?query=CON&cid=DM107557_Catalyst_Subscriber&bid=348615610)



<https://ced.ifmbe.org/>

## IFMBE Clinical Engineering Division (CED)



Together ...

# Thank you!



... We Can Make It Better ... Everywhere

## IFMBE CED 2021 CE Competency & Leadership Webinars:

Lessons learned & changes in practice for Clinical Engineers in the Time of COVID:

# Covid-19 Vaccination in Latin America

September 1, 2021

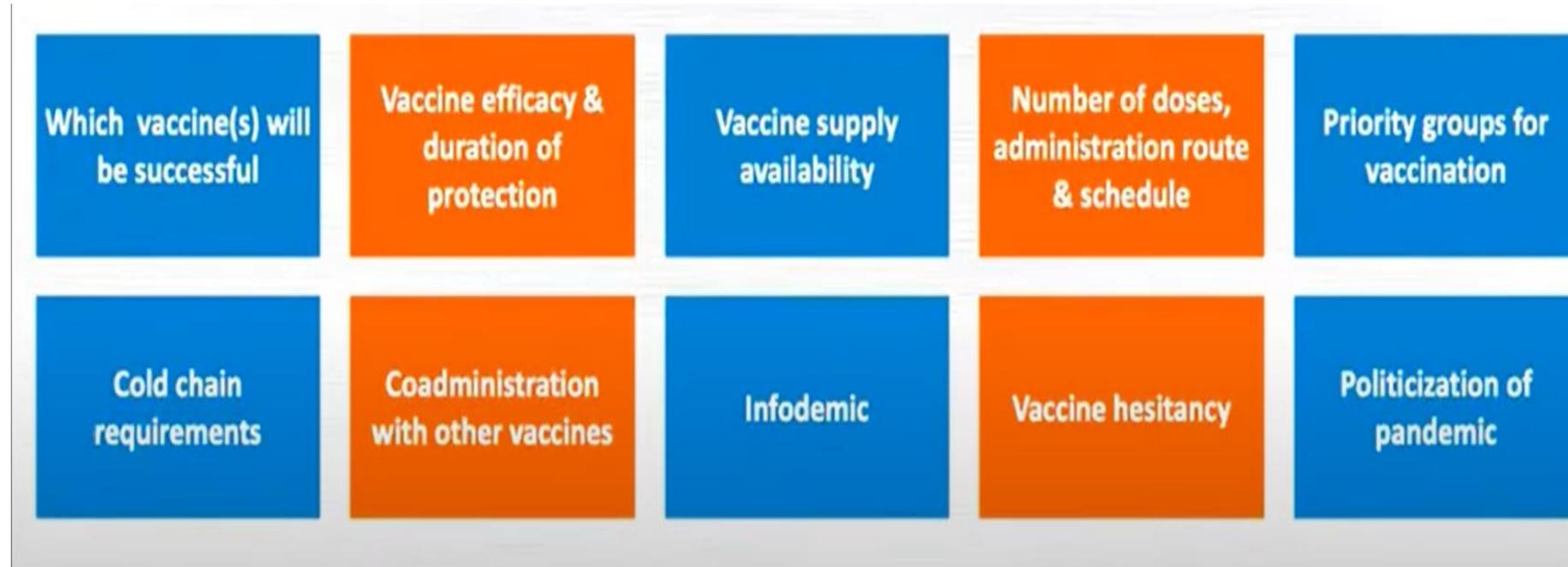


Rossana Rivas, PhD Candidate; Consultant, WHO Collaborating Center for Health Technology Management in US

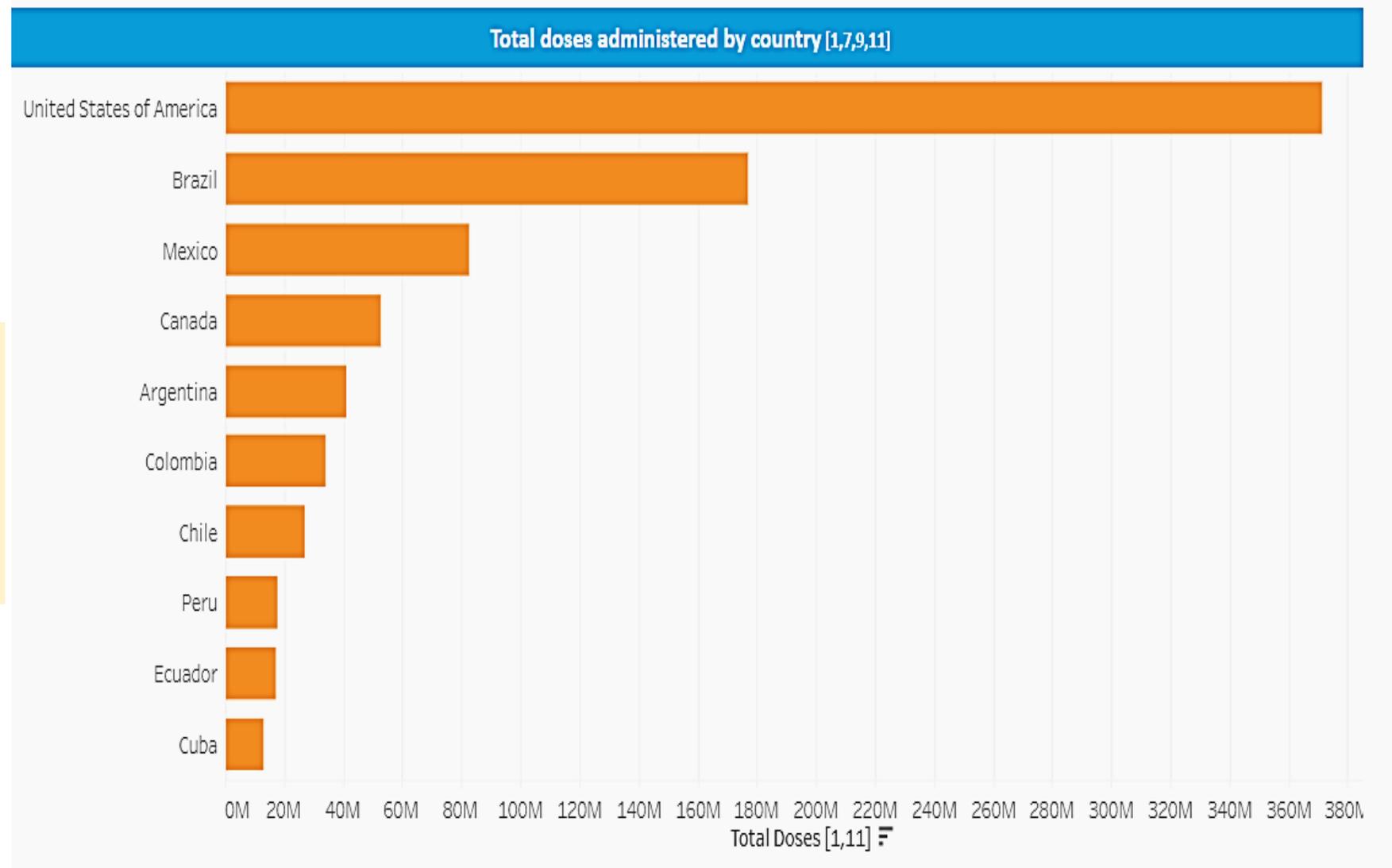
# Covid-19 Vaccination's Planning

Successful deliver of a Vaccination Programme depends among other issues on:

- Government decisions and actions in vaccine Procurement, Distribution, Prioritisation and Management.
- Capacity and Effectiveness of Regulatory agencies.



# COVID-19 Vaccination in the Americas (1)

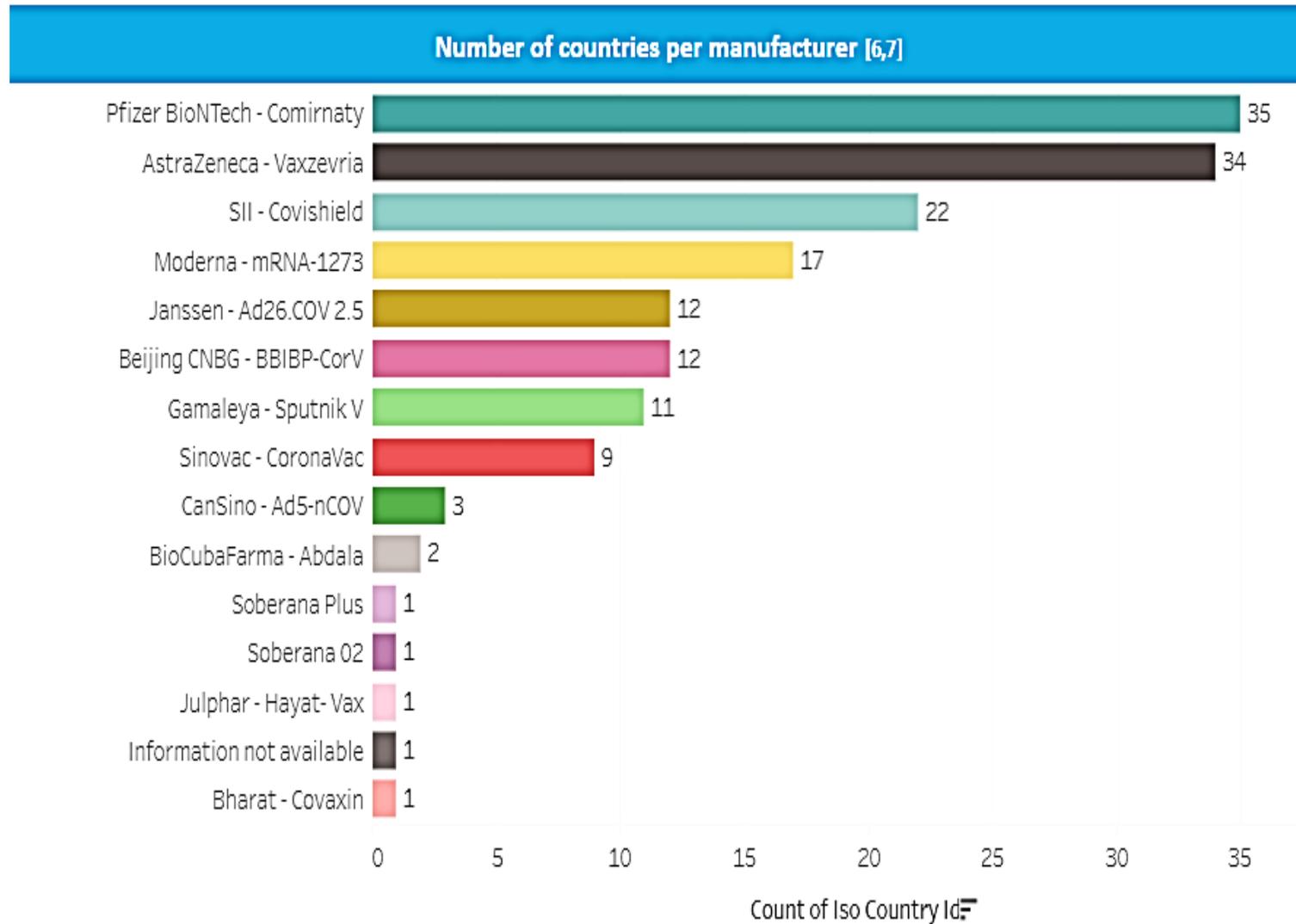


- Low percentage of the total population in LAC has been fully vaccinated. (PAHO/WHO)

Reference: [COVID-19 vaccine doses administered in the Americas \(paho.org\)](https://paho.org)

# COVID-19 Vaccination in the Americas (2)

- Some negative factors which determine vaccination program's low effectiveness are: difficult access to public quality health services and lack of good governance. (OECD)



Reference: [COVID-19 vaccine doses administered in the Americas \(paho.org\)](https://paho.org)

# References

- Updated WHO Strategic Advisory Group of Experts-SAGE Roadmap for prioritizing uses of COVID-19 vaccines in the context of limited supply [Updated WHO SAGE Roadmap for prioritizing uses of COVID-19 vaccines in the context of limited supply](#)
- COVID-19 Vaccine Introduction Toolkit [COVID-19 vaccine introduction toolkit \(who.int\)](#)
- COVAX-Working for global equitable access to COVID-19 vaccines <https://www.who.int/initiatives/act-accelerator/covax>
- Cold Chain – PAHO/WHO Resource Center [Cold Chain - PAHO/WHO | Pan American Health Organization](#)
- WHO Immunization Supply Chain & Logistics [Essential Programme on Immunization \(who.int\)](#)
- Guidance on developing a national deployment and vaccination plan for COVID-19 vaccines [Guidance on developing a national deployment and vaccination plan for COVID-19 vaccines \(who.int\)](#)
- Guidance for Implementing the Regional COVID-19 Vaccine AEFI/AESI Surveillance System [Guidance for Implementing the Regional COVID-19 Vaccine AEFI/AESI Surveillance System \(paho.org\)](#)

# *Together, we can make it better!*

*Cold Chain requirements, Vaccine Supply availability, Regulation, Management of Information and Evidence based Communication are some topics related to Clinical Engineer's capacities.*

## *Thanks*

Rossana Rivas, PhD Candidate; Consultant, WHO Collaborating Center for Health Technology Management in US  
<https://www.linkedin.com/in/rossana-rivas-tarazona-a936aa3/>

**IFMBE CED 2021 CE Competency & Leadership Webinars:**  
**Lessons learned & changes in practice for Clinical**  
**Engineers in the Time of COVID:**  
Reviewing CED-WHO webinar findings over the past 18 months

**September 1, 2021**

**Kun Zheng (Alan) CCE, Senior CE, Children's Hospital of ZMU, General Secretary of CSCE**



# Clinical engineering's role

## HTM Innovation in the time of COVID - Draft IFMBE CED February 2021 Webinars

	11:00 am - 12:40 pm, New York time on <b>Wed 24 Feb</b>		11:00 am - 12:50 pm, New York time on <b>Thu 25 Feb</b>
11am Intro..	<b>Dan Clark</b> , UK (EURO) & <b>Shauna Mullally</b> , Canada (AMRO) Speakers from all 6 WHO Regions:	11am Intro	Moderators: <b>Jim Wear</b> , USA & <b>Riad Farah</b> , Lebanon
11:05+	1. <b>Asset Management</b>	11:05+	1. <b>Personnel: Training, Recruitment &amp; Staffing</b>
	A. Start-up of a national approach (conducted a national WHO Biomedical Equipment Survey for WHO for COVID19 related equipment) <b>Tazeen Bukhari</b> , MOH Pakistan (EMRO), January 2021 MOH report attached (10 min)		A. Regional LA&C CE-HTM training, <b>Tobey Clark</b> , University of Vermont, USA, AMRO, WHO CE-HTM Collaborating Center Director, <a href="https://www.linkedin.com/in/tobey-clark-b8735711/">https://www.linkedin.com/in/tobey-clark-b8735711/</a> (10 min)
11:15+	B. Expansion of national collaboration of public hospitals across Mexico, <b>Roberto Ayala</b> , MOH Mexico, AMRO Interim Director General of CENETEC, <a href="https://www.gob.mx/salud/%7Ccenetec/estructuras/ing-roberto-ayala-perdomo">https://www.gob.mx/salud/%7Ccenetec/estructuras/ing-roberto-ayala-perdomo</a> , and <a href="https://www.gob.mx/salud/cenetec">https://www.gob.mx/salud/cenetec</a> (10 min)	11:15+	B. National CE-HTM Recruitment & Staffing, <b>Dr. Jitendar Sharma</b> , India, SEARO, AMTZ CEO and Managing Director, <a href="https://www.expresshealthcare.in/news/who-global-forum-on-medical-devices-held-in-vizag/407829/">https://www.expresshealthcare.in/news/who-global-forum-on-medical-devices-held-in-vizag/407829/</a> (10 min)
11:25+	C. Q&A - (10 min)	11:25+	C. Provincial CE-HTM Recruitment & Staffing, <b>Mladen Poluta</b> , South Africa, AFRO, Director, Health Technology, Western Cape Dept. of Health <a href="https://www.linkedin.com/in/mladen-poluta-b4b28613/">https://www.linkedin.com/in/mladen-poluta-b4b28613/</a> (10 min)
11:35+	2. <b>Parts &amp; Manuals</b>	11:35+	D. Q&A - 5 min
	A. A Regional approach, <b>Li Bin</b> , MOH China (WPRO) Medical Equipment Management Quality Control Center (MDMQCC) affiliated to Shanghai 6th People's Hospital was set up by the Shanghai Ministry of Health in 2005. Professor Li Bin, director of the clinical engineering department of Shanghai 6th People's Hospital, serves as chief of MDMQCC; responsible for supervising medical device management for Shanghai's 120 top hospitals - (10 min)	11:40+	2. <b>Regulatory Impact</b>
11:45+	B. A national pilot, <b>Ray Dalton</b> , CEO ReLink Global Health, USA-Haiti (AMRO); <a href="https://www.relinkglobalhealth.org/leadership-team/">https://www.relinkglobalhealth.org/leadership-team/</a> , has created a nation-wide directory of healthcare providers and resources; conducting a regional pilot of providing appropriate equipment and sustainability support systems in North Haiti. (10 min).	11:50+	A. Regional & National Impacts, <b>Stefano Bergamasco</b> , Italy, EURO, WHO Health Technology Advisor, Owner & Director, Medtech Projects <a href="https://www.linkedin.com/in/stefanobergamasco/">https://www.linkedin.com/in/stefanobergamasco/</a> (10 min)
11:55+	C. Q&A - 10 min	12:05+	B. Q&A - 5 min
12:05	3. <b>Panel: Strategic Disaster Planning:</b> <b>Shauna Mullally</b> , <b>Ray Dalton</b> , <b>Fred Hosea</b> , <b>Yadin David</b> , <b>Tobey Clark</b> , <b>Rossana Rivas</b> , <b>Li Bin</b> , <b>Zheng Kun</b> & speakers (30 min)	12:15+	3. <b>Teamwork</b>
12:40+		12:20	A. CEs working in difficult times, <b>Jennifer DeFrancesco</b> (10 min)
		12:50+	B. CEs collaborating with key stakeholders, <b>Manish Kohli, MD</b> Both USA, AMRO (10 min).
			c. Q&A - 5 min
			4. <b>Panel: Leadership in a time of crisis:</b> <b>Elliot Sloane</b> , <b>Mario Casteneda</b> , <b>Adriana Velazquez</b> , <b>Jennifer DeFrancesco</b> , <b>Manish Kohli</b> , <b>Nancy Pressly</b> & speakers (30 min)

**Strategic Disaster Planning/asset management and PPE allocation**

**Leadership in a time of crisis/training, teamwork, regulatory impact**

**Lessons learned:** in addition to skillset, mindset training /online learning/asset online management/telemedicine(digital health)/CE innovations

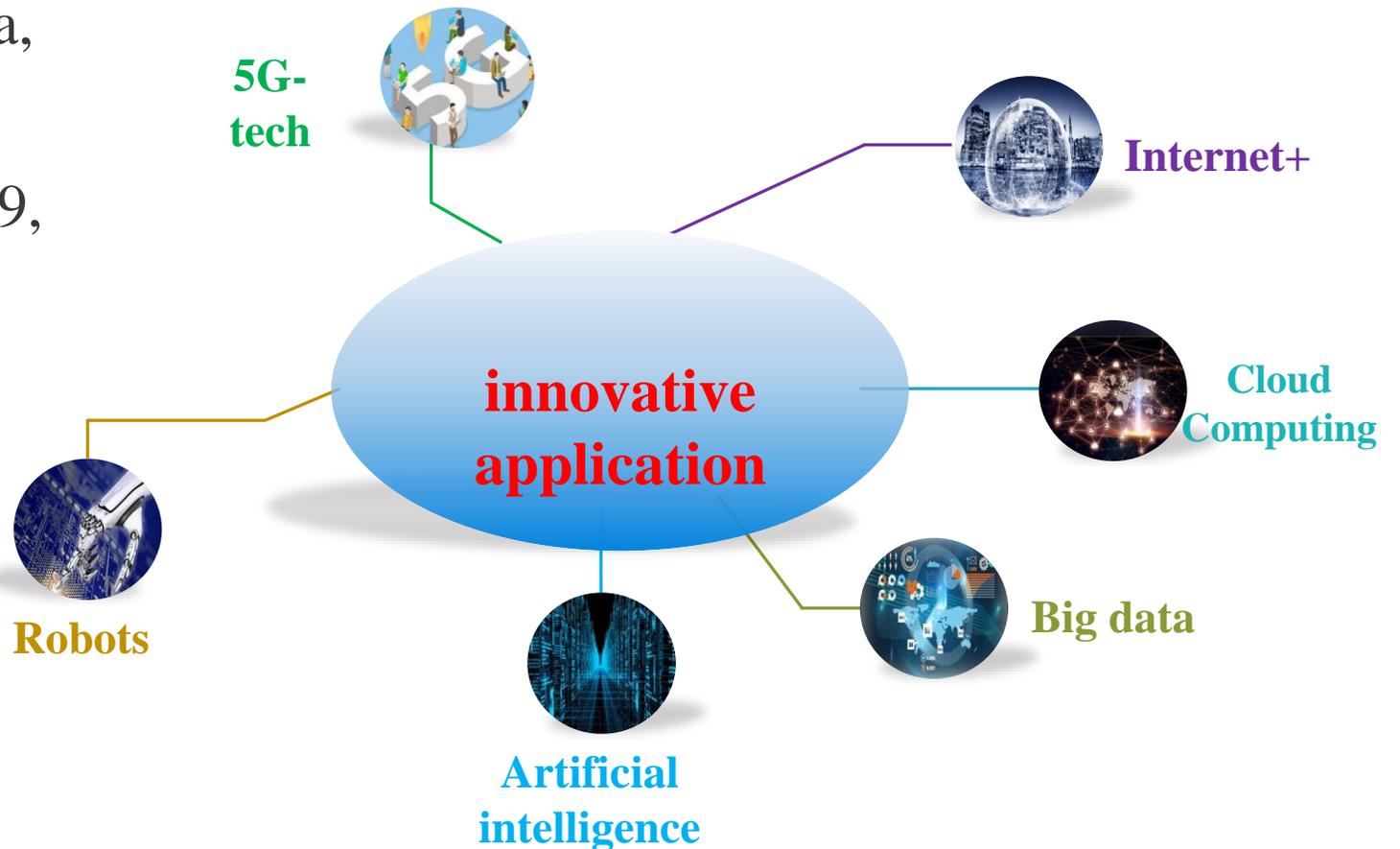
## **changed CE practices** the CSCE Top 10 Progress Events in Clinical engineering in China in 2020 report

- **CE's role fighting COVID and other emergencies: relevant equipment and PPE allocation and testing, protocols, norms and books...**
- **CE's innovation**
- **CE's leading role played in hospital based medical device HTA: participation and contribution to the region-wide evaluation and demonstration of digital diagnosis and treatment equipment etc**
- **Construction of HTM platform based on ICT and IoT**
- **Shifting to closer teamwork with broader circle: information technology department(CEIT), facility engineering, infection control, ...along with all stakeholders. NOT only combating the COVID, but also cyber security, incorporating medical devices into information systems...**
- **Online learning and education...**

# Participating innovative applications combating COVID

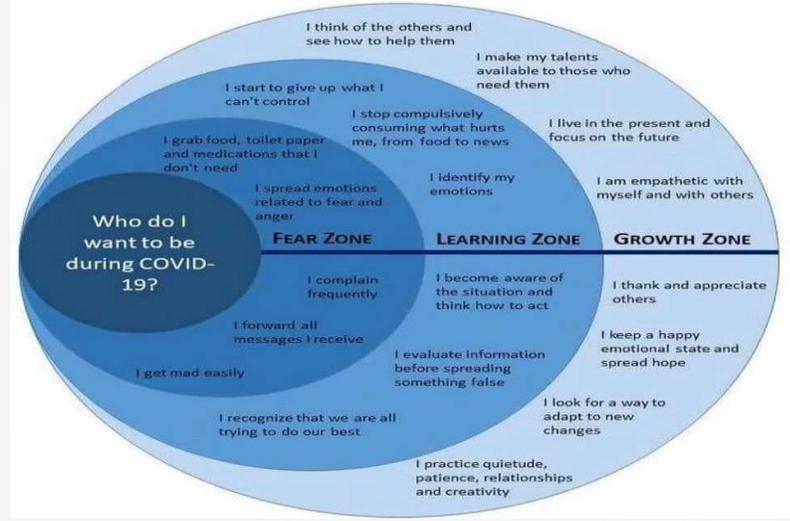
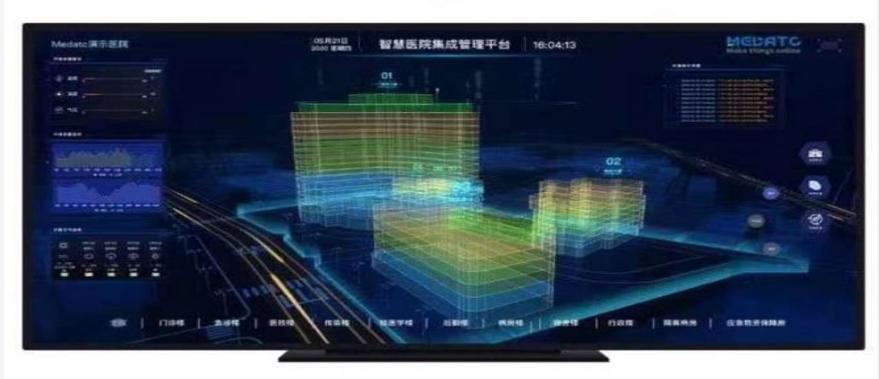
- Artificial intelligence, big data, 5G-tech and robots are playing vital roles in fighting COVID-19, with a variety of innovative applications.

Great changes will take place in the future!



# HTM/CE innovation in the time of COVID

HTM platform based on ICT and IoT, Digital Twins, Telehealth, CE online learning...



Together, we can make it better!  
Together, we are making it better!

THANK YOU

Kun Zheng  
Director, Logistic Service,  
Children' s Hospital Zhejiang University School of Medicine  
Phone : 1-86-571-86670191  
Email: zhengkun@zju.edu.cn

**IFMBE CED 2021 CE Competency & Leadership Webinars:**

**Lessons learned & changes in practice for  
Clinical Engineers in the Time of COVID:**

**Women in Clinical Engineering - United States**

**September 1, 2021**



**Carla E. Gallegos, Co-Founder Healiom, SRx Health / Advisor DocBox, R-Zero Healthcare**

# The Rising Value of Clinical Engineering Leadership, Sponsorship, and Participation

## 'A time for Professional Transformation'

*"The biggest challenge has been getting people to realize that technology can facilitate your care."*

- New Alliances
- The 'new Virtual' experience
- Digital Agility
- Digital Diagnostics and Remote Patient Monitoring
- AI and IoT
- Quality Improvement
- Sourcing relevant equipment and PPE
- Contactless Commerce
- Covid Infection control
- Cyber security
- Incorporating medical devices and Lab Tests into Telehealth
- Innovation, applications, RTLS, Digital Twin combating COVID
- Clinical Trials and Specialty Pharma
- Start Ups and Venture Capital

# Thank You for Your Leadership, Comittment & Partnership!

Carla Gallegos

[carlaelainegallegos@gmail.com](mailto:carlaelainegallegos@gmail.com)

Mobile or Txt: 707.364.6743

IFMBE CED 2021 CE Competency & Leadership Webinars:

# Lessons Learned and Adjustments in Clinical Engineering Practices as a Result From Covid-19

September 1, 2021



**Jennifer DeFrancesco, DHA, MS, FACHE, CHTM**, Associate Medical Center Director, Dayton VAMC, Dayton, OH, USA;  
IFMBE-CED Collaborator

*The views expressed in this presentation are those of the authors and do not necessarily reflect the position or policy of the Department of Veterans Affairs or the United States government.*

# Skills Needed in Difficult Times

- Ingenuity
- Foresight
- Resilience
- “Get-it-doneness”
- Growth Mindset

# What Hospital Administrators Need From CE

- Not the same old song and dance
- Proactive problem solving
- Understand emerging trends
- High Reliability Organization
- Step up to the plate

# Call to Action

- Connect with your C suite
- Inform yourself
- Sit at the table
- Speak up





# Faculty panel and Q&A from participants

Collected from **Chat** and **Q&A** Functions on Zoom during the presentation



IFMBE Clinical Engineering Division (CED)

<https://ced.ifmbe.org/>

# Thank you!

**Together ...**



**We Can Make It Better ... Everywhere!**