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Cover Story

Pandemic Prevention Strategies

Editorial

Alexandre Lourenço
Editor-in-Chief EXEC |
HealthManagement.org
President Portuguese Association of Hospital Managers
Coimbra, Portugal
al@healthmanagement.org

Pandemic Prevention Strategies

The COVID-19 pandemic has exposed numerous vulnerabilities in global health systems. The existing facilities have been insufficient, and much of non-COVID-19 care has been suspended. The infrastructure and supply chains have proven to be easily disrupted. The public health efforts led by local, national and international agencies have received a lot of criticism. After the initial shock of global lockdowns, the public is now gradually recovering and is now demanding answers and guarantees from those at the top. With the second wave already emerging in some regions and the global North approaching the winter (i.e. flu) season, do we have those answers? Are we ready to withstand new challenges that we are likely to face based on the knowledge and experience gained so far?

In this issue, we talk about the lessons learned from COVID-19, analyse various public health strategies for the 'new normal,' such as immunity passports and the use of digital technologies, and look for solutions that would enable us to better handle future infectious disease outbreaks.

A group of researchers led by Prof. Amir Khorram-Manesh provide the Swedish perspective on the COVID-19 management. Fons Rademakers describes how the BioDynaMo model, developed at CERN, is used to study COVID-19 spread in closed spaces. Prof. Simona Agger Ganassi focusses on the post-pandemic 'new normal' while Prof. Stefan Heinemann explores the ethical issues behind the potential introduction of COVID-19 immunity passports.

Rafael Vidal-Perez reflects on the role of telecardiology as seen through the lens of the pandemic, and Prof. Florencio Travieso stresses the importance of data intelligence in predicting future outbreaks. JJ Coughlan and Corman Mullins look into how the changes in communication during the pandemic have led to the rise of the virtual clinic and Lloyd Humphreys analyses the ways digital technologies can be used for mental health care.

In the Management Matters section, experts provide their perspective on the current and future developments in healthcare. Prof. Derek Alderson talks about the rapid changes in the world of surgery and the need to adapt to these changes. Peter Kapitein weighs the matters of risk, cost, benefit and trust within the healthcare 'check and balances' system. Héctor González-Jiménez shares his opinion on how COVID-19 is impacting the role of robotics in healthcare, while Donna Prosser summarises the lessons in patient safety we have learnt during the pandemic.

We hope you will enjoy this issue and will gain inspiration from it. As always, your feedback is welcome.

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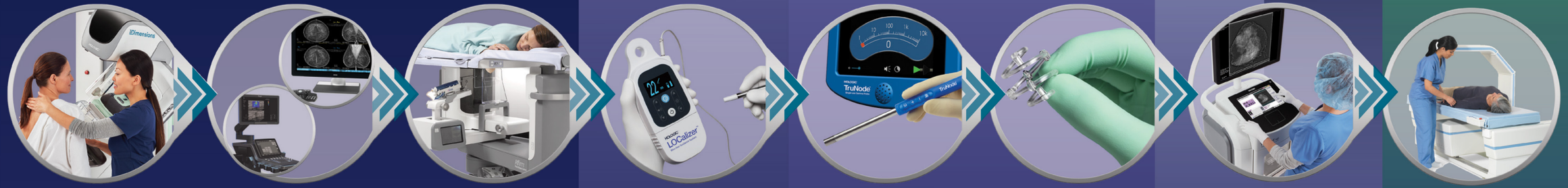

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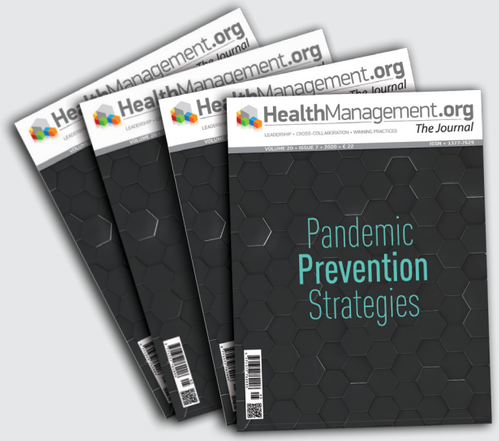

The COVID-19 pandemic has served as a strong reminder as to how global healthcare systems can become vulnerable to new threats to human health. In this issue, we talk about the strategies used to manage the pandemic, lessons learned from COVID-19 and what we can do to prevent future infectious disease outbreaks and identify solutions and strategies that would enable us to better handle future threats.

To contribute, contact us on **Interested@HealthManagement.org**

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Contributors

Prof. Derek Alderson, UK
With his main clinical interest in oesophago-gastric cancer surgery, Prof Alderson is Emeritus Professor of Surgery at the University of Birmingham. He held leadership positions at a number of organisations (including the RCS), was Editor-in-Chief of BJS and now heads BJS Open.

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Emilia de Alonso, Hologic
Emilia is a chemical and mechanical engineer and holds an MBA (IESE Business School). She held commercial leading positions with various medical device companies. Passionate about women´s health, Emilia joined Hologic Iberia leading the Breast & Skeletal Health commercial division.

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Dr Niclas Arvidson, Sweden
Dr. Arvidson is a medical officer for communicable diseases, Centre for Defence Medicine, Swedish Armed Forces, and Senior Physician Infectious Diseases Specialist, Department of Infectious Diseases at Institute of Biomedicine, Sahlgrenska Academy, Gothenburg University.

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Marco Belardinelli, ASG Conductors
Marco is Business Unit Director of the MRI Division at ASG Conductors, with a special focus on the technology and market development of the MROpen Evo, the "best MRI experience" system based on unique superconducting technology and other innovative applications.

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Dr JJ Coughlan, Germany
JJ Coughlan is a medical doctor, specialising in cardiology. He currently works at German Heart Centre, Munich.

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Bob Craske, Agfa HealthCare
Bob Craske has been in Healthcare on the consumer front since 1976 in roles ranging from radiography, clinical instructor, Radiology and IT department management and PACS administrator. He has also held a series of progressive regional and global roles focusing on product management, application and marketing.

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Prof. Arch. Simona Agger Ganassi, Italy
Prof. Ganassi has over 12 years of experience as member of the Ministry of Health Evaluation of Health Investments Team. Other areas of expertise include strategic planning, hospitals and energy, health urbanism and public procurement of innovation for the health sector.

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Dr Héctor González-Jiménez, Spain
Currently Associate Professor in Marketing (ESCP Business School, Madrid), Héctor worked in marketing, education and corporate strategy at various organisations and companies. His works now spans areas such as consumer behaviour and human-robot interactions.

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Prof. Stefan Heinemann, Germany
With his work focussed on ethics and business of digital medicine and AI, Prof. Heinemann is a professor of Business Ethics (FOM), spokesman of the Ethics Ellipse Smart Hospital (UH Essen) and part of multiple professional and educational organisations in the healthcare sector.

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Dr Lloyd Humphreys, UK
Dr Lloyd Humphreys is a clinical psychologist, NHS Innovation Accelerator alumnus and Head of Europe at SilverCloud Health, the leading digital mental and behavioural health platform.

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Peter Kapitein, The Netherlands
As a patient advocate, Peter connects patients, researchers and clinicians in the fight against cancer, to get cancer under control and have patients and their loved ones a good quality of life.

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Alexandre Lourenço, Portugal
Hospital Administrator at Coimbra University and Hospital Centre and a consultant for WHO, Alexandre is President of the Portuguese Association of Hospital Managers and holds various positions in EAHM, EHMA and a number of healthcare organisations around the world.

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Prof. Amir Khorram-Manesh, Sweden
Prof. Khorram-Manesh is Research Advisor Swedish Armed Forces, Senior University Lecturer in Surgery/Disaster Medicine, Institute of Clinical Sciences, and Executive board member of GEMREG (Gothenburg Emergency Medicine Research Group) Sahlgrenska Academy, Gothenburg University.

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Dr Cormac Mullins, Ireland
Corman Mullins is a final year specialist registrar in anaesthesiology at St. James's Hospital Dublin. He has a Master's qualification in Health Services Management from Trinity College Dublin and has expertise in change management, strategy and leadership within the healthcare setting.

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Dr Donna Prosser, USA
Having been in the healthcare industry for 30+ years, Dr Prosser is currently Chief Clinical Officer at PSMF. Prior to joining PSMF, she worked as a healthcare consultant, and held administrative, education and clinical positions with several health systems.

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Dr Fons Rademakers, Switzerland
Since 1991, Fons has been working at CERN. For 20 years, he worked on the development of the ROOT data analysis system now used to store, process and analyse all particle physics data in the world. Since 2014 he works for CERN openlab currently leading the BioDynaMo development.

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Dr Yohan Robinson, Sweden
Dr Robinson is the Medical Research Director, Swedish Armed Forces, and Head of Centre for Research on Disaster Medicine, Institute of Clinical Sciences, Sahlgrenska Academy, Gothenburg University.

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Prof. Florencio Travieso, France
Buenos Aires-born, France-based, Florencio has a 20+ years' international experience in advising, consulting and litigating. Teaching in Universidad de Buenos Aires and business schools around France for the last 10 years, his focus is innovation and digitalisation in healthcare.

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Dr Rafael Vidal, Spain
Dr Vidal is a Cardiac Imaging Consultant in the Cardiology Department of Hospital Clinico Universitario de A Coruña. Fellow of the European Society of Cardiology and the American College of Cardiology. Spanish Society of Cardiology – Board Member (Treasurer). Association for Acute Cardiovascular Care -Board member.

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Tobias Silberzahn
Tobias Silberzahn is a trained biochemist and immunologist. He is Partner at McKinsey's Berlin office and member of Healthcare Practice and Innovation Practice. Tobias leads the global Health Tech Network, a community of ~500 digital health start-ups, and hosts the MedTech R&D Industry Roundtable.

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Sourabh Pagaria, Siemens Healthineers
Sourabh Pagaria is responsible for Siemens Healthineers business in Southern Europe. He is a thought leader on how Data, AI and joint public-private approach can reshape the future of healthcare.

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Editorial Board

Alexandre Lourenço
Editor-in-Chief EXEC
Centro Hospitalar e Universitário de Coimbra, Portugal
al@healthmanagement.org

Prof. Lluis Donoso Bach
Editor-in-Chief Imaging
Hospital Clinic – University of Barcelona, Spain
ld@healthmanagement.org

Prof. Tienush Rassaf
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tr@healthmanagement.org

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Editor-in-Chief IT
University Hospitals of Geneva
cl@healthmanagement.org

Christian Marolt
Executive Director
HealthManagement.org, Cyprus
cm@healthmanagement.org

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Team

HealthManagement.org

Brussels Office:
Rue Villain XIV 53-55, B-1000 Brussels, Belgium
Tel: +32 2 2868500, Fax: +32 2 2868508
brussels@mindbyte.eu

Limassol Office:
166 Agias Filaxeos, CY-3083 Limassol, Cyprus
Tel: +357 25 822 133, Fax: +32 2 2868508
office@mindbyte.eu

Headquarters:
9, Vassili Michaelides, CY-3026, Limassol, Cyprus hq@mindbyte.eu

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Rapidity of Change in Surgery

Interviewee: Prof Derek Alderson | **Emeritus Professor of Surgery | University of Birmingham | Birmingham |** UK | **Editor-in-Chief | BSJ Open**

In early July, Professor Derek Alderson stepped down as President of the Royal College of Surgeons (RCS). Shortly before that, Prof Alderson discussed with HealthManagement.org the current challenges in education, research and leadership areas and shared his views on the future of surgery.

One of your interest areas is improvement of surgical standards through education, research and clinical performance. Since the start of your tenure as president of the RCS in July 2017, where have you seen the most encouraging moves and achievements in the above areas?

I suppose the fundamental change is to get surgeons to understand that their role in the modern world is not simply the delivery of clinical surgery, but it is simply looking after patients and being able to do safe and effective operations on them. The world of clinical surgery is changing quickly, and for someone who is focussed on only a small clinical area, it is insufficient to sustain them for the next 30 to 40 years in a career.

The surgical community should understand that there are other roles. That is the real change. The surgeon should not be viewed simply as a person who does operations on people; the surgeon of the future has a much broader portfolio and more responsibilities. Of course, developing clinical skills is fundamental and the most important for any surgeon.

I would say, however, that all surgeons, as they go through their training and as they progress through their career, must not forget that they also have the responsibility to educate and train as part of their regular job.

I also believe that all surgeons should be involved in quality improvement programmes. In doing so, most contribute to patient-based research, such as clinical trials and other types of studies that directly affect patient care. By doing quality improvement work you raise questions such as why is something better? And the questions have to be answered by doing proper, well-organised research studies. Thus, you develop a culture of clinical research through participation in quality improvement programmes. That is the second essential aspect of a surgeon's career.

In addition, surgeons must get involved in the management and leadership of the profession and at the local level, within their own hospital or region. Surgeons are the most experienced individuals in a clinical team, so people will always look to the surgeons for degrees of leadership. Understanding the healthcare system that you work in, which is always becoming more and more complex, and being willing and having the skills to lead is also fundamental.

When I look at all these strands – clinical skills; education and training; research; management and leadership, I don't think any one individual is going to be an expert in every area. But every surgeon must have some experience in each of those areas, and the amount of time you devote to each one will vary during a good career. At the beginning, of course, surgeons want to develop their clinical skills more than anything else. Later in their career, some might move away from the direct care of patients more into the management of their hospital or the healthcare system in general. The emphasis will vary at different times. I do not see one particular route that suits everyone, but people have to embrace all of these ideas in order to have a successful career.

We are seeing the change already. We see an increased number of specialists with interest of being involved in clinical trials. We have set up a system in the UK, a clinical trials network, that would be reliant on input from trainees. This network now exists across the whole of the UK in all surgical specialties, and many countries in Europe have created similar research networks based on trainees. There is, in fact, a global surgical network of trainees who contribute to trials, mainly in low- and middle-income countries and sub-Saharan Africa.

You wrote about the necessity for surgical curricula to include training in management and leadership. Why do you think these skills are so critical for future surgeons?

This is because of the rapidity of change. Let me give you a simple example. If a surgeon nowadays completes a training and has not had any training in robotics surgery, I would say that – unless they could in some way develop all of those skills – this surgeon will become a dinosaur. Because they cannot offer the best the patient might want. The surgeon has to have a more flexible attitude right from the start in their career and not expect the patient group that they treat to never change in the next 20 to 30 years.

So many new developments are occurring even within just the clinical management of the patient. We rely on much bigger teams. We are beginning to see

the need to get patients more fit for major surgery before they even come to the hospital, what we call pre-habilitation. We increasingly rely on information like genomics that is altering the nature of surgery. We will do more surgery to prevent problems and less surgery on advanced problems. Therefore, people have to be ready to change. It is very difficult to know exactly what things will look like in, say, ten years' time. And if we do not give people the skills to be able to change, they will become fossils within their own career.

and increase throughput. The use of that type of technology is already making a difference.

It is likely that robotics will be incorporated increasingly into surgery, which means it becomes more technological. We will require more assistance and help from people with robotics expertise in order to see that whole area develop properly and correctly. We will see that beginning to influence training more and more, for a young surgeon to carry up an operation in a simulator, similar to those used by airline pilots. The impact of technology will be enormous, and this will alter the way we deliver surgical care.

to the systems that already exist.

The most important goal is to show that robotic surgery offers benefits to patients over and above existing systems, that it is not too expensive for a healthcare system to bear and that it is cost-effective. If, for instance, patients were able to recover faster and get back to work sooner, then perhaps the societal cost of robotic surgery is less than of conventional surgery.

Robotics is already being seen as an important element in some branches of surgery, such as urology or colorectal cancer surgery. Undoubtedly, it will be looked into in far more detail in the next five to ten years and will acquire more research evidence to show when it is beneficial and when it is not.

Surgeons must get involved in the management and leadership of the profession and at the local level

What else would you like to see implemented in future curricula?

I would most like to see a situation where no trainee surgeon would ever carry out an operation on a human that they would not be able to demonstrate their competence in a simulator. I would also like to see a situation where no surgeon ever goes into an operating theatre without having been trained for that type of surgery in a virtual or simulated environment.

If everybody could undergo these two types of training before they attempt to do an operation, even under the best supervision in the world, it would make surgery incredibly safe and it would instil fantastic confidence in patients in all parts of the world.

How do you see the surgery hospital environment changing in the next five to ten years?

We will see more technology getting into the hospital. For example, one of the consequences of the COVID-19 crisis has been the use of video conferencing and video consultations replacing face-to-face consultations. Not that it completely eliminates the need of face-to-face consultation and examination, but it can make everything simpler and more straightforward, speed up the hospital processes

Could you expand on your ideas about robotic surgery? What are its opportunities and challenges?

There are two challenges here. The first is convincing everyone, including politicians, those who organise the healthcare systems, that robotic surgery is beneficial for patients, that you get better results by using robotic assistance than with conventional approaches. To gain that evidence takes time. You have to go through learning curves, you have to understand how to make use of the robotic system, and then you must prove that it is better for patients in some demonstrable way. In the meantime, of course, robotic surgery is expensive compared to other alternatives that are currently available, which is an important aspect from the healthcare economy point of view.

Another problem that we have to solve is how we train sufficient surgeons to become competent and good at robotic surgery as new robotic devices come to market. There are quite a few new robotic systems that are likely to be available in the next few years in addition

How do you think genomics could influence future surgery for better outcomes?

Genomics will have two major effects on surgery. The first is it will allow us to identify patients with high risk of developing certain surgical problems and to be able to offer them some form of surveillance. This, in turn, will facilitate early detection and treatment at an earlier stage that might be substantially less invasive.

The second effect is that by getting a profile for a patient, we can probably predict a number of parameters, such as the risk someone might have in relation to a particular operation or the best sequence of treatments for them. Now we do that on a very primitive genomic basis, but with modern genomics and all of the added information, it may be that we will become much better at it because a patient's profile tells us which of these treatment pathways will be best for that patient.

Some healthcare 'modellists' favour the idea of deep generalists over super specialists in the future healthcare setting. Where do you think surgeons could fit into such a paradigm if at all?

It is something of a minefield when we talk about specialism and generalism. The generalism of 10 or 20 years ago has really disappeared, so we have to be careful defining the subject here. If we take orthopaedic surgery, we have surgeons who are principally interested in trauma and those who are principally interested in elective non-traumatic orthopaedic surgery. Within that group as well there are those who specialise in hip or knee surgery and those who specialise in spinal surgery. Even within those broad areas there are subspecial levels.

We have a dilemma here, a practical problem. In order that every surgeon should understand their subject comprehensively, all surgeons need exposure to a wide variety of problems. But how do you expose people to certain areas of training without trying to make them achieve what we call competence in that clinical area? How do you construct training programmes and curricula that make people want to pursue that career? How do you enthuse the surgeon to believe that they could be doing a lot of good if they went down a certain line?

On the other side, there are the needs of the population and the country and its healthcare system. The surgeons we have trained do not always want to do what the population needs in terms of surgery. People often translate this into 'there's too many specialists and not enough generalists.' I'm not really sure that this is the correct way of looking at it.

What we need is to have more people in the system anyway, and we need to identify that very small number of highly technical, highly specialised operations that require a lot of resources and can only be done in a limited number of hospitals, and focus on putting those there.

At the other end of the scale, we should be doing our level best to make use of technology that allows as many people as possible to have their surgery close to their home and not to have to make long journeys to other cities because that is where certain operation is being done. We somehow need to balance these two sides.

Has the COVID-19 crisis highlighted any areas in surgery that proved strong or weak or showed potential for improvement?

There are several big lessons to learn from COVID-19. The first, of course, is the issue of preparedness. It becomes incumbent on all healthcare systems to think much harder about the future and be prepared for various scenarios. At the moment, we have to learn how to cope with or become better prepared for a viral pandemic. The sense of being prepared is a lesson we have had to learn because some countries were not well-prepared for something like that. In the meantime, there are other events that occur in different countries where preparedness is relatively weak. Some countries should be thinking much harder about how they would prepare for natural disasters or major terrorist incursions, for instance.

The second lesson is that we have learnt to collaborate more. Much of the competition that might have existed between countries in terms of supporting other countries with their healthcare problems have been handled admirably by many. We are seeing some real change as some of the protectionism that we might have experienced in the past, has disappeared. I think the COVID-19 crisis emphasised how important everything is on a global perspective, how important it is for people to understand the problems of others, pay attention to them. Of course, some countries are worse affected than others, but it has made the people realise that sharing – in learning, in collaboration – will be critical as we try and go forward.

Lastly, I think it has made us see what digital technologies can do. There are some quite simple technologies that could be and, in fact, have been used to make a big difference in the COVID-19 crisis. Video consultations or the development of apps to allow contact tracing are two obvious examples here.

A side effect of the pandemic has been the abundance of research shared with no peer review. How do you feel about this phenomenon?

This is a two-edged sword. In a crisis it is beneficial because sharing information rapidly is critical when you have a changing situation and no past evidence to draw upon. It was understandable for the scientific community to feel that it was reasonably responsible to move away from traditional practice in terms of publication. On the other hand, we must not forget the value of peer-reviewed publications and careful scientific assessment of the work in order to put work into true perspective. There is the danger of an enormous amount of low-quality publications or information being put out there as a result of trying to avoid or minimise the peer review process. But as long as people do not forget about the importance of doing well-designed studies with appropriate scientific rigour, I do not have a problem with it.

What do you wish for the future of the RCS after you step down from its presidency?

Today, the big problem is the lack of surgery in many parts of the world. WHO estimates that 16 million people die each year from what is called avoidable surgical death. And the next main challenge is the fact that many people do not have access to safe and effective surgery in their society or country. Advanced systems like ours, and organisations like the RCS owe it to the rest of the world now to encourage governments to invest more in surgery, so that they can begin to deliver effective, reasonable surgical care to their population in a way that at the moment is not being done. The number of people who die from, for instance, infectious diseases nowadays is far fewer than the number of patients who die for the want of surgery. There has to be greater attention paid to the need to offer surgery on a global scale. That is what I would like to see more than anything else. If colleges like ours won't do it, who will do it? ■

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Risks, Costs, Benefits and Trust in Healthcare:
Why and When Do We Trust?

Author: Peter Kapitein | **Patient advocate | CEO | Inspire2Live | Amsterdam |** The Netherlands

With artificial intelligence and personalised medicine playing an increasingly important role in today's healthcare, one cannot help but wonder about the regulation of these fields. An expert analyses the pros and cons of the 'checks and balances' system that exists today and argues that too much regulation may result in negative patient outcomes.

Key Points

- The two sides of any regulation, the regulators and those who are regulated, have opposing views on whether more or less of it is needed.
- In healthcare, there is a fine line between proper reaction and overregulation, and the latter often becomes prohibitive to new research and development.
- When calculating the cost of new medicines and associated risks, the regulators tend to miss the real focus, i.e. the patient themselves.
- With more regulation, exceptions will come to the forefront, which will mean leaving many patients without hope for survival.
- In the end, regulation is all about trust, and here the banking industry may serve as an example to healthcare.

Bureaucratic legislation has a killing effect on all creative endeavour. No matter how wisely framed and well intentioned, legal formalities tend to become inflexible.
Freeman Dyson (1975)

In a recent discussion about Artificial Intelligence (AI), data and healthcare, I was asked a relevant question: "What sort of regulation do we need for AI in healthcare?"

A very thought-provoking question! Regulation in general is already a heavily discussed subject, with strong feelings on both sides, for and against. Do we need more regulation? Do we need specific regulation? Are the checks and balances at the right level? Might a moratorium on regulation be a good idea? Are we aware of the hidden costs when we say 'no'?

On one side of the discussion are the lawyers, supervisors and regulators who earn their living from regulation. Their answer is usually, "Yes, we need more and specific regulation for AI." On the other side are the ones who are being regulated, mostly the companies, institutions and professionals. They usually complain about the extra work, cost and operational obstacles caused by regulation; they want less. Incidentally, there are no bad intentions from either side. It's simply "the way we work" (Kapitein 2018a), but the question here is specifically about healthcare. In the end, as final stakeholders and the object of the data involved, we, the patients and patient advocates, simply say, "Please, no more regulation. Stop talking about the abuse of data. Use our data!"

I will go back to the original purpose of regulation, and that is to enable the citizen to trust important things in their life, such as food quality, product safety, safety in traffic and in aviation, reliability of money and savings, et cetera. Might trust also be a solution to keep the process rolling and at speed? Should an important outcome of regulations be trust? When do we trust?

Regulations

Regulation is often necessary and helps. It helps to build trust. There is, in my opinion, no doubt about that. It ensures that we take care in doing things the

proper way. In aviation, for example, it has done an enormous amount of good on the part of safety. It saves lives. The focus was exactly on saving lives. And when we regulate, we need to keep the focus on the essence (the ultimate objective). In healthcare that should be the patient.

Rules and regulations are constantly adapting to cover new developments and new perceived risks. The two airplane crashes in 2018 and 2019 with the Boeing 737 Max were caused by faulty software. That type of plane has not been allowed to fly for over a year now. It is very unlikely that any passenger would trust this plane until there is strong evidence that the problem has been completely analysed and fixed. This looks like a very forceful but also a reasonable reaction. Not an overreaction.

Now consider the case of a medicine: thalidomide in the early 1960's. It was a sleeping pill, safe and with few side effects, so it became a success and was even available without prescription. But then babies started to be born with deformities and after a few years it was discovered that thalidomide was the cause. Of course, it was immediately taken off the market. Nevertheless, after good (additional) research and safety checks (it seemed to be effective and is made available under a solid safety protocol), it is now used only for very specific treatments, for instance, for multiple myeloma.

Another effect of the thalidomide case, however, was that the protocol for testing a medicine before release has become much more restrictive. So much, that today a medicine may exist that could be of major benefit for a patient with terminal cancer and a predicted lifespan of three months, but the medicine cannot be given because its long-term side effects may be unknown. "But doctor, I have three months to live, those side effects will never appear!" This is an obvious case of regulators overreacting.

Overreacting is what we quite often do. When we regulate, it has become the norm to focus on the exceptions rather than the main problem. Regulation of medicines was originally intended to protect patients from unscrupulous doctors. Now, it protects the doctor from lawsuits by patients, because the doctor cannot be sued for malpractice if they have stringently followed the protocol, even at the cost of not fulfilling a medical need of the patient. This liability culture started in the U.S. and has now solid ground in Europe as well. The only ones who are at risk in this situation are not the regulators, professionals, doctors and industry, and neither they nor the patient advocates are involved in the decision-making process. This example is not an exception, it's common practice in hospitals for patients, and I'm pretty sure that there is no bad intention on the part of anyone involved. We're in 'a way of working' that makes these absurd things become reality for people; for patients on a daily basis (Kapitein 2018a).

Another example is the use of patient data. Almost all patients want their data to be used for research in order to achieve better treatments. We need regulation (checks and balances) that prevent users from misuse and abuse, not hinder the use of patient data. I think that the checks and balances are in place. I will elaborate further on this later in the article.

It's my belief that the General Data Protection Regulation (GDPR) is meant to improve the interoperability of data between research institutes. In practice, this interoperability is severely restricted, but not in order to protect the patient's data. The two main reasons for this are:

- Most researchers simply do not want to share their data before publication. This is not a good thing because the data are patient data and should therefore be available for everybody, anytime. These same data could and should be used by other researchers simultaneously. Cooperation speeds up the process of research, not competition (Kapitein 2018b).
- Industry never publishes the data of the trials that fail (the so-called 'failures'). Therefore, these data also can't be shared. Data on failures are also important for research, especially when we evolve towards personalised medicine. When we are able to diagnose the individual patient, and have gained knowledge on personalised medicine, then that 'failure' might be a good treatment for an individual patient. Up until now, the treatment is prevented from reaching the market because there is a medicine that, based on statistics, has a better score. As a consequence, the patient loses their life while a possible treatment might have been available.

So, the problem is not the GDPR. The problem is that institutions, researchers and industry are protecting their own interests by misusing the GDPR because of a wrong focus in their work.

Hidden Costs of Saying No

When we want a new treatment to be designed, developed, tested and implemented, we are quite often able to calculate the costs. We write a plan and make an estimate, based on experienced people's opinions, and we come to a reasonable figure. That figure can then be used to make a business decision on the investment. What is missing in this business plan is that 'taking no action' also has its costs and losses. Doing nothing doesn't mean 'no cost.' Doing nothing sometimes costs a lot more than taking action. Doing nothing sometimes costs lives, as Professor Dr Joep Lange (HIV/AIDS researcher/clinician) stated so powerfully: "Inaction kills." These are, among others, 'the hidden costs of saying no!'

The cost of saying yes can be calculated most of the time and demonstrated in a style that is familiar and congenial to lawyers, whereas the cost of saying no is a matter of conjecture and has no established legal standing. Besides, if those costs are the lives of patients, that burden is not carried by the institution or company deciding on its investment, whereas the financial gains in patents, fees and prices definitely contribute to their bottom line. Therefore, we need more knowledge and a more realistic balance of uncertainties and risks.

According to Freeman Dyson (1975), there are two facts of life that make it difficult for political authorities to reach wise decisions and which therefore cause many hidden costs.

1. The unpredictability of technology.

In our situation: the output of industry in designing and developing new medicines.

2. The inflexibility of bureaucratic institutions. In our situation: there are rules, and the rules determine the answer to the question about doing right or wrong.

1) I think this is true. The uncertainty of the output and outcome of industry is a big problem. Making new medicines is certainly not mathematics. These uncertainties are a problem for industry but also for government or health insurance companies/payers. We simply have difficulties with calculating the costs, and therefore we think that medicines are too expensive. The price of medicines is far too high, but not for the reasons that most people believe. The so-called 'cost of capital' is the most important reason why medicines are so expensive. The structure of the financial complex of investors and shareholders, banks, pharmaceutical companies, hospitals and doctors are responsible for these enormous costs (Gupta Strategists 2019), and the regulations for bookkeeping and profit calculation provide a way to make profit mechanisms ever more seemingly effective but also more complex and risky.

2) I can be short on this one, for in the first paragraph I write about the rules that prevent doctors from treating dying patients with a medicine that has not been tested in a phase 3 trial because of long-term effects. It's a strong and painful example of what happens when the subject, the patient (the essence) plays no part and has no power in this decision. It is, however, not caused by the doctors alone, but by the stakeholders in the institutions and corporations involved in the medical processes. Also, patient organisations can be part of the problem when they argue against early access and deny their fellow patients this hope. It is, in other words, a problem of "the way we work," the medical industrial complex.

Let us not forget that regulations in healthcare start with politicians who make the rules, and the regulator who implements them. During this process of making and implementing, many changes to what was intended can occur. In the end, the politicians have the primary responsibility, but every other ('next' in the chain) stakeholder has a responsibility as well. According to Hannah Arendt (2005), one never loses their responsibility when part of a larger scene. Some thoughts from this great philosopher, who did a lot of work around responsibility that helps us making the right decision, are worth noting: "You can be responsible for things that you have not done. You cannot be guilty of things you have not done, although you can pay for it." Her plea was for thinking to be a humane process; that is recognising the importance in making the difference between good and evil: "The sad truth is that most evil is done by people who never make up their minds to be good or evil."

The problem is not that the costs are too high, the problem is that regulators (whether in healthcare or finance) have another focus in their work. They miss the essence, and therefore the costs are not in control.

Cost, Benefit and Risk

Who wants to take a risk? When it comes to chances, people fight harder to protect what they have than to gain something new (Kahneman 2013). Patients will fight hard to stay alive. But do they always get this chance from healthcare? We saw how patients are prevented by regulators, doctors, industry and health insurance companies from being treated because of the uncertainty of the long-term effects of medicines, even when they are dying. Patients want to fight but do not get the chance!

Risk equals chance multiplied by impact. This is exactly what is missing in healthcare when we look at the individual patient. The risk of a treatment for a patient is in many cases close to zero. There might be long-term effects, but for the dying patient they are irrelevant, which means that there is no risk for the patient. The impact of saying no and withholding the medicine from them is enormous and precise: certain death. When they take the drug, they have a chance.

The reason why a patient doesn't get the chance for these new experimental drugs is that the rules have been driven by other risks: the risks of physicians who might get sued because of the effects of a drug. Also, the cost/benefit ratio for a physician is quite different to that of the patient, and these risks have been determined by the regulators giving no say, or only a formal say to patients. If any, this is conducted mostly by representatives of patients and not with the patients themselves who have the unmet medical need.

The difference to be recognised between patients and citizens (non-patients) is urgency. When there is urgency, your decision is different from when there is no urgency. The lack of concern influences the risk/benefit ratio, and people who are not dealing with unmet medical needs act differently because they have something material to lose. When you have nothing to lose, because you're dying, it is simply wrong that you don't even have the right of self-determination in evaluating risk (Bunnik et al. 2018).

And let's not forget: people in different economic and cultural situations make different decisions. A Colombian woman once told me that in Colombia people were more concerned when their computer was stolen than when their data were misused or abused. The computer was the 'now,' the data are the 'future.' Most regulations are made by politicians or by big bureaucratic institutions like the European Medicines Agency and the Food and Drug Administration where the employees have little or no knowledge about these situations.

The problem in healthcare is that the actual cost/benefit ratio is not the ratio involving the patient's life. It is the ratio of other stakeholders in the medical industrial complex, and they miss the essence.

Checks and Balances

In my opinion, there is enough regulation. More regulation, especially when dealing with AI and data analysis in healthcare and personalised medicine, will kill the opportunity for patients and take away their hope. AI can be a chance for better diagnostics and treatments, and therefore better quality of life. Regulation quite

often stifles innovation (as stated in the opening quote from Freeman Dyson). Healthcare has fallen too much into the hands of regulators: lawyers and politicians. We patients experience these problems daily. We pay the costs and we take the risks.

Let me give you an example. When we want an existing drug to be 'repositioned' and registered for another disease, we have to deal with a lot of issues that are already in place for this drug. This is natural because it's another disease. Yes, but off-label, a physician is allowed to prescribe it. What's the difference between prescribing it 1,000 times off-label and registering it for general use, so long as the patient and the doctor have an agreement on the prescription and its use, with informed consent in place?

It is my belief that a lot of regulation, checks and balances are already in place. Therefore, I make a plea for a moratorium on regulation when AI and personalised medicine come on the stage. Let me tell you why checks and balances are at the right level.

We can exchange data because of the GDPR. I know the barriers, but we can exchange and use data; we only have to ask the patients. Don't be afraid to share it, and no, your publication is not of greater importance than our lives, so hurry up; please share!

Other checks and balances deal with science and the scientists. When they misuse our data, their career is dead; more or less the same for industry: there is a risk of their business failing. Misuse of data leads to no registration of their product (this might hurt patients as well when it concerns a good drug). They get fined. However, in most cases, this doesn't hurt industry too much. But no industry wants to be a second Cambridge Analytica, and that wasn't even about patient data. The reputation of big pharma is not very good, but what happened to Cambridge Analytica was a serious image problem of different dimension with a huge business impact.

Regulation should be in place for the general issues dealing with patients and safety. They should not deal with the exceptions. We can deal with exceptions using common sense. When we try to regulate all the exceptions, we block the introduction of new medicines and the repositioning of existing ones. Finally, we end up in the situation (which is, in fact, already the case) that so much work has to be done to register a medicine that only big pharma can afford to do, needing huge apparatus. We don't want that. Young, innovative and relatively small companies should have the opportunity to enter the market as well.

Trust and Speed of Trust

Now, after all, comes the easiest part of the article: 'Trust.'

It's all about trust. We put our life in the hands of a physician because we trust them. We give our data when we have trust. We use the data (as scientists and industry) when we trust that all is in order and we won't get sued. When we trust, we regulate the general issues and not the exceptions. The exceptions are dealt with using common sense. Trust is connected to the question of whether the checks and balances are in place. I think they are.

When I ask people, "Do you trust banks?" nobody says "Yes!" We all have our savings in a bank account because we trust the checks and balances. When a bank goes bankrupt, our savings are guaranteed up to a certain amount of money. We know that upfront. Governments and banks have now taken measures so that we can trust our money in the bank.

Banks may do risky things with your money (like lend it), but in the end, you get your money back the moment you ask for it. When necessary, you get it in the physical form: banknotes. You are protected!

Therefore, we don't want more regulations. We know that the checks and balances are in place. Therefore, we trust. What banks can do, healthcare can do as well.

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Conflict of Interest

None.

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Improving Workflow Through Enterprise Imaging

Author: **Bob Craske | Departmental Solutions Marketing Director | North America | Agfa HealthCare**

COVID-19 continues to present new challenges to healthcare providers. As a leading healthcare IT partner, Agfa HealthCare is committed to supporting its clients during the COVID-19 crisis. Health Management.org spoke to Bob Craske, the Department Solutions Marketing Director for Agfa HealthCare to discuss Agfa's newest Enterprise Imaging platform that facilitates image exchange, universal viewing, and cloud-based sharing and helps create more efficient workflows throughout the health system.

Key Points

- Agfa HealthCare's Enterprise Imaging solution (Agfa EI) is a complete platform for the management of image based medical records, from acquisition through to results distribution.
- It is engineered to support remote diagnostic services from both an architectural and work perspective.
- Agfa EI uses a rules-based workflow engine to assist customers in organising increasing and complex workloads.
- The platform allows customers to expand their image management strategies at their own pace, just as they did when the EHR was introduced. Consider Enterprise Imaging to be the IHR, or the Imaging Health Record, complementing the EHR.

What is Enterprise Imaging? Can you provide us a brief overview?

Agfa HealthCare's Enterprise Imaging (Agfa EI) is a complete platform for the management of image based medical records. Purpose-built as a single stack of services with a single database, Agfa EI allows our customers to share these services and expand their image management strategy from traditional departments such as radiology and cardiology. Different service lines throughout the enterprise can apply those same proven services without the need for additional infrastructure costs. Agfa EI is our fastest and newest platform. Our primary goal was to develop a new paradigm for helping our customers achieve effective clinical, business, and operational strategies for image based medical records. The platform combines all the essential services required to do image capture, display, reporting, and results distribution for all images, including DICOM and non-DICOM. Agfa EI is not only useful for traditional radiology or cardiology workflows, but can be deployed across all image producing departments, including clinical photography, wound care, dermatology, ophthalmology and more.

Can you talk about how radiologists have had to switch to remote/home reporting during the COVID-19 pandemic and whether you think they will continue to do so post-pandemic?

COVID-19 has placed different constraints on many different customers, depending on their location. We have a platform that can adapt to their changing needs by, for instance, providing them with mobility, with the same experience they have in the hospital, but now at a remote location. So, whether it be their home, a remote office or wherever they choose to work, the clinician can stay productive, with the patient information securely and readily available. Our platform is able to provide the same experience with the same performance independent of location.

This has proven to be crucial in our current COVID-19 world. Our customers were easily able to relocate radiologists' display stations from the hospital environment to their homes with essentially the same user experience and level of service available to them.

As with other industries, we see COVID-19 will change the way people work and remote reading will be the norm going forward.

What benefits does Enterprise Imaging offer to radiologists in terms of remote working, workflow and user experience?

Enterprise Imaging is engineered to support remote diagnostic services from both an architectural and work perspective. By permitting the diagnostician the ability to match their personal preferences and experience, there is no need to adjust workflows and expectations (such as display protocols and processing capability). The user experience is identical, regardless of location. This is a vast improvement from the old-fashioned use of different viewers across different locations. We believe in one user, one experience.

How can Agfa EI help manage increased clinical imaging volume and changing demand due to COVID-19?

Enterprise Imaging is an ever-evolving platform, and Agfa HealthCare is committed to its constant improvement to meet the emerging demands placed on our customers. As volumes increase within the institution or across its affiliates, Agfa EI will use its rules-based workflow engine to assist customers in organising the increasing workloads. From activity overviews that organise tasks, through prioritisation lists and escalation workflows, timely healthcare delivery can be provided across dynamic workloads. Our platform is also highly scalable. The technology is replicated on virtual machines and there is no need to reconfigure the system, thus making it easy to scale.

Also, it is important to understand that until recently, clinical imaging volume has actually decreased as a result of COVID-19 because non-elective procedures have been delayed. However, the number of chest ultrasound, chest x-rays and chest CT has increased because they are the primary diagnostic tools being used for diagnosis during COVID-19. Therefore, we're not seeing a shift in volume but a shift in volume type. But, volumes are starting to return to normal and our platform is designed to handle the changing demands.

Do you have any examples of customers who have adapted to this new delivery model? What has been their experience? Any challenges they've faced?

Agfa HealthCare has many Agfa EI customers who employ remote reporting. Their profiles run the gamut from smaller institutions who employ non-local diagnosticians through traditional models altered by the pressures of the pandemic. Their experiences have been very personal, as we all know staying productive while working at home is a unique challenge. The Agfa EI workflow engine has been designed to provide identical user experience regardless of location and removes the additional challenge of adopting to a different viewer or workflow and allows the consumer to transition between the two models easily. I recently spoke with a "remote" diagnostician who works from multiple states to support one institution and his emphatic statement to me was, "If you took Agfa EI away from me, I would likely choose to retire rather then go back to disparate workflows."

Does EI work efficiently for multi-facility networks or is it better designed for single department use?
Enterprise Imaging employs a new paradigm in workflow organisation based on tasks that cascade the study from order to results. These tasks are organised by any combination of customer preferences, from the traditional modality workflow through to specialty and location tasks. The workflow engine allows our customers to focus on what is most relevant to their responsibilities as well as ensure the user is aware of all reporting tasks regardless of origin. Enterprise, by definition, means mutli-facility networks but single departments can benefit as well.
We find that some customers deploy Agfa EI as a single department solution and then wish to extend the platform's services and benefits to additional service lines. The technology stacks are modular, so it is easy to expand its footprint.

How can you make it easy for radiology departments to use EI? Do you offer remote demos, remote installation etc.?
We really enjoy demonstrating our solution for radiologsts and other clinical care givers. That's when we can 'brag' about how we can help them read with more confidence, in the most timely way, from wherever they are located. Just recently I have been working with a long standing customer to help them leverage the new workflow model available in Agfa EI. My team, as well as our applications, R&D and product management groups have provided remote education to hundreds of Agfa EI customers across the globe, essentially imparting best practices learned from a variety of institutions.

Once a decision is made to move to Agfa EI, our Professional Services organisation engages the client's teams with our expert implementation methodology. This proven gated and accountable process guides the client from building Enterprise Enablement, through Business Process Transformation, all the way to the Go Live and beyond.

Do you think Enterprise Imaging can enhance the role of the radiologist in the post-pandemic world?
Absolutely. A radiologist or cardiologist or any diagnostician has to be seen as a valuable link and contributor in the chain of healthcare. I think collaboration and putting a face to a report and creating the interactive session or capability allows radiologists and cardiologists to establish themselves in their own community.

As a healthcare IT provider of a 'mission critical' application, we are deeply committed to support our clients' efforts during and after the COVID crisis. We already established COVID specific workflows and developed new collaboration technology working with Mircrosoft Teams® that will be used long after COVID is behind us.

Will remote working and reporting continue to be essential in a post-COVID world?
I don't expect remote reporting to ever go away. I believe it is going to become more and more the norm. It is true that we are in the midst of a pandemic and need remote reporting. But I think what's going to happen is that it's going to afford radiologists an understanding of what it is like to work at home. It's not just about technology; it's learning the behaviours of working at home once that has been established, and maintaining your focus and your productivity. I think the pandemic is really just a catalyst for something that was waiting to happen.

Do you think this platform could have any impact on radiology training?
We've developed a platform that offers the ability to do all of your work virtually. This includes rounds, or teaching sessions, or the ability to review an image together even if you're 3 miles apart or more than 300 miles apart. That's powerful education that can still be maintained, even strengthened. And that is critical. Within our platform, we have both what's called peer review, which is sort of a standard reading and accreditation of diagnostic quality and we offer new workflows for peer learning, which is an advanced take on peer review. Peer learning allows our customers to create learning tracks to provide user experiences to help students understand what they need, how they need it, what they're doing in their report and so on. It gives them the opportunity to learn from those with experience. And it can all be done virtually.

If you were to list a few reasons why radiology departments should transition to Enterprise Imaging, what would those be?
The first reason would be our consolidated platform approach, allowing customers to expand their image strategies at their own pace, to deploy modules in as many or as few service lines as preferred and replace disparate departmental solutions. The Agfa EI consolidated platform technology emulates the EHR model of reducing complexity and redundancy across the enterprise.

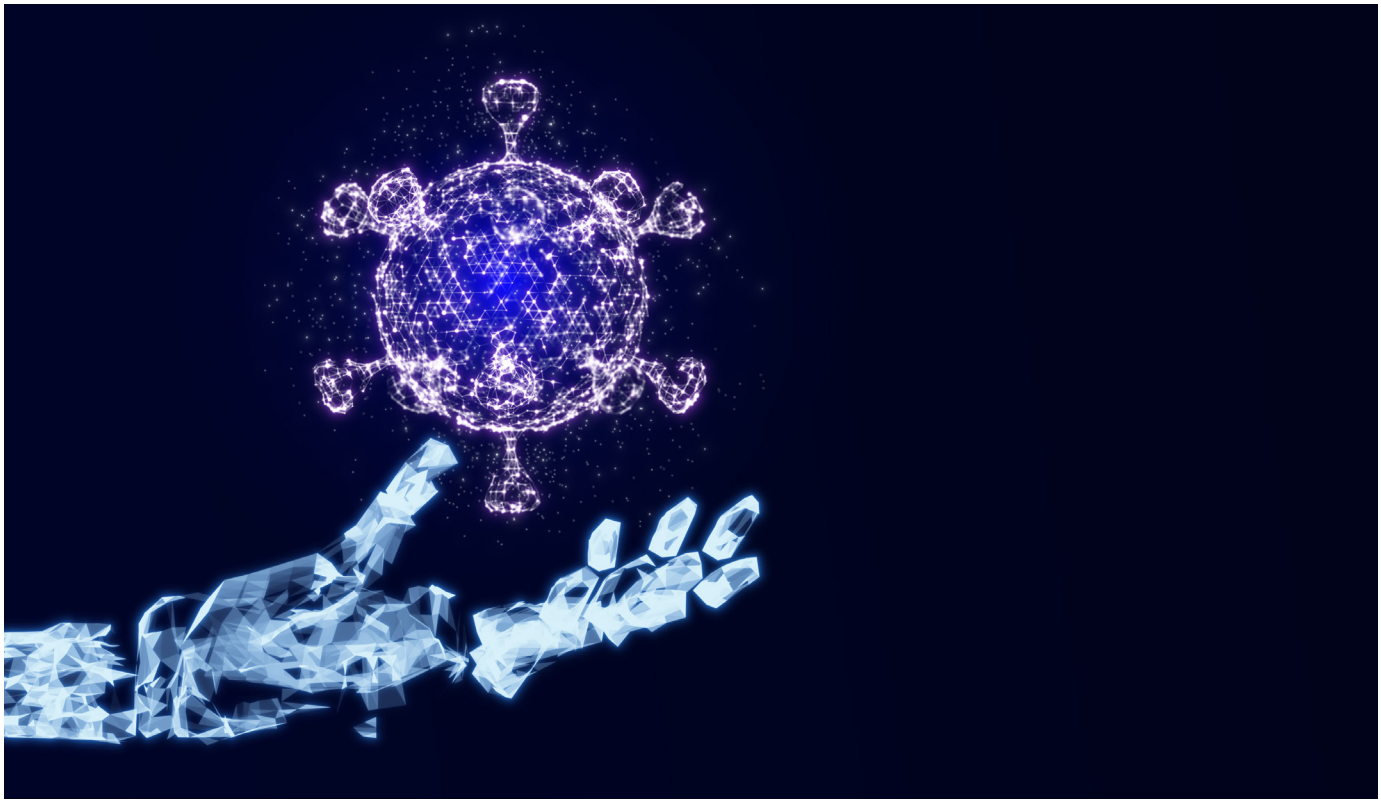
The second is the power of the desktop to deliver standard and advanced image processing of nearly any medical image in one viewer, leveraging a powerful workflow engine. Eliminating so many specialised viewers allows our customers to stay focused on one desktop with one workflow, regardless of simple or advanced needs.

Thirdly, Agfa HealthCare has had an Enterprise vision for more than 10 years and was the first technology provider to bring that concept to market in the early 2010's. Experience can not be easily developed overnight and our customers have chosen the EI platform to leverage Agfa's experience as a partner, a guide and a consultant in order to achieve their strategic and operational objectives. ■

COVID-19 Paving the Way for Robots in Healthcare?

Interviewee: Dr Héctor González-Jiménez | **Associate Professor in Marketing | ESCP Business School | Madrid |** Spain

HealthManagement.org spoke to Héctor González-Jiménez, Associate Professor in Marketing at ESCP Business School in Madrid and researcher about COVID-19 and the use of robotics in diagnosis and treatment. Héctor is interested in interdisciplinary research that addresses phenomena on the self and consumption. Currently, his work spans areas such as cross-cultural consumer behaviour, body image and consumption, and human-robot interactions. Here, he comments on the impact of robotics in healthcare and especially on COVID-19 patients.



What do you think are successful and efficient uses for robots in the healthcare space?

Research suggests that there are synergies between robots and humans that can be leveraged in the health-care space and in particular during a crisis. Humans and robots complete a variety of tasks that are linked to different types of intelligence. As outlined by Huang and Rust (2018), there are four types of intelligence. Mechanical, analytical, intuitive and empathetic. Robots and AI are already very proficient in completing mechanical (e.g.repeated actions and

movements) and analytical tasks (e.g. data analysis). For instance, basic tasks (registration, room information, etc.) in reception areas can already be accomplished by a robot equipped with AI, or a simple AI interface in the form of a tablet. Furthermore, in hospital settings, AI and robots can be used to remind staff to provide treatment or medicine to patients. In some cases, the robot can even take the medicine to patients.

What has your research shown in terms of successful and efficient uses for robots in the COVID-19 space?

China and Thailand already offer some initial evidence on how robots can be leveraged during the current coronavirus pandemic. Medical professionals are using robots to take medicine to patients or to measure their temperature. In doing so, they reduce human-to-human contact, thus reducing potential infections. Moreover, robots are being equipped with UV lights to disinfect rooms and themselves, thus also sparing human intervention in these tasks. Besides these tasks, robots are also used as a contact point between medical staff and patients as medics are able to communicate with patients from a distance via the robots media interface. Outside the hospital, the Chinese government is also using autonomous vehicles to take supplies to people in need that are quarantined in their homes. However, to date this is observational evidence. Empirical data that can offer quantitative insights on the potential benefits and drawbacks is still not available due to the recent nature of these applications.

Do you think that robots can have a detrimental effect on patients?

If patients are conscious, the use of a robot may affect their psychological wellbeing. Researchers argue that especially in moments of trauma and stress, such as an accident or disaster, humans may be especially sensitive and emotionally fragile. Imagine that during such a moment a victim is waiting for a medical professional or emergency response professional to rescue them. Suddenly, being confronted with a robot may further accentuate their anxiety, especially if they have not interacted with this type of technology before. In such situations a human touch is still quite relevant, especially in terms of a patient's psychological wellbeing. This notion ties in with the four intelligence types. At this stage robots are still not able to accomplish tasks that require empathetic intelligence at the level of humans. Therefore, the application of independent robots may be useful in some instances, but at least for now, collaboration between humans and robots may still be more fruitful.

If the 'social distancing' contributions of robots to the COVID-19 crisis is limited, how do you think healthcare managers/department heads could approach the need for distancing instead?

This is a good question, and I do not want to step into the field of the experts that have to manage such situations live and on a daily basis. That being said, robots and AI could actually be useful in helping with 'social distancing.' Rather than human doctors facing patients directly, there may be situations where they can use robots to treat patients from a distance. In such scenarios it would be fruitful for medical professionals to explain or even introduce the robot to the patients in person. This could reduce the initial surprise if a patient encounters a robot. After that introduction, medical staff could then use robots for some tasks to reduce human contact. Furthermore, social distancing can also be promoted by using autonomous delivery vehicles, thus reducing human contact for delivery service workers. These are just some examples of potential applications. These will, of course, also largely depend on the resources available and the technology readiness of the patients and country context.

What do you think the most significant lesson is for healthcare management and public health from this crisis?

Readiness is key. I am aware that it is difficult to invest significant resources to account for scenarios that may not happen, or rarely happen. Imagine you invest into robots that could be used during a pandemic, but then hardly use them until a crisis happens. It would be difficult to justify such an investment to your funders. Looking back, we are always smarter, but predicting the future is challenging to say the least, and realistically healthcare managers do have budgetary resource constraints and often need to focus on current needs.

Nevertheless, there are still things we can learn from the current crisis.

In my opinion, the main takeaway is that if applied correctly, robots, AI and humans can collaborate and enhance healthcare service provisions (see examples in China). Robots and AI are sometimes portrayed as an enemy of humanity, because of associated employment issues. There are, of course, valid arguments to support this thesis. However, as outlined above, there are also benefits.

As a researcher I am rather interested in the societal and psychological implications that come with the integration of robots and AI. From that perspective, I believe that is it integral to introduce these technologies gradually. Furthermore, staff, patients and stakeholders need to be educated on the potential benefits. This also requires close collaboration with the media, because the narrative about robots and AI in the media can have a vast impact on social acceptance of these technologies.

Lastly, in the long term, some of the acceptance issues may be solved with time as new generations grow up. Today´s youth is being already raised in a very tech-driven environment; hence they will likely grow up to embrace these technologies with less resistance than current generations. ■

Future of Patient Safety: What We've Learned from Pandemic

Author: Dr Donna Prosser | Chief Clinical Officer | Patient Safety Movement Foundation | Irvine (CA) | USA

The COVID-19 pandemic has resulted in an unprecedented level of public scrutiny of patient care, and developing highly reliable systems is no longer going to be optional for organisations in the future. Healthcare leaders are now challenged to implement new cultures focussed on sustaining safe, person-centred care for both patients and health workers.

Key Points

- Despite a focus on high reliability for the past 20 years, healthcare remains prone to error.
- Most organisations have not yet established high reliability systems because it requires a change in the culture that is embedded from the frontline to the boardroom.
- Leaders must complete an honest assessment of their organisational cultures before planning for improvement.
- The Patient Safety Movement Foundation provides free resources to assist organisations in becoming highly reliable.

The COVID-19 pandemic has stressed healthcare delivery beyond anything we have seen in modern times and has exposed the foundational gaps that most systems continue to have in safety and reliability. For years, the nuclear power and aviation industries have shown us that it *is* possible for high-risk organisations to operate error-free for very long periods of time. In healthcare, we have resisted embracing these concepts for several reasons, and patient care remains prone to error and fraught with risk.

If we have learned anything from this pandemic, it is that being highly reliable is no longer optional. This poses a great challenge for healthcare leaders, who are dealing not just with the realities of the financial, quality and safety implications of the pandemic, but also with severe staffing issues due to clinician burnout, illness, and in some cases, death. However, the public has begun to *demand* better, safer care, and their voices will only become louder in the coming years. Our reality is that we now have no choice but to do the difficult work of truly adopting a culture of safety while also managing the resource issues that so many currently have.

Those leaders who are well versed in quality improvement concepts know that a problem cannot be effectively solved unless the root cause is first identified. This then begs the question: what is the root cause of *why* most hospitals have not yet established safer and more reliable systems? Understanding the answer to that can go a long way in helping organisations to improve, and the answer is this: *because it's really, really hard to do.*

Background

Our modern healthcare culture has always been paternalistic, and clinicians have historically seen themselves as the experts who were here to heal people. Patients and families, intimidated by their lack of knowledge, readily accepted that the doctor was in charge and rarely questioned their expertise. Nurses were taught to do 'what was best for the patient,' even if this sometimes was not aligned with the patient or family's goals and desires. This clinician-centred culture is completely opposite to the patient-centred culture of safety that is inherent in highly reliable systems.

As clinicians, we were taught that independent, autonomous practice was our responsibility, and that making mistakes was definitely not acceptable. Most of us learned through fear and intimidation, and those who couldn't handle it often left their profession completely. Unmasking safety concerns was considered a slight against colleagues, and we were encouraged to limit incident reporting to minimise liability for the hospital.

Many consider errors in healthcare to be part of the cost of doing business and dispute the statistics that preventable error results in millions of deaths across the globe each year. Some don't think that zero harm is possible, and so have focussed more on improving medical outcomes with new drugs and treatments than improving *system* and *process* outcomes. The resulting complexity in the care environment makes it very difficult for the frontline to consistently and reliably follow the standards of care.

Consider how many documents you have in your organisation that guide clinical practice. How many policies, procedures, protocols, order sets, standard work, pathways, education modules and newsletters do you have that the frontline needs to know about and apply to their own practice? If you're like most, it's a complicated web of information that requires its own level of expertise to efficiently manage and understand.

Patient safety, and health worker safety, will never improve until we change this reality by becoming more highly reliable. Creating a foundation for safe and reliable care includes three critical components: a person-centred culture of safety, a holistic continuous improvement framework, and a model for sustainment. Each of these components is relatively new in healthcare and requires a significant shift in behaviour at every level of the organisation to be effectively implemented.

Becoming Highly Reliable

So, where do organisations begin? Start with an honest assessment of your leadership team's commitment to becoming more highly reliable. If such a transition is not supported by the governing body and executive team, it will not be successful. If your frontline leaders do not have the ability to effectively manage change and hold their teams accountable, then you will be equally unsuccessful.

Consider the atmosphere of respect, honesty and trust in your organisation. Do your team members feel safe admitting that they made a mistake? Is the process of reporting errors and near misses an easy one? Do nurses and technicians feel comfortable respectfully challenging others with a higher level of perceived authority? If not, then such behaviour must be addressed first. Sometimes this means making difficult decisions about who remains on the team. Clinicians who are highly skilled experts but create toxic work environments cannot be tolerated.

Observe the complexity of the care environment. Is it easy for the frontline to access what they need to know about what is expected of them, or do they rely on 'group think' and do whatever their peers are doing? Are care processes standardised, or does each physician practice differently, therefore requiring nurses and other clinical staff to learn multiple different ways of managing care? Is everyone involved in a patient's care considered part of the team, or are some disciplines excluded from collaboration and communication? Effective teamwork and the development of more efficient care processes that simplify the expectations of staff is critical in creating a safe environment.

Finally, how do you measure improvement? Examine how you collect data, when and why. Are you able to trend different quality and safety measures to tell a story about the overall health of the organisation and care processes? Have you validated the integrity of the data, and are they accurate? Are you measuring just for the sake of measuring, or using those data to inform your improvement work? Many leaders are so focussed on specific metrics, especially those they are required to report, that they fail to see the bigger picture. Patients generally have more than one problem; they are not impacted by a single metric, and it is critical to understand the interconnectedness of all outcomes.

Conclusion

You cannot complete an assessment of your culture from your office or desk. Although this requires deep data analysis, it also involves going to the point of care to understand what is happening. Ask open-ended questions, provide a safe space for answers, and quietly observe without judgement. No one organisation has exactly the same issues as another, so your journey to becoming highly reliable needs to be based upon the root causes you uncover during your assessment and analysis. Only then can you begin to prioritise and plan your next steps. Although the work is difficult, it is not impossible. A united leadership team that supports their clinicians and respects the voice of the patient can do this much more easily and successfully.

If we have learned anything from this pandemic, it is that being highly reliable is no longer optional

With public scrutiny of the management of this pandemic at an all-time high, the World Health Organization is calling on global leaders to focus on health worker and patient safety on 17 September 2020 for World Patient Safety Day. Both are necessary to create highly reliable systems. The level of awareness about healthcare safety that this annual event will create over the next several years will force organisations to improve. Do it now; don't wait until you are obligated. The Patient Safety Movement Foundation provides free resources that can help. Visit us at patientsafetymovement.org to learn more.

Conflict of Interest

None.

Remote Patient Monitoring for Safe and Effective Management of COVID-19 Patients

Author: **Tobias Silberzahn | Partner | McKinsey & Company, Inc. | Berlin,** Germany

Remote patient monitoring (RPM) and the role it can play in the early detection of COVID-19 complications, increasing patient safety, and reducing the risk of spreading infection.

The spread of the COVID-19 pandemic has posed immense challenges to medical professionals around the world. As personal interactions between medical professionals and patients have suddenly become fraught with danger, interest in digital technology has increased.

Much has been written about the benefits of telemedicine and its steep increase in usage during the COVID-19 pandemic. In this article, the focus will be on remote patient monitoring (RPM), which has been much less covered in media and healthcare publications so far.

RPM allows patients to measure and share their vital signs with physicians, often using apps coupled with medical devices such as pulse oximeters or thermometers. At the physician practice, data from multiple patients can be aggregated and displayed on an electronic dashboard, which can then be monitored by a medical professional. Based on medical rules, the electronic dashboard typically ranks patients by severity of symptoms. This allows to rapidly identify those patients in need of attention. When remote patient monitoring and telemedicine are combined in one application, the medical professional can directly interact with patients in a physically distanced and secure way via video call. In addition, some RPM applications can be supplemented with algorithms that – for example – could predict which patients are likely to experience complications. Given that an estimated 40% of COVID-19 patients are asymptomatic,[1] and 23-36% of all hospitalised patients end up requiring intensive care,[2] such algorithms can be especially important during the COVID-19 pandemic.

While RPM could be performed using strictly analogue methods such as telephone checkups, the use of smartphone apps to automate the process of quantitative data collection reduces the effort to manage an RPM programme. And the use of video calls as an integral part of an RPM programme adds a "personal" dimension to the monitoring process.

In the context of COVID-19, the integrated use of RPM and telemedicine can help to achieve five objectives (Table 1).

Given that RPM plus telemedicine move the interaction between doctor and patient into the virtual realm, the provision of medical care via RPM and telemedicine can provide medical care in remote areas with few physicians. In a pandemic setting, RPM and telemedicine can provide value through its application in two models:

RPM-Hubs with RPM-focused medical personnel (could be part-time or full-time RPM activity depending on patient numbers), with the capacity to monitor large numbers of patients. Such hubs can help shoulder the burden when COVID-19 patient numbers spike in infection hotspots or when broad national increases in infected COVID-19 patients threaten to overwhelm the established health system infrastructure. Such RPM hubs could be established at:

- Hospitals/academic medical centres
- Centralised care hubs

Regular ambulatory care facilities with medical personnel trained to use RPM. In this setting, RPM is typically used for monitoring local COVID-19 patients – either by GPs or local "COVID-19 focus practices" in a certain municipality. If applied broadly across a country (by training large numbers of GPs, for example), a country could add an effective tool in its arsenal against COVID-19, which could include:

- Primary care practices (e.g., GPs)
- Other outpatient medical practices or designated "COVID-19 focus practices"
- Local health authorities employing medical professionals
- Local clinics or local hospitals

Each of the two models has its own benefits, and the choice of which model to deploy will depend on the legal framework and pre-existing characteristics of national and local health systems.

RPM hubs can deliver benefits of scale – with few RPM specialists being able to monitor large numbers of patients. From an implementation perspective, it is relatively simple to set up a few RPM hubs at major hospitals (compared with

training thousands of ambulatory care practices how to use RPM). Hubs can be set up to provide a "backbone" for a large-scale pandemic response, allowing them to be quickly deployed to provide remote patient monitoring for patients in pandemic hotspots where localised outbreaks have occurred. Lastly, RPM practitioners within RPM hubs will gain experience and expertise in the use of RPM and telemedicine for COVID-19 patients – and how to interpret vital parameters of COVID-19 patients to decide when medical interventions or hospitalisation is needed. They will be more likely to have institutional connections into academia so as to share and disseminate this expertise, and in fact remote patient monitoring teams may plausibly be located at university hospitals.

On the other hand, establishing RPM in ambulatory settings comes with it its own set of advantages. Ambulatory care facilities, with their local focus, can leverage pre-existing doctor-patient connections. Patients might feel more comfortable from being treated by "their" doctor, especially in a remote setting, as opposed to having to become accustomed to interacting with a stranger. Moreover, doctors who know their patients can leverage their knowledge of those patients' dispositions and pre-existing conditions. Should the patient's condition warrant a personal visit or hospitalisation, then the corresponding logistics would be easier to organise (compared with RPM in a long distance setting).

Of course, both models could be set up in complementary fashion as well – with ambulatory practices practicing RPM as a "first line of defence" plus RPM hubs (e.g., at major hospitals) ready to step in when local health system resources get close to capacity when COVID-19 infections rise.

During the COVID-19 pandemic, pilot projects of remote patient monitoring plus telemedicine have shown promising early results. As part of a pilot project conducted in the United Kingdom, it was reported that among 244 patients monitored remotely in "virtual wards," zero fatalities occurred (the RPM platform "Medopad" from the company Huma was used during the pilot project).[3] Furthermore, compliance of patients with the RPM solution was high, also among the 40% of patients who were between 60-80 years old. In a particularly effective use of medical resources, at-risk medical personnel were deployed to conduct remote monitoring activities, thus protecting this group's health without reducing medical resources or medical expertise.

One concerning effect of the COVID-19 pandemic has been its detrimental impact on patients suffering from pre-existing medical conditions such as cancer, heart conditions, kidney disease, pulmonary diseases, or chronic immune or respiratory diseases. For such patients, the sudden reduction of in-person medical visits (or interrupted clinical trials) has posed a grave health risk. Using RPM plus telemedicine for these patients can be a high-impact measure to maintain medical support and to protect these vulnerable populations from COVID-19 infection.

RPM plus telemedicine can help to achieve 5 objectives during the COVID-19 pandemic:

1	**Detect COVID-19 complications early**	Detect medical complications of COVID-19 patients as early as possible, allowing early medical intervention to prevent severe disease or save a patient's life
2	**Use health system capacity prudently**	Preserve precious hospital/ICU capacity for those who need it most, and reduce the amount of "prophylactic" hospitalisations of Covid-19 infected patients (i.e., who are hospitalised "to be on the safe side")
3	**Increase safety for vulnerable patients**	Establish a safe path of interaction for vulnerable patients (e.g., patients with chronic diseases, cancer, rare diseases)
4	**Expand monitoring capacity**	Empower ambulatory practitioners to monitor multiple patients simultaneously, and to triage the most serious cases
5	**Reduce personal contacts**	Interrupt infection chains by significantly reducing the number of in-person contacts between doctors and patients

Recent research has also indicated that COVID-19 caused a reduction in the number of patients diagnosed with serious diseases, with an effect shown on cancer diagnoses in the United States.[4] For cancer and other serious diseases, a patient's chance of survival depends in large part on diagnosing the disease at an early stage. While remote patient monitoring and telemedicine are not designed to enable sophisticated diagnostic procedures (such as imaging), they could be used as a tool to conduct an initial consultation.

The COVID-19 pandemic has led to renewed and increased interest in remote patient monitoring as a means of providing safe and effective medical care. The technology can aid in early detection of COVID-19 complications, help preserve hospital capacity, increase patient monitoring capacity, increase practitioners' and patients' feeling of safety, and help reduce the risk of spreading COVID-19 infection.

In light of the upcoming autumn/winter period in the northern hemisphere, RPM could be an effective tool to help save lives of COVID-19 patients and other vulnerable patient populations. ■

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Management of COVID-19 Pandemic – The Swedish Perspective

Author: Prof Amir Khorram-Manesh | Institute of Clinical Sciences | Sahlgrenska Academy Gothenburg University | Department of Research and Development | Swedish Armed Forces Center for Defense Medicine | Gothenburg, Sweden

Author: Dr Niclas Arvidson | Department of Research and Development | Swedish Armed Forces Center for Defense Medicine | Department of Infectious Diseases at Institute of Biomedicine Sahlgrenska Academy | Gothenburg University | Gothenburg, Sweden

Author: Dr Yohan Robinson | Institute of Clinical Sciences | Sahlgrenska Academy | Gothenburg University | Department of Research and Development | Swedish Armed Forces Center for Defense Medicine | Gothenburg, Sweden

Among all countries affected by COVID-19, the Swedish pandemic strategy has polarised the political and global media response, where both condemning and acknowledging voices are heard. The question thus arises whether the Swedish approach is unique, and what reasoning leads to this strategy. This report does not discuss the outcome or validity of this strategy but aims to explain the current Swedish approach to COVID-19 management, which is not medically unique but requires a specific socio-political setting. Irrespective of the approach, the world needs to be ready for the next pandemic or public health emergency through investing in social development, community empowerment, and educational initiatives.

Key Points

- Pandemic affects all nations.
- Social and cultural factors can influence management strategies.
- Current strategies may not be implementable globally, and new ones are needed.

Background

The Coronavirus (COVID-19) was discovered in the Chinese municipality of Wuhan in December 2019 and quickly spread to other regions of China and the world. There were early reports of confirmed exported cases from Thailand, Japan, and South Korea in January 2020. By the end of January 2020, isolated cases appeared in some of the European Union (EU) member states. The number of cases continued to increase, and by March 2020, all EU member states had reported COVID-19 cases, almost all related to persons visiting China or visitors from China. On 30 January 2020, the World Health Organization (WHO) declared the outbreak of novel coronavirus a public health emergency of international concern, and on 11 March 2020, a global pandemic. The WHO has coordinated the global combat against the disease. The EU Council, together with other EU institutions, started monitoring the situation and taking action by adapting relevant EU legislation, coordinating information sharing between member states, assessing needs, and ensuring a coherent EU-wide response (Goniewicz et al. 2020).

The COVID-19 virus spreads primarily through droplets of saliva or discharge from an infected person´s cough or

sneezes. Most people infected with the COVID-19 virus experience mild to moderate respiratory illness; they also recover without requiring special treatment. Vulnerable groups such as the elderly and those with underlying medical problems are more likely to develop severe illness. Currently, there are no specific treatments or vaccine for COVID-19 and the best way to prevent and slow down transmission is information and prevention (Cascella et al. 2020). Among countries affected by COVID-19, Sweden seems to make headlines in international news about its strategical approach to COVID-19 management. This strategy differs from other countries, which aggressively initiated their approach by mass testing, and quarantine (Tatem 2020). Political and social comments both in condemning and admiring the Swedish strategy have been published in global news and media. These reactions raise the question of whether the Swedish approach is unique and on what basis it is formed and conducted.

Global Strategy

Due to the lack of specific antiviral treatment or a vaccine, the treatment of identified cases has been symptomatic. In the guideline published by the WHO, based on lessons learned and scientific evidence derived from earlier epidemics, there are recommendations for the prevention and treatment of COVID-19. However, the most crucial action is to prevent the spread of the disease by initiating and implementing preventive measures (Cascella et al. 2020). The focus on prevention concerns two distinct populations: Healthcare workers and the general population. Healthcare workers caring for infected individuals should utilise contact and airborne precautions to include personal protective equipment. The general population has been recommended by the WHO to frequently wash their hands, use portable hand sanitizer, avoid contact with the face and mouth after interacting with a possibly contaminated environment, and maintain social distancing (Hellewell et al. 2020; Remuzzi et al. 2020).

Factors Influencing the Social Response

To implement the WHO´s recommendations, there is a need for firm commitments from many groups of the society. Politicians have to make crucial decisions in favour of public health and not in their socio-political interests. Unanimous and consensus-based decision-making is the best option for a country to cope with all shortcomings and to distribute all available resources in a fair and sound process. Party political stands create distrust among the population, and worsen the trust between the government and public (Lee 2018). Industrial producers can play a vital role by shifting their production towards the needs of society. This behavioural shift is the foundation of solidarity and accountability towards the society they serve (Sakris et al. 2020). There is no limit in healthcare workers' enthusiasm to serve the people and do what they have been trained to do. However, they need the right protection and space to act in confidence (Ran et al. 2019). Finally, one of the essential factors in all emergencies is civilian engagement. As prevention counts, the hygienic measures and recommendations such as social distancing are significant and vital factors to prevent the spread of the infectious cycle. These parameters are influenced by other factors such as cultural background, state of poverty or well-being, education, and a functioning infrastructure (Fast 2020; Cohen et al. 2006; Browning et al. 2003).

The cultural backgrounds often determine social engagement and the states of physical and mental health. The custom, habits, and social commitment form the identity of a nation. Consequently, due to the demography of human beings, we have various ways of living and reacting and thus act differently in a given situation. It is then evident that social distancing can be hard to implement in some countries, while it is more comfortable in others. The state of well-being is another critical point. A society with no poverty lives in well-served communities, while underserved communities have all reasons to be in search of the vital and crucial necessities in life during a pandemic. The lack of education, especially in underserved communities, is a significant obstacle in information sharing and the promotion of civilian empowerment. The infrastructural functionality of a society depends both on the cultural and historical background and on the government's priority for their citizens and contributes significantly to the ability to maintain social distancing (Fast 2020; Cohen et al. 2006; Browning et al. 2003).

The Swedish Healthcare and Perspective vs. COVID-19

The Swedish healthcare system is decentralised, and its responsibility lies with the regional councils and, in some cases, local councils or municipal governments, according to the Health and Medical Service Act (Hjortsberg and Ghatnekar 2001). The role of the central government is to establish principles and guidelines and to set the political agenda for health and medical care. Regional councils are political bodies whose representatives are elected by region residents every four years. The connection between central and local politicians, who are regular citizens, brings decision-making in health issues closer to the public. The Public Health Agency provides the national government, government agencies, municipalities, and county/regional council evidence-based knowledge regarding infectious disease control and public health, including health technology assessment. The agency reviews and evaluates new treatments from medical, economic, ethical, and social points of view. Information from the reviews is disseminated to central and local governments and medical staff for decision-making purposes.

Three basic principles apply to all health care in Sweden: firstly, human dignity, i.e., all human beings have an equal entitlement to dignity and have the same rights regardless of their status in the community. Secondly, need and solidarity, i.e., those in the greatest need take precedence in being treated. Finally, cost-effectiveness, i.e., when a choice has to be made, there should be a reasonable balance between costs and benefits, with cost measured in relation to improvement in health and quality of life (Hogstedt et al. 2004). Political decisions and individual choices can influence many health determinants. For several reasons, it is therefore essential to be able to describe and analyse the evolution of the population's health, lifestyles, and living conditions. The national public health survey is a national study on health, lifestyle and living conditions, which has been conducted annually since 2004 and comprised a random sample of individuals aged 16–84 years. The survey aims to show the population's state of health and to monitor changes in health over time as a part of a follow-up of public health policy. The Swedish legislation clarifies and expands providers' responsibility in conveying information to patients, guarantees patients the right to a second opinion, and ensures the choice of provider in outpatient specialist care. In Sweden, welfare attitudes, political institutions' responsiveness, government performances, and policy issue are significant determinants of political trust, which is among the highest in the EU (Statista 2019).

With the outbreak of COVID-19, initial steps were taken to analyse and recommend appropriate measures for the potential spreading of the virus. The main foundation in the Swedish strategy is the shared responsibility of individuals and authorities, mutual respect of individual rights and needs. Each regional public health office was alerted to identify possible cases, and information was delivered to all medical facilities, primary healthcare centres, and the public by using direct contacts and media conferences. Daily report on the outcome and planned strategies based on actual data has been delivered to all involved agencies and the public, along with recommendations regarding needed precautions, hygienic measures, and social distancing. Hospitals and other medical facilities have been prepared, and pandemic plans have been activated. Collaboration with all agencies has been established.

The main foundation in the Swedish strategy is the shared responsibility of individuals and authorities, mutual respect of individual rights and needs

Being aware of the shortcomings and resource scarcity, Sweden decided to protect vulnerable groups in the society actively. Information, instructions and recommendations was communicated on a regular basis to the rest of population. In the cultural and behavioural setting of the Swedish society, no restrictive measures were applied and people were asked to follow the Public Health Agency's recommendations. The unity and consensus in the strategic decisions made was enhanced by frequent and informative media conferences in which government officials and institutions participated (Public Health Agency of Sweden 2020). Currently the infection fatality rate for Sweden, on this first week of June 2020, is comparable with other countries utilising other measures (U.K. 9%, Sweden 11%, Netherlands 13%, and Italy 14%). One interesting observation is that many prosperous countries are at the top of the list of COVID-19 affected countries with high infection fatality rate (Khorram-Manesh et al. 2020). These countries are supposed to manage emergencies and protect their citizens.

Conclusions

Besides organisational shortcomings and medical resource scarcity, including the lack of vaccines, the most challenging part of the COVID-19 pandemic is the socio-cultural and

socio-political strategies. This may explain the differences in management approaches between countries (Remuzzi et al, 2020; Fast, 2020). Irrespective of the strategy, following conditions must be fulfilled before a society can address, accept and implement the authorities' recommendations for pandemic management. First, there must be a collaborative culture among agencies and the public. Secondly, there must be a culture of consensus, which allows free discussions, but acceptance of the final decision based on the majority votes. The latter can be expressed through democratically chosen representatives based on the reigning constitution (Saltman 2005). Furthermore, people can only stay at home and maintain social distancing if they live in a society, which offers welfare, with minimal poverty, appropriate educational level, and a well-functioning infrastructure. These all contribute to build a community that follows recommendations, fights the pandemic together, and creates a trustful relationship between the government and the public (Cohen et al. 2006; Browning et al. 2003; Khorram-Manesh 2020).

Although these prerequisites are prevalent in many countries, Sweden is harvesting the results of its previous efforts during this pandemic (Hjortsberg et al. 2001). It has essential constitutional support for the government, necessary trust in the public-government relationship, developed infrastructure, cooperative industry, and well-educated and safe-minded citizens. The current development of the Swedish civilian defence healthcare system has also contributed to improved civilian-military collaboration. Civilian-military initiatives have resulted in the rapid set-up of field hospital intensive care units supporting the healthcare system during the pandemic. The outcome of this pandemic is yet to be told, and its evaluation may indicate a change of strategy for upcoming pandemics. The Swedish approach to COVID-19 is not unique from the medical perspective, but undoubtedly unique in the socio-political regard. Independent of its outcome, the COVID-19 pandemic has shown that all countries suffer from a pandemic and one nation can neither be immune to, nor fight alone against the disease. The world should get prepared for the next pandemic by increasing its resiliency through investing in social capabilities, community empowerment, and educational initiatives.

Conflict of Interests

Authors declare no conflict of interest. ■

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Using BioDynaMo to Study COVID-19 Spread in Closed Spaces

Author: Dr Fons Rademakers | Chief Research Officer | CERN openlab | CERN | Meyrin | Switzerland

The open-source BioDynaMo platform was developed at CERN to assist life scientists in creating biological simulations. Since the start of the COVID-19 pandemic, the platform has been adapted to simulate how the coronavirus spreads in populations, which can help to control the pandemic and inform decisions for similar outbreaks in the future.

Key Points

- In life sciences, the 'single researcher's project' approach may not be efficient for the development of biomedical research.
- BioDynaMo's open-source design facilitates the examination of biological models by minimising the coding efforts for researchers.
- Against the pandemic background, BioDynaMo is being applied to simulate various epidemic scenarios using the SEIR model.
- A simulation of SARS-CoV-2 spread in closed environments is presented.

BioDynaMo started as a collaborative knowledge transfer project at CERN, with the goal to 'share knowledge' that is present at CERN in the areas of computer simulations, efficient and scalable software development and long-running sustainable software collaborations with the fields of life science. The main problem at hand was the absence of a standardised and high-performance platform for conducting in-silico biomedical experiments (i.e. simulations). Simulation is an indispensable tool in aiding biomedical researchers to understand complex biological systems and, ultimately, to develop new medicine. Life scientists traditionally follow the 'single researcher's project' approach, in which a model is developed to investigate a specific scientific question and is abandoned after the question has been answered and the work has been published. This inhibits other scientists from building upon prior work and effectively slows down the pace of biomedical research, making it a societal problem at large.

Platform Applications

BioDynaMo is an open-source C++ framework where life scientists can easily create, run and visualise 3D agent-based biological simulations. It was designed so that users can examine their biological models with minimal coding effort and rely on our highly optimised execution engine that deals with the intricacies involved in the world of high-performance computing. The compute-intensive part of mechanical interactions in the BioDynaMo code base has already been made compatible to run on graphics processing units (GPUs). In order to push the boundaries of biomedical research even further, we are now working on accelerating extracellular diffusion computations on GPUs. An example of a mechanism addressed by BioDynaMo is that of predicting the growth and the 3D morphology of a tumour as shown in Figure 1.

Our platform enables the simulation of 1.24 billion agents on a single server and 12 million agents on a

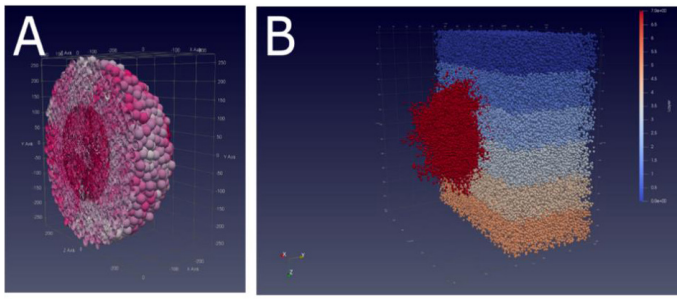

Figure 1. BioDynaMo Simulation: of large-scale tissue dynamics. Cancerous cells (red) interact with healthy cells (other colours) in a layered cortical tissue. Overall, such agent-based models allow to simulate cellular dynamics, interactions between cells of different types and the effects of changes in the extracellular space.

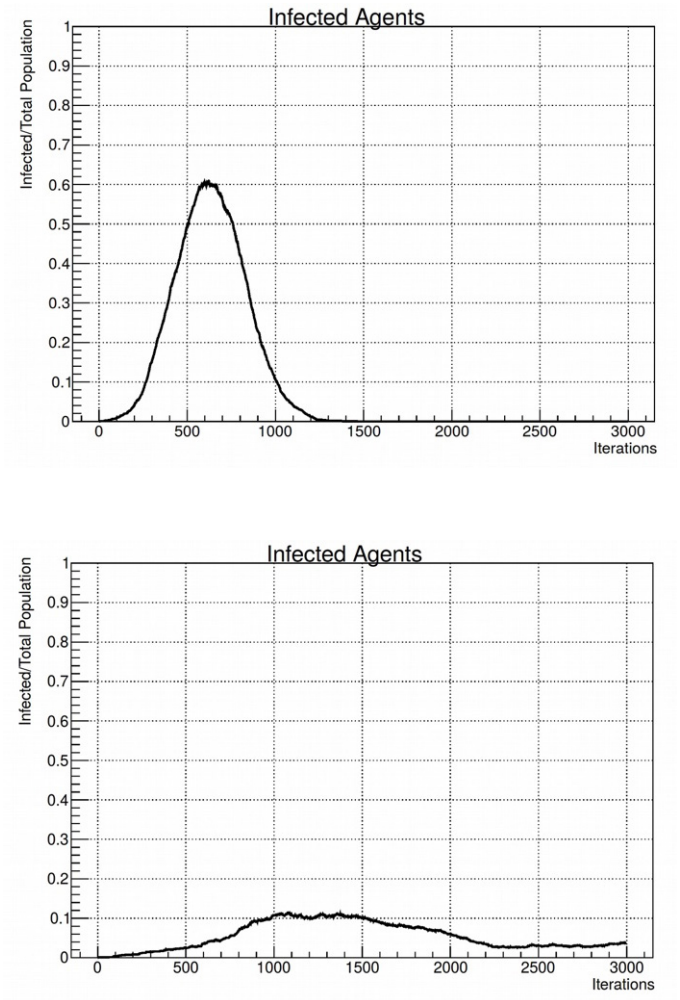

Figure 2. BioDynaMo Simulating Quarantine: in this simulation we vary the moving_agents_ratio variable, which says which fractions of the agents are allowed to move freely, from 1.0, fully free, to 0.25, to simulate the flattening of the curve due to quarantine.

laptop. BioDynaMo places a lot of focus on hiding computational complexity and providing an easy-to-use interface, such that the life scientist can concentrate on biological aspects, rather than computational. BioDynaMo helps scientists translate an idea quickly into a simulation by providing common building blocks, and a modular and extensible software design. An analysis of the performance of the platform and demonstration of its capabilities with three example use cases: soma clustering, neural development, and tumour spheroid growth, is presented in a preprint article by Breitwieser and colleagues (n.d.).

These features have convinced several labs to run their simulations using BioDynaMo. Researchers from the University of Cyprus simulate cancer development; scientists from the University of Tel Aviv together with industry partners are working on accelerating drug development; scientists from Newcastle University are studying neural development; and a joint team from the TU Darmstadt and GSI simulate the damage induced by exposure to ionising radiation on the tissue level.

During the recent COVID-19 pandemic, BioDynaMo has been modified to run simulations on how the virus SARS-CoV-2 spreads through a population. Due to its modular design, it was fairly simple to change the agents from having cell to having human behaviours allowing to model different epidemic scenarios, where humans are either Susceptible, Exposed, Infected, or Resistant (SEIR model) (Figure 2). Using an agent-based system allows for the simulation of global models as well as very fine-grained models where the agents are contained in a city, neighbourhood or street.

The conclusions taken from these studies are useful not only to control the virus in the present but also to know how to deal with similar viruses and future outbreaks. In addition, the current pandemic will provide a trove of experimental data that can be used to tune the models and simulations to be more precise next time.

Use Case: COVID-19 Spread in Closed Environments

In one of these types of simulation, BioDynaMo is used to study the spreading of viruses in indoor spaces, specifically SARS-CoV-2 virus that causes COVID-19, in droplets and aerosols. We are investigating several scenarios, such as public transportation (bus, metro) and buildings (supermarkets, offices). In these simulations BioDynaMo is in charge of simulating the behaviour and characteristics of individuals, while the ROOT (Brun and Rademakers 1997) geometrical modeller is used to define the precise environmental geometry (Figure 3).

Each individual can then independently move around in these environments where infected individuals can possibly contaminate healthy ones through the spreading of droplets and aerosols. By studying different geometries,

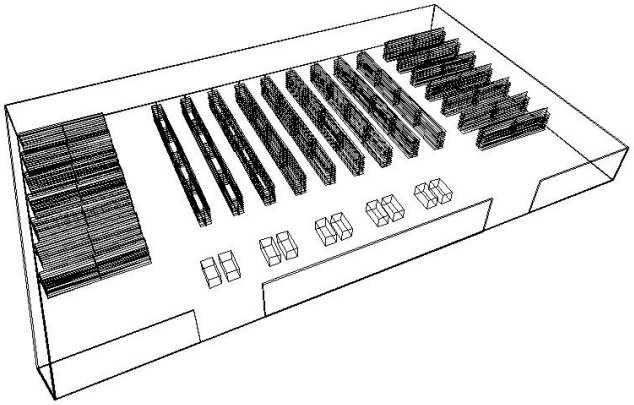

Figure 3. ROOT Geometrical Modeller: a geometry of a supermarket.

airflows, distancing, masks and other parameters, we can hopefully determine, which environments are best to avoid virus build-up and prevent people from getting infected. This is a work in progress.

This study is done in close cooperation with the epidemiological department of the University of Geneva to make sure that our simulations reflect correctly the many observed cases of virus outbreaks in closed spaces.

This work is sponsored by a grant from the European Open Science Cloud (EOSC) and will be made available as a programme that can be run on the EOSC infrastructure for other scientists' benefit.

Conflict of Interest

None. ■

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Leveraging Data and Digital Technology for Pandemic Prevention

Author: Sourabh Pagaria | Executive Vice President & Head of Southern Europe | Siemens Healthineers

The COVID-19 pandemic has changed the way healthcare works. HealthManagement.org spoke to Sourabh Pagaria to discuss the future of data and digital technologies as strategic assets for pandemic prevention in future.

Key Points

- There is a need to adopt technological solutions to help extend reach of clinical staff and improve patient experience.
- Artifical Intelligence (AI) and Machine Learning (ML) powered solutions will play an increasing role in improving clinical outcomes as well as operational workflows in healthcare organisations.
- Healthcare organisations would need to transform themselves into digital enterprises to thrive in the post COVID-19 era.
- Long-term partnerships within and beyond healthcare ecosystems can help healthcare organisations meet these challenges.

In light of the challenges healthcare systems across the globe have faced during the COVID-19 pandemic, what do you expect in healthcare over the next few years?

The COVID-19 pandemic has challenged healthcare systems all over the world placing an unprecedented stress on them. It has also accelerated the adoption of digital technologies. Significant changes in the healthcare landscape are already conspicuous and over the coming years, we will see further tectonic shifts that can be clustered as follows:

Digital Health will become mainstream: Use of digital solutions will continue to grow even after the immediate threat of COVID-19 is over, as patients, providers, and payers alike discover the benefits of virtual forward triage and eICUs, remote care, home monitoring, and digital communications channel. There will also be increased acceptance of AI as a clinical decision support tool to enable fast triaging and reduce unwarranted variations in care. Hospitals would need to build infrastructure to leverage operational data to efficiently manage patient flow and caregiver workflow. Perpetual shortage of medical staff and increased risk of infections will also force adoption of technology solutions to help extend the reach of clinical staff using technologies like eICUs, teleradiology and telemedicine

Increased consumerism will drive focus on patient experience: Increased adoption of digital technologies like telehealth and self-monitoring devices like wearables will challenge the traditional physician-patient relationship in many ways. Hospitals and health systems will need to focus on patient experience management, and engage them through digital channels across various stages of care continuum. They would also need to build services that can cater to different price and service level expectations among different consumer/patient groups for e.g. Millennial and Generation Z population segments are seemingly willing to pay membership or subscription fees that support convenience and on-demand use.

Expansion of outpatient care and decentralised testing: The risk of getting infection at a hospital which is also managing infectious populations will deter some patients from seeking care in that setting. Hence, adding ambulatory sites to delivery networks will make it more feasible for health systems to offer a safe and convenient "infection free" environment to both patients and care providers.

What are the top factors that you see as necessary for healthcare organisations and businesses going forward?

Managing change while delivering: Healthcare organisations and businesses have a huge transformation challenge ahead of them. To excel in this era of fast adoption of digital technologies, increased focus on patient experience and need for transformation of care delivery (from centralised to decentralised and remote as well as from episodic to continuous care) would mean building completely new skills, processes and investing in new technologies. They have to do all this while current business and actual services would also need to continue uninterrupted during the change. Finding the right balance between very fast transformation and progressive fade out of actual service will be the key for success. This is a huge change management effort which will require buy-in, focus and commitment from all levels of the health system leadership.

Balancing competing financial priorities: Additionally, budget constraints have to be managed to continue supporting traditional flows and technology investments while financing a very fast transformation that needs investments in new technology and talent. Healthcare systems would need to explore new financial models with various stakeholders including payers and technology partners to align the risk-return profile of these investments.

Increasing attractiveness for non medical talent: The Industry has been sort of endogamic due to the very special training needs and professional requirements of healthcare, but now, specially in technological and specialised functions, companies will have to integrate people from outside of the industry like information technology, cybersecurity, data science, lean management etc.

Building a learning culture: True, sustainable digital transformation goes beyond adopting new tools and technologies. It requires a culture change and reorientation around more data-driven care models. Simply digitalising current processes and procedures won't be enough; healthcare providers, med tech companies, government agencies, payers and patient advocates will have to work together to sustainably deliver seamless digitally enabled care across a wide variety of care settings. Realigning organisations around data-driven, digitally enabled processes and care models is paramount to the long-term success of healthcare enterprises.

It is clear that these challenges are too big for healthcare institutions to face alone. In my view, well thought through long-term partnership within and beyond healthcare ecosystems can help manage this challenge.

Compared to other industries, the healthcare industry has not been able to completely leverage data and digital technologies. Why do you think that is?

Digital transformation of healthcare is inevitable but certainly not easy as digitalising healthcare requires profound changes in the way healthcare systems operate. There are many factors which have impeded the penetration of digital technologies and proper leveraging of power of data in healthcare:

Fragmentation of patient data: More often than not, even within healthcare systems, the patient data are dispersed in various silos which have low interoperability – labs, radiology, outpatient practices, physician offices and pharmacies. With increasing use of wearables and self monitoring devices by patients this problem has only compounded. This problem gets even more severe if patient goes to a healthcare provider outside a network during his care cycle.

Digital transformation of healthcare is inevitable but certainly not easy as digitalising healthcare requires profound changes in the way healthcare systems operate

Lack of high quality operational and clinical data: Even in the institutions where proper data infrastructure was put in place to bring data together at one place the challenge of ensuring that meaningful data is captured with proper identifiers like time stamps, machine readable physician notes has remained. In most cases, this has required redefining workflows and data capture responsibility within care teams to make it work.

Resistance in using digital communication channels in both patients and physicians: Healthcare delivery was always characterised by deep face to face interactions between caregivers (doctors, nurses) and patients. This was considered necessary to have empathy in these interactions especially with older patient population. COVID-19, however, has challenged both providers and patients to explore digital channels for the same. Using digital channels generates high quality data about the patient journey and disease progression which was not available earlier.

Lack of expertise: As said before, healthcare institutions have not been the first choice of talent that has driven

digitalisation revolution in other industries due to the endogamic nature of technology developments and lack of career paths for such talents. However, many leading institutions have realised this and have been bringing in cross industry talents into highly visible management positions like Chief Data Officer, Chief Digitalisation Officer who, in turn, are then catalysing this transformation.

Do you think partnerships and alliances with technology companies could help healthcare organisations better leverage data and digital technologies?

Because of the scope and complexity of digital transformation in healthcare, partnerships between healthcare provider organisations and industry are vital to success. Medtech partners with broad and integrated healthcare portfolios hold particular advantages for healthcare enterprises that are ready to embrace digital transformation. Such partnership can help provider organisations leverage technology to upgrade their organisations both in the near term, to better cope with the urgency of the pandemic, and in the long term, by investing in strategic digitalisation efforts. Such partnerships need to look beyond immediate financial benefits to one party and take an approach of co-creation, joint innovation and co-leveraging of mutual competencies and assets in order to deliver meaningful improvements in clinical and financial outcomes from such efforts.

Partnerships between healthcare provider organisations and industry are vital to success

COVID-19 has also revealed the role telemedicine can play in healthcare. Apart from fulfilling social distancing goals, what other benefits can telemedicine provide?

COVID-19 has indeed changed the face of medicine and telehealth has become the norm virtually overnight at many institutions due to restrictions on face to face appointments; one of our customers reported an increase in the share of telehealth visits from <1% of total visits to 70% of total visits, reaching more than 1000 video visits per day in just 4 weeks.[1] Overall, there is substantial evidence that home-based telemedicine reduces care costs in a number of chronic conditions including congestive heart failure and diabetes.[2] When done well, telemedicine can also deliver patient satisfaction that is at least equivalent to in-person care.[3] Telemedicine when coupled with AI can also enable fast triaging and quickly identifying critical cases requiring urgent medical attention. This use case becomes very relevant especially during times of pandemic with high patient load. There will always be a role for in-person care, but the benefits of telemedicine and remote monitoring point to sustained growth in their utilisation in the coming years.

What role do you think Artificial Intelligence and machine learning can play to improve quality of care?

AI-powered solutions are becoming more and more common in everyday clinical practices as they relieve physicians of routine tasks, enable more precise diagnoses, and give medical staff more time for supporting patients and families. Most of the Artificial Intelligence we see in use today is actually application of Machine Learning (ML) algorithm on specific problems. For clinical applications like using AI to automatically detect nodules in lungs using data from CT scans, the algorithms were trained on large clinical data sets which were created over a broad sample population and broad time scale. This important work is a prerequisite for using AI in a clinical setting and when done right can enhance productivity of clinical staff manyfold while also improving quality of care. We are also seeing applications of ML in improving operational workflow in hospitals by leveraging operational data for e.g. with one of our customers we worked on applying ML in predicting patient inflow into ER departments depending on external conditions like time of the year, weather conditions etc. This can enable hospital managers to better plan staff levels and capacity which means more patients can receive better care thereby improving quality of care.

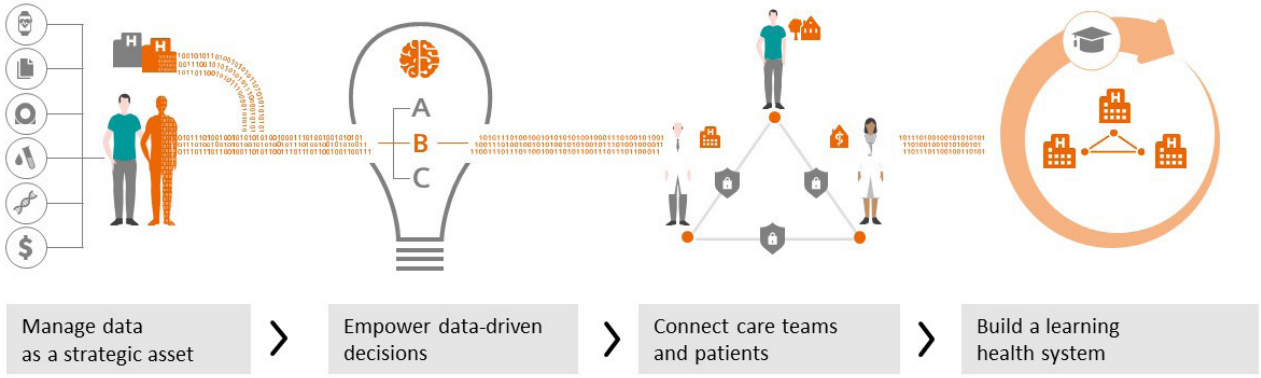
How can healthcare systems realise the full potential of Big Data?

We have recently released a comprehensive paper on "Digitalizing Healthcare" where we have articulated the key steps healthcare organisations can take to become Digital Enterprises.[4] In summary this means:

Managing data as a strategic asset by creating infrastructure and processes to integrate data from multiple sources like imaging, laboratory, physician offices, payers, wearables and genetics on secure and easily accessible data platform. Managing issues related to cybersecurity and data privacy would need to be an integral part of this effort.

Empowering data-driven decisions making by deploying

How to build a digital enterprise



decision support tools for clinical use cases (fast triaging in ED, automated reading of body scans, therapy decision support tools etc.), operational (staff capacity management, patient load balancing across various locations) and consumer use cases (health informatics apps and dashboard for self recording of health data).

Connecting care teams and patients using digital platforms to deliver an integrated care experience. Apart from investing in telehealth and remote monitoring platform, building interoperability between hospital and physician offices, integrating data from wearables and other self monitoring platforms should also be part of this effort.

Building a learning health system which builds commitment within the organisation to both digital transformation and a culture of continuous improvement and knowledge/best practice exchange among the physicians. An important aspect of this effort would be to create leadership buy-in with joint targets, aligned incentives, and a commitment to transformation. Building the right organisational structures, including a dedicated team to support evaluation and learning activities throughout the organisation

What steps should healthcare systems take to ensure they are better prepared next time for a pandemic like COVID-19?

A new pandemic is unfortunately inevitable but health systems can be better prepared for the next event. The COVID-19 experience has highlighted the need for precise, coordinated and data-driven response. Three areas which would need focus are:

Applying testing, tracing and technology: This would include decentralised and random community testing, contact tracing and surveillance enabled by digital tools and using AI-driven telehealth platforms and chatbots for fast triaging and identification of high-risk patients at home to avoid hospitals becoming epicentre of infection.

Building community health information infrastructure: Local and national health authorities should also invest in building digital community health information infrastructure. These Artificial intelligence (AI)-driven community health monitoring centres would become enormous treasure troves of information. Using AI and machine learning, the spread of contagious diseases could be predicted and monitored. Such centres would, of course, need help in the form of hospital admissions data from all private and public facilities so they can take timely and effective actions to contain the transmission.

Ensuring preparedness of hospitals to manage community outbreaks: Preparedness is the key to mitigating a disaster. There are two aspects to consider when it comes to being prepared for a healthcare emergency:

1. Conducting disaster management drills at community level to test coordination between multiple hospitals in a community
2. Ensuring flexibility of infrastructure and staff such that temporary infrastructure like isolation wards, beds and even ICUs can quickly be set up in the wake of a community outbreak. ■

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Prevention and Innovation for the Post-Pandemic New Normal

Author: Professor Arch. Simona Agger Ganassi | Member of the Council of Health Care Without Harm –Europe (HCWH –EU) | Member of the Board, European Health Property Network (EuHPN) | Member of the National Council of SIAIS | Italy

Prevention and Innovation appear to be basic concepts for building a post-COVID-19 "new" normal, but which personal paradigms, and which collective actions would make them a reality beyond words?

Key Points

- Prevention: the system of measures to assure protection in case of predictable events with negative impact on people and environment.
- Innovation: methodology to activating first of all the detection of unmet needs and the consequent stimulus of realising products or services satisfying them.
- Pandemic: an infectious disease widespread over a whole country or the world.
- Healthcare infrastructures: the complex system of healthcare assets, including hospitals.
- Systems Analysis: a method to study complex technical, social, etc. problems breaking them down into basic elements, of which the important part is then to evaluate their interrelations. Introduction of changes and study of the effects make SA an important programming and planning tool for complex realities.
- Urban way of living and quality of urban life: determined and affected by situations and conditions internal and external to the area. Urban planning deals with physical layout of human settlements, that is, it concerns the development and design of land use and the built environment, having the goal to improve the quality of life of the planned area.

Introduction

It is a difficult exercise, certainly not only for me, but for anyone who wants to take the road of putting together a cogent reflection about the world after the pandemic that, like an immense tornado, has upset the whole world and it is still upsetting large parts of it.

Observing what is going on in this unusual summer in Europe, on one side we hear people asserting that nothing can be the same as before, and on the other the collective behaviour seems to show that basically we are all eager to go back to "normal," - as I like to say - "put our feet back in the old shoes."

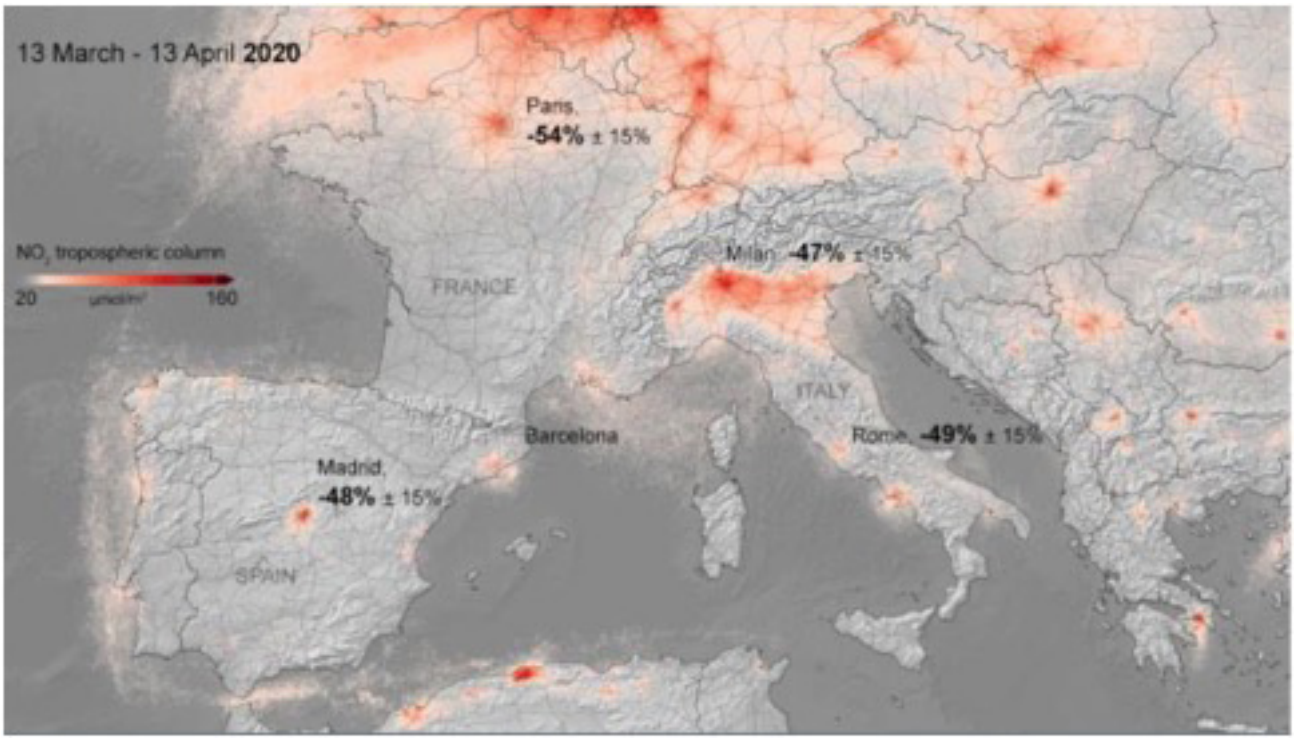
In a prevailing atmosphere of uncertainty, it is understandable that the old normal seems an appealing refuge-port, almost unconsciously rejecting the recognition that it doesn't, it cannot, exist anymore. If there is one consciousness acquisition that should remain in our memory forever is that health is the most precious asset we have.

Situations and habits that generation after generation we have absorbed and accepted have been highlighted to us in their disastrous consequences, and their negative impact on our life. Changes are necessary and we need to first embrace collective actions for a different, a more respectful/balanced way of living in our planet and the necessity of rediscovering parameters of higher human qualification as persons and as members in our global community.

Pandemic and Climate Change

The first point to stress in the search of protection from other similar human catastrophes is that pandemic and climate change are two sides of the same coin.

We have by now sufficient scientific evidence that



Air pollution remains low as Europeans stay at home. Image from the European Space Agency.

deforestation and reduction of wild areas, anthropologic interference in biodiversity, and effects related to climate change, could be the triggers of viral attacks. In short. the protection of human and planet health go side by side. Even if this scientific conclusion is almost universally accepted, other correlated aspects are not.

Pandemic and climate change are the symptoms, not the cause of dramatic disasters produced on people and environment. Therefore, the other awareness that we have to acquire is that the cure, the actions for a "new" normal have to be addressed not only to the effects, but to the causes behind them. What does it mean concretely?

In an article, "Why climate change isn't our biggest environmental problem, and why technology won't save us," Richard Heinberg (2017) has highlighted several relevant aspects which, in my opinion, are valid for our pandemic, even if his article was written before COVID-19. The connection is evident. Our main "ecological" problem, he states, is overshooting. This concept is well known and indicates that the demand by whole humanity and its parts (i.e. countries, cities, activities etc..) for natural and ecological resources exceeds what Earth can regenerate. It gets generally measured year by year using the concept of footprint. COVID-19 has caused humanity's ecological footprint to contract compared with 2019, pushing the date of Earth Overshoot Day (EOD) back by about three weeks. This shows the connection between anthropogenic activities and the excess of demand on natural resources. Certainly it cannot be considered the way of solving the problem. Responses such as COVID-19 and climate change natural disasters are the symptoms of our broken relationship with our environment, for which we have to tackle the causes to achieve substantial results.

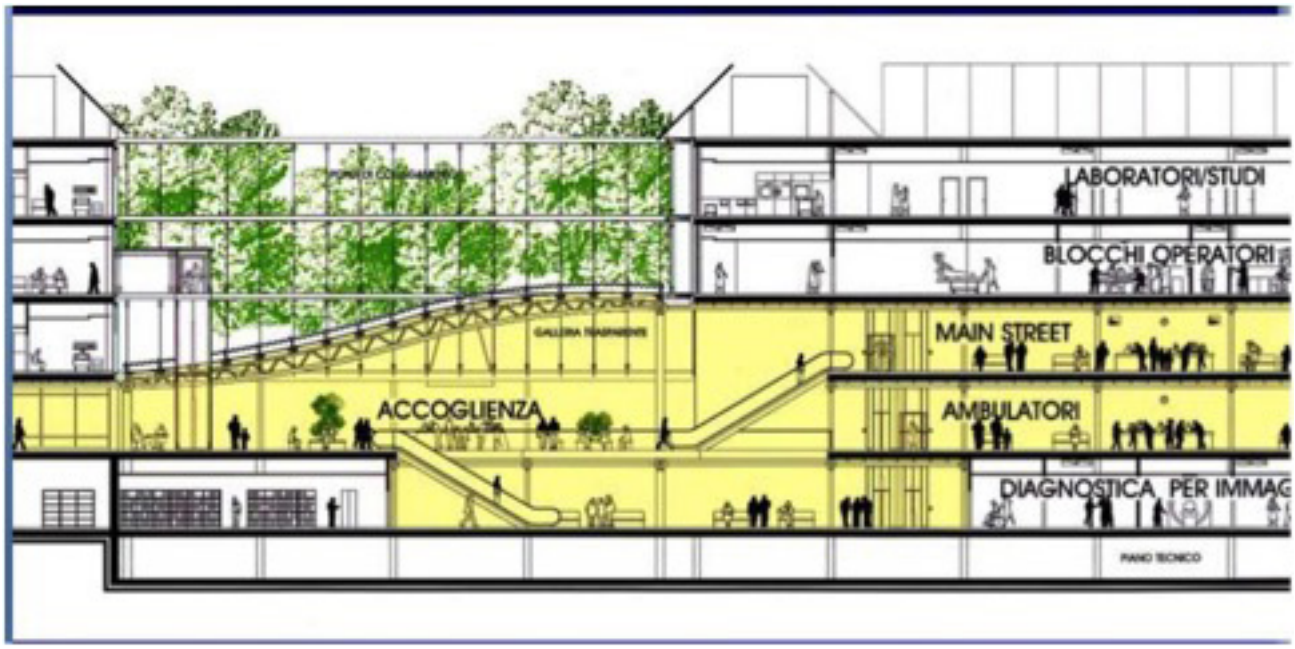
A Different Way of Thinking for a Different Approach

Overshooting, scientifically recognised as the cause of the natural disasters of which we suffer, is a systemic problem that needs to be addressed in the search for our post-pandemic new-normal. There is a need for a systemic approach, involving all components of which the most impacting are the excess of population, consumerism, pollution, loss of biodiversity, overexploitation of natural resources and other related issues.

In the '70, under the guidance of one of its fathers Lester W. Milbrath, the ecologic movement got a strong impulse from systemic thinking. Striking studies like "Limits to Growth" (Meadows et al. 1972) were produced. The work of Jay Forrester become universally known and many books appeared, one of the most relevant being "Overshoot" by William R. Catton Jr. (1982).

In most recent times this approach has left the ground to a vision more focused on separated problems. In the constant emphasis on the warming of the planet, the systemic correlation with the problems mentioned above are rarely stressed. Climate change is basically considered and treated as the cause, not the symptom.

So, in parallel, there is a need to recognise that we have



The Renzo Piano committee Decalogue for a "new" urban hospital published in 2000

primarily to protect the health of human being and of the environment. The pandemic should make us aware that, as Antonio Bonaldi (2020) clearly states in his article Verso l'Ecologia della Salute, "We must accept that we live in a hyper-connected world that offers us many opportunities, but which can also represent a serious threat and above all that it obeys laws other than those typical of mechanistic thought that have accompanied us in the last three centuries. The linear approach is important but must be combined with a new way of thinking, given that reality is multidimensional and the complex biological and social systems in which we live are not reducible to their constituent elements and do not respond to linear logics of cause and effect" (Bonaldi 2020).

Prevention and New Alliances

All this bounces back into the issues that are the focus of our interest: how to see prevention for the "new normal." No single discipline can give the clues, has the keys for reaching such a complex goal. The cooperation and the sharing of knowledge and tools is an important achievement, necessary, but not sufficient. What we need is a further step, that we have pointed out above: to embrace a systemic approach to address our complex problems as a whole, or when creating subsystems, treat them as such.

To comprehend it better concretely, let us take a small step back and focus on hospitals. In trying to analyse what went wrong dealing with the "virus," hospitals, healthcare facilities and the complex of the public health care system were obviously the first one to go under scrutiny. All over Europe at least, it become common to stress that in the last ten years or more the prevailing policy approach was that the health system was a burden in the public budgets that needed to be reduced. What followed was that in many EU countries, heavy cuts in funds was made, and we have to add, not only heavy cuts, but also done inappropriately. The operators of the health care services analysing the impact of the pandemic promptly concluded that the deficiencies impeding the appropriate response to the emergency, were almost entirely to be charged to insufficient resources. The cut of funds producing a lack of medical personnel in all capacities, slow and scarce supply of protecting devices, exponentially increased the difficulties posed by the virus – the unknown and unexpected enemy.

Regarding health facilities, i.e. hospitals and generally the built healthcare infrastructures, they have shown to be insufficient in responding to the extraordinary and accelerated growing needs, also because of their age and insufficient maintenance. Especially among architects, engineers and generally technical health specialists, the word that has become a sort of mantra is **redundancy**, together with **flexibility**. Certainly these are two concepts that will mark from now on the so called new model of hospitals. The same appears to be the case with respect to the opening of medical schools to an increased number of students and/or envisaging new ways to attract young people toward healthcare services. These new interventions are certainly important and badly needed in many realities, characterised by non-functional old hospitals and out-of-date clinical equipment. It is probably where most of the money awarded to

healthcare by national governments and, in the case of Europe, by the European Union, will be invested. Hopefully these new financial resources will be addressed to aspects such as mitigation and altogether to the aspects of resilience that concern climate change related risks.

However this is not sufficient to be considered as necessary **prevention**. It is undeniable that new waves of COVID-19 or of other viruses, as many experts are fearing will arrive, **preparedness** and **resilience** will be very important to save human lives and to mitigate the impact, but it is not the complete, deep lesson that the pandemic, from which we are still suffering, has to teach us. We also have to consider the pandemic as an unrepeatable occasion for making human and environmental health the centre of our priority of action and this means to shoot for more impacting goals than resilience and mitigation. Prevention is this higher step; it is not a matter of only medicine, it concerns life.

We can grant that medicine, healthcare facilities in general and services, have a big role in **repairing/fixing** us when ill, and possibly helping us to regain health, but the medical experts tell us that health is guaranteed by health services in about 15-25% cases. Most of our well-being depends on the environment to which we are exposed, our style of life, the structure of the cities we live in, the quality of air, our social environment, and the food we eat. Meaning there is a complex number of factors that have to be addressed in order to build our post pandemic "normal." No single discipline will give the clues, or has the keys for reaching such a complex goal. The cooperation and sharing of knowledge and tools is an important achievement, which is necessary, but not sufficient. What we need is to take a further step: embrace a systemic approach to address as a whole, the tangle of complex relations and interconnections that, as said before, present our problems.

Anthropology, social sciences, economy, architecture and urban planning, the different specialties of medicine, biology, management, communication and many other disciplines of different fields of knowledge should contribute to build a new approach for a comprehensive prevention, platform of a new normal and of a prevention addressed to human and environmental health through the reduction of overshooting.

Urban Environment as Primary "Gym" for a New Post-Pandemic Normal

Two considerations about the response to the pandemic impact seems to me relevant. Public health authorities in many instances have been stating that the weak link of the system has been the health service in "the territory," meaning the health infrastructures for services out of cities and different from hospitals. The other, and I underline this positively, is the sudden interest for urban spaces, and the importance of design of the cities and housing. I am considering them together, because they can, together, contribute to the prevention that we would like to achieve for the post-pandemic normal.

The idea to overcome the model of hospitals as "silos" or "citadels" has been a challenge since a long time now. An example is the results of the commission of the Italian Ministry of Health, led by Renzo Piano, that in 2000, concluded its work presenting a meta-project of open hospital, as part of the city, encompassing commercial city activities, letting green dominate healing spaces. This however did not became the model of a "web of care" distributed in the territory so that a new concept of urbanism could materialise.

In the meantime, urban areas have increased their negative environmental impact, the community sociality has given the place to urban isolation and seclusion, the living conditions are for larger areas unpleasant and unhealthy, more and more plagued by traffic problems, air and noise pollution, waste and disorder.

So, repeating what I said before, why not transform the pandemic tragedy into a unique opportunity to pursue the goal of transforming our urban areas into environments that keep us healthy and that respect health and cover the needs of people of all ages - from children to elderly?

As for the new concept of hospitals, urban designer, planners, architects together with other advocate of new ways of urban living have produced ideas and studies related to urban spaces and health. The US has been working for several years through an organisation called Congress of New Urbanism and their "Charter for a New Urbanism" (1996). It is well summarised in this sentence: "New Urbanism is a planning and development approach based on the principles of how cities and towns had been built for the last several centuries: walkable blocks and streets, housing and shopping in close proximity, and accessible public spaces. In other words: New Urbanism focuses on human-scaled urban design."

These principles and studies provide important background information. As we have indicated in the title, urban space appears to be an interesting gym to practice to change the situation of our urban areas, and to transform them from unhealthy, unfriendly, unmanageable places to live in into our best encouragement for new style of life.

The pandemic offers a unique opportunity for reaching the real prevention, but this imposes something I would say fits more concretely into the needs of our European cities at least, that, above all the cultural and historic differences, they all suffer from similar problems. An important confirmation comes from the call for papers issued by Liesbeth van Heel, senior policy advisor/researcher at Erasmus MC in the framework of ARCH21, an initiative launched to connect researchers and practitioners around the conference theme, of which the first of three first topic is: "Health promotion in society – how reshaping unhealthy environments can support the needed change in human behaviour." It confirms that the goal of improving our cities, our urban areas, starting by not accepting the decay in which they are, is of fundamental and

great importance for developing the real prevention concept for the post-pandemic normal.

Thinking the Unthinkable Through Innovation in PPI

It is certainly true that the policies of the past decades in several European Countries were oriented to the closing down of small hospitals and accepting, if not favouring, the growing of private health infrastructures. The so called "spending review" has deeply penalised the health system, at least in countries like Italy, as we have already mentioned.

It is equally true that cities, also small cities and villages, have become more and more unliveable: traffic, waste, pollution, disorder, impossible use of public spaces and green areas are the classic results in a good number of nations of the relative free hand to an urbanisation driven by economic goals, most of the time based on land speculation.

Now is the time to invest in a different way the resources that will be made available to the public health system. Innovation seems to be used as a magic word for improving our post-pandemic world. Yes it can be possible, but only if innovation is a tool understood and used appropriately.

I have learned, working in the public health system, of the opportunities offered to all the public sector by the procedure called PPI - Public Procurement of Innovation. The European Union stimulates projects of this type and, under the guide of the best possible teacher, Gaynor Whyles, I have understood its value. First of all it is a participatory process. It requires, in fact, the contribution, in the case of the healthcare sector, of people working in specific areas without difference of professional level. The importance of this experience is that it addresses an unmet need that is not satisfied by products already present in the market. A further step involves organising "market sounding," which will involve, in a totally open way, the branches of industry that could be interested. The latter have to become convinced that the innovative new products (or processes) will have a market. The tender will follow and potential producers can organise for studying and then offering them. It is not an easy procedure, but the results are surprising. New ways of cleaning hospitals beds in a cheaper, more efficient way, less demanding in terms of personnel engaged and overall more environmentally friendly, have come out in our experience, as well as other results in terms of catering, hotel services improving the wellbeing of patients. These solutions are often more sustainable and cheaper.

Innovation, as satisfaction of unmet needs or change in old procedure, used in any public area, will produce even more results, applied in the framework of a systems approach. This, in fact allows the evaluation of which interventions can produce the best domino effect and can constitute the leverage for an even more impacting result. The post-pandemic moment, when we assume there will be funds granted to the healthcare system and to the urban communities, is, as we have already stated, a unique moment for using innovation for a lever of change and having the possibility to think of solutions that were unthinkable before and get them! .

Conclusion

The long procedure in examining which foundations can have a new post-pandemic normal, has brought me to conclude that prevention is certainly the appropriate goal, if it is intended as a way to include in our actions and decisions the health of people and of the environment, which are interdependent. Certainly big policies for respecting water and save ocean and glaciers, for fighting deforestation, for a more impacting and universal fight against poverty, are indispensable but they belong to another level of analysis. To stay at what can be influenced by us, simple people, we have to contribute to the largest diffusion of the consciousness of the need for developing different styles of life, eating habits, appropriate use of plastic and others subjective choices. We have to convince ourselves that we cannot go back to the old normal, simply because it doesn't exist anymore.

The new normal needs to be founded on changes that we have to contribute to, to determine the urban structure and environment and its integration with the health system of care. These can be the foundations on which to build prevention not only against possible future new viral attacks, but also against the decay of our environment and health conditions that, without the pandemic shock, too large a population of people seemed to be getting adjusted to or consider ineluctable and to induce the policy makers, who have turned their shoulders, considering these problems impossible to solve, to turn around again and apply the new means of innovation in public procurement that can be a fundamental leverage for the new normal. ■

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Smart Thinking:

Oxford, GE to use AI against COVID-19 pneumonia; French team builds database with GE software

With the COVID-19 pandemic ongoing, efficient collection, analysis and management of patient data may play a pivotal role in supporting clinical decision-making and improving outcomes. GE Healthcare is part of several AI-driven projects in the UK and France, which are aimed at assisting clinicians with diagnosis, triage and treatment of COVID-19 patients.

Scottish microbiologist Sir Alexander Fleming famously discovered penicillin in London in 1928, but it was a team at Oxford University that purified and tested the antibiotic just in time for use during World War II. Oxford is again stepping up to help the world fight back, and this time it's against the COVID-19 pandemic. Scientists at the British university's Jenner Institute are leading the global race for a vaccine for the new coronavirus, with the results of human trials likely to emerge any day now.

The city of dreaming spires, as Oxford is known, is also home to another important project that's studying how artificial intelligence (AI) could help the diagnosis and treatment of one of COVID-19's main complications: pneumonia. The University of Oxford-led National Consortium of Intelligent Medical Imaging (NCIMI) is working together with GE Healthcare to devise software tools that can analyze medical imaging, laboratory and clinical data to help predict which patients stand the greatest risk of developing severe respiratory distress, a key cause of mortality for COVID-19 patients.

"We hope to develop a simple, mathematical prediction model for COVID-19 pneumonia to determine how well patients will do," says Fergus Gleeson, a consultant radiologist and professor of radiology at the University of Oxford.

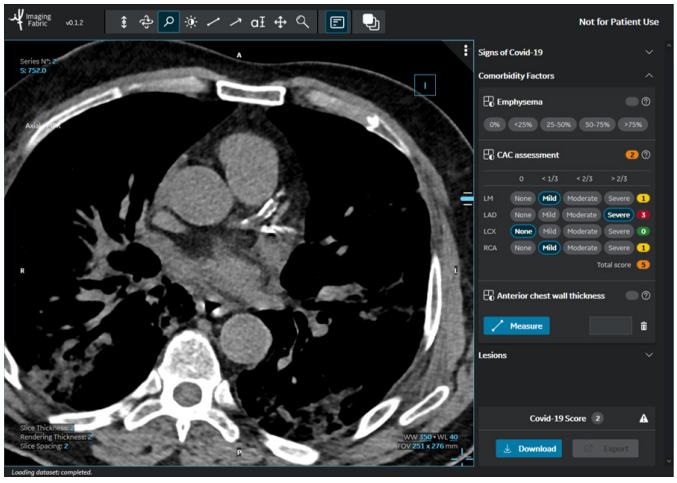
Gleeson says that COVID-19 patients with pneumonia generally fall into three categories: those who weather the disease well and might be able to recover at home, those who require admission and might either recover without significant interventions or deteriorate and require active monitoring, and those at risk of imminent deterioration, who may need to be admitted to an intensive care unit (ICU). But it is not always easy for clinicians to judge which category a patient belongs in.

The AI-enhanced COVID-19 Prognostic Algorithm study (HOST) may be a step on the way to allowing clinicians to more quickly make those calls. Gleeson says clinicians could enter key information about patients who present at hospitals with suspected COVID-19 into software that generates instant insights and predictions about them. These insights would help them diagnose, triage and treat with more speed and accuracy. "It would provide a base level of care for all patients," says Gleeson. It may also allow a hospital to prioritize its resources for the patients who are at the most risk.

The Oxford-based consortium will train algorithms developed by GE Healthcare engineers on mountains of imaging, biological and hematological data gleaned from thousands of machines and patients in the U.K. and beyond. "It's predominantly imaging-based [data], but we will combine this with as many other parameters as we can," says Gleeson, who splits his time between clinical care and academic research.

Across the English Channel in France, GE Healthcare is also collaborating with Assistance Publique-Hôpitaux de Paris to create a giant database around chest imaging in COVID-19 patients. This major study aims to analyze 10,000 thoracic CT scans to better understand patients' responses to COVID-19 and develop tools to automatically assess the severity of the disease.

A group of 20 expert radiologists involved in the project is using 3D image visualization software developed by GE Healthcare on the EDISON™ platform to analyze virus-affected areas and provide information on vascular, pulmonary or overweight comorbidity factors likely to



influence the course of the disease, such as the appearance of arteries, the appearance of unaffected lungs or the amount of fat in the chest wall.

"The physician reading the CT scan is interested in identifying early signs of the disease and assessing its extent," explains Professor Marie-Pierre Revel, head of the cardiothoracic imaging unit at Cochin Hospital in Paris, who leads the STOIC project (thoracian scanner for the diagnosis of coronavirus-19 pneumonia). "But the scan also provides other patient data, allowing us to establish a severity score that can be correlated with the patient clinical course. All this data is now available and should help us better understand why some individuals develop a severe form of the disease."

For example, most COVID-19 patients at hospitals in recent months have received a chest x-ray, while a smaller proportion have undergone CT scans, some of which have been performed as CT pulmonary angiograms – which allow clinicians to see how blood is flowing through the lung. The data from such images, such as the size and position of blood clots if present, will join that avalanche of biological and hematological data, which include electrocardiographic (ECG) readings, blood oxygen levels and biochemical measures of inflammatory responses. Added to the mix are data about the patient's treatment – whether they received high-flow oxygen or required mechanical ventilation in an ICU, or were sent home to recover. These caches are supplemented with data on clinical outcomes, allowing the algorithm to include the information on the patient's condition, treatment and outcome when it generates insights and predictions.

"As health systems manage COVID-19 cases, clinicians can benefit from new technologies to help triage and determine which patients are likely to develop respiratory distress and longer-term complications," said Kieran Murphy, President and CEO of GE Healthcare. "If we can help ensure patients are quickly placed in the right care setting, this may help to improve outcomes."

GE Healthcare is looking at other targets in this field. Recently, it announced its Thoracic Care Suite, a collection of algorithms that analyze chest X-rays and flag abnormalities for radiologists to review, including pneumonia, tuberculosis and lung nodules. The software also outputs a score for the eight possible abnormalities, which helps clinicians accelerate diagnosis and treatment. In one study, results showed a 34% reduction in reading time per case[1].

Back in Oxford, the HOST trial will last 12 months, and Gleeson hopes that, in the not too distant future, a clinician will be able to input a few data points about a patient – such as a blood oxygen level, an ECG reading and x-ray data – into a web-based picture archiving and communication system (PACS). The system is intended to instantly output a percentage likelihood that a patient will require admission to the hospital, or potentially admission for high-flow oxygen or ventilation.

In the longer term, Gleeson is optimistic about the potential for AI-derived insights in medicine. Also on his radar is AI modeled on international data sets that can generate insights about COVID-19 patients based on their ethnicity. "This is about the development of algorithms that can be validated at actual hospitals in the real world," he says.

The partners will also work with the U.K.'s National COVID-19 Chest Imaging Database and the British Society of Thoracic Imaging.

Article previously published on GE Reports.

[1] GE Healthcare data on file. - https://www.ge.com/news/reports/smart-thinking-oxford-ge-use-ai-against-covid-19-pneumonia-french-team-builds-data-base-ge

(You Gotta) Fight for Your Right (to Party!)?

COVID-19 'Immunity Passports' through ethical lens

Author: Dr Stefan Heinemann | **Professor of Business Ethics** | **FOM University of Applied Sciences | Essen** | Germany | **Spokesman** | **Ethics Ellipse Smart Hospital of the University Medicine | Essen** | Germany

The possibility of introducing the so-called COVID-19 'immunity passports' has been widely discussed in the recent months. It is, however, undermined by the lack of consensus on countless fundamental issues, such as immunity, effectiveness of antibody testing or the balance between individual liberties and public health safety. An ethics expert questions the legitimacy of such an approach in the current circumstances.

Key Points

- The COVID-19 pandemic has a much greater impact than past epidemics, especially because there is still no consensus on its characteristics and the relevant public health measures.
- Despite the widening availability of antibody tests and their increasing sensitivity and specificity, they do not equal an 'immunity certificate.' The balance of benefit and damage is yet to be achieved.
- It is not unlikely that the immunity passport concept implies false incentives, such as unfounded overconfidence or deliberate abuse of the system.
- An insurance for immunity and infectiousness is not possible today and is also a fundamentally problematic concept in the context of medical statements.
- As a result, there is no consensus on whether immunity passports are legitimate. Regardless, they must not lead to discrimination or stigmatisation, convincing arguments for the introduction are hard to find.

"That hypocrite smokes two packs a day."
Beastie Boys

Freedom Through Immunity?

SARS-CoV-2 is special, not only for medical but also for sociological reasons. In a recent tweet Dr Nahid Bhadelia, MD nailed it for me: "This isn't the common cold. And it isn't Ebola. It's harder to tackle COVID-19 because it's in the between space. Society doesn't know how to handle the risk that does nothing to some & takes everything from others. It's testing our individual focused post-modern culture." Of course, SARS-CoV-2 is part of basic biology, but humanity seems to be more fundamentally overburdened by dealing with the pandemic than with pandemic crises of past ages.

This is not least due to the fact that, despite the well-known family of coronaviruses, immunity, infectivity, disease and, ultimately, vaccination cannot be clarified in the shortest possible time to such an extent that clear, hardly controversial measures on the political level can be derived from them and convincingly represented. On the contrary, SARS-CoV-2 appears to be a moving target. Our learning curve is rising impressively in the sphere of science as well as in the sphere of clinical care and everyday handling. However, the continuing dynamics of findings, decisions and measures,

and adjustments of those are overstretching the people in the states characterised by individualistic hedonism to an extent that should not be underestimated. Even if the states are dealing with the pandemic with varying degrees of success, there is still no consensus on what exactly makes the pandemic control successful. Is it low death rates, low infection rates, low growth rates, progress in the development of a vaccine, successful education of the population, good commitment of the population in the implementation of the appropriate measures, support for the economy and its effects, or something else?

There is a clear tension between the concept of freedom that is an essential task of the state to preserve in peace, and the security of citizens in public healthcare. Security and freedom are currently in a special debate, if freedom could to some extent be linked to personal immunity. The question of how, and if, the so-called 'immunity passports' could be a legal, legitimate and effective measure in the interests of public health and fight against SARS-CoV-2 and COVID-19. Above all, the ethical dimension of this question is of such complexity that the German Ethics Council has initially requested more time from the Federal Government before it can comment on the ethical issues of an immunity passport (for examples of the debates in Germany see Ulrich 2020. With the 'Corona-Warn-App' launched on 7 July 2020, this topic has once again moved into the public focus, e.g. Heinemann and Heckmann 2020; Persad and Emanuel 2020; WHO 2020).

Descriptive and Normative Challenges*

A whole range of different SARS-CoV-2 antibody tests are now available (Kontou et al. 2020; U.S. Food and Drug Administration 2020; Kohmer et al. 2020), which not only provide increasingly reliable results in terms of accuracy (sensitivity) and statement quality (specificity) but can also be performed in highly automated systems. With regard to the tested individual, however, even with specificities of 99.8%, which some antibody tests now provide, the question of positive predictive value arises. Do they not also measure coronavirus antibodies other than those of SARS-CoV-2 and are the results really reliable? This question is, of course, relevant for the tested individual. Nevertheless, a *carte blanche* in the sense of an 'immunity certificate,' which must be evaluated ethically and critically anyway, cannot be given with a simple antibody test. This cannot be the goal, and for a good reason.

The goal is to obtain a good epidemiological assessment for political decisions, and for this purpose, the data are certainly precise enough. With the rates of infection increasing, the positive predictive value for the individual will also increase and thus in the end even enable a reliable statement. To achieve this, however, a lot of testing is required. And so, what Weinstein and colleagues recently formulated in connection with waiting for safety of SARS-CoV-2 antibody tests applies: "There is no such thing as a 100% safe bet. Let's not permit an unattainable ideal to be the enemy of a very good option that we currently have" (Weinstein et al. 2020, p. 3). Already in April WHO summarised: "At this point in the pandemic, there is not enough evidence about the effectiveness of antibody-mediated immunity to guarantee the accuracy of an 'immunity passport' or 'risk-free certificate.' People who assume that they are immune to a second infection because they have received a positive test result may ignore public health advice. The use of such certificates may therefore increase the risks of continued transmission" (WHO 2020). Initiatives in research and public health are increasingly available to address this challenge.

The idea of safety, as Weinstein et al. (2020) further explain, is a category that can only be used to a limited extent for the tradition, topicality and future of evidence in medicine in general, at least if it is meant to be 100% accurate. No diagnosis, no therapy has an accuracy of 100%, and according to the core principle of medical ethics, to avoid harm, one always chooses the option that has a more likely benefit and generates the least possible harm. It is much more reasonable to conduct an explicit inventory of benefit and harm, whereby four independent pieces of information must be weighed against each other when evaluating serological tests as a basis for the reintegration of persons into the labour market or special protection policies for vulnerable target groups.

A *carte blanche* in the sense of an 'immunity certificate' cannot be given with a simple antibody test

The prevalence of SARS-CoV-2 antibodies in the population has to be better understood and the performance of serological tests in terms of their sensitivity and specificity has to be significantly improved. Another question is how exactly SARS-CoV-2 antibodies confer immunity and, in particular, the relationship between the SARS-CoV-2 antibody level and the resulting accuracy and persistence of the present immunity.

Let us not forget the question of what it means if a PCR test is positive. The so called Ct value measures the

multiplication of the virus genome and at a high value the COVID-19 test is positive, but the patient is probably no longer highly infectious. This value is always measured, so far a limit of 30 is discussed as Ct value. However, it is clear how important the details of the tests are; precision is not always an advantage, it depends, as with any information, on what is actually measured with what objective. A shorter quarantine would be conceivable on the basis of such considerations, for example, and would probably be much easier to communicate to the public.

The question raised by Weinstein et al., i.e. the offsetting of damage and benefit in this almost utilitarian form, will not be resolved ethically and practically. It is correct, however, to point out that it is necessary to take a well-balanced risk when weighing up benefit and damage, and to be prepared in principle to allow for as little error as possible in exchange for the even more serious error of not testing at all or not testing enough for SARS-CoV-2 antibodies.

When one thinks back to the first HIV antibody tests, it is basically the same as it is today with SARS-CoV-2 antibody tests, whereby today's HIV antibody tests come close to the desired 99%+ specificity. It is not unlikely that SARS-CoV-2 antibody tests, provided that the testing is sufficiently broad, can also achieve this leap in quality and in a much shorter time. Andersson et al. (2020) come to the following conclusion after critical evaluation, with reference to the situation in England: "Monitoring the COVID-19 epidemic is important. The only current justification for large-scale SARS-CoV-2 IgG antibody testing is for research purposes, including public health surveillance to inform epidemiology. This should be done through carefully designed studies with clear objectives, sampling frames, inclusion criteria, and consent procedures. Without this framework, it will be difficult to interpret the results of *ad hoc* patient testing, and their applicability will be uncertain" (pp. 1-2).

An immunity passport is most likely associated with false incentives. On the one hand, it is an incentive not to continue to protect oneself sufficiently, and thus to take an infection risk for oneself and others in the unlikely event of a false negative test result. For the false positive case, quarantine is still the least dramatic and, eventually, unnecessary measure, but it becomes more critical if incorrect treatments are used. In addition, there could be an incentive to deliberately infect oneself (especially if there is a justified or unfounded suspicion that one does not have to expect a serious course of the disease) in order to be able to claim possible perks of an immunity passport, either professionally or privately.

Of course, parties, understood here as a catchword for the characterisation of certainly initially justified claims to an individual lifestyle within the framework of the legally permissible and certainly also part of a specific form of essential urban culture of experience, are not *per se* an irrelevant part of life (not to speak of the live-communication and entertainment industry, which faces major challenges that are ruinous and can also mean the loss of personal economic existence for many employees). And yet, celebrating is not a human right. The protests against the corona rules in Germany show that a right to party – understood here, of course, as a metaphor for the desire for 'normality' in lifestyle – could indeed be a sufficiently strong incentive to interpret an immunity passport in a direction that is no longer appropriate for the holder with positive results. For people currently going, again and again, to partly uncontrolled demonstrations against the 'corona fraud,' a basic inclination to consciously accept an infection is to be assumed, since serious consequences are not believed in anyway and low-threshold measures, such as the wearing of mouth-nose protection masks, are already evaluated as an inadmissible interference with the liberty rights.

There is an exhausting tension between the concept of freedom and the security of citizens in public healthcare

The abuse in handling immunity passports might be very high. Only in the event that the pandemic would have succumbed to a vaccination campaign would discrimination be less likely, since personal immunity could be achieved without negligently taking a risk for oneself and others. In this case, an immunity passport would be identical to vaccination cards already widely used today (also for entry, for example) and would be less interesting as a tool for problem-solving in the event of a pandemic.

The exciting potential of immunity passports is certainly the idea of being able to use immune persons in a (also and especially medical) profession without risk. The broadly existing desire to overcome not only the professional but also the private restrictions and to go back to aerosol-driven, superspreader-endangered places like bars, parties, shows, churches (not to speak of risk-free schools or universities) or whatever else corresponds to one's lifestyle without risk of infection seems to be very seductive. This could lead to a run for antibody testing, which on the one hand would have to be financed (which under certain circumstances could also be done privately), and on the other hand put a heavy strain on

the testing capacities of the laboratories. Valid antibody tests with high specificity and sensitivity even at low prevalence are conceivable, but we are not there yet. This would require much more widespread testing. Especially since it can be asked whether the same purpose could not be achieved with other, ethically less controversial means, namely an at least gradual improvement of the low-risk application possibilities for at least some occupational groups. Only mass testing, while maintaining the selected test system, can provide data on the prevalence measured with that system. In addition, only mass testing can provide any results at all due to the currently very low prevalence (in Germany); at a prevalence of less than 1%, small test collectives are pointless (Zeiler and Heinemann 2020). Even with 2%, two out of three immunity passports would be incorrect and thus endanger people. Private antibody tests, whose results would neither be data protected nor statistically evaluable (since only the private testers would see the data, comparable to a rapid pregnancy test), would not be an advantage for a pandemic control strategy and are therefore rather critical.

Current developments of the antibody point-of-care rapid test are shortly before market launch. Even without an immunity passport, anyone can already buy a more or less good antibody test privately – even online – and realise their possible right to knowledge in this way (Vakharia 2020). At least to a certain extent, because too little is known about reinfection.

But even without an immunity passport, which would have to be issued by the authorities to prevent abuse through private, non-transparent and misleading offers, the education of the population would be essential, because education about what a certain immune status now means or not in terms of personal protection is essential. Unfortunately, the argument that a great deal can be achieved together in terms of mutual protection through masks, distance and hygiene seems to presuppose too much solidarity, so that individual solutions may be preferred. And this certainly includes individual, inexpensive and readily available tests, but these must also be objectively convincing and classified in a way that guides the actions of the individual person. It is still far too uncertain to talk about personal immunity (and infectiousness), let alone how effective it is and for how long it lasts. Immunity passports, which would probably be digital if they were actually introduced, are also being discussed to revive travel. So many advantages could as a result also drive another server form of fraud, identity theft.

A further, secondary, conceivable problem with immunity passports is also on the allocation level, the question of allocation criteria to avoid privileges is here as well. The test capacities for antibody tests are considerable, but never so large that all residents could be tested at once. The question therefore arises as to who may and who may not enjoy the privileges potentially associated with a test first. Regulations analogous to those that are important for the distribution of the vaccine should be discussed here. Ultimately, the ethical problem is similar for antibodies and the actual disease test. The question always arises as to who may or even has to deduce what consequences from the result for what legitimate reason.

All in all, an immunity passport would be more likely to lead to unsolidary behaviour. Moreover, the measures, which are already difficult to mediate, would be even more difficult to enforce, since two classes of persons would be confronted with the measures, the immune and the non-immune ones. The individual risk of committing to wearing a mask, keeping distance and maintaining hygiene, even if all these measures were ultimately useless, should be significantly lower than the humanitarian and social risk of the pandemic – if it makes sense to protect oneself and others in a low-threshold manner. Many people are closed to this simple risk logic, and an immunity passport should not support the risk logic. A SARS-CoV-2 infection, like other diseases or precursors to diseases, must not lead to discrimination, not even stigmatisation. “Stigma as well as other harms could potentially negatively impact a person’s employability, promotability, insurance rates, access to housing, etc. These ethical concerns heighten the need for policy advisors to reflect beyond the science when they consider enacting antibody passports” (Bramstedt 2020, p. 3).

In the case of immunity passports, would wages rise for employees who can show a positive passport? From a market perspective, perhaps, but from the perspective of cognitivist ethics, this case should be avoided. The universalisability of ethical values is also valid in the pandemic. A so to speak immunological distortion of the social contract would only be legitimisable if higher goods were preserved in the sense of a material hierarchy of values through immunity passports. This requirement arises from the ethical demand for solidarity and dignity, also and especially in liberal societies. The simultaneous demand for security does not, firstly, descriptively exclude this because, as seen, there are many difficult incentive traps (not to mention legal challenges). Moreover, it is difficult to justify in normative terms why natural or even artificial immunity should in any way create special rights (e.g. to party). Rather, acceptable advantages are conceivable with a priority consideration of special occupational groups with high risk as in medical care, which is an analogous allocation challenge with a possible vaccination. Immunity passports have the potential to do more harm than good (also see Zeiler and Heinemann 2020). A lack of immunity is not a disability and so the inequality may be fostered, may be illegal (as in the U.S. Americans with Disabilities Act), but must be criticised as unethical with good reasons.

Discussion Perspectives and Solution Corridors

There is no consensus on the question of the legitimacy of the immunity passports in Germany or, as far as can be seen, elsewhere in the world. In a recent paper, Greely (2020)

comes to a summary worthy of agreement:

"Potential strategies to implement immunity passport policies require a comprehensive assessment of benefits and harms, and what would least restrict individual liberties without significantly heightening the threat of COVID-19. Current scientific uncertainty on the extent and duration of antibody-mediated immunity to SARS-CoV-2 makes this challenging. Some countries are likely to push ahead with an immunity passport program to accelerate economic recovery. However, ill-conceived policies have the potential to cause severe unintended harms that could result in greater inequity, the stigmatization of certain sectors of society, and heightened risks and unequal treatment of individuals due to erroneous test results. The risk of such harms could be reduced through a centralized policy with clear guidelines on which sectors of society to prioritize for testing and rigorous mechanisms to validate test results and identify cases of reinfection. Sector-based policies that prioritize access to testing based on societal need are likely to be fairer and logistically more feasible, while minimizing stigma and reducing incentives for fraud."

Immunity passports are already not a wise measure in pandemic management from an ethical but also a pragmatic point of view. Under the aspects mentioned above, rapid tests for SARS-CoV-2 antibodies, more COVID-19 tests and broad antibody tests, for example, in the context of blood donation, are more sensible. 'Golden passports,' no (Bramstedt 2020). However, the Wild West of antibody testing also needs to be ended by clear regulation based on anti-discrimination, antibias and valid data for public health. The individual benefit will always be the decisive argument, unfortunately not always the ethical insight. It is therefore important to keep this benefit in mind when regulating. This is only possible through considerable efforts in education. Otherwise, the potential benefits of immunity data via antibody testing would most likely be quickly squandered by the social and medical costs of a test strategy that creates false incentives.

Conflict of Interest

The author states that no conflict of interest exists. For this article the author has not used any studies on humans or animals. ■

* The first half of this passage is taken from the German original of Zeiler and Heinemann (2020), translated by S. Heinemann with some changes.

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The Role of Telecardiology – Lessons from COVID-19

A Missed Opportunity or a New Hope?

Author: Dr Rafael Vidal-Perez | Cardiac Imaging Consultant | Cardiology Department | Hospital Clinico Universitario de A Coruña | A Coruña, Spain

At the beginning of the COVID-19 pandemic, with lockdowns and restrictions of physical contact, many editorials in scientific journals started to speak about the telemedicine solutions but no telemedicine programme can be created overnight. In cardiology, the branch of telecardiology is well developed and the COVID-19 pandemic showed us the potential of this tool and the need for improvement in the months to come.

Key Points

- Telemedicine is not something new; it is well known from the beginning of the twentieth century.
- Cardiology has clearly covered all formats of telemedicine.
- Teleconsultation is not the Holy Grail; advantages, disadvantages and limitations have been well described.
- Main lessons on telecardiology during the COVID-19 pandemic: key for safety for patients and physicians, unmasked many clinical visits as unnecessary, in some ways a return to the days of personal home visits, big capacity for adaptation in the cardiovascular field.

Telemedicine Something Unknown?

At the beginning of the COVID-19 pandemic, with lockdowns and restrictions of physical contact many editorials in scientific journals started to speak about the telemedicine solutions (Hollander 2020), but many highlighted that no telemedicine programme could be created overnight. Due to this, only the health systems that have already implemented telemedical innovations can leverage them for the response to COVID-19.

Telemedicine is not something new. It is well known from the beginning of the twentieth century. One of the first examples was electrocardiography. In the early 1900s, Einthoven transmitted heart tracing via telephone lines from the local hospital to the laboratory where his string galvanometer was located (Einthoven 1906). The importance of this tool started to grow in 1960s with some initial experiences.

Telemedicine is defined as "medicine at distance." Another way to define this could be "the practice of medicine without the usual physician-patient physical confrontation, via an interactive audio-video communications system." But unfortunately for us, before the pandemic, telemedicine was not a history of success. Problems mentioned in 1984 by Higgins (1984) were still present in 2020:

1) There is resistance from many doctors who feel threatened by alternative approaches to the practice of medicine.

2) The initial expense in setting up telemedicine systems is high and it is difficult to justify the costs.

3) Physician reimbursement and legal implications need to be resolved.

Telecardiology Before COVID-19

Cardiology has clearly covered all the formats of telemedicine and we can discuss telecardiology as something real in daily

practice, but not properly implemented. The current formats of telemedicine used in cardiology are:

A) Synchronous (live)

-Remote consults or Teleconsultation

-Live Video/Audio

B) Asynchronous (store & forward)

-E-Consultation

-Imaging Documents

In the field of cardiology there have been multiple experiences on telecardiology and probably the main target was establishing a link with primary care through teleconsultation or e-consultation tools with different results. Teleconsultation is not the Holy Grail. Advantages, disadvantages and limitations have been well described (Table 1).

Advantages	Disadvantages	Limitations
They avoid exposure to contagion	Difficulty in correctly identifying the patient	Lack of legal coverage
They reduce the need for resources	Communication problems due to sensory deficits	Lack of coverage by some liability insurance
Waiting list deadlines are shortened	Impossibility of physical examination	Obtaining signature for informed consent
Greater ability to prioritise patients	Impossibility of complementary examinations	Difficulty expressing oneself due to lack of experience before a teleconsultation
They facilitate the organisation of care circuits	Loss of non-verbal communication	Lack of generalised access to video calls

Table 1. Advantages, disadvantages and limitations of teleconsultation
Adapted from Rev Esp Cardiol (Barrios 2020)

The value of establishing a teleconsultation with primary care is known from previous experiences as Olayiwola and his team have shown (Olayiwola 2016). They tested the usefulness of electronic consultation as a way to improve the relationship between primary care and cardiology in areas with difficult access to healthcare. In this study, approximately half of all referrals to cardiology met the study criteria to be sent through electronic consultations, and two thirds of them did not require a face-to-face visit; furthermore, electronic consultation reviews were completed, on average, almost a month before those sent for a face-to-face consultation, even those considered urgent by the sending physician. With these data, the authors suggested that teleconsultation does not put patients at risk and that, in fact, it may be a way to improve access to specialised care. Further studies showed that the associated costs are lower in the long term (Anderson 2018).

Teleconsultation in cardiology is proving to be a great tool that can improve communication between primary care and cardiology specialists in the areas in which it is implemented. It also has a non-negligible educational value in the long term and reinforces the interaction between professionals.

We must not forget that sometimes very complex strategies are not needed from telecardiology to offer improvements in the cardiovascular field. A very clear example was the Tobacco, Exercise and Diet Messages (TEXT ME) trial, which based its strategy simply on reminder messages of healthy habits via short message service (SMS) in patients with proven coronary heart disease after discharge from hospital (Chow 2015). At six months, levels of LDL-cholesterol were significantly lower in intervention participants, with concurrent reductions in systolic blood pressure and body mass index, significant increases in physical activity, and a significant reduction in smoking. The majority reported the text messages to be useful, easy to understand, and appropriate in frequency.

Lessons From COVID-19 on Telecardiology

The first lesson is security from both ends (patient and physician). All the scientific societies in cardiology (Driggin 2020) went in the same direction as Hollander proposed in New England and adapted for this review: “the central strategy for surge control is “forward triage” - the sorting of patients before they arrive in the hospital. Direct-to consumer (or on-demand) telemedicine, a 21st-century approach to forward triage that allows patients to be efficiently screened, is both patient-centred and conducive to self-quarantine, and it protects patients, clinicians, and the community from exposure. It can allow physicians and patients to communicate 24/7, using smartphones or webcam-enabled computers. Respiratory symptoms - which may be early signs of COVID-19 - are among the conditions most commonly evaluated with this approach. Health care providers can easily obtain detailed travel and exposure histories. Automated screening algorithms can be built into the intake process, and local epidemiologic information can be used to standardise screening and practice patterns across providers” (Hollander 2020).

The second lesson COVID-19 has unmasked is that many clinical visits are unnecessary and likely unwise. Telemedicine has surged; as we suspected social proximity seems possible without physical proximity. Progress over the past two decades has been painfully slow towards regularising virtual care, self-care at home, and other web-based

assets in payment, regulation, and training. The arrival of COVID-19 has changed that in weeks. One open question for the months to come: will the lesson persist in the new normal - that the office visit, for many traditional purposes, has become a dinosaur, and that routes to high-quality help, advice, and care, at lower cost and greater speed, are potentially many? Virtual care, well-scaled, would release face-to-face time in clinical practice to be used for the patients who truly benefit from it (Berwick 2020).

The third lesson is that telecardiology, in some ways, is a return to the days of personal home visits. Elderly patients, those with low health literacy, or those who have limited access to technology can be provided tools and teaching to adapt. For sure, this will be a tactic to help eliminate barriers and increase access. Telemedicine has the potential to make health care more personalised, efficient, and coordinated. It has the potential to improve efficiency, patient and clinician satisfaction, and health outcomes (Poppas 2020).

The fourth lesson is the big capacity for adaptation in the cardiovascular field. Many recommendations have been created in less than a month or two, to help in the management of the pandemic and the cardiology aspects specially focused on telecardiology in many cases. A good example are the dynamic web pages related to COVID-19 created by principal cardiovascular societies:
-European Society of Cardiology: https://www.escardio.org/Education/COVID-19-and-Cardiology
-American College of Cardiology: https://www.acc.org/latest-in-cardiology/features/accs-coronavirus-disease-2019-covid-19-hub
-American Heart Association: https://professional.heart.org/en/covid-19-content-an-aha-compendium

Conclusion

Telemedicine has been with us for a long time but is not properly implemented. Telecardiology provides excellent opportunities. It allows patients to take on a more active role in the healthcare system, facilitates patient-physician collaboration/communication. It has the potential to make smart use of every byte of data (more personalisation, better information, an overall improvement in healthcare services), and shows promising results in cardiovascular prevention.

Obviously the telecardiology organisation is a challenge for the health system, especially in times of a pandemic: We must prevent misuse due to the significant potential for system overload, and we need to evaluate constantly its usability, data accuracy and validation of the results obtained

We will need better and appropriate regulation of its use and we must be ready to overcome the resistance to change to a new cardiology practice.

Conflict of Interest

None. ■

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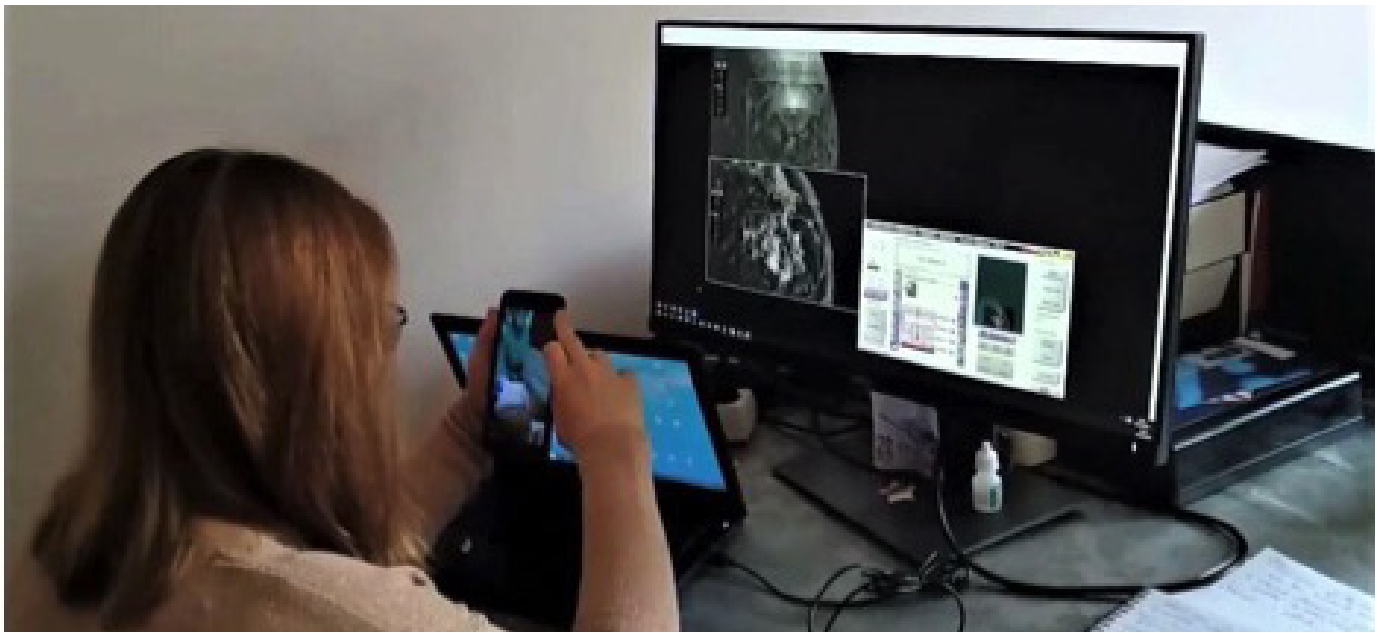
The Promise of Remote Solutions

Author: Emilia De Alonso | Country Sales Lead | Spain & Portugal | Breast/Skeletal Products | Hologic, Inc.

Hologic Iberia shares their experience of providing remote-based support to clinicians in hospitals in Spain during the COVID-19 pandemic. Despite the challenges, switching to remote interaction proved to be a success thanks to the expertise of Hologic's teams. This may now become a new promising direction for the company.



In March, hospitals across Spain began making an unprecedented appeal to Hologic Iberia's Breast and Skeletal Health Solutions Team: to find a way to help guide them through complex breast biopsies involving Hologic's 3Dimensions™ and Affirm® systems – even as Hologic couldn't provide onsite support because of COVID-19.

Since the coronavirus pandemic took hold across Europe, medical centers have canceled their non-emergency procedures, instead concentrating on treating COVID-19 patients and others with the most urgent conditions, including women who quickly need biopsies because they face aggressive breast cancers.

Like staff from other medical technology companies, Hologic's field-based teams are largely avoiding in-person visits with customers during the pandemic because of social distancing guidelines.

In Spain, Hologic had never conducted remote-based support for breast biopsies, but the new challenge energized the Clinical Applications Team. Members of the team worked rapidly to identify a solution, and brainstormed with colleagues to determine the best way to provide support to our customers.

"We were a little nervous as we started planning," said Lourdes Lobato, the Clinical Applications Team Leader. "But we were also confident because we know the biopsy equipment really well and because we have built very strong, close relationships with our customers."

In turn, those healthcare providers trust Hologic's confidence.

"They see the quality and expertise that we always bring,

This video screen capture shows a breast biopsy team in Ibiza, Spain thanking Hologic for our remote guidance during a procedure.

and the care we have for them and patients. We have built trust over time during in-person visits, where we provide initial and ongoing training. We are available for them whenever they need us, and that dedication generates a lot of trust," said Javier Pozo, the Breast and Skeletal Health Solutions Marketing Manager for Hologic Iberia.

Hologic started a pilot project to find solutions. For each biopsy procedure, cooperating with the Hospital's IS department, Hologic connects with the designated hospital's computer. As Hologic's Connectivity Team ensures a stable secure, and smooth connection, the Clinical Applications Team monitors the entire procedure remotely via virtual communication platforms.

Lobato and the other Clinical Applications Specialists guide healthcare providers on upcoming steps and actions with the biopsy device. Hologic Iberia has provided such support for about 20 breast biopsies – always with prior consent from the patients.

"Our solution has added another level of trust and appreciation because our customers value the convenience and technological versatility we're offering," Lobato said. "Nothing will replace face-to-face relationships, but this kind of remote interaction can increase flexibility and efficiency for everyone and enables us to support our customers during this difficult time."

Building on the success of the biopsy project, Hologic Iberia aims to offer more remote-based support. Possible additions include boosting distance education and training with specialized software, webinars and other resources.

Whether it's onsite or remote-based service, Pozo said the goal remains the same for him and his coworkers: "We do our best to help patients achieve the best possible outcome. In the case of breast biopsies done during the COVID-19 pandemic, we're helping women to still receive a timely diagnosis, so they can move on with their lives and treatment if needed. That's a gratifying experience for us." ■

We Are Hologic

As a leading innovative medical technology company primarily focused on improving women's health and well-being through early detection and treatment, we strive to make advances toward greater certainty for our customers by providing them with cutting-edge technology that makes a real difference. We move to narrow the gap between doubt and confidence and work to achieve both incremental and transformational progress to improve patients' lives.

We are passionate and resolute in our purpose; we call it The Science of Sure. This ethos is extended throughout our core offerings: Breast & Skeletal Health, Diagnostic, and GYN Surgical Solutions. We believe it is our responsibility to offer our customers ever-greater certainty – what we call progressive certainty – by pushing the boundaries of science.

We act with integrity. We innovate with determination. We are Hologic.

How Data Intelligence Will Be Crucial for Predicting the Next Pandemic

Author: Prof Florencio Travieso | Co-director of MSc in Health Management & Data Intelligence, Law professor | emlyon business school | Lyon | France

Artificial intelligence developments in machine and deep learning are benefitting from the experience of COVID-19 to pave the way for future pandemic outbreaks.

Key Points

- The generalised use of big data in healthcare implies a revolution that is reshaping the industry as we know it.
- Artificial intelligence has shown to be the key for unveiling trends in the spread of COVID-19.
- The lessons learnt through the application of machine and deep learning in the healthcare sector will be vital for predicting and preventing the spread of future outbreaks.

Over the last few months, we have understood that COVID-19 is a unique pathogen, highly contagious and capable of causing significant health, economic and social impact.

The speed of the spread and the effect on certain populations have both alerted and inspired medical doctors, healthcare practitioners as well as data scientists, to try and find a solution and a future means of prevention.

No one can predict the future. We may be able to grasp hints of events to come, based on our previous experience and assessment of multiple factors and variables, but there is no clear certainty of what is next.

In the context of the current COVID-19 pandemic, we have learnt that big data plays an important role in better understanding the different characteristics of the virus around the world. One of the current challenges is to predict the future presence and spread of the virus using all types of forms of big data.

There are reports of data use to curb the spread of different diseases through urban design. An historical event illustrates this notion: during a cholera outbreak in London in 1850, physician John Snow discovered, through data analysis, that the areas that were being served by a particular water pump were more affected than others. Shutting down that pump helped to control the pandemic (Pisano 2020). Another example of data use is what is currently known as the *15-minute city* approach (Paris En Commun and Milano 2020) that creates decentralised nodes of basic needs for the user (education, work, transportation, markets, green areas) in order to reduce the need for massive circulation of people within a city. Circumscribing a certain amount of people to a '15-minute radius,' would, in principle, reduce the spread of potential pathogens.

All these approaches, directly or indirectly, are using current data trends in order to determine future mechanisms to reduce and prevent the spread of a disease in cities (Pisano 2020).

Big Data and AI

Big data and algorithms are useful to gather and rapidly analyse large quantities of data, such as symptoms, underlying health conditions as well as location of risk patients and available hospitals. Mobile phone applications have proven to be efficient up to a certain degree to track symptoms and locate persons with special needs, while tracking the geographical evolution of the spread of the virus.

One example is an application that helps researchers determine the speed with which the virus is spreading and the areas in which this is happening, the regions in the country with higher risks, and the persons at risk, depending on the evolution of their symptoms (King's College London 2020). This application has also been applied in the project TwinsUK, mapping the incidence of genetic basis of multiple diseases through a base of over 15,000 identical and non-identical twins.

Big data currently allow data scientists and companies to access an enormous amount of data (structured and unstructured) that can be brought together thanks to the power of artificial intelligence (AI).

One of the current challenges is to predict the future presence and spread of the virus using all types of forms of big data

Current Key Applications of Data Intelligence

China's approach to handling the coronavirus at a very early stage is a concrete example that has almost become a benchmark for the rest of the world. Particular actions were taken to tackle the epidemic using big data, notably online dissemination of information on patients, AI-assisted infection risk identification, temperature monitoring, online screening, AI-assisted radiological image interpretation and intervention recommendations; big data analytics for epidemic prevention and control, including predictive modelling and turning point projection; supercomputing for vaccine and drug development; telemedicine services; telecommuting and online education; drones deployed for crowd activity monitoring; IT security and growth of the 5G and internet-of-things devices use.

The cases of the Guanggu Fangcang and Tongji Hospitals, where cloud technology was used to create a 'smart hospital,' is an interesting application of data intelligence to speed up processes in the hospital and maximise safety and efficiency through online diagnosis (American College of Cardiology 2020).

The hospitals gathered data about patients in the cloud, provided guidance about treatment while making registration and the transferring of patients to the designated available block much faster. Additionally, 5G technology (and AI-enhanced lung imagery) allowed professionals to share a large number of images between hospitals in different cities, allowing other professionals to provide additional annotations that would ultimately improve and train the algorithms. Robots, equipped with cameras, temperature-screening

sensors and radars, were also used in the isolation areas to safeguard medical staff from infection (reducing the stress and strain on humans and the need of additional protective clothing).

Talent, Prevention and Prediction

Thanks to the current tools in data analytics, a Canadian company was able to track the virus and predict the countries where it would spread next. This software company is capable of tracking and predicting the spread of over 150 diseases around the world.

The natural language processing (NLP) and machine learning (ML) powered software combines the analysis from official public data provided by organisations like the Center for Disease Control and the World Health Organization. Interestingly, it also integrates less structured data, like commercial airplane circulation, insect and animal population statistics, weather data from satellites and local general and healthcare information. By combining these datasets, they were able to anticipate the spread of the disease based on the volume of travellers from Wuhan to Bangkok, Tokyo, Phuket, Hong Kong, Singapore and Seoul, cities where the infection rates had been growing.

Different data intelligence techniques and methods have been applied to determine the nature of the virus and predict, to the best extent possible, the health outcomes of patients.

A study performed in 2020 in Italy (Coccia 2020) has shown that acceleration of transmission of COVID-19 can be associated with different forms of air pollution. Cities that had more than 100 days of air pollution (PM10 or ozone) had a higher average of infected individuals (over 3,600) compared to cities with less than 100 days (over 1,000 infected).

A similar analysis – as a consequence of the incidence of winds – has been drawn between hinterland (2,200 infected individuals with 80 polluted days per year) versus coastal cities (940 infected cases with 90 polluted days per year).

A case of prediction has been developed using artificial neural network curve fitting techniques (Tamang et al. 2020), whereby using public World Health Organization data researchers were able to predict future trends in infection. These forecasting methods were able to present an intelligent model with simple calculations combining data from different countries.

Another example is the use of deep convolutional neural network (CNN) to detect COVID-19 using chest x-ray imagery. This model uses a machine learning system (deep learning) that trains a computer model to perform classification tasks directly from pictures, texts or sounds (Alazab et al. 2020).

Challenge of Future Prediction

With today's technology, companies should be able to predict a future pandemic, not only through the use of current models and data, but through different unstructured sources of datasets nourished by direct healthcare sources as well as indirect sources, from social media to weather or even pollution.

In view of the progress of the last few months, it is clear that the COVID-19 outbreak will serve as an example for companies dealing with data analytics. Existing data and classifications will be annotated and the algorithm refined with previous inaccuracies corrected, thereby integrating new datasets to increase precision and prediction capacities for the future.

Conflict of Interest

None. ■

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Communication in the Time of Corona

The Rise of the Virtual Clinic

Author: Dr JJ Coughlan | German Heart Centre | Munich, Germany

Author: Dr Cormac Mullins | Department of Anaesthesiology | Intensive Care and Pain Medicine | St James's Hospital | Kilmainham | Dublin, Ireland

In this article, we discuss some aspects of note with regard to virtual clinics, including their proposed benefits and associated challenges. We end by providing some tips for healthcare providers who are beginning to incorporate virtual consultation into their practice.

Key Points

- The COVID-19 crisis has heralded unprecedented change across healthcare systems globally.
- This has led to the rapid integration of virtual clinics into clinical practice.
- There are several differences between communicating with a patient in a face-to-face setting and over a telephone. It is important for physicians to bear these in mind when interacting with patients via telemedicine.
- Virtual clinics may provide several advantages for healthcare systems, including easier access to specialised care for geographically or socially isolated populations.
- Whatever the communication modality, healthcare providers should strive to maintain effective, patient centred communication and care throughout this pandemic.

Introduction

"The single biggest problem in communication is the illusion that it has taken place."
George Bernard Shaw, Irish Playwright

The coronavirus pandemic has resulted in widespread changes to the way healthcare is delivered worldwide. Virtual clinics have long been mooted as a potential solution to a wide array of challenges associated with the delivery of care. This unprecedented global healthcare emergency has led to the rapid integration of virtual clinics into clinical practice. The precipitous nature of this change has resulted in unique challenges which may require innovative solutions in order to ensure the delivery of high quality, patient-centred care.

In this article, we discuss some aspects of note with regard to virtual clinics, including their proposed benefits and associated challenges. We end by providing some tips for healthcare providers who are beginning to incorporate virtual consultation into their practice. As highlighted by the quote at the beginning of this article, truly effective communication is a complex, multi-faceted process that is challenging to achieve in the real world setting. We feel that, as healthcare providers, it is critical that we all strive to maintain effective, patient-centred communication throughout these challenging times. Our hope is that this article will help our readers achieve this.

What is Telehealth?

We will begin by defining some of the terms related to virtual clinics. Telehealth is defined as the distribution of

health-related services and information via electronic information and telecommunication strategies. This umbrella term can relate to a variety of different services, including education, monitoring, health promotion and real time interaction. Telemedicine is a related term that generally refers more specifically to the provision of clinical services and eHealth has also been used interchangeably with telehealth in the UK and Europe. As such, 'virtual clinics' would fall under the umbrella terms of both telehealth and telemedicine. A virtual clinic generally refers to a clinic where the patient does not need to go to the doctors office or waiting room. Instead, they can talk to and see their doctor via their telephone, smartphone, tablet or computer. Virtual consultations between doctors can also be performed in a similar manner. For example, the provision of a heart failure specialist's advice to general practitioners via web based conferencing (Gallagher et al. 2017). There are undoubtedly a multitude of potential varieties of virtual clinic/consultation spanning the spectrum of medicine, from primary to tertiary care. The basic commonality is that they all seek to ensure that a patient can receive appropriate care, from the appropriate person at the appropriate time, using technology to achieve this goal.

The Rise of the Virtual Clinic

As Plato's Republic stated; 'our need will be the real creator.' The current pandemic necessitated a seismic shift in service delivery and the widespread adaption of telemedicine. Healthcare providers were unable to bring patients in for face-to-face reviews and so innovative solutions were required. While this rapid change was undoubtedly impressive, it may mean that many healthcare providers struggle to keep pace. In the next sections, we discuss some aspects of note with regard to virtual consultation with the aim of helping healthcare providers to adjust to this new care paradigm. Where possible, we provide reference to existing literature. However, it is important to note that these manuscripts come from a variety of settings and that what works in one setting will not necessarily work in another. Patient demographics, cultural and societal factors must all be taken into account at a local level in order to determine the optimal approach. Guidelines are also available with regard to telemedicine and telehealth and it is important that practitioners ensure that their local practice is aligned with best-practice guidelines within their own jurisdiction (American Telemedicine Association 2009).

Differences in Communication

There are several differences between communicating with a patient in a face-to-face setting and over a telephone. It is important for physicians to bear these in mind when interacting with patients via telemedicine. Previous studies have demonstrated that telephone interactions can result in a reduced perception of affiliative behaviours (Sadikaj and Moskowitz 2018). An affiliative behaviour is a social interaction that functions to reinforce social bonds with a group. One study reported that there tended to be a mismatch during phone conversations between an individual's self-perception and how the other person in the conversation perceived them. This study was performed in cohabiting couples. As such it is likely that relative strangers (like a physician and their patient) would have even more difficulty interpreting each other's behaviour. It is important that physicians bear this in mind and are cognisant that there may be a mismatch between how they are perceiving the clinical interaction and the patients' perception.

Building rapport is an important part of any clinical interaction and this may be more challenging over the telephone. This may be particularly challenging if the doctor and patient have not met before. Specific research has been carried out with regard to building rapport in telemedicine, particularly focusing on psychological medicine (Glueck 2013). The physician-patient relationship has been found to have a small but significant effect on patient outcomes and correlates with improved patient satisfaction and well being (Kelley et al. 2014; Sheikh et al. 2019). Another study found that patients who were highly satisfied with telemedicine tended to comment on medical communication skills from their healthcare provider that demonstrated patient centred relationship building (Elliott et al. 2020).

Research in general practice has suggested that telephone consultations may result in less problem disclosure than face to face meetings (Hewitt et al. 2010). The authors suggested this may be because telephone consultations tend to be mono-topical. It may also be due to difficulty in picking up non-verbal cues, reduced attention to patient concerns or unconscious limitation of opportunities for patients to disclose problems. However, the researchers in this study did not find that doctors limited disclosure in telephone consultations and overall found that there was little difference in communicative practices between face to face and telephone communications. Video consultation may allow for greater visual feedback and facilitate rapport building but there is limited research to support this at present (Hammersley et al. 2019).

Potential Benefits

Many benefits exist of the telephone interview. This mode of communication can provide easier access to specialised care particularly for geographically or socially isolated populations (Opdenakker 2006). Remote communication can facilitate care for those who have difficulties attending in person. This may include a variety of groups, such as parents looking after small children, shift workers, marginalised groups or those with physical disabilities. For example, it has been shown to successfully engage, retain and cure patients with hepatitis C from marginalised rural communities in Canada (Lepage et al. 2020). The reduced financial and time cost compared

to a face to face interview may support a shift in the delivery of care to the community setting. This can provide greater integration of high quality care outside the hospital setting. In the long term, this may be more sustainable, may better meet the needs of the community and may result in improved networks of communication between primary, secondary and tertiary services.

The nature of the consultation can dictate whether telephone interview is useful. Routine follow up appointments where verbal responses provide sufficient information for the consultation are most suited to virtual clinic/consultation (Mann and Stewart 2000). For other consultations, particularly where additional information is required (patient attitudes, behaviours or clinical examination), the telephone interview may be less useful. Importantly, the interviewer may have less control over the phone to create the optimal atmosphere for appropriate medical consultation (Gergen et al. 1973). While visual feedback is absent, many social cues still exist on the phone (voice pitch and tone, speech volume, speech patterns). This provides telephone consultation with some potential advantages over some forms of computer mediated communication such as email and chat boxes. Learning how best to use each form of virtual consultation may take time and require an initial 'trial and error' approach with patient and healthcare provider feedback. If this feedback results in tailoring of the service, it may prove very useful with regard to optimising service delivery. This requires a culture that encompasses values like continuous reflection and iterative improvement.

Patient feedback is very important in order to develop a service as it is inevitable that there will be a degree of personal, regional and departmental variability with regard to patient attitudes toward telemedicine. One size does not fit all and while some patients may be enthusiastic about virtual consultations, others may prefer to continue with face-to-face consultations if possible. It is important that healthcare practitioners take this into account and strive to respect each individual's autonomy as much as is possible and permissible. For example, it may be thought that elderly patients who may be less au-fait with technology may not have the same attitudes toward telemedicine as teenagers who have grown up with smartphones. However, it is important not to stereotype as some studies have shown similarly positive attitudes to telemedicine in elderly and younger patients (Greenwald et al. 2018; Kaambwa et al. 2017).

Patient Perspectives on Telemedicine

This mention of patient feedback brings us to an important question in telemedicine: what do patients think about virtual consultation? Thankfully, there has been some research in this field. However as a relatively new area of scientific enquiry, this is somewhat limited. In addition, there is substantial variability with respect to the delivery of telemedicine. For some patients, the ability to discuss personal issues over the telephone can provide greater comfort and ease. Some personal issues may be so sensitive that participants may be reluctant to discuss face to face with an interviewer. This may lend additional privacy and anonymity for those with stigmatised medical conditions or those suffering from phobias of doctors and hospitals, termed "iatrophobia" and "nosocomephobia" respectively. Visual anonymity can result in greater "self-disclosure" where more intimate personal information is revealed and this has been shown to result in greater positivity about the consultation (Gergen et al. 1973; Archer 1980). It has been suggested that an important aspect of delivering telephone care is ensuring that the patients' knowledge and understanding of the intervention is addressed (Rushton et al. 2020). This should include explaining to the patient how the consultation will work at a practical level, the rationale behind it and the aims that are trying to be achieved.

One size does not fit all and while some patients may be enthusiastic about virtual consultations, others may prefer to continue with face-to-face consultations if possible

Tips for Doctors Performing Telemedicine

Finally, we present some tips for doctors performing telemedicine for the first time. There is no panacea to ensure that a virtual clinic appointment will go well but these tips are intended to represent a common sense starting point for healthcare providers dipping their toes into the water.

1. Make sure both you and the patient are on the same page

It is important to clarify the patient's perception of the consultation. Ask for their feedback on the consultation and encourage them to engage in the process on an equal footing with their healthcare provider. Check that the patient was happy with their virtual consultation and ask if there was

anything that could be improved.

2. Take time to build rapport
Recognise that rapport may be more difficult to establish via telemedicine and invest time in this. Do not rush through the consultation but instead try to take time and maintain the normal rhythm of the patient-physician interaction. Phone consultations can have a tendency to be more mono-topical and problem-focused and it is important to try to maintain a holistic approach.

3. Encourage disclosure of problems
Encourage patients to disclose issues or problems. Give them time to disclose issues during the consultation and an opportunity at the end to bring up any other concerns. Recognise that subtle cues and nuances may be missed over the phone and so try to explicitly give patients an opportunity to disclose.

4. Explain follow up plans
Ensure the patient is aware of plans for further follow up, if any. Explain when they can expect to be seen again, any investigations you intend to organise and if the patient is required to do anything. For instance, do they need to make an appointment with the secretary or will the secretary contact them? If a further clinic appointment is required, clarify if this will be in person or another virtual appointment. Enquire with the patient as to whether or not they have a preference for in person or virtual appointments in the future.

5. Listen!
Finally, as William Osler said; 'Listen to your patient, they are telling you the diagnosis.' If we can bear this adage in mind when performing telemedicine, it is likely that the rest of the consultation will fall into place.

We wish all of our colleagues the best of luck as they strive to continue to provide high quality healthcare during this pandemic.

Conclusion

The rise of virtual clinics during the coronavirus pandemic has changed our delivery of care. While these clinics have some drawbacks, it is clear that for the foreseeable future they will be an integral part of how we manage patients.

We believe that it is our responsibility as healthcare providers to ensure that we provide care for our patients in a manner that they are comfortable with and that respects their individual identity and cultural beliefs. It is important that we prioritise this approach in regard to virtual clinics.

Healthcare organisations should consider providing dedicated training to staff in telemedicine to promote good clinical practice and optimise service delivery.

Conflict of Interest

None. ■

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MROpen EVO System - The Next Generation in Positional MR Imaging

Author: Marco Belardinelli | Business Unit Director | Paramed MRI Unit | ASG Superconductors | Italy

ASG Superconductors is an Italian company specialising in superconductive magnets design and in manufacturing innovative superconducting wire (MgB2) and MRI systems. HealthManagement.org spoke to Marco Belardinelli, the Business Unit Director of the MRI Division at ASG, with a special focus on the technology and market development of the MROpen EVO, the "best MRI experience" system based on unique superconducting technology and other innovative applications.

Can you tell us something about the MROpen EVO MgB2 MRI Scanner?

The MROpen EVO system is the next generation in positional MR imaging. The MROpen EVO is the world's only superconducting, cryogen-free MRI system, offering high-quality imaging, a small carbon footprint and all of the functionality of a truly positional MRI system. The wide open design of the MROpen EVO is extremely patient-friendly, greatly reducing claustrophobia and offering the patient high-quality diagnostic images in a comfortable scanning environment.

ASG Superconductors has been offering an MgB2 MRI system for several years. Is the new product an upgrade over the last one?

It definitely is. The MROpen EVO is powered by a brand new digital spectrometer and a new software interface completely designed and developed in-house from start to finish. We released new coils and positioning tools to increase efficiency and to better stabilise the patient while being scanned in an upright and weight-bearing position. We also developed new pulse sequences to complete the offering for the end-user.

The MROpen EVO MRI Scanner uses cryogen-free technology. Can you please explain how that works?

Superconductivity is a wonderful property. It allows an enormous amount of current density, i.e. the strong magnetic field required by MRI clinical scanners, but unfortunately, it comes at a cost. Superconductivity needs insanely low temperatures. Conventionally closed MRI scanners work at around 4K, (approx. -270°C or -450°F) thanks to a bath of cryogen liquid helium. In other words, conventional scanners use a bath of boiling helium to keep the magnet cool. But helium isn't a renewable element, and nowadays, it is not only hard to find it but also very expensive. Those who are waiting for a helium refill following a so-called "magnet quenching" know what I am talking about. We at ASG have a different approach. Thanks to MgB2, our own technology, we can have superconductivity at a higher temperature. Still very low, but high enough to allow the use of a closed gas cooling system making the MROpen EVO the only cryogen-free and superconductive open MRI Scanner available in the market.

How is this scanner different from other products in the market?

MROpen EVO provides exceptional patient comfort, delivering a light MRI examination in a relaxing and reassuring environment. You can walk into the scanner, and you can sit, lie slightly backward, lie horizontally or even stand. With no barrier between the patient and the surrounding environment, patients can see around them at all times or enjoy watching TV while comfortably sitting in the scanner undergoing an MRI procedure. All this simply can't happen in conventional closed MRIs or even in "traditionally open" (C-shaped) systems.

Who is the product designed for, i.e. who is the main target market for the scanner?

The MROpen EVO is designed for the patients and to offer them the best MRI experience along with the opportunity to have a more accurate diagnosis when upright and/or

Operator Console - MR-GUI Pro acquisition software

MROpen Evo – The upright cryogen-free superconductive MR scanner

weight-bearing examinations are necessary. To this extent, the imaging centers offering our solution can deliver a better and more appealing service to their patients, and the radiologist can benefit from the additional information coming from scans performed in non-traditional ways. In fact, being able to scan a patient in the position of symptom makes a big difference.

Is there any data or feedback on patient experience with the product? What has been the response from centres that have installed the scanner?

The best answer to this question would come from the patients and from the centers themselves. Countless times our customers have seen patients showing up at their doors because they couldn't complete a scan anywhere else because of their specific condition or because of claustrophobia, and we take huge pride in knowing we are giving them an option. The MROpen EVO installations and customer base are growing and what's interesting is that several of our customers decided to install the MROpen in more than one of their centres: either as a stand-alone solution or as a complimentary one combined with traditional scanners.

What would you say are the primary clinical advantages of the MROpen EVO Scanner?

The primary clinical advantage is definitely the possibility of scanning the patient in the position of symptoms and compare the results with a regular supine examination. Over the years, we have witnessed many diagnoses changing when putting the patient in an upright or weight-bearing position compared to the standard MRI. Not to mention the many cases in which the wideness of the MROpen EVO made it the only system where certain patients could undertake an MRI because of their condition. Misdiagnosis not only provides bad service to the patient, and this alone should be enough, but it also increases the overall costs of the health system considering all the additional exams and procedures the patient will have to ultimately go through.

How can imaging centres benefit from using the MROpen EVO Scanner?

The first way is by offering a service almost nobody else offers and by giving the patients the opportunity to undergo a stress-free MRI exam. MRI equipment has become a commodity. Almost all imaging centres today use different versions of the same technology, and it is difficult for them to differentiate their offering to the patients. The MROpen EVO not only gives the opportunity to stand out from the competition, but it also does so by making the overall MRI experience way better for the patient and by giving the radiologist a new set of information that you can only access when the patient is scanned in a non-supine position.

Anything else you would like to add?

We are constantly working to improve the MROpen EVO in order to make the best MRI experience even better. AI integration and technological advancements are only two of the aspects we are working on. Finally, since customers and patient awareness is crucial, we are investing in communicating the MROpen EVO uniqueness to all of our targets: radiologists, MRI centres, patients and the research world in a new way, at least for us. The next step is a brand new product website, it will go live in October, and it will be the next step in our new digital communication. ■

Website: www.mropenevo.com

Lessons Learnt from COVID-19:
A mental health perspective on the use of digital technologies

Author: Dr Lloyd Humphreys | Head of Europe | SilverCloud Health | London | UK

While capacity in the health system was increased to manage COVID-19 infections, the experience for mental health was very different – services were closed and referrals fell by 90%. What are the lessons learnt for managing mental health services in a future pandemic and what is the role of digital technology?

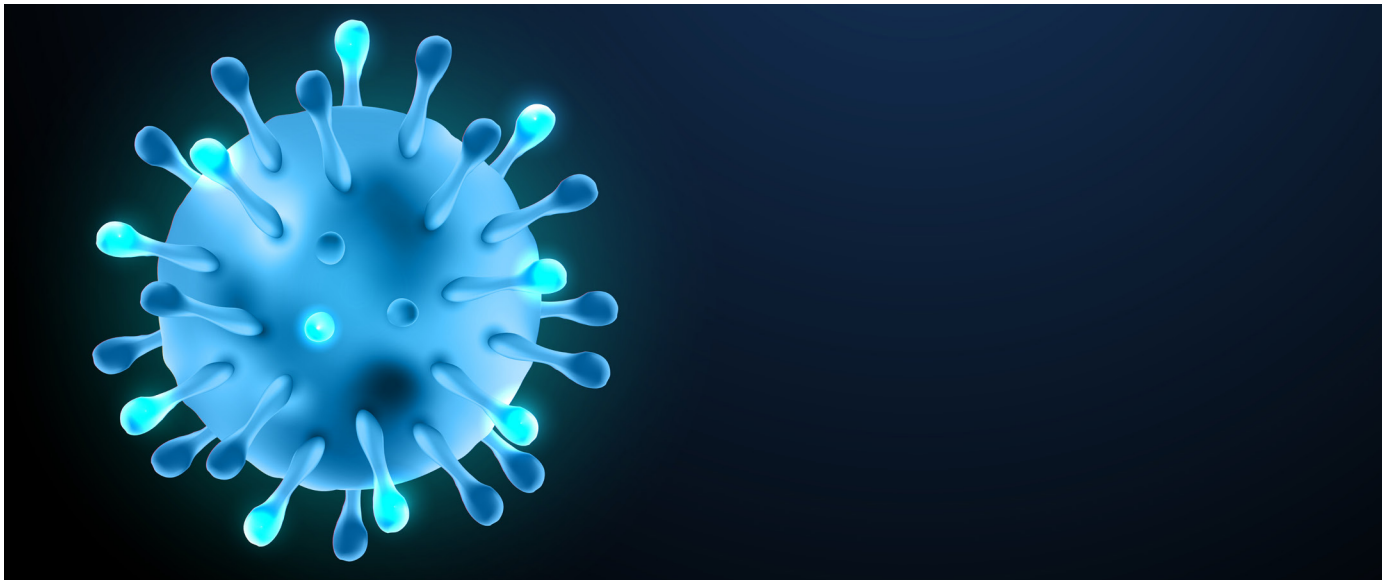
Key Points

- Mental health has had a different experience during the pandemic than services managing the COVID-19 infection.
- Data predicts a six-fold increase in mental health referrals in the wake of the pandemic, underlying the need for a tech-enabled mental health services model.
- Scaling up of technology gets overlooked in incident planning, and the impact of this on the vulnerable not getting appropriate level of mental health care.
- Planning is key for digital therapy technology suppliers, e.g. load testing, capacity, security and ability to scale up.
- To avoid the 'wild west' of apps and digital solutions, service providers should consider scaling up across their different services and a range of mental health conditions.
- A multi-channel approach should be used to drive awareness of solutions, with coordination between national bodies.

As the UK government enters 'phase 3' of its healthcare response to COVID-19 and other health systems around the world plan for managing the upcoming winter season, it becomes prudent to take stock of the initial response to the pandemic and to see what lessons should be learnt from the experience. This is particularly important through the lens of mental health because, while capacity increased for managing the infectious disease of COVID-19, mental health had a different experience, with services closed and staff re-deployed or forced to work from home. At the same time, the number of referrals fell by up to 90%. This was despite the collective turmoil, stress and trauma facing millions of people experiencing isolation, grief at the loss of loved ones and the psychological impact of frontline care workers enduring a pandemic on a scale not seen for a century.

This stark picture was highlighted by a recent House of Lords Report (Lewis 2020) published on 22 June, which looked at the impact of lockdown on individuals' mental health, the impact on individuals with pre-existing mental health conditions prior to the pandemic, and the loss of funding and operational capacity for mental health services and charities. Furthermore, the Office for National Statistics reported that between 24 April and 3 May 2020, 75% of British adults were "very worried or somewhat worried" about the effect that COVID-19 was having on their lives. Further data released on 15 June showed that the equivalent of 19 million UK adults were experiencing high levels of anxiety.

With the inability to see people face-to-face and the reduced capacity for mental health service delivery, there was significant attention on digital health and technology solutions. It was their moment in the spotlight, rather than being often considered a 'nice to have' they became a critical part of enabling services to stay open. So how did they perform and what can we learn to help mitigate against further waves of COVID-19 and the inevitable winter pressures?



These are not inconsequential questions to ask – looking at the data it is predicted that there is a 'tsunami' of mental health problems on its way (Inkster et al. n.d.), with some forecasting that over the next few months there will be a six-fold increase in referrals. It is imperative that planning takes place now with the backdrop of a technology-enabled mental health service delivery model.

Planning Is Everything

"Peace-time plans are of no particular value, but peace-time planning is indispensable."
Dwight D. Eisenhower (1950)

Health systems have had years of planning for different scenarios, from winter pressures to critical incidents and disaster planning. However, all of these plans rely on people and places, and at its simplest are about increasing bed capacity and staffing numbers. COVID-19 highlighted that whilst this was essential to deal with the surge in patients with infectious diseases, it did not meet the needs of all the other patients requiring health care services that could no longer see a health-care professional (HCP) face-to-face or come into a building for tests. The critical measure of the impact of COVID-19 – excess deaths – is testament to this lack of planning, which in the future should take a holistic view and include the rapid mobilisation of technology-enabled care and processes.

The scaling of technology is currently overlooked in incident planning. The consequences of this have unfortunately been seen in mental health services, where staff were redeployed, and the most vulnerable were often unable to receive their normal level of care. Those with pre-existing mental health issues are at particular risk of worsening symptoms (Chatterjee et al. 2020), with suicide rates having increased. These consequences of COVID-19 are likely to continue to increase and peak much later than the disease progression of the virus.

Planning is also key for technology suppliers. For example, many digital therapy organisations saw a surge in usage, with one reporting in excess of a 450% overnight increase. If sufficient headroom in capacity and bandwidth is not available, then a service may fail, leaving patients unable to access critical services at a time of greatest need. Load testing is essential, along with regular security testing. This has been highlighted by the growth in Zoom video conferencing, with questions over robustness of security protocols due to people randomly guessing a meeting ID and joining a video conference. Frequent vulnerability scans, penetration tests and ensuring that the technology addresses the top ten risks identified by the Open Web Application Security Project (OWASP) are essential. If technology is to be seen as part of critical infrastructure, then it can no more fail than the rest of the health system.

Lastly, as a digital solution provider you must be able to scale the resources required to deliver, from project management to training. For example, implementing online training for health professionals can be highly effective in increasing coverage and the number of people able to access solutions. In the case of the leading provider of digital mental health, more than 1,200 professionals were trained in the space of three weeks, and UK coverage increased by an extra 20 million people able to access a solution.

There Is (Seemingly) a Digital Solution for Everything

"The web and physical world is plagued with abundance – people need help sorting through all the good and bad stuff out there. The tyranny of choice is causing psychic pain and frustration for people."
Jason Calacanis

When the initial crisis hit, there was an influx in advertising from digital technology suppliers, being the supposed answer to everyone's problems. With this noise it is difficult to differentiate

between the quality, evidence-based solutions and the 'vapourware' looking to get a foothold in healthcare. This noise saw some technology solutions rapidly scale, without evidence to demonstrate their impact. This was addressed, to some extent, much later into the pandemic, with the creation of a dynamic purchasing framework in England where proven digital solutions could be catalogued and then implemented locally, but so far this has not been used for mental health delivery planning.

One robust way to address this 'wild west' of apps and digital solutions is for service providers at a local and national level to recognise their existing digital estate and leverage these assets – scaling up their existing solutions horizontally across their different services and vertically across the continuum of mental health experience. Can a digital technology used with mild to moderate mental health (e.g. within Improving Access to Psychological Therapies) be applied in community mental health? Can a digital pathway for young people be replicated for adults? This provides rapid mobilisation – an established digital solution is easier to deploy elsewhere within an organisation – and a more cost-effective approach.

One caveat to this scaling is to consider how a solution can be utilised effectively and the gap that it will fill during a pandemic. For example, self-help information and support are good for normalising and providing reassurance but do not offer effective help, being the start of someone's journey to better mental health. Online peer support is a natural extension to this but suffers the same problems, it is not a therapeutic intervention. Video consultations and text messaging are essential when you cannot see someone face-to-face but lack the ability to scale as they are still a one-to-one approach that can be impacted by redeployment. Digital therapy, such as internet-based cognitive behavioural therapy has the extensive evidence-base and robustness to scale up quickly but may not be appropriate for more complex clients or those requiring crisis interventions. Therefore, taking a single solution approach could lead to people having an unsatisfactory experience when it does not fully meet their needs.

Taking Coordinated Approach to Drive Awareness

Having the right solutions available and at the right time is meaningless if the intended recipients do not know they exist or that they are available to them. Whilst the initial response to support NHS frontline workers saw a huge surge in awareness building from NHS Employers and NHS England, the visibility has not been maintained. Social media is a channel to build such awareness, but other mediums should not be overlooked. A continuous multi-channel campaign that is sustained over time is essential, so whilst the initial wave of hundreds of thousands of downloads and usage of digital suggested a very positive impact, over the coming months there has been a tail-off. Coordination between national bodies is essential but can sometimes be at odds with one another across NHS England and Improvement, Health Education England and NHS Employers. It is heartening to see the interim NHS People Plan (NHS 2020) that specifically calls out mental health and wellbeing, but ensuring that people working on the hospital wards, care staff in the communities, people in GP surgeries and everywhere else are all familiar with what is available.

More needs to be done to coordinate with social care, and the creation of the Care brand (Department of Health and Social Care 2020a) and the associated app to support frontline care staff was laudable, the awareness 'on the ground' was less so – this can be seen from one digital mental health provider that saw a tenth of the usage from the Care app than it did from the NHS workforce.

Summary

Whilst there is some hope that mental health provision has a head start on an impending crisis, and there is additional funding being made available (Department of Health and Social Care 2020b) for both service providers and charities, now is the time to identify appropriate digital solutions, plan in detail for a technology enabled service and drive awareness. It is critical that no one gets left behind, whether that be young people or people from diverse backgrounds that may be digitally excluded (Ellwood and Bell 2020). Though digital services may not be the panacea we are hoping for, they do form a critical part of our future response to challenges. This can already be seen by national responses of digital mental health in Scotland and Wales that are now being rolled out at scale and dedicated investment in distress intervention.

Conflict of Interest

None. ■

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Upcoming Issue

Cover Story: New Care Delivery

The healthcare industry continues to face challenges. The COVID-19 pandemic, the consistent increase in chronic disease prevalence, an ageing population, lack of drug development, antibiotic resistance, obesity, shortage of healthcare personnel and other similar issues need to be addressed. Maybe it is time to look at new care delivery models and strategies. We explore this and much more in our upcoming issue.

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