

## **11:10 Novas tecnologias na Cardiologia em 2023 Para facilitar ou complicar?**

Moderação Kevin Domingues | João Costa Lopes | Carla Marques

**Daniel Ferreira** Cardiologia, Hospital da Luz Lisboa





28.<sup>a</sup> EDIÇÃO  
**CARDIO** SANTARÉM

SANTARÉM HOTEL | 22 E 23 DE SETEMBRO 2023

**11:10 Novas tecnologias na Cardiologia em 2023  
Para facilitar ou complicar?**

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# Disclosures

Concerning this presentation:

Clinical Director



DF 2023

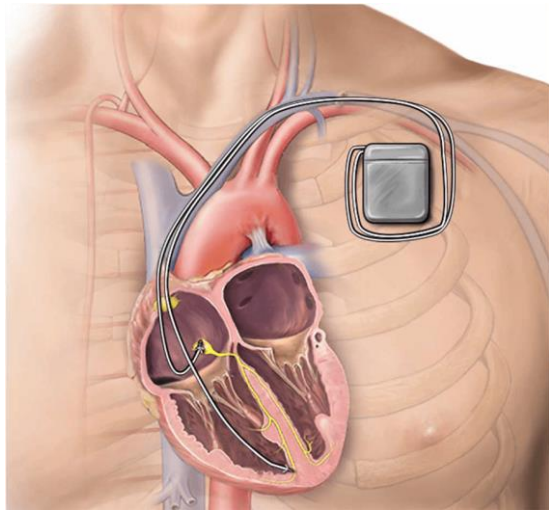


# Para facilitar ou complicar?



GIFMANIA





NEWS • Conference News | EHRA 2021

## ✉ ICD Implant Commonly 🖨 Brings Anxiety, Depression

Being proactive and educating patients about the possibility of anxiety after the implant, and what to do about it, is key.

by [Todd Neale](#) | APRIL 30, 2021



Published in final edited form as:

*Heart*. 2011 March ; 97(5): 371–381. doi:10.1136/hrt.2009.184119.

**Changes in anxiety and depression over 2 years in medically stable patients following myocardial infarction and their spouses in the Home Automatic External Defibrillator Trial (HAT): A Longitudinal Observational Study**



Conclusion

There was no evidence that home AEDs caused psychological distress among patients. Even among those who were psychologically distressed when they were assigned to receive either CPR training or CPR/AEDs, home AEDs did not influence changes in patients’ depression or anxiety or spouses depression when compared with CPR training. Among psychologically distressed spouses, AEDs may keep anxiety higher than it would be otherwise. Interventions to reduce anxiety of spouses who are psychologically distressed may be indicated when their partners receive an AED.



# Technological advances in cardiovascular medicine



Imaging diagnosis



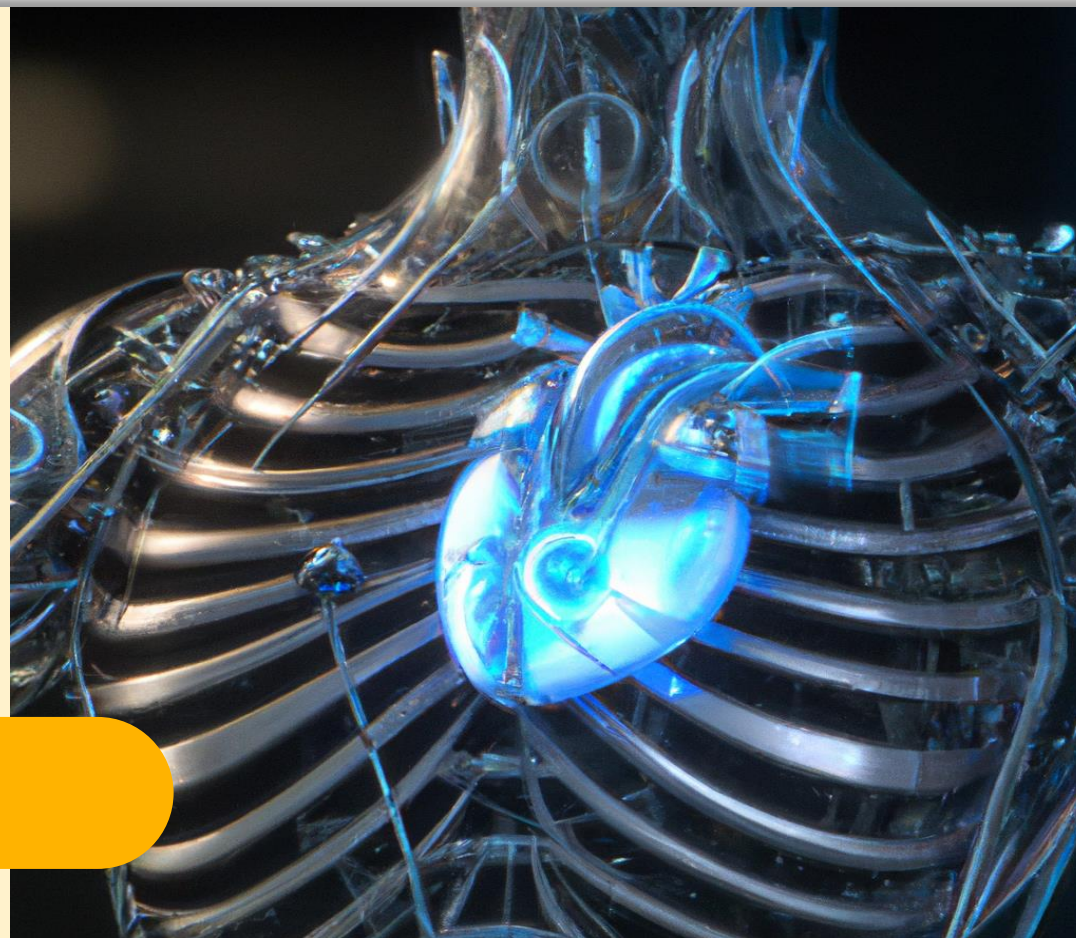
Minimally invasive surgical interventions



Implantable medical devices



Economic sustainability





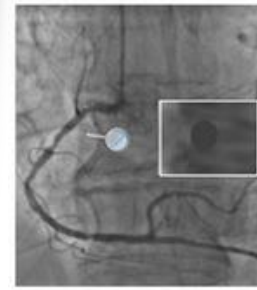
# Integration of different imaging modalities with other markers of disease

Am J Transl Res 2017;9(7):XXX-XXX  
[www.ajtr.org](http://www.ajtr.org) /ISSN:1943-8141/AJTR0052818

**Review Article**  
**An integrated approach to coronary heart disease diagnosis and clinical management**

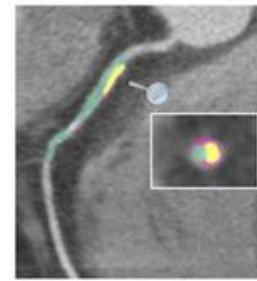
Teresa Infante<sup>1</sup>, Ernesto Forte<sup>1</sup>, Concetta Schiano<sup>1</sup>, Carlo Cavaliere<sup>1</sup>, Carlo Tedeschi<sup>2</sup>, Andrea Soricelli<sup>1,3</sup>, Marco Salvatore<sup>1</sup>, Claudio Napoli<sup>1,4</sup>

## Imaging modalities



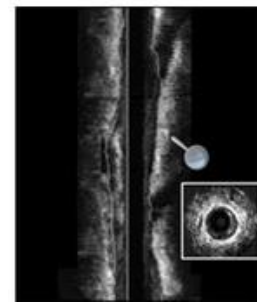
### XRA

- ✓ Lumen
- ✓ Flow
- ✓ FFR



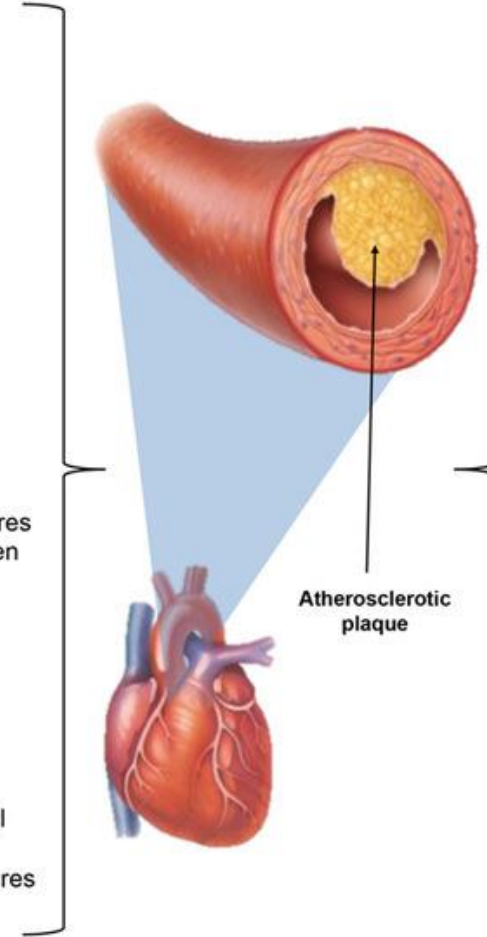
### CTCA

- ✓ CAC
- ✓ RI
- ✓ Plaque features
- ✓ Plaque burden
- ✓ FFR CT



### IVUS

- ✓ Lumen
- ✓ RI
- ✓ Vascular wall
- ✓ EEM
- ✓ Plaque features



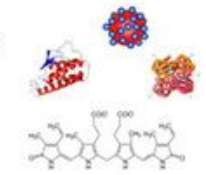
## Cellular markers

- ✓ PBMCs
- ✓ Neutrophils
- ✓ Lymphocytes
- ✓ EPCs
- ✓ CD31<sup>+</sup> cells



## Biochemical markers

- ✓ Inflammatory molecules
- ✓ Cytokines
- ✓ Adhesion molecules
- ✓ Enzymes
- ✓ Metabolites



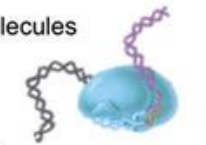
## Epigenetic markers

- ✓ DNA methylation
- ✓ ncRNAs

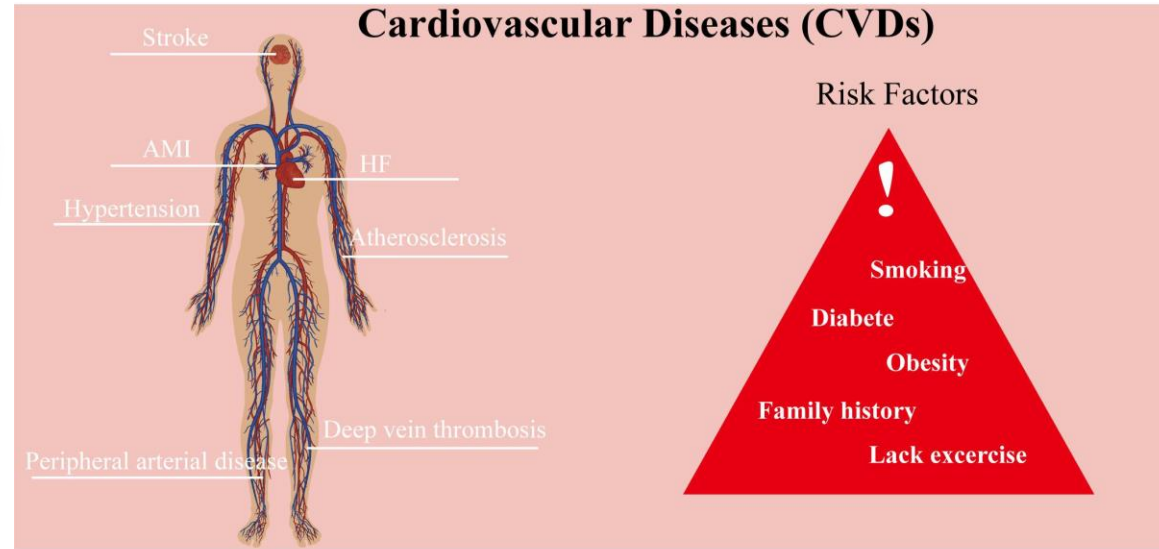


## Transcriptional markers

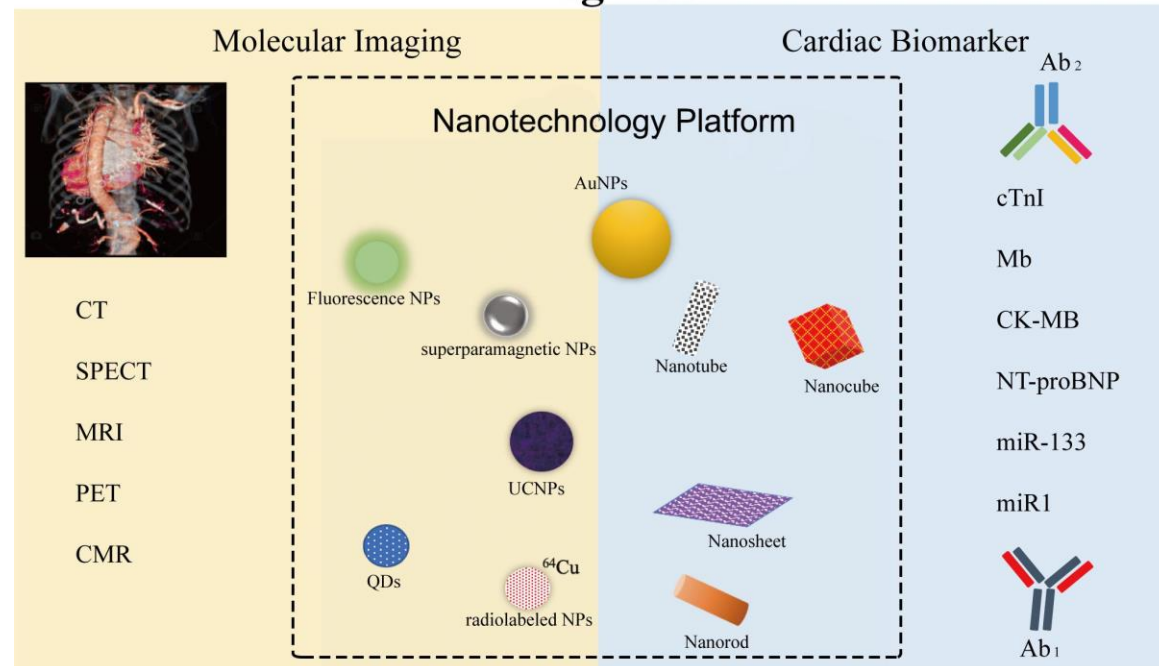
- ✓ Pro- and antioxidant molecules
- ✓ Cell motility proteins
- ✓ Signaling receptors
- ✓ Transcription factors
- ✓ Inflammatory mediators
- ✓ Metabolism mediators



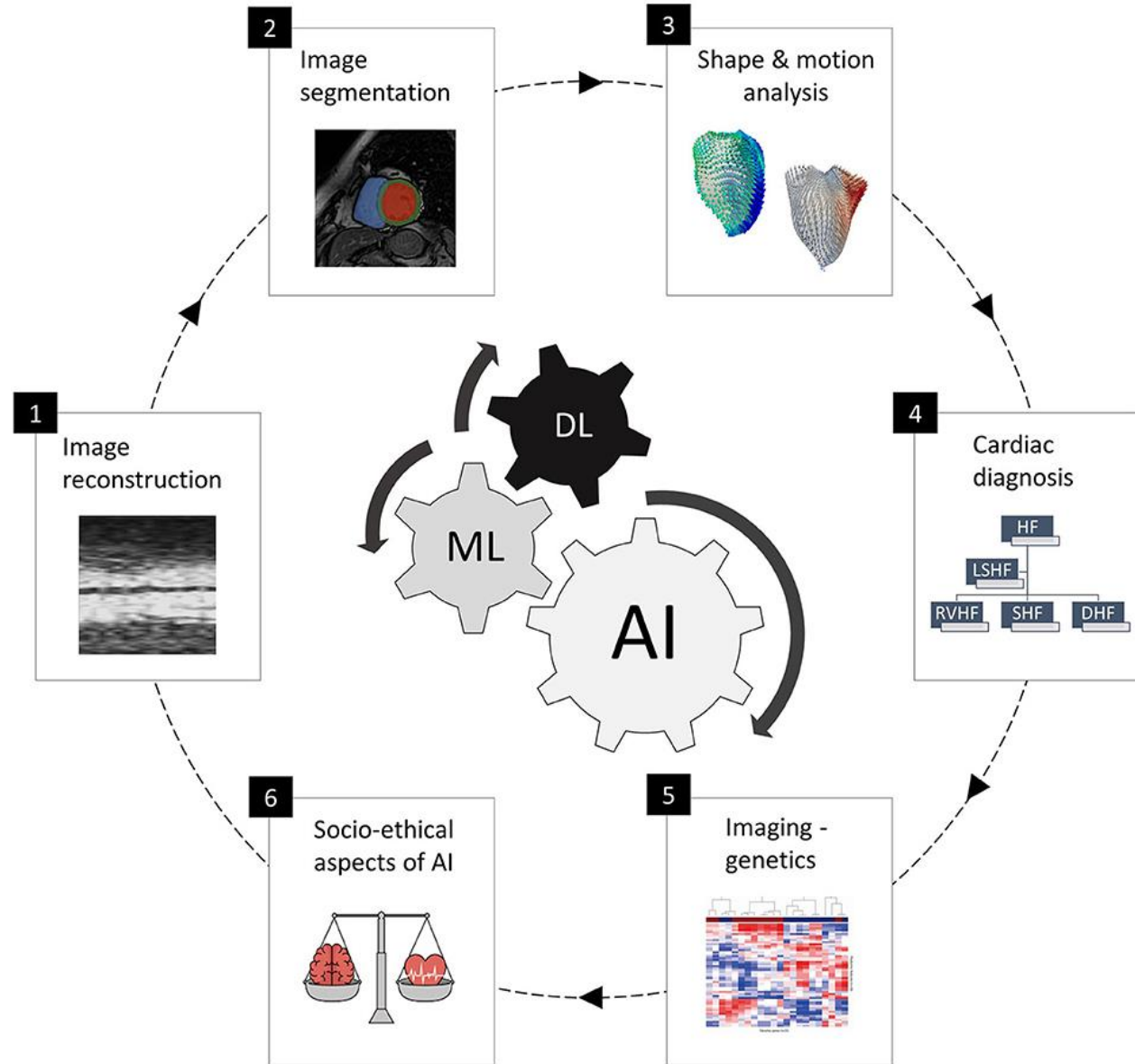
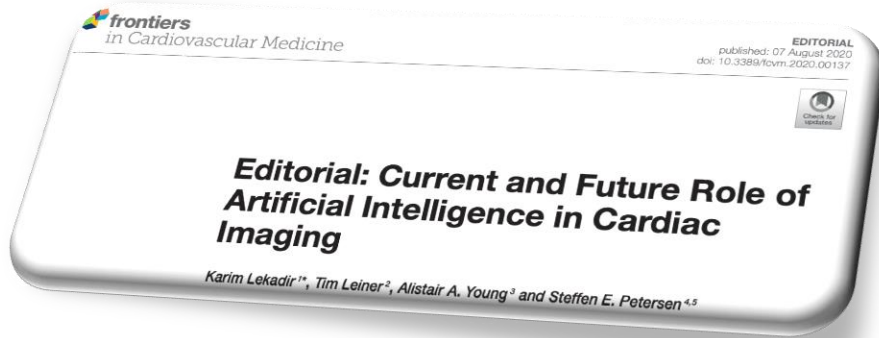
# Integration of different imaging modalities with other markers of disease



## Diagnosis

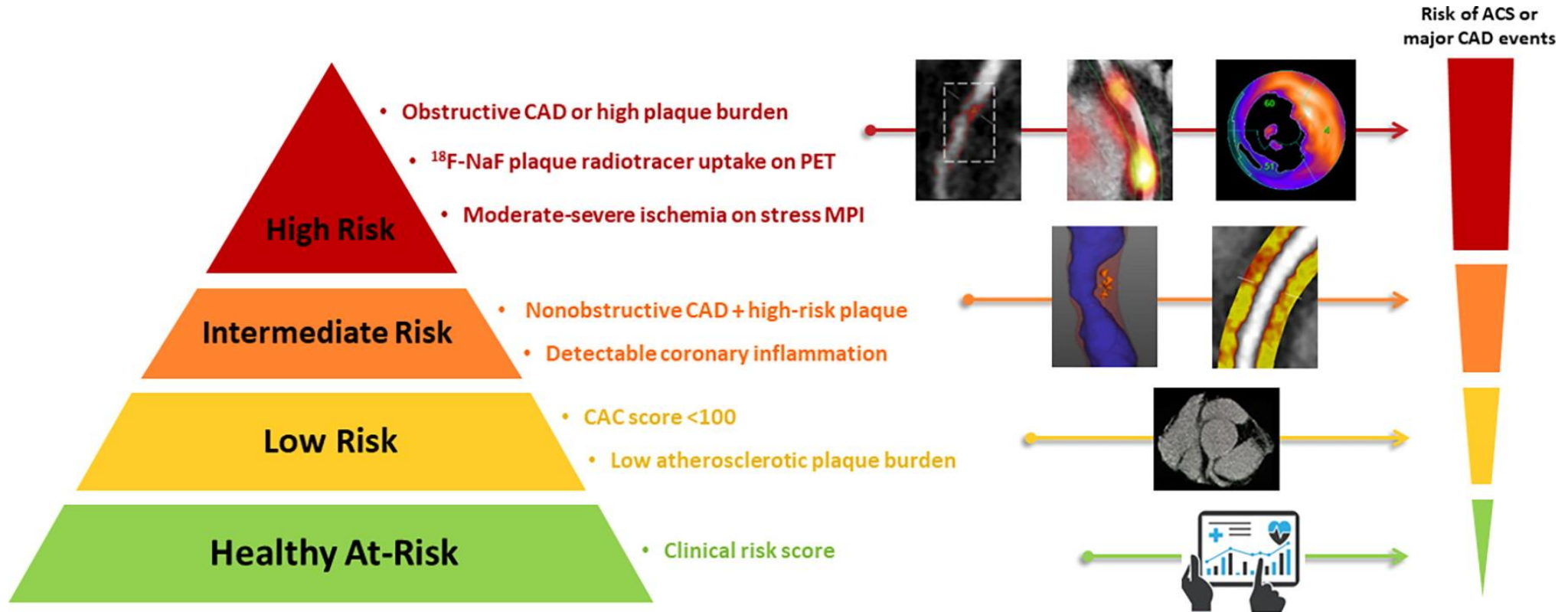


# Role of AI in cardiac imaging



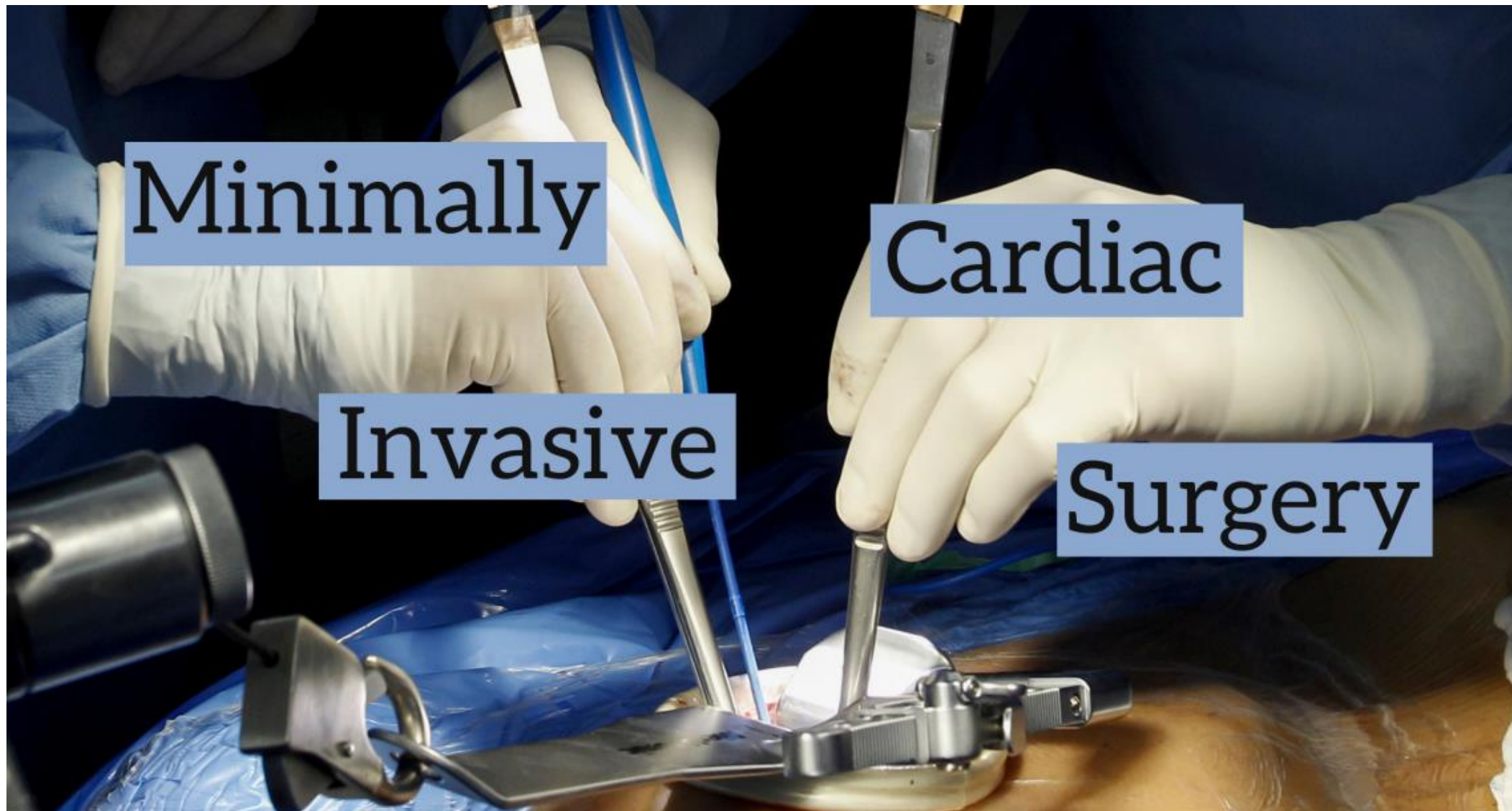


# Role of AI in cardiac imaging



## ARTIFICIAL INTELLIGENCE APPLICATIONS

- Automated quantification of prognostic imaging biomarkers
  - Direct prediction of cardiovascular risk from images
- Integration of imaging and clinical data for individualized prognostication



Minimally

Cardiac

Invasive

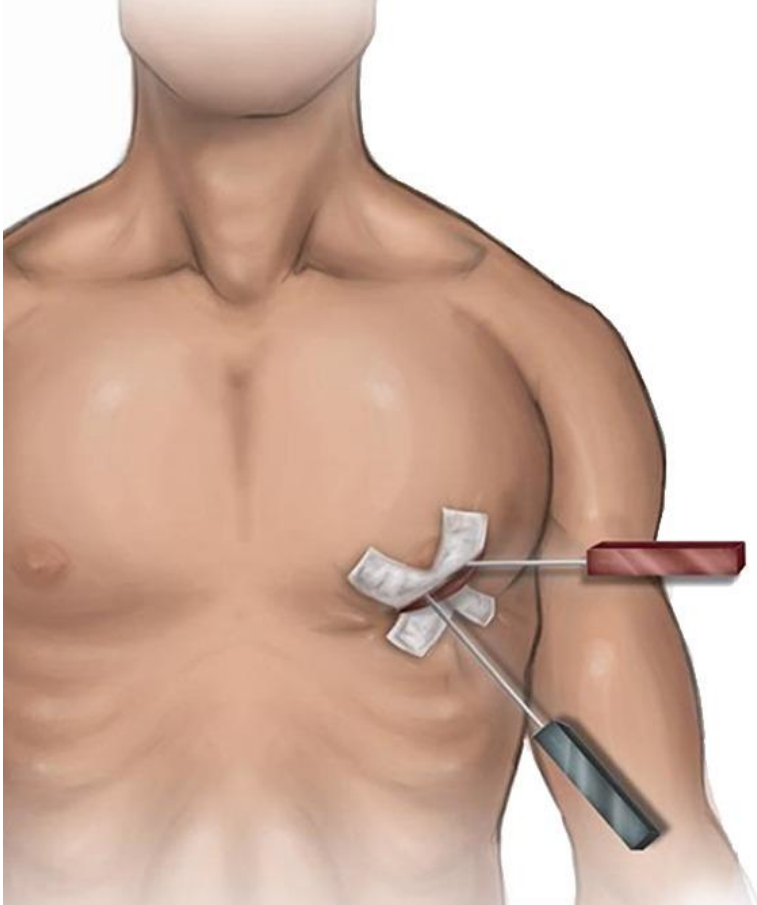
Surgery

# Increment of minimally invasive cardiac surgery

Traditional heart bypass incision

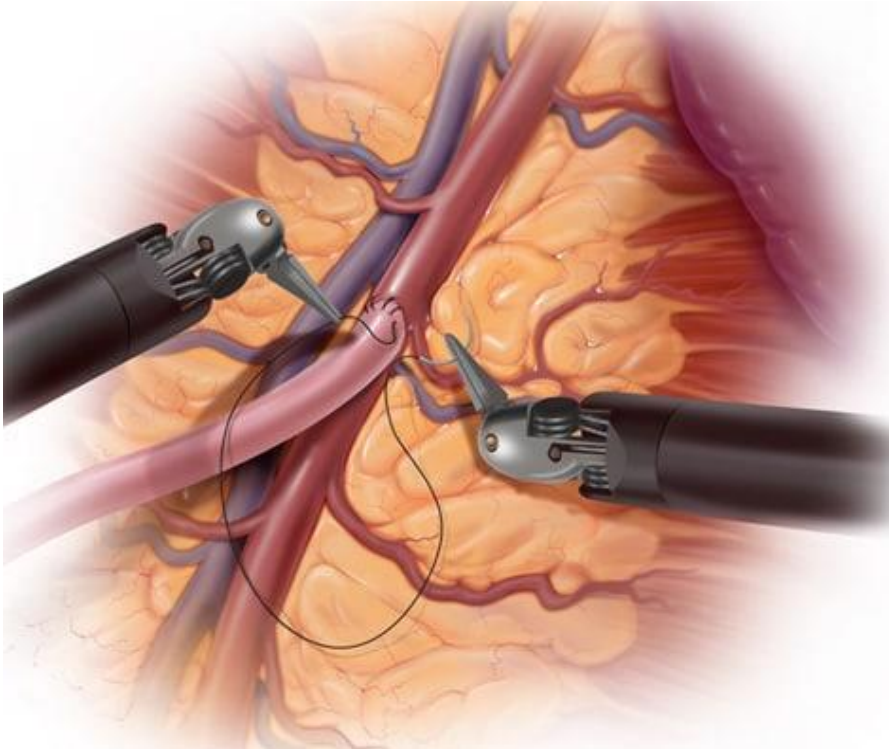


Minimally invasive heart bypass incision

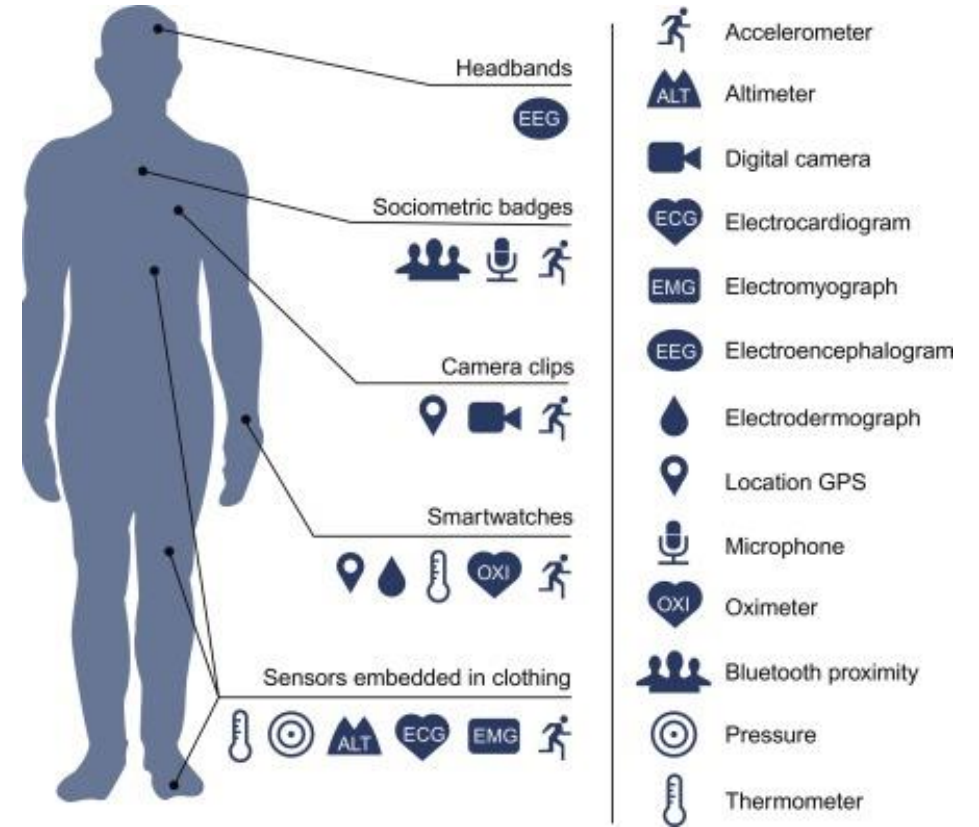
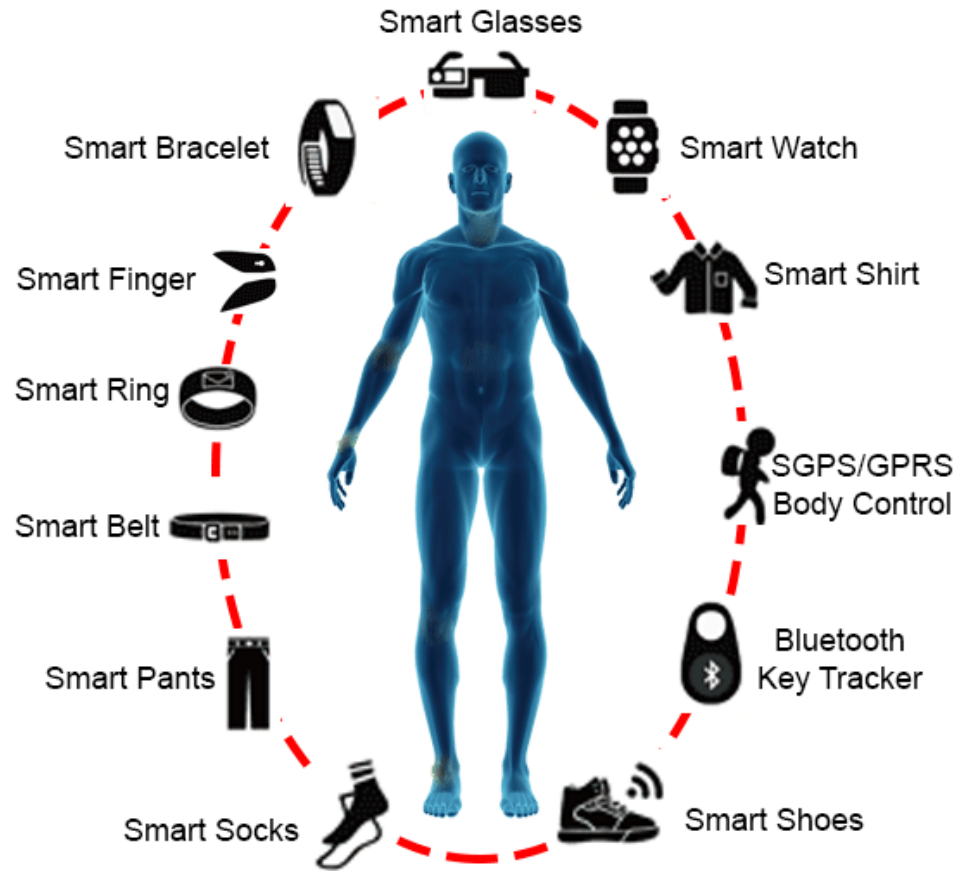




# Increment of robotic-assisted cardiac surgery



# From wearables to insidables



# WIRELESS IMPLANTABLE MEDICAL DEVICES

Deep Brain  
Neurostimulators



Cochlear Implants



Gastric  
Stimulators



Cardiac Defibrillators/  
Pacemakers



Foot Drop  
Implants

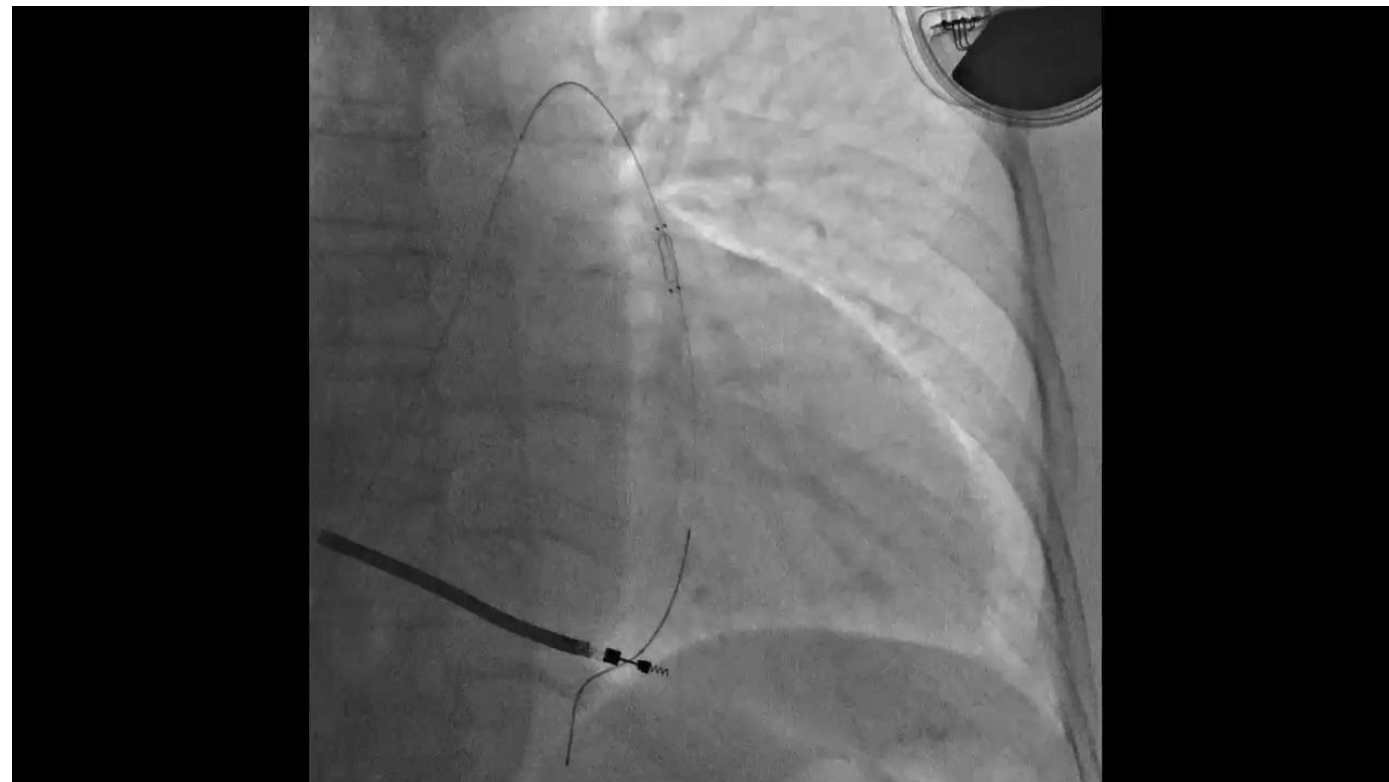
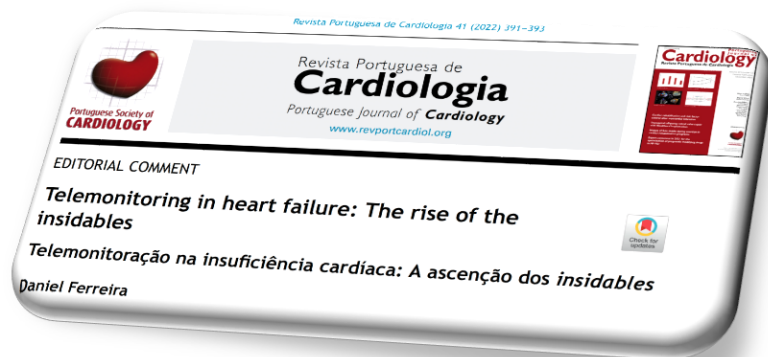
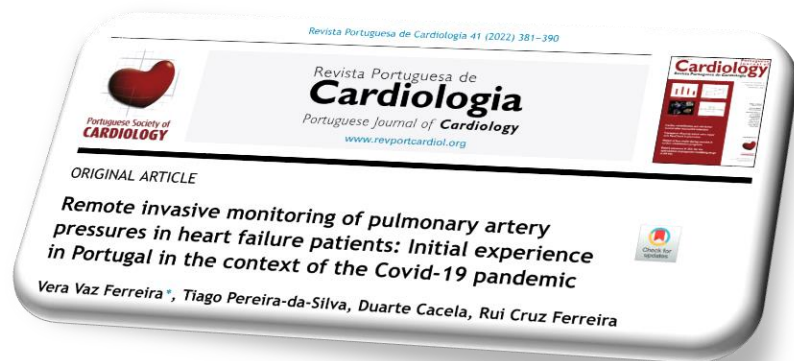


Insulin Pumps





# The rise of the insidables



# New therapeutic approaches



Stem cell-based therapies



Gene editing and gene therapy



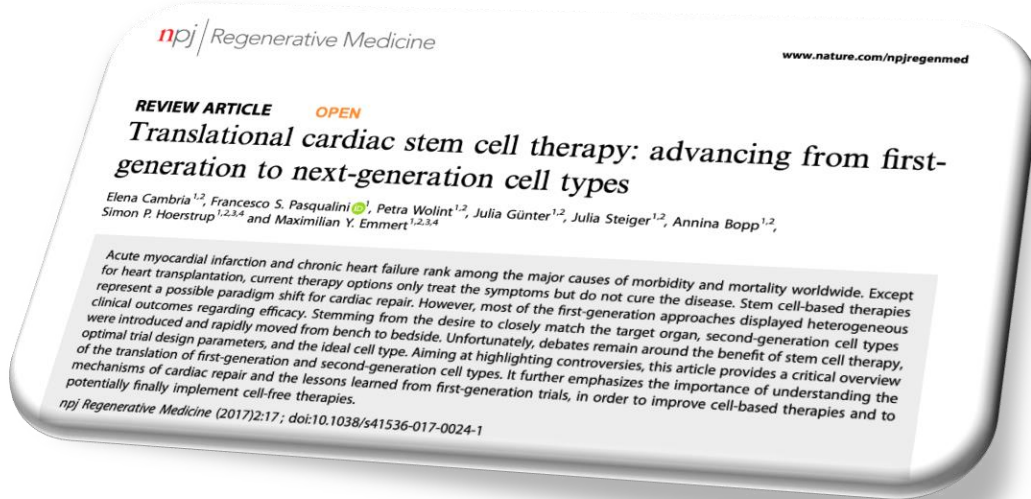
Precision medicine



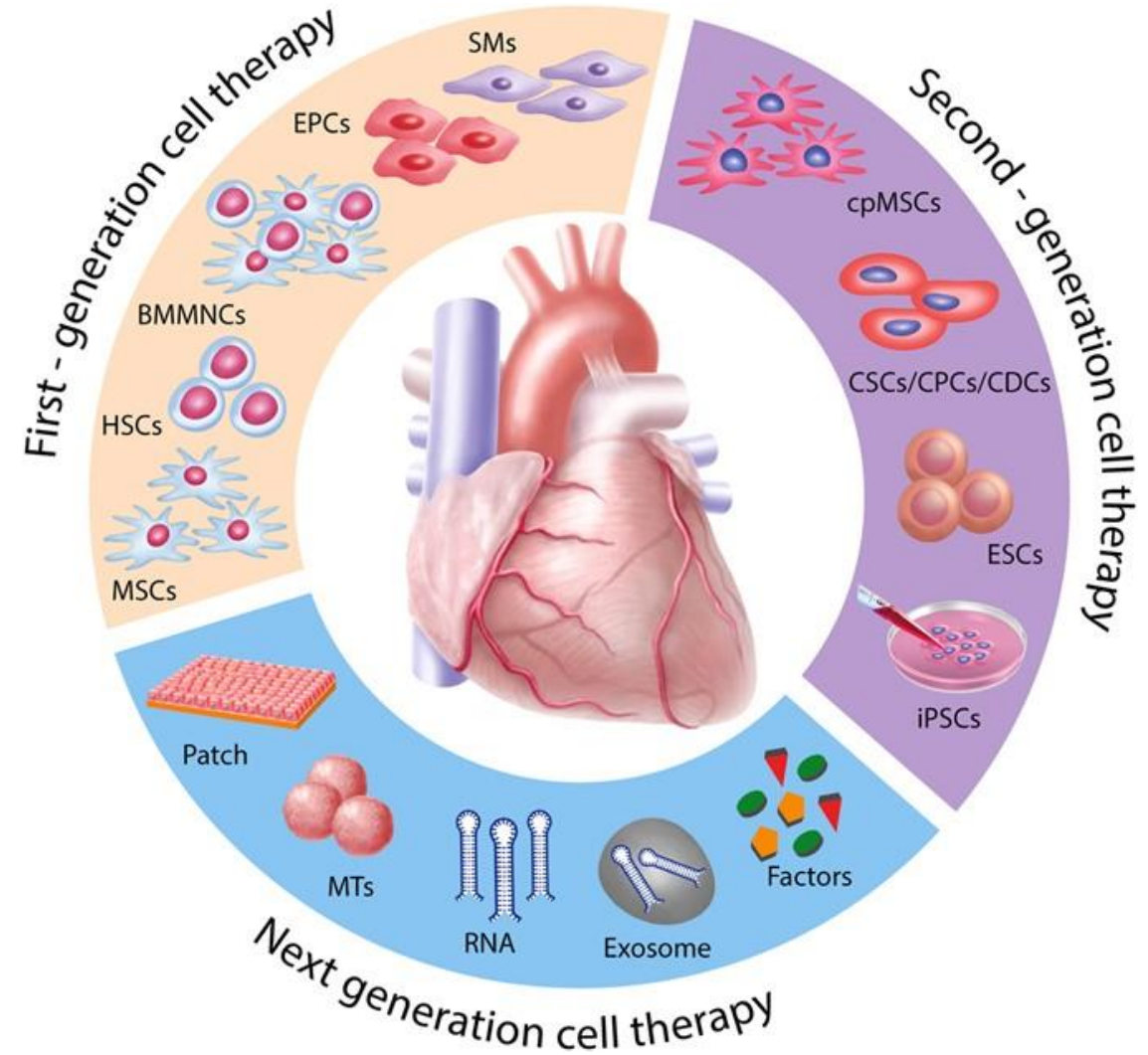
Personalized medicine



# Future of stem cell-based therapies

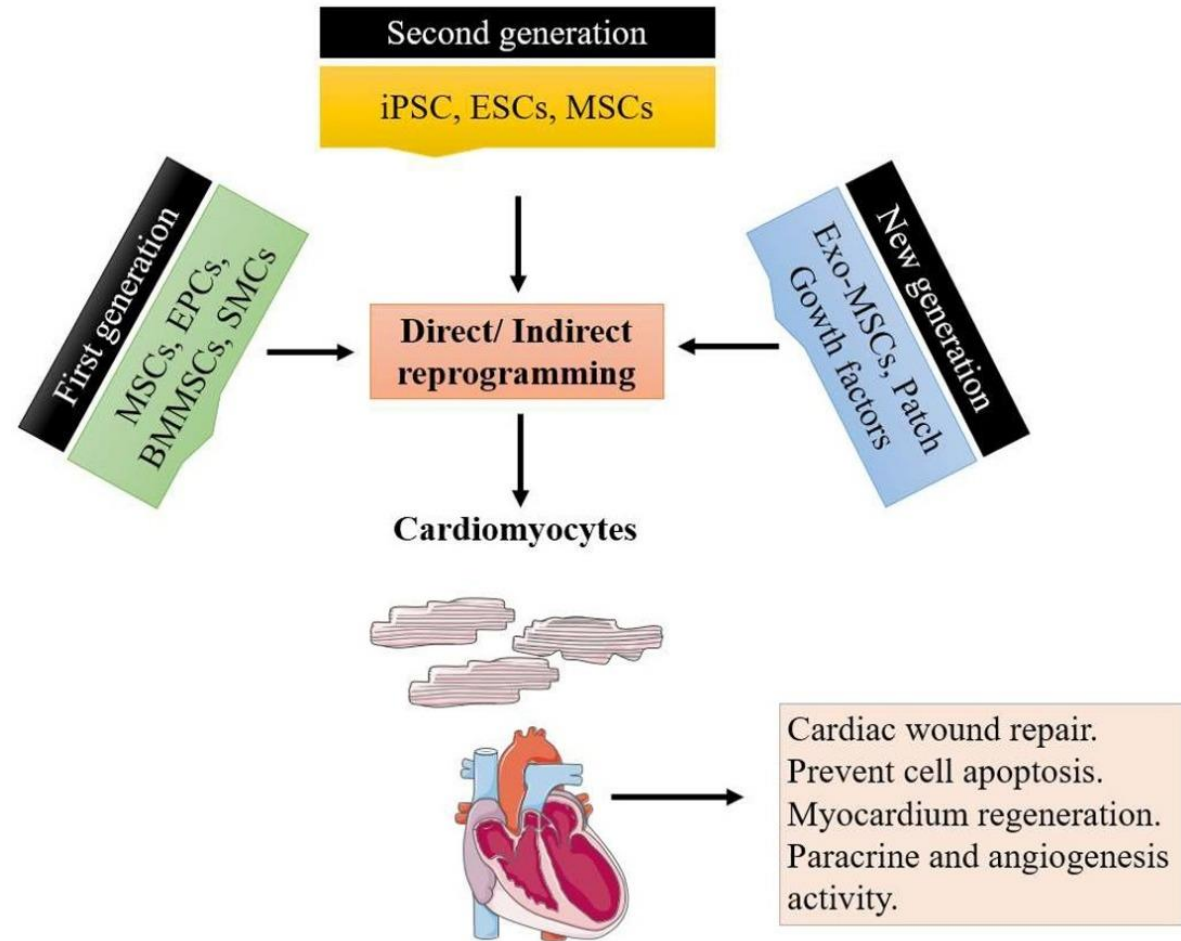


Next-generation therapies for cardiac repair are directed toward cell enhancement (e.g., biomaterials, 3D cell constructs, cytokines, miRNAs) and cell-free concepts (e.g., growth factors, non-coding RNAs, extracellular vesicles, and direct reprogramming)

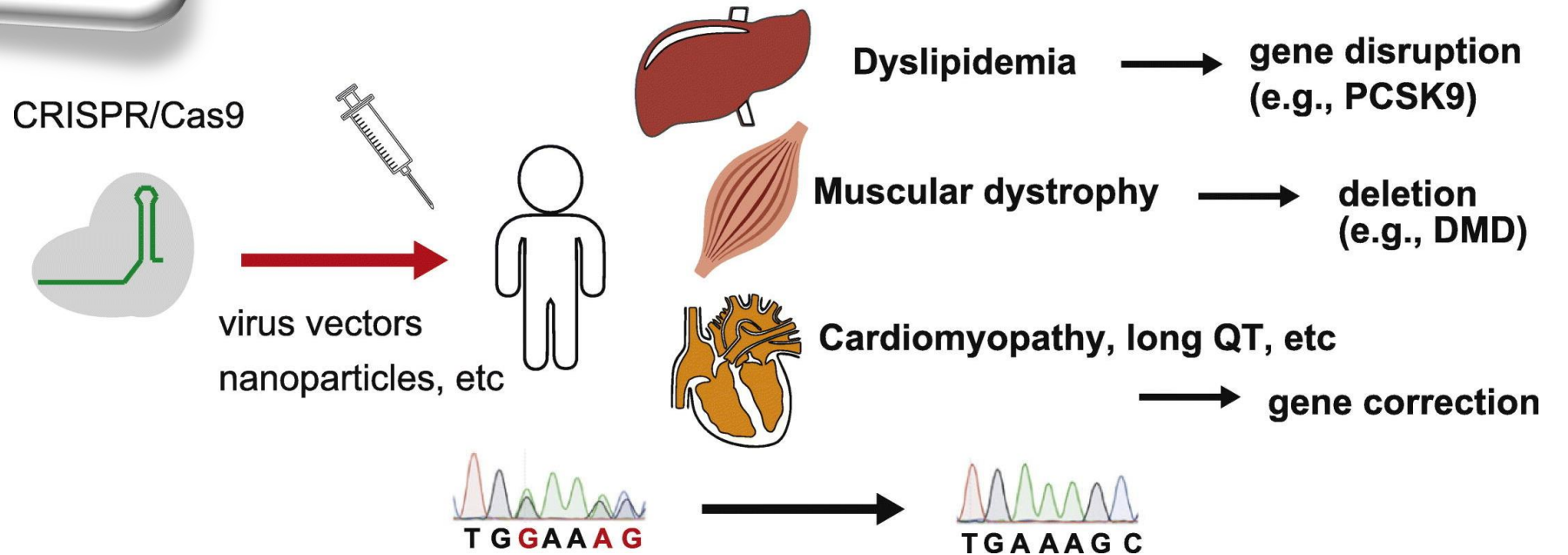




# Future of stem cell-based therapies

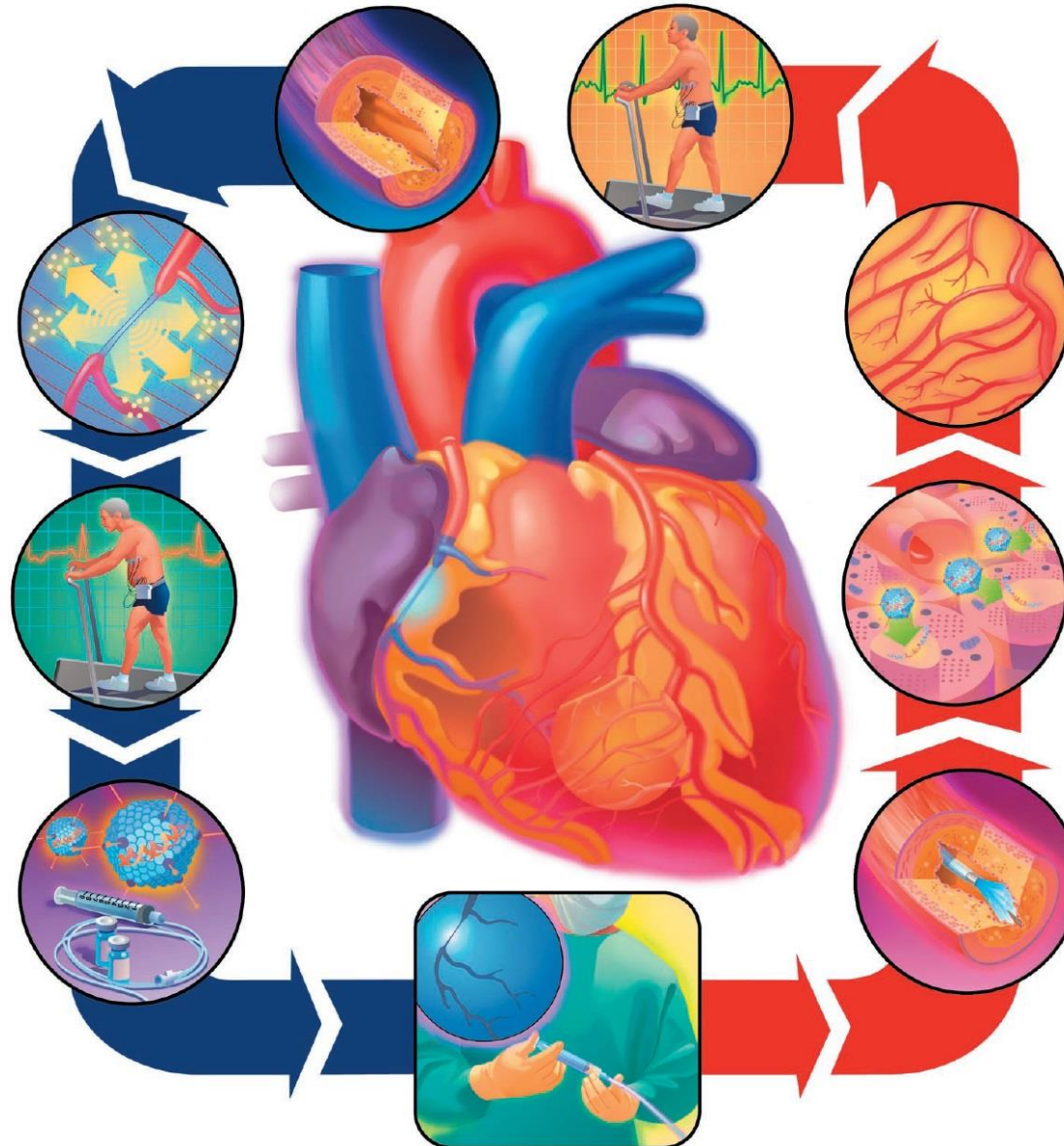


# Gene editing for cardiac disease



# Gene therapy for cardiac disease

By Christopher J. Reinhard

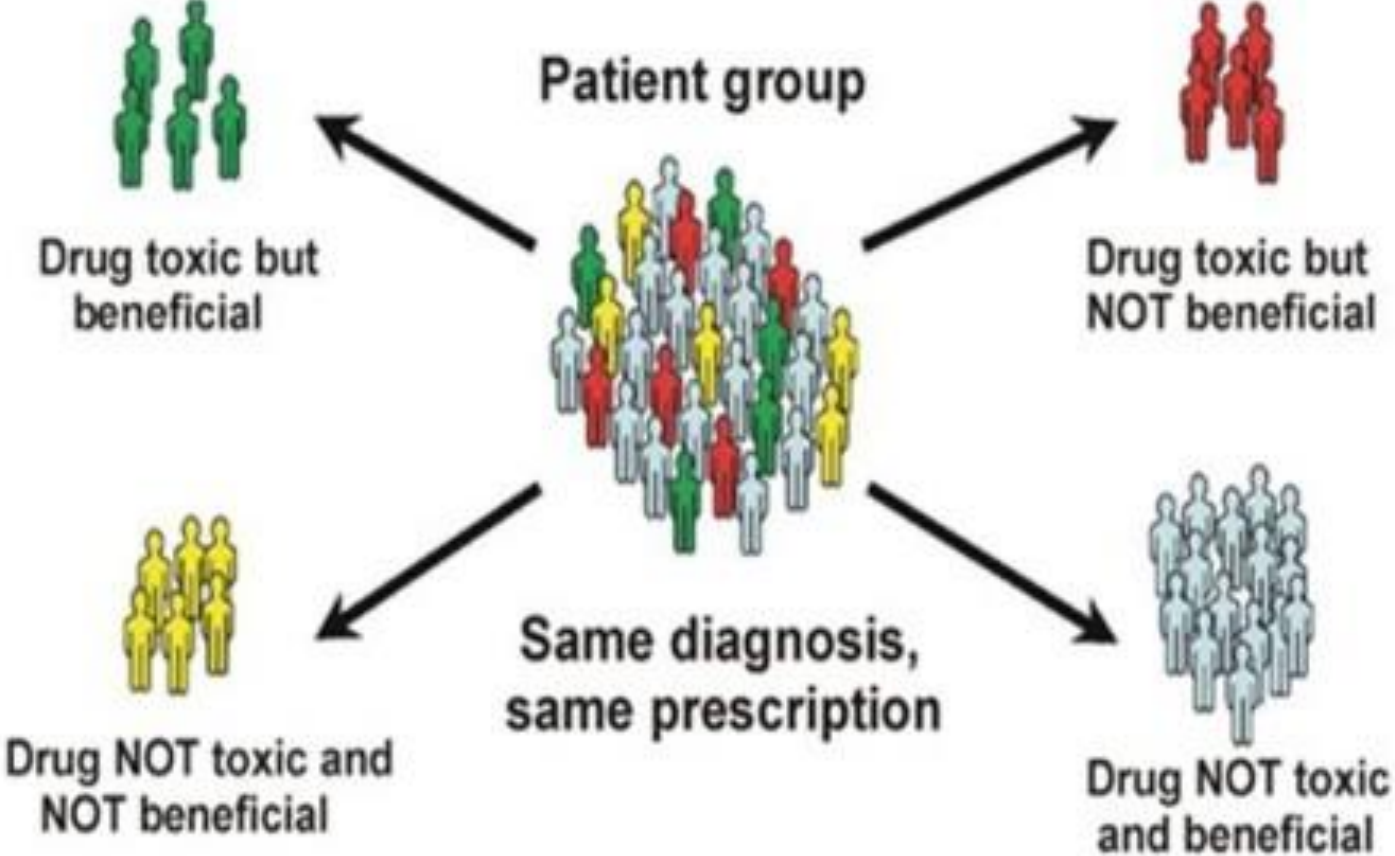


## Potential angiogenic healing process

- 1 Blocked artery due to build-up of fatty and plaque deposits inside the lining of arterial wall
- 2 Signal of ischemic injury
- 3 Clinical diagnosis of myocardial ischemia due to coronary artery disease
- 4 Collateral Therapeutics' non-surgical catheter-based proprietary gene therapy approach
- 5 & 6 Intra-arterial administration of gene therapy product through cardiac catheter by an interventional cardiologist
- 7 Transfection of angiogenic growth factor genes into heart cells
- 8 The growth of collateral circulation following angiogenic gene therapy
- 9 Improved blood flow and heart function following angiogenic gene therapy



# Precision and personalized medicine

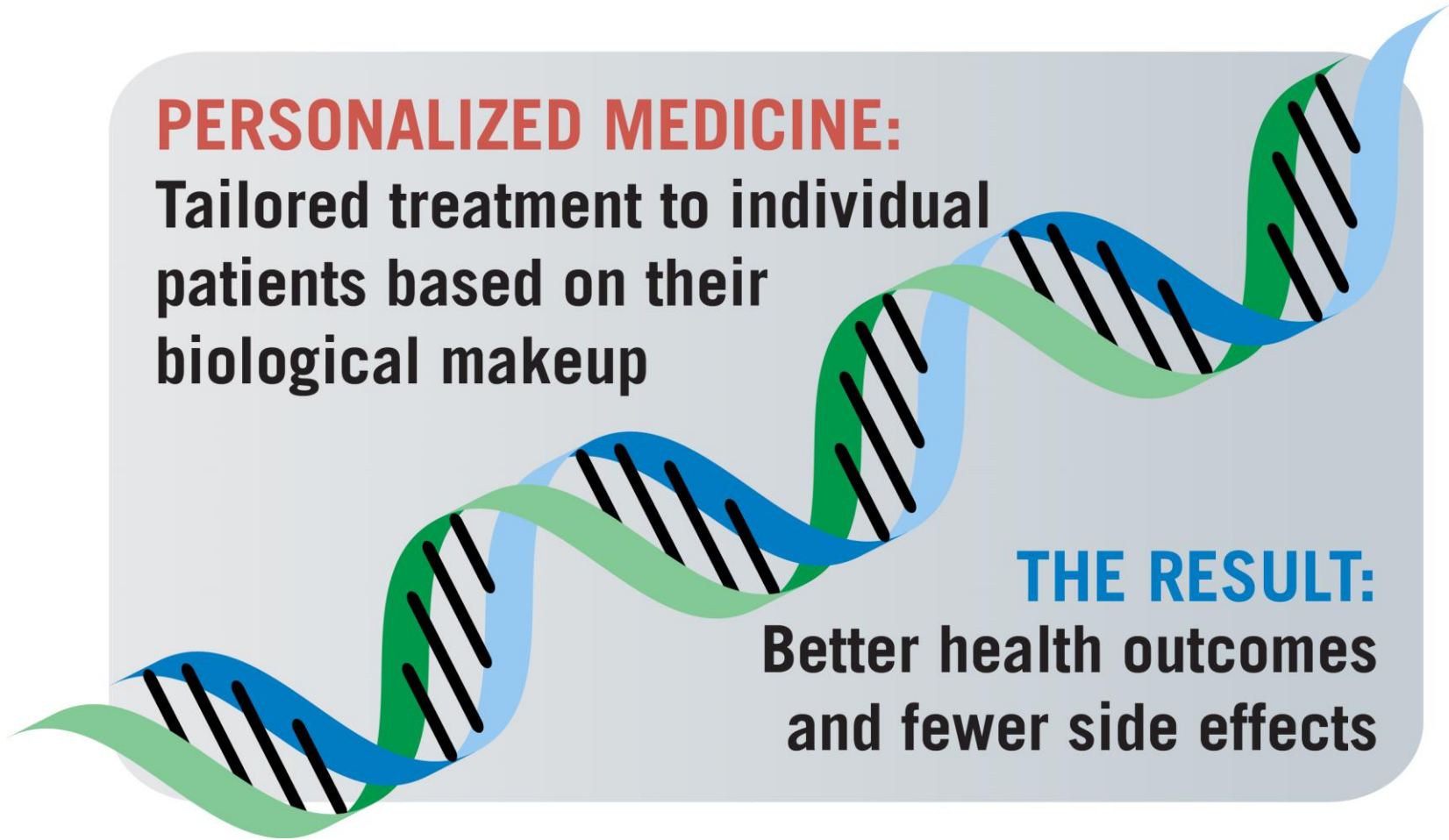


**PERSONALIZED MEDICINE:**

Tailored treatment to individual patients based on their biological makeup

**THE RESULT:**

Better health outcomes and fewer side effects



Precision and personalized medicine





# Precision and personalized medicine



## Personalized medicine aids in

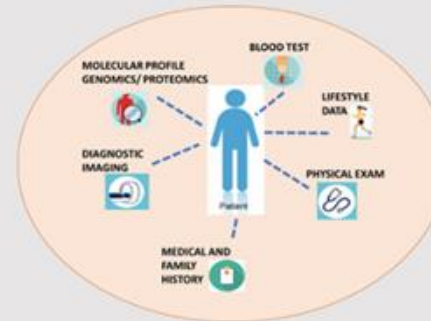
- 🔬 Early detection of disease
- 🔬 Faster and precise diagnosis
- 🔬 Offers personalized treatment

### PREVENTION



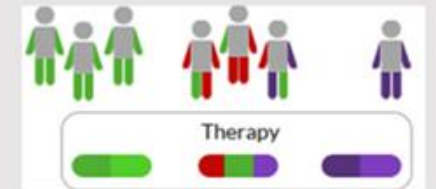
Early detection of patients at risk, Improve preventive measures (individual/collective)

### DIAGNOSIS



Accurate disease diagnosis enabling individualized treatment strategy

### TREATMENT



Improved outcomes through targeted treatments and reduced side effects

# Artificial intelligence in cardiovascular medicine



Use of data in medical practice



Rise of AI in healthcare

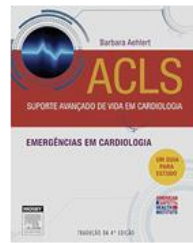


Impact on HCP training



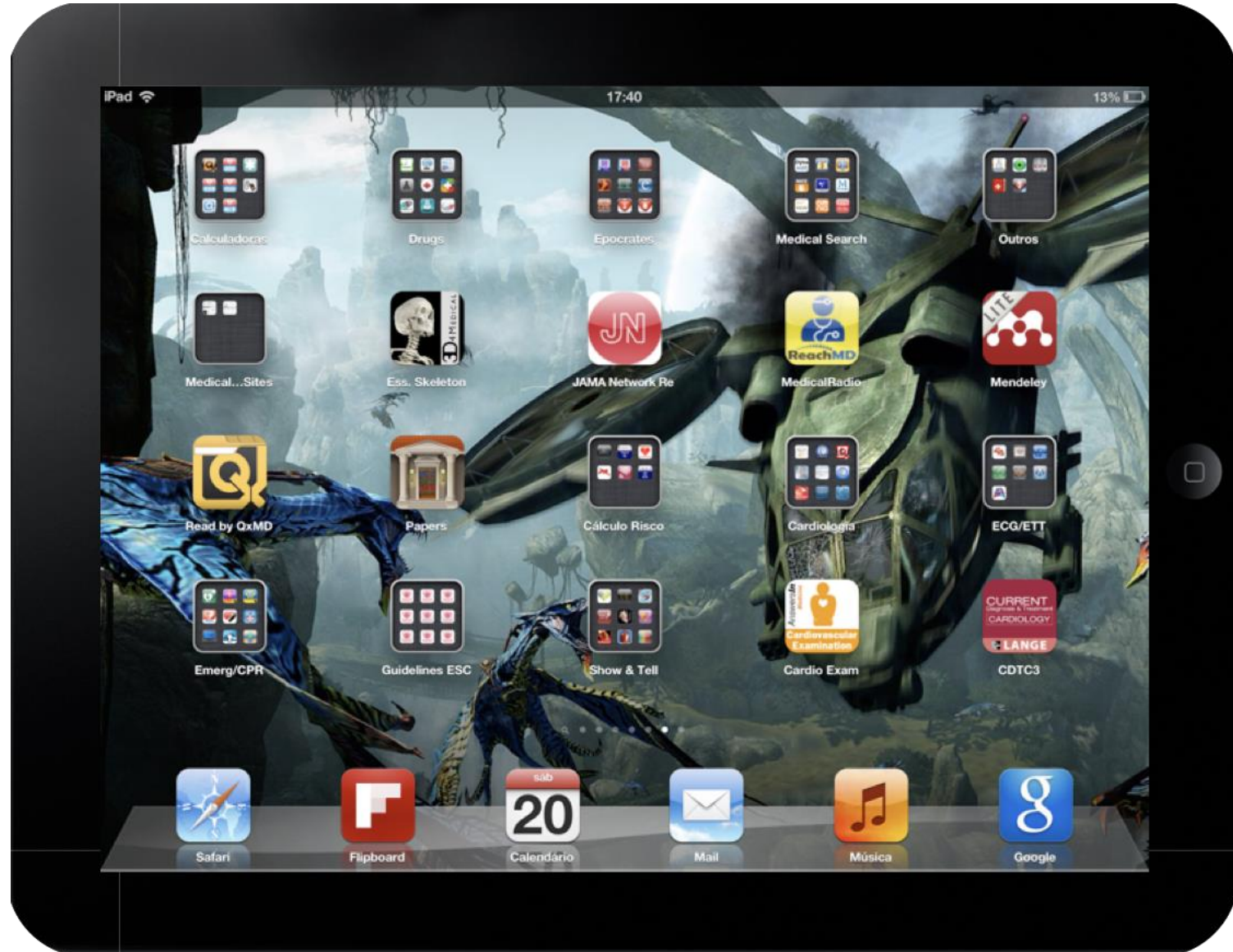
Security and reliability risks





X

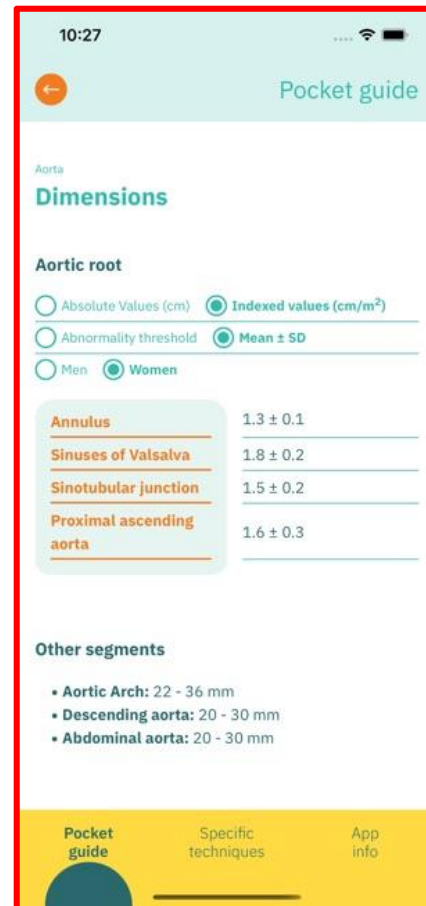
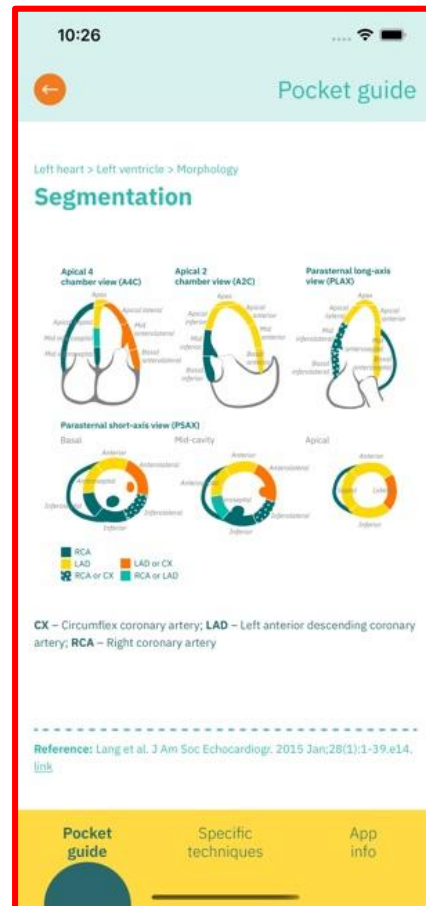
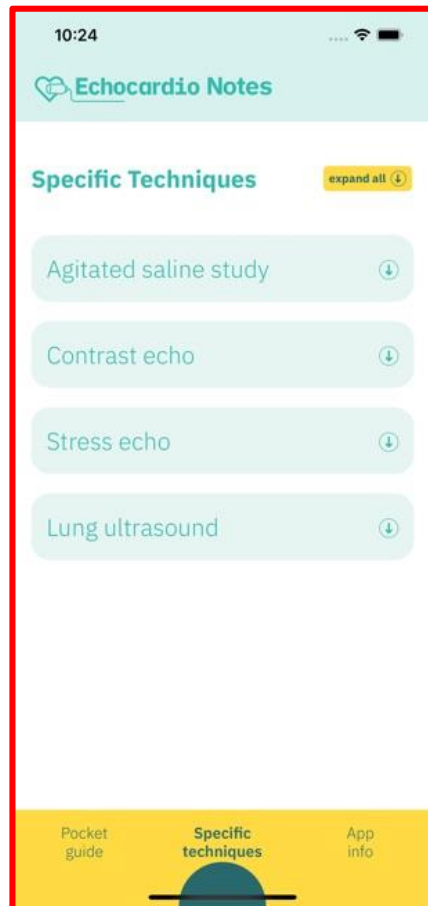




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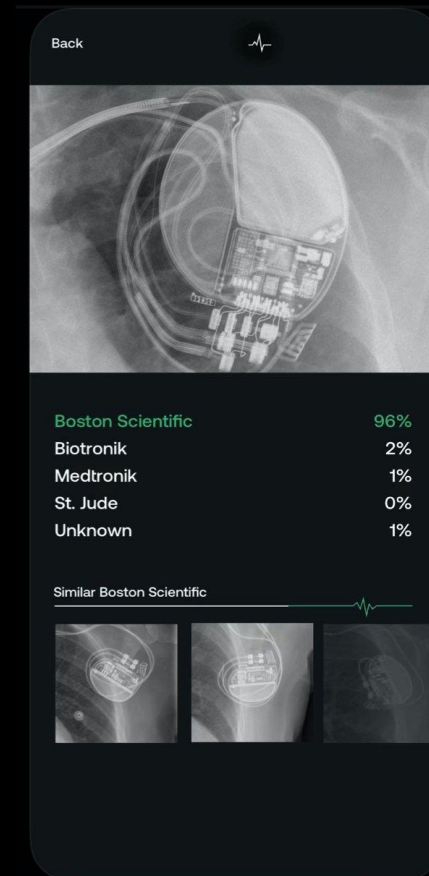
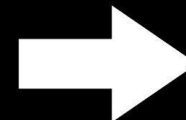
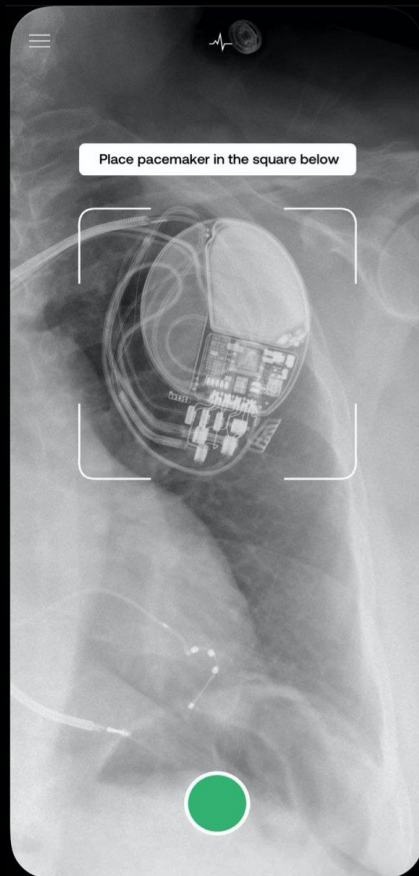




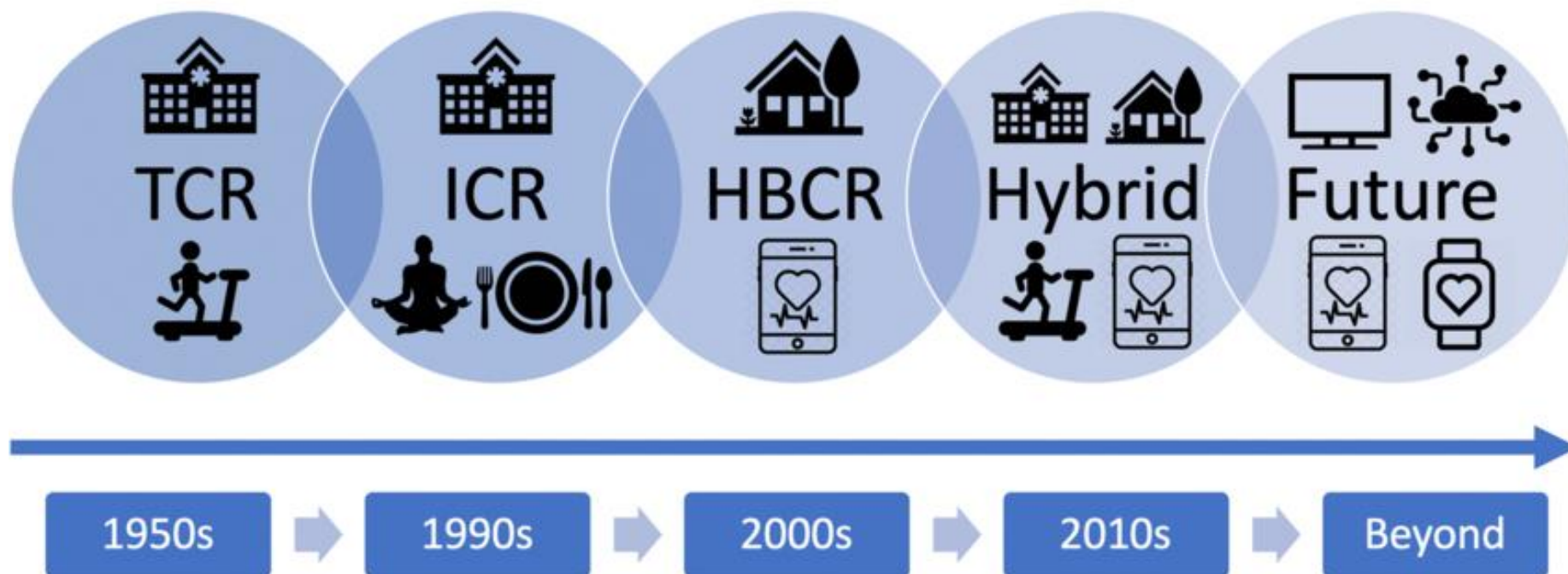




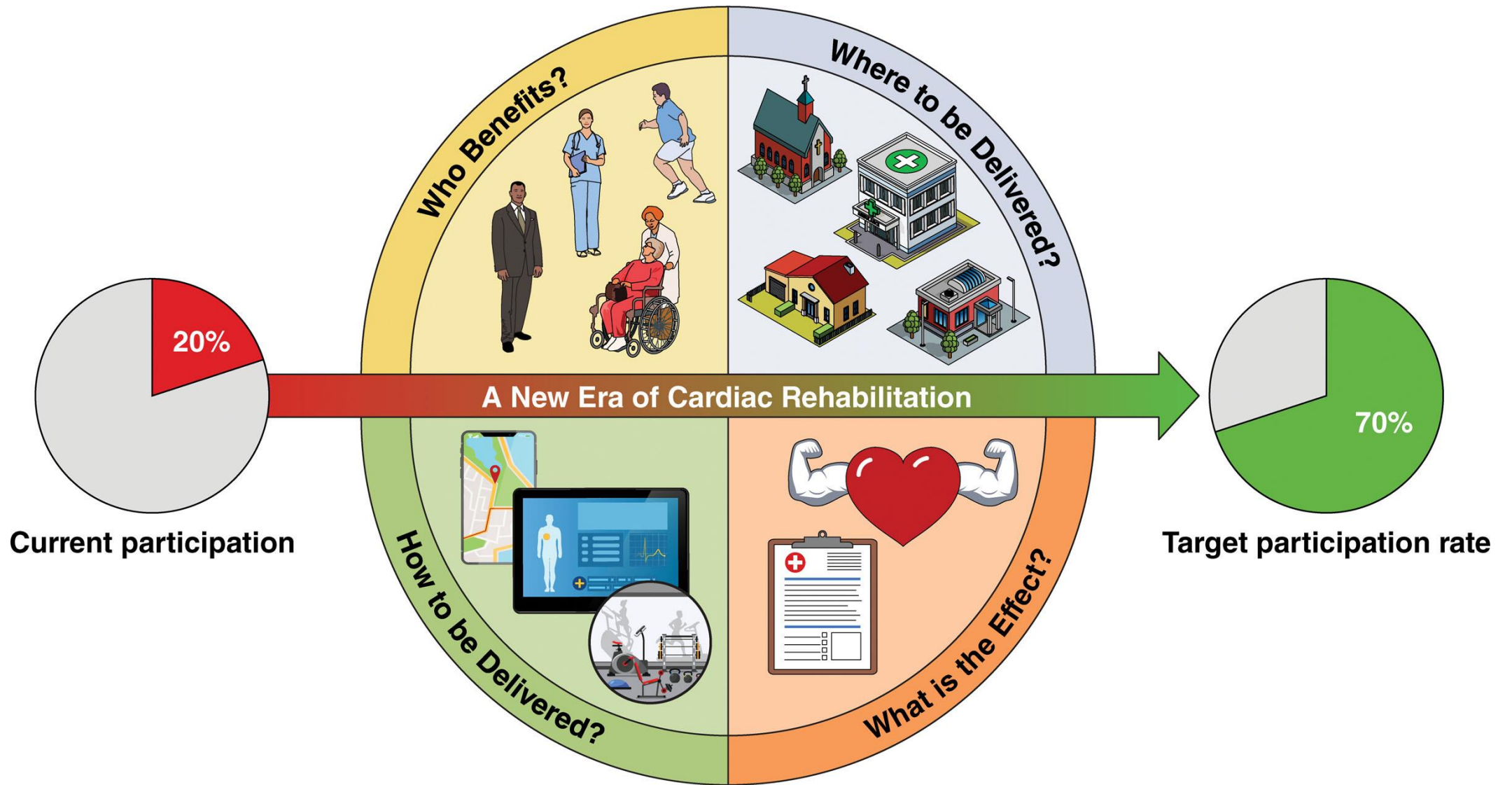
# Pacemaker-ID App



## Evolution of Cardiac Rehabilitation



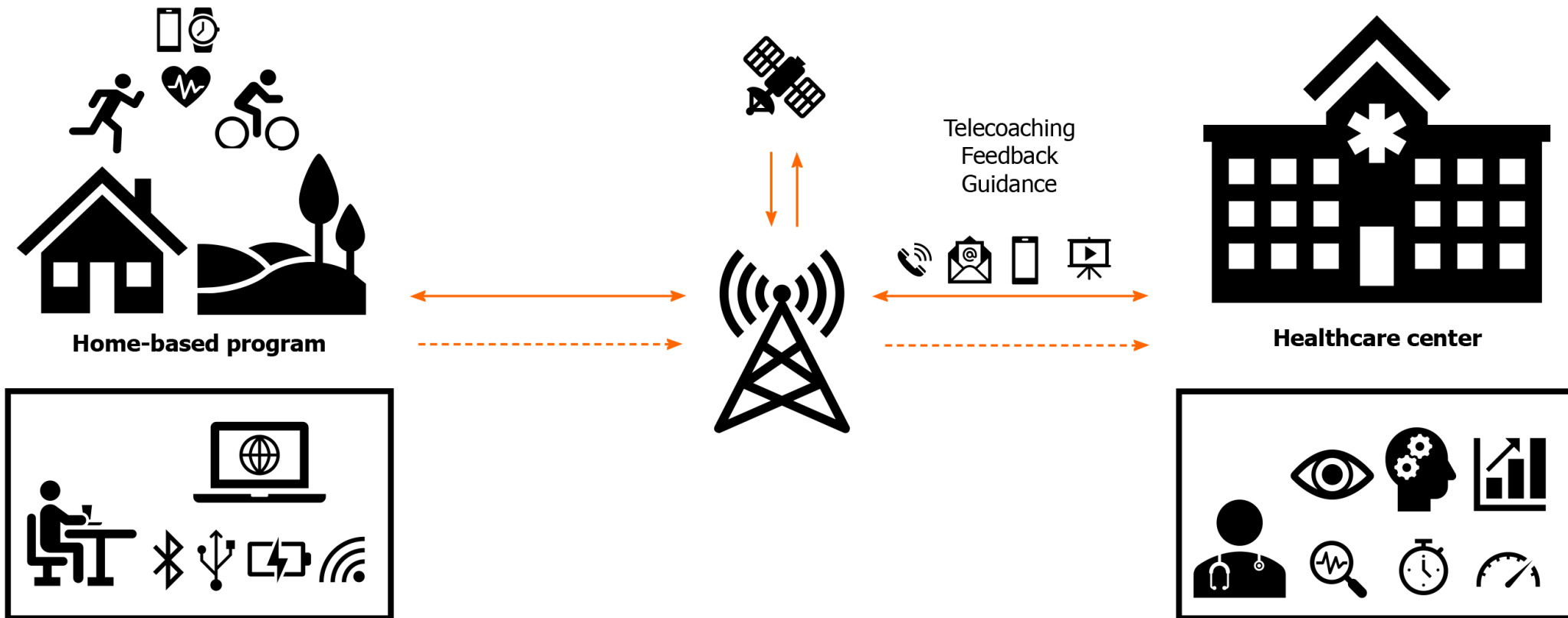
TCR = traditional cardiac rehabilitation (CR), ICR = intensive CR, HBCR = home-based CR





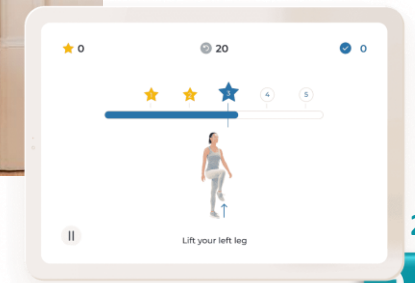
# Hospital Santa Cruz aplica fisioterapia com realidade virtual na reabilitação de pacientes internados na UTI





# What is Digital Physical Therapy?

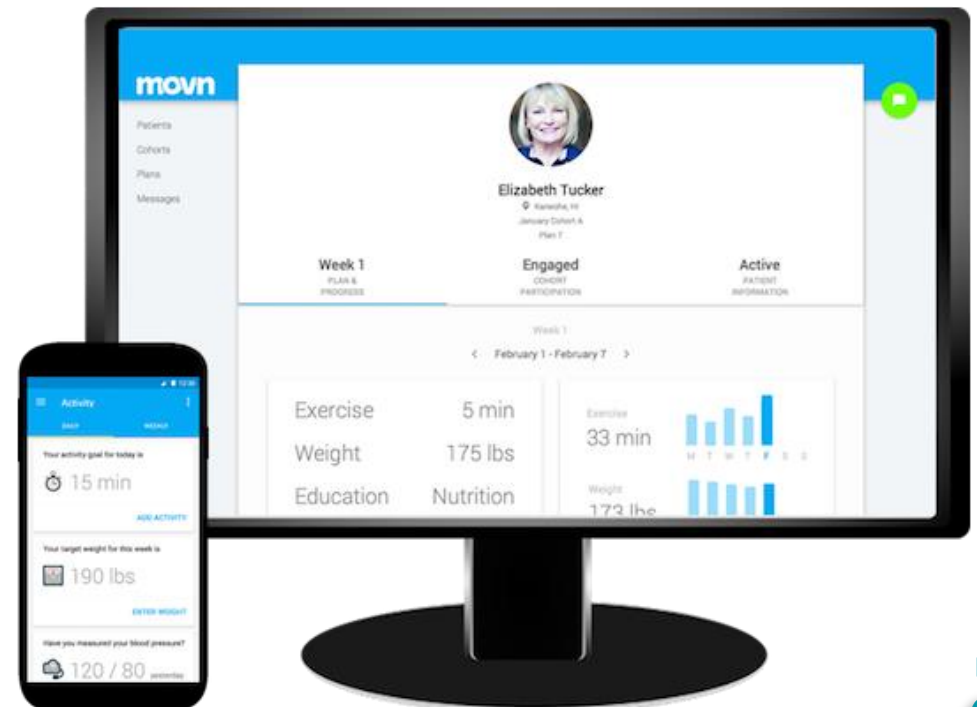
Digital Physical Therapy pairs a human therapist with Sword Health's digital therapist. This combination is proven to deliver high-quality care that can be accessed anytime, anywhere.



2023



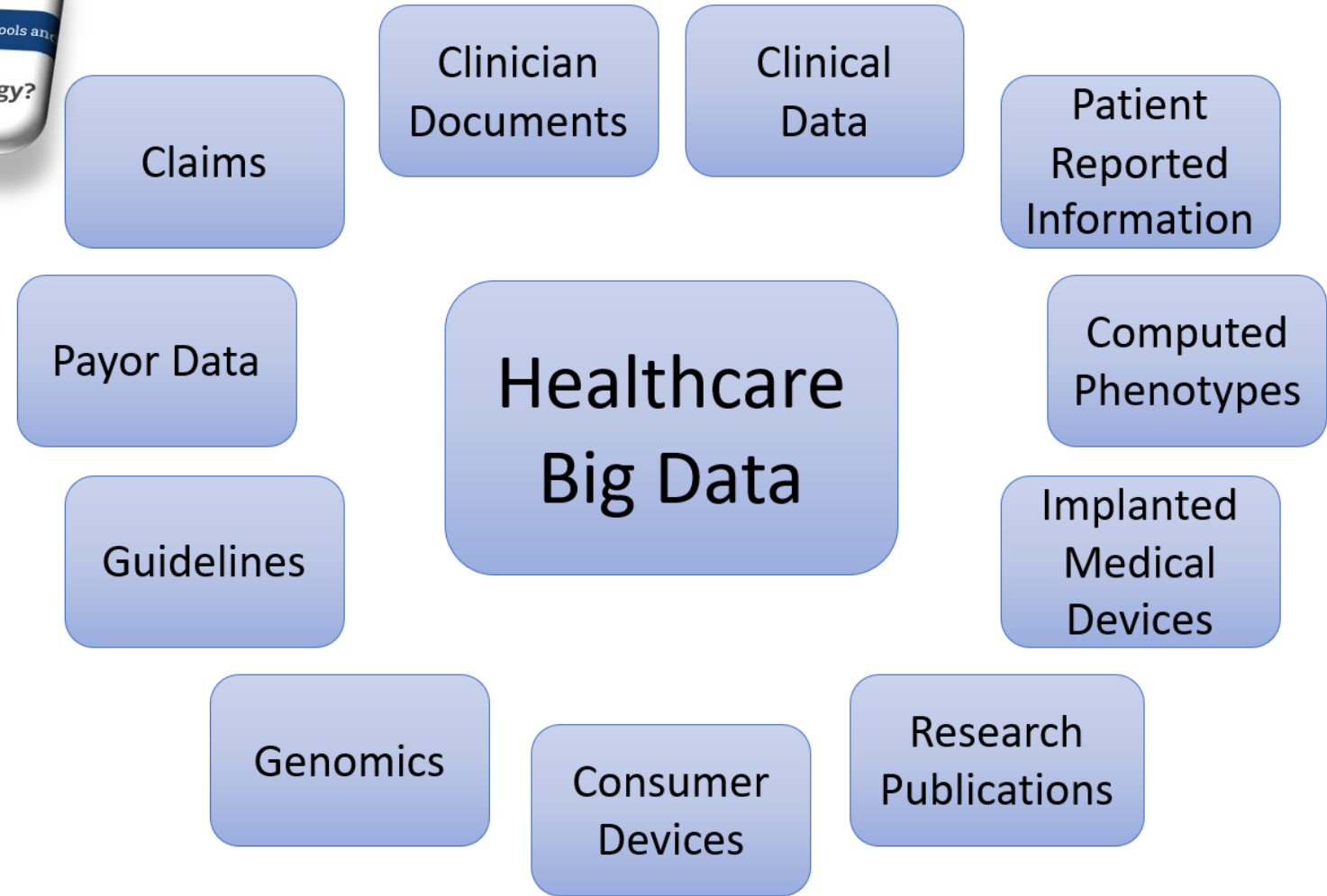
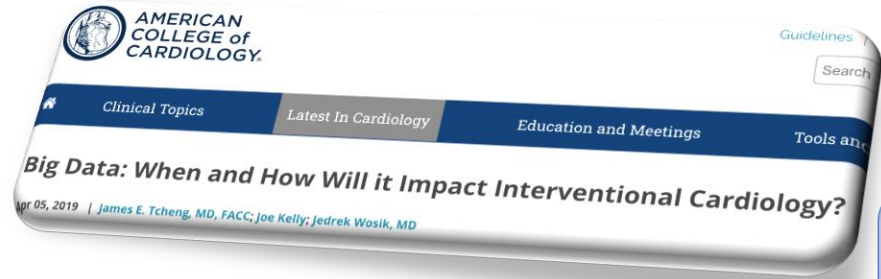




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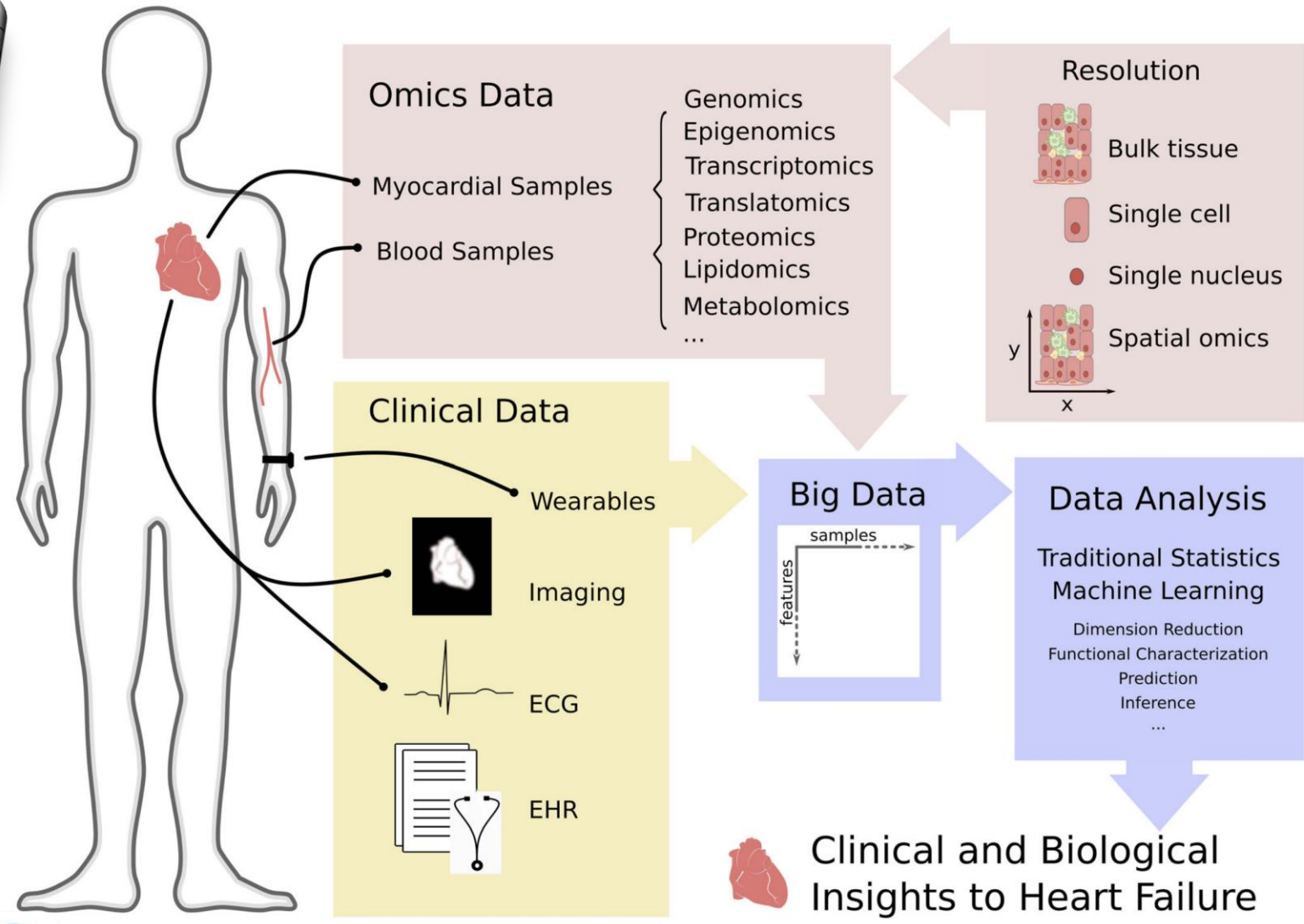
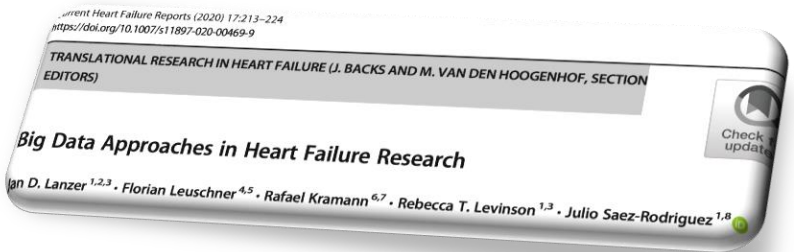



# Sources of data in healthcare





# Types of big data in heart failure



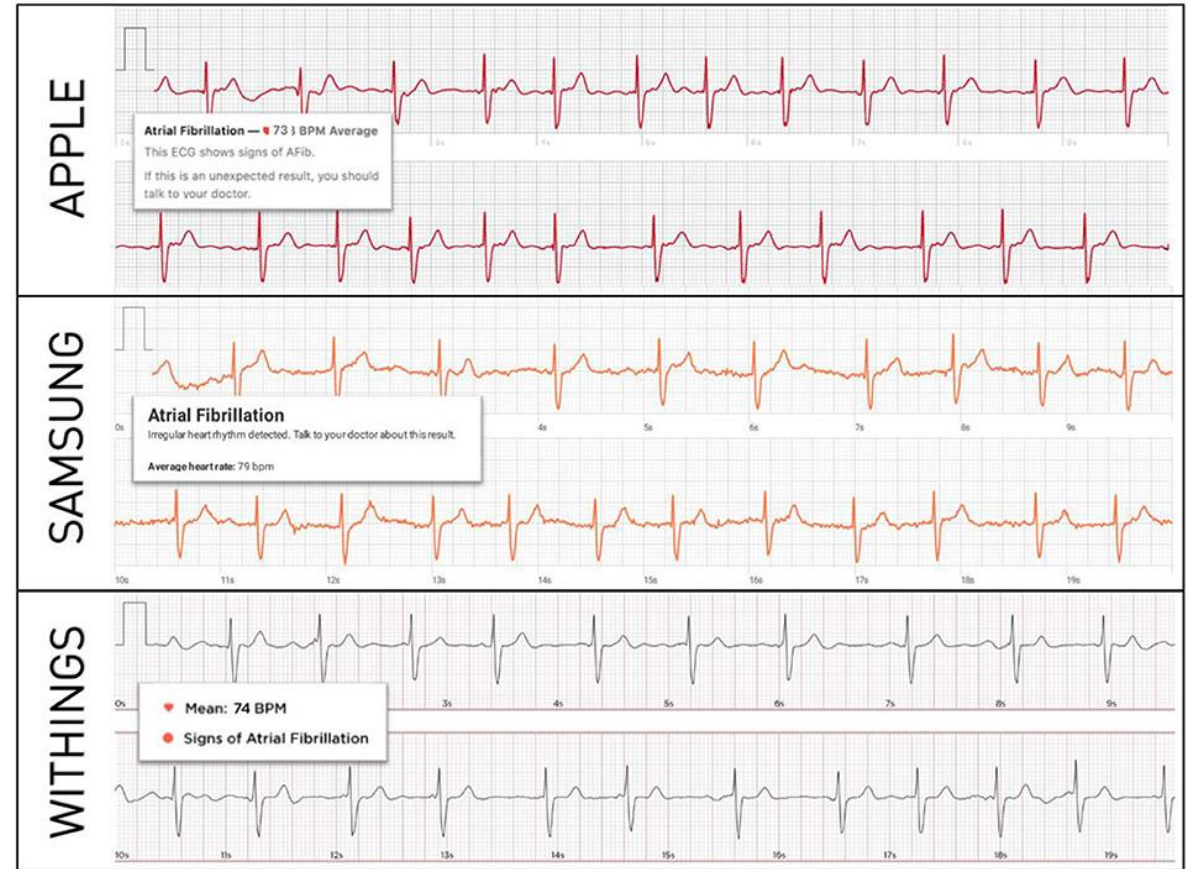
 Clinical and Biological Insights to Heart Failure



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### Sinus Rhythm — ❤️ 78 BPM Average

This ECG does not show signs of atrial fibrillation.



25 mm/s, 10 mm/mV, Lead I, 511Hz, iOS 12.1.1, watchOS 5.1.2, Watch4,4 — The waveform is similar to a Lead I ECG. For more information, see Instructions for Use.

### Atrial Fibrillation — ❤️ 118 BPM Average

This ECG shows signs of AFib.

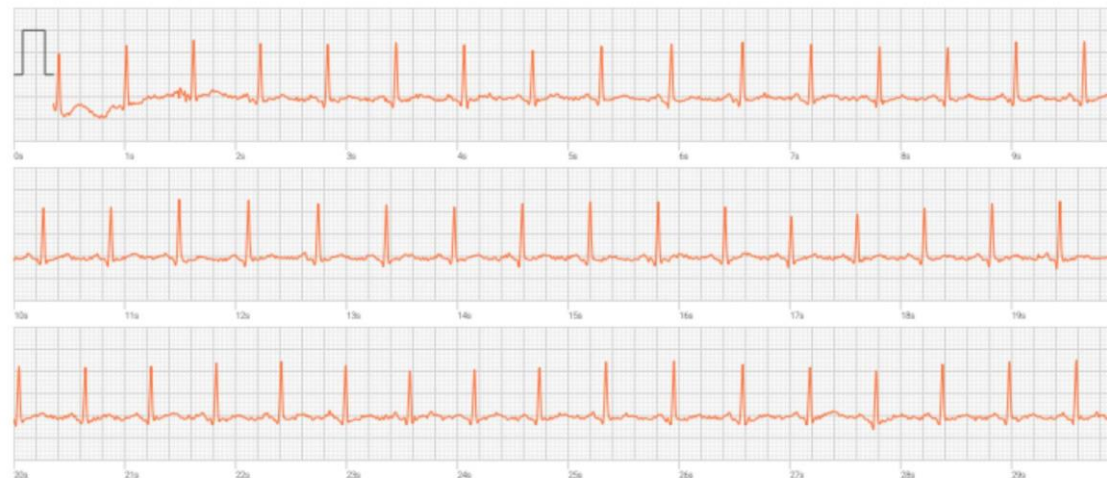
If this is an unexpected result, you should talk to your doctor.



## Atrial fibrillation

Irregular heart rhythm detected. Talk to your doctor about this result.

Average heart rate: 98 bpm





[Redacted]

[Redacted]

Para: Daniel Ferreira

Doentes 1 de junho de 2017, 16:14



Olá Viva Dr Daniel Ferreira,

Como sabe também tenho o apple watch.

Há algum tempo para cá instalei várias apps quase toda sobre a análise do ritmo cardíaco e comecei a notar algumas alterações.

Por exemplo, hoje pelas 11:01, sentado á minha secretária navegando pela internet, sem notar pessoalmente algumas alterações no meu ritmo cardíaco ou arritmia, ao verificar todos as apps, notei, em todas, um pico de 151 batimentos.

O que fazer?

1. Marcar consulta urgente para o senhor? a consulta de telemedicine com o Dr. está apenas marcada para 14/08/2017!
2. Não ligar? e continuar observando!

Desde já o meu obrigado pela sua melhor atenção.

Abraço

[Redacted]

PS:

Tenho as seguintes apps:

1. Fit Heart - Instant Heart Rate Monitor
2. HeartWatch
3. Cardiogram
4. HealtView
5. Fit Heart



DF 2023



NOS 13:02 79%

[< Anterior](#) Todos os dados [Editar](#)

BATIMENTOS POR MINUTO

58 - 89	02/07/2017	>
58 - 106	01/07/2017	>
59 - 102	30/06/2017	>
60 - 104	29/06/2017	>
58 - 97	28/06/2017	>
59 - 102	27/06/2017	>
54 - 99	26/06/2017	>

Hoje Dados de saúde Fontes Ficha médica

NOS 13:05 79%

[< Anterior](#) Todos os dados [Editar](#)

83	1/07, 14:59	>
88	1/07, 14:49	>
74	1/07, 14:43	>
82	1/07, 14:39	>
106	1/07, 14:35	>
88	1/07, 14:22	>
78	1/07, 14:19	>
89	1/07, 14:13	>
74	1/07, 14:08	>

Hoje Dados de saúde Fontes Ficha médica



## Eight Reason Why Future Computers will make better Decisions than Doctors

business trends, future scenario, historical perspective, new strategy, powerful idea, prediction, social trends, technology trends

January 5th, 2014

Costo 17 | 8-1 32 | Tweet 36 | Share 50



...and eight reasons why we will still need doctors



# MODERN DATA SCIENTIST

Data Scientist, the sexiest job of 21st century requires a mixture of multidisciplinary skills ranging from an intersection of mathematics, statistics, computer science, communication and business. Finding a data scientist is hard. Finding people who understand who a data scientist is, is equally hard. So here is a little cheat sheet on who the modern data scientist really is.

## MATH & STATISTICS

- ☆ Machine learning
- ☆ Statistical modeling
- ☆ Experiment design
- ☆ Bayesian inference
- ☆ Supervised learning: decision trees, random forests, logistic regression
- ☆ Unsupervised learning: clustering, dimensionality reduction
- ☆ Optimization: gradient descent and variants

## PROGRAMMING & DATABASE

- ☆ Computer science fundamentals
- ☆ Scripting language e.g. Python
- ☆ Statistical computing package e.g. R
- ☆ Databases SQL and NoSQL
- ☆ Relational algebra
- ☆ Parallel databases and parallel query processing
- ☆ MapReduce concepts
- ☆ Hadoop and Hive/Pig
- ☆ Custom reducers
- ☆ Experience with xaaS like AWS



## DOMAIN KNOWLEDGE & SOFT SKILLS

- ☆ Passionate about the business
- ☆ Curious about data
- ☆ Influence without authority
- ☆ Hacker mindset
- ☆ Problem solver
- ☆ Strategic, proactive, creative, innovative and collaborative

## COMMUNICATION & VISUALIZATION

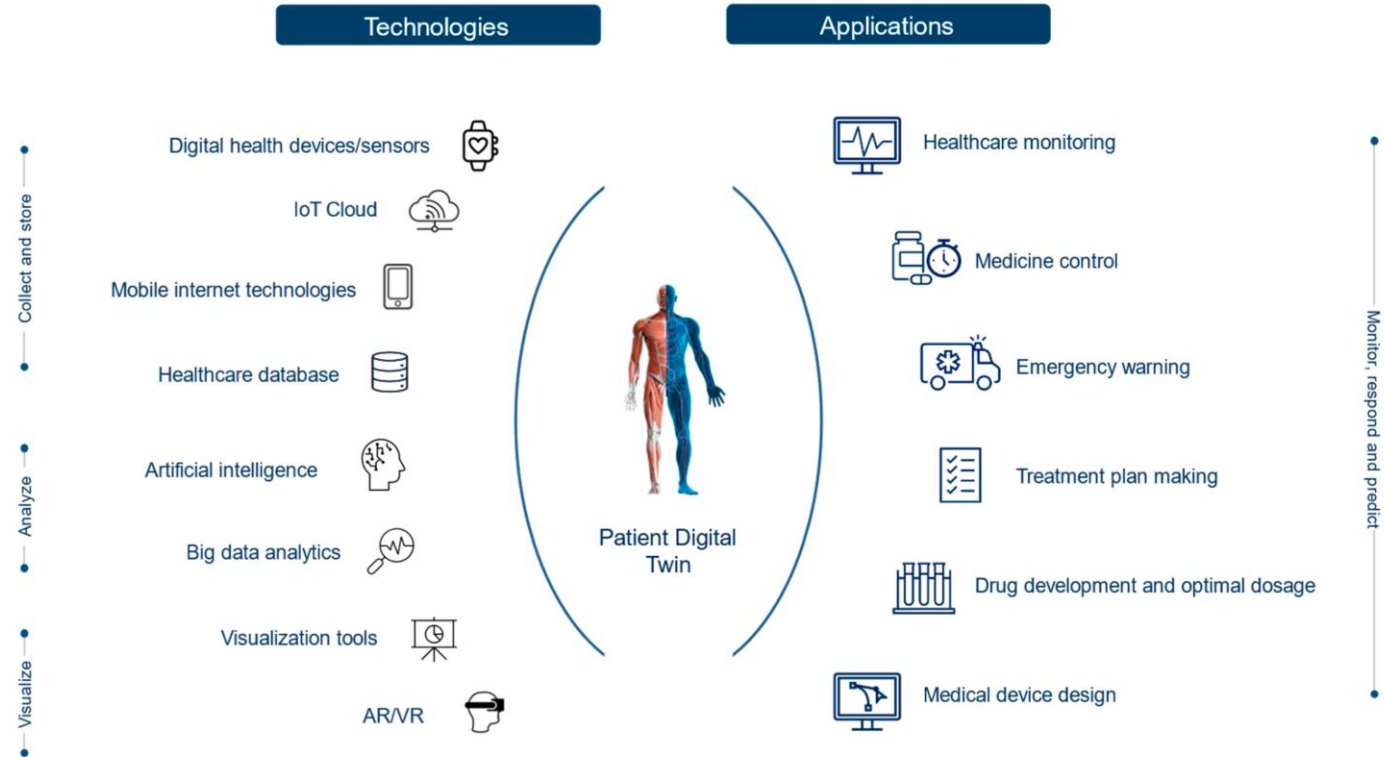
- ☆ Able to engage with senior management
- ☆ Story telling skills
- ☆ Translate data-driven insights into decisions and actions
- ☆ Visual art design
- ☆ R packages like ggplot or lattice
- ☆ Knowledge of any of visualization tools e.g. Flare, D3.js, Tableau



Meet your digital twin



# Digital twins applications in Medicine

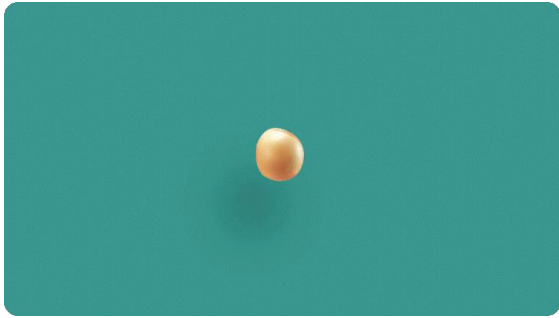


How DTs in healthcare differ from standard monitoring or standard medicine control?

- Digital Twins allow**
- Real-time information interchange between physical and virtual copy of the patient/object/environment
  - Use of data to predict individual patient-specific evolutions

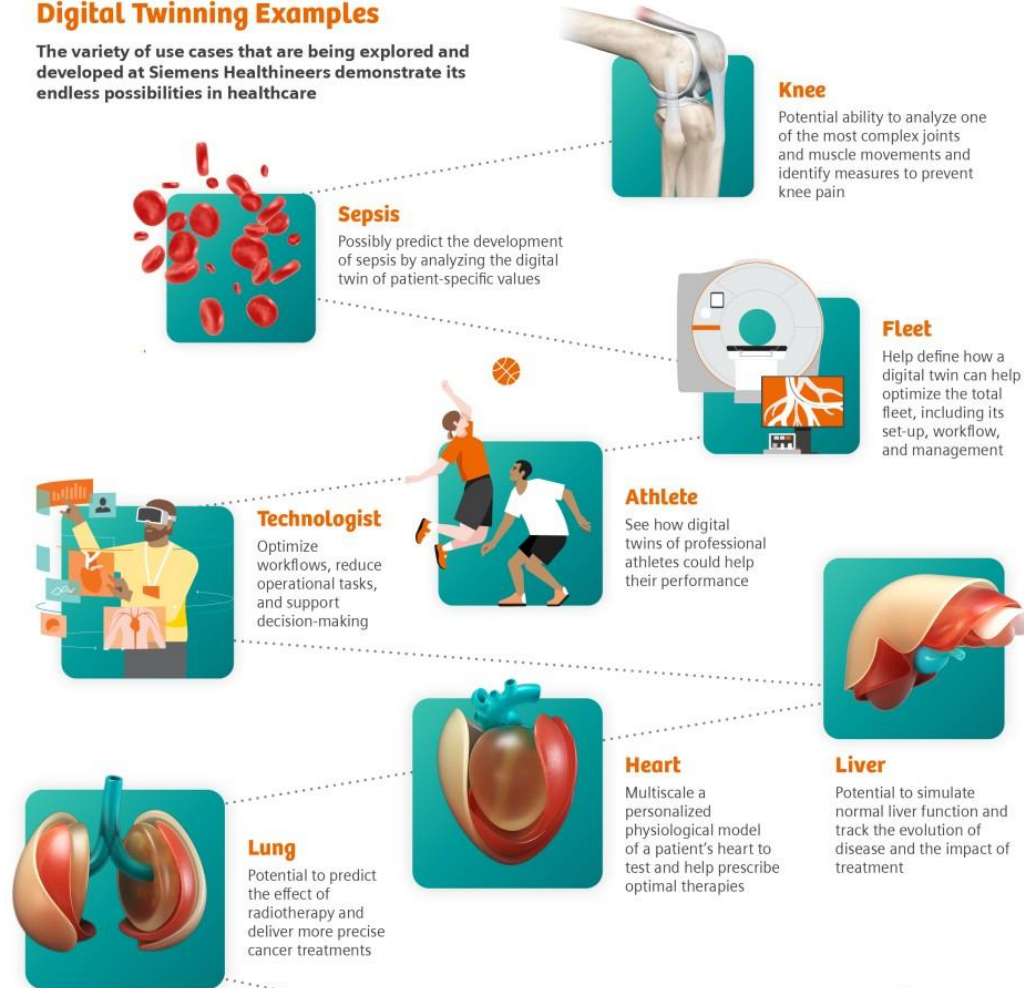


# Digital twins applications in Medicine



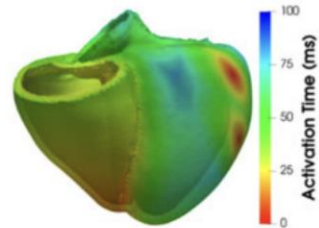
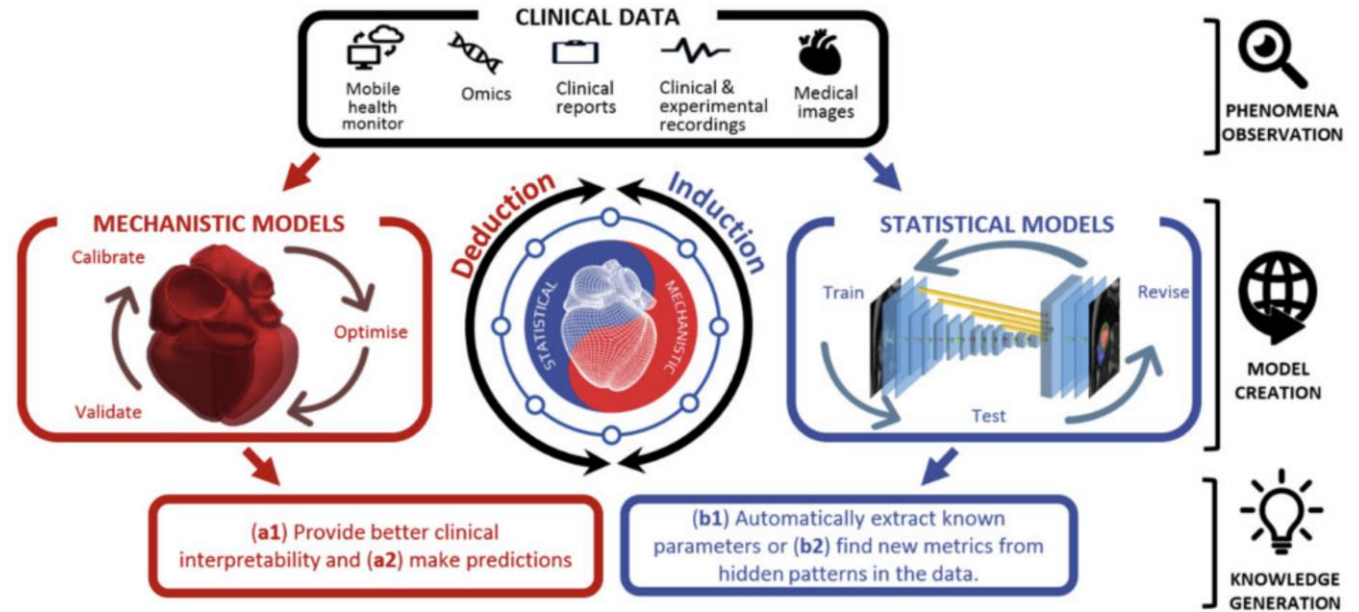
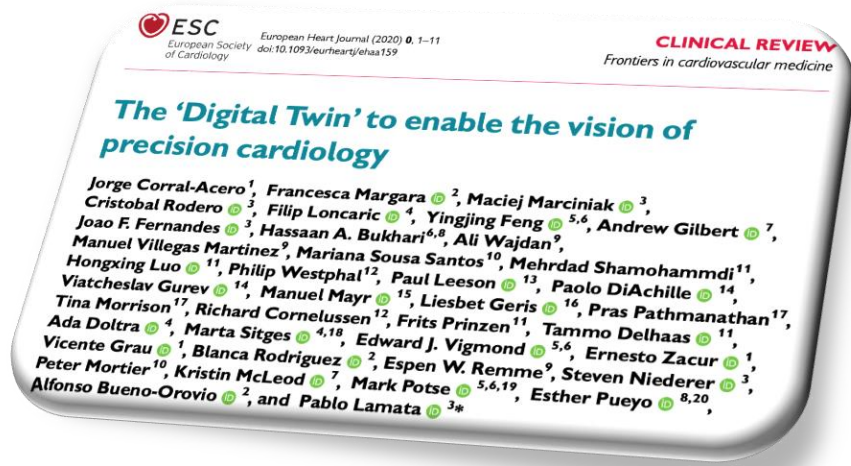
## Digital Twinning Examples

The variety of use cases that are being explored and developed at Siemens Healthineers demonstrate its endless possibilities in healthcare

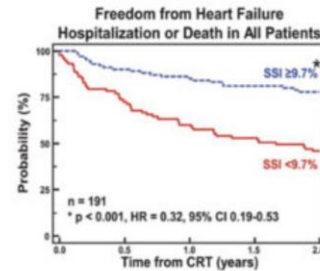


...and more

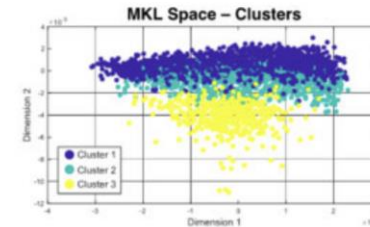
# Digital twins applications in Cardiology



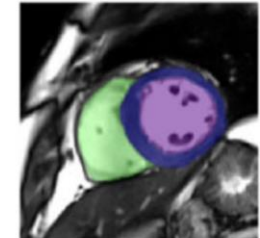
**a1) Patient-specific electromechanical computer simulations**



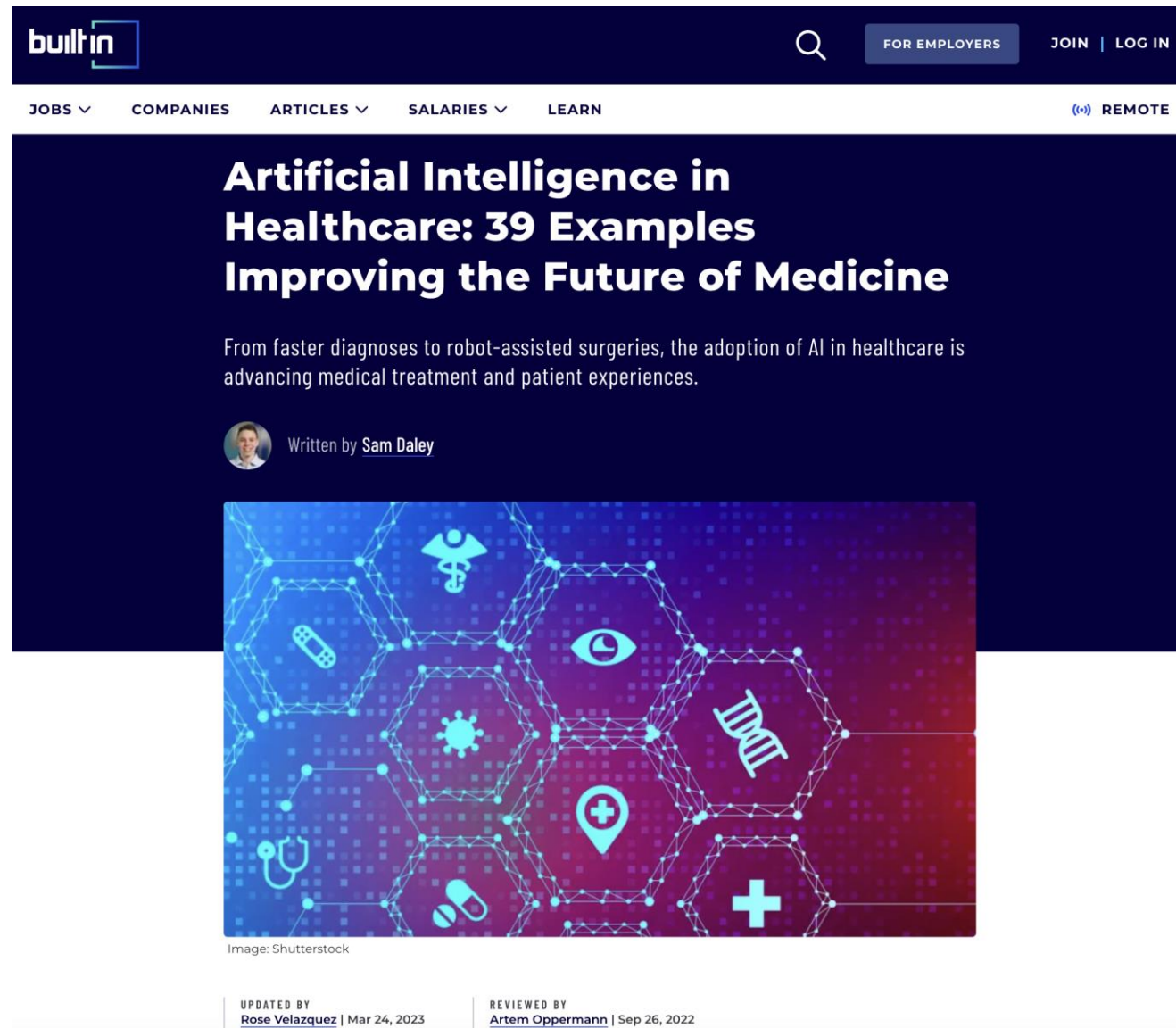
**a2) A strain-based parameter based on myofiber mechanics simulations can help to predict CRT therapy response**



**b2) Unsupervised machine learning can integrate clinical data to predict outcomes and categorize patients based on similarity**



**b1) Automatic cardiac MR segmentation using a deep learning neural network**



The image is a screenshot of a BuiltIn article page. At the top, the BuiltIn logo is on the left, and a search icon, 'FOR EMPLOYERS' button, and 'JOIN | LOG IN' links are on the right. Below the logo is a navigation bar with 'JOBS', 'COMPANIES', 'ARTICLES', 'SALARIES', and 'LEARN' menus, and a 'REMOTE' filter on the right. The main content area has a dark blue background with the article title 'Artificial Intelligence in Healthcare: 39 Examples Improving the Future of Medicine' in large white text. Below the title is a sub-headline: 'From faster diagnoses to robot-assisted surgeries, the adoption of AI in healthcare is advancing medical treatment and patient experiences.' The author's name 'Written by Sam Daley' is shown with a small profile picture. A large graphic below the text features a grid of hexagons with various medical and AI icons like a caduceus, bandage, virus, DNA, location pin, and plus sign. At the bottom, there are two columns of text: 'UPDATED BY Rose Velazquez | Mar 24, 2023' and 'REVIEWED BY Artem Oppermann | Sep 26, 2022'. A small 'Image: Shutterstock' credit is visible below the graphic.

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## Artificial Intelligence in Healthcare: 39 Examples Improving the Future of Medicine

From faster diagnoses to robot-assisted surgeries, the adoption of AI in healthcare is advancing medical treatment and patient experiences.

Written by [Sam Daley](#)

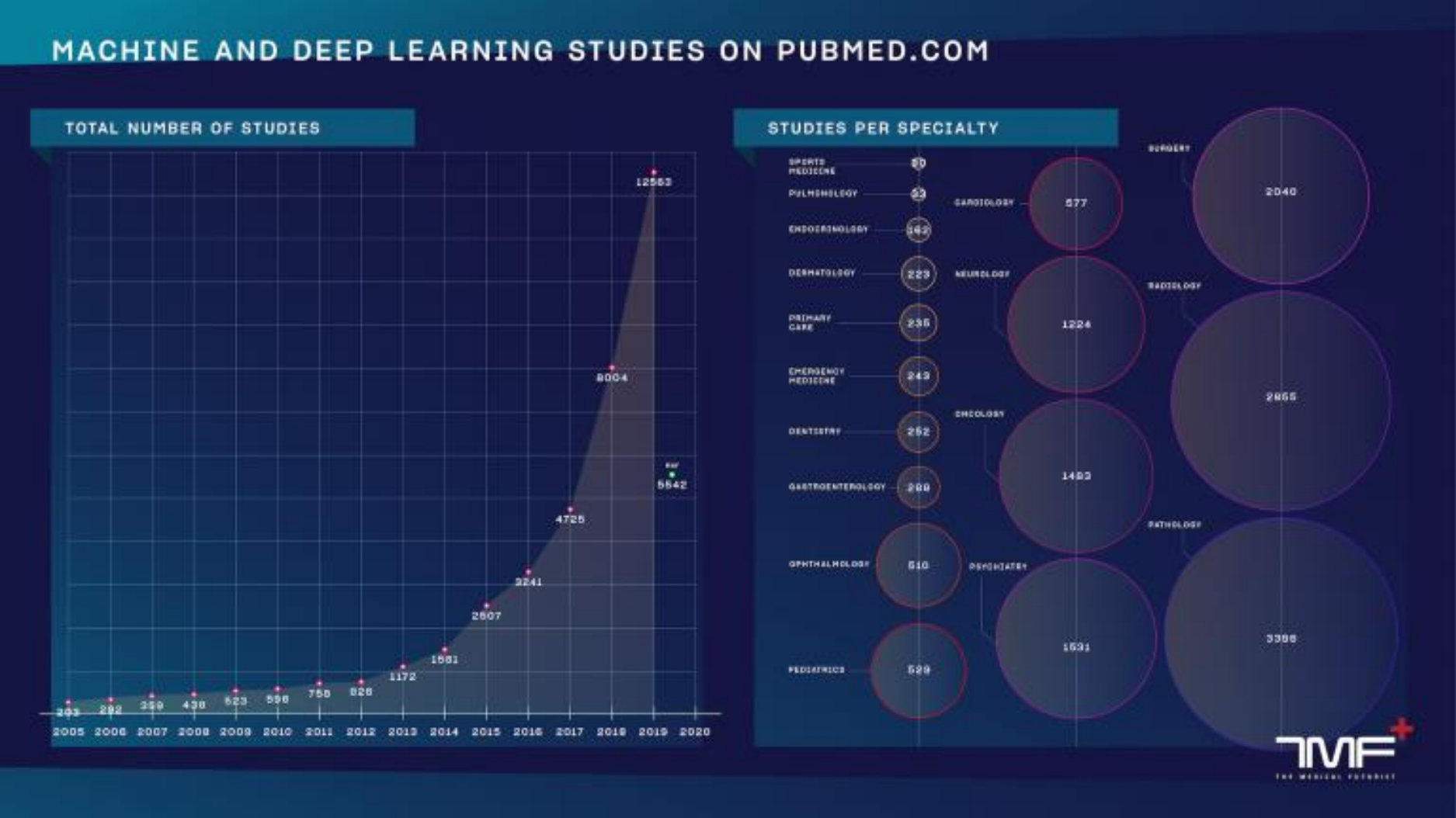
Image: Shutterstock

UPDATED BY [Rose Velazquez](#) | Mar 24, 2023

REVIEWED BY [Artem Oppermann](#) | Sep 26, 2022



# Number of published AI studies is on the rise



# Large Language Models are here



**BOOM**

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## ChatGPT Is Now Aiding The Healthcare System Also, But It Has Risks

Early adopters have started using ChatGPT to assist with mundane tasks like writing sick certificates, patient letters and letters asking medical insurers to pay for specific expensive medications for patients.

By - The Conversation | 26 Feb 2023 10:48 AM • 11 mins read



Large Language Models have arrived to healthcare also

# ChatGPT and Healthcare: The Future Is Here



BGO Software

07 FEB 2023 - 14 MIN READ



**ChatGPT is just the tip of the generative AI iceberg**



DF 2023



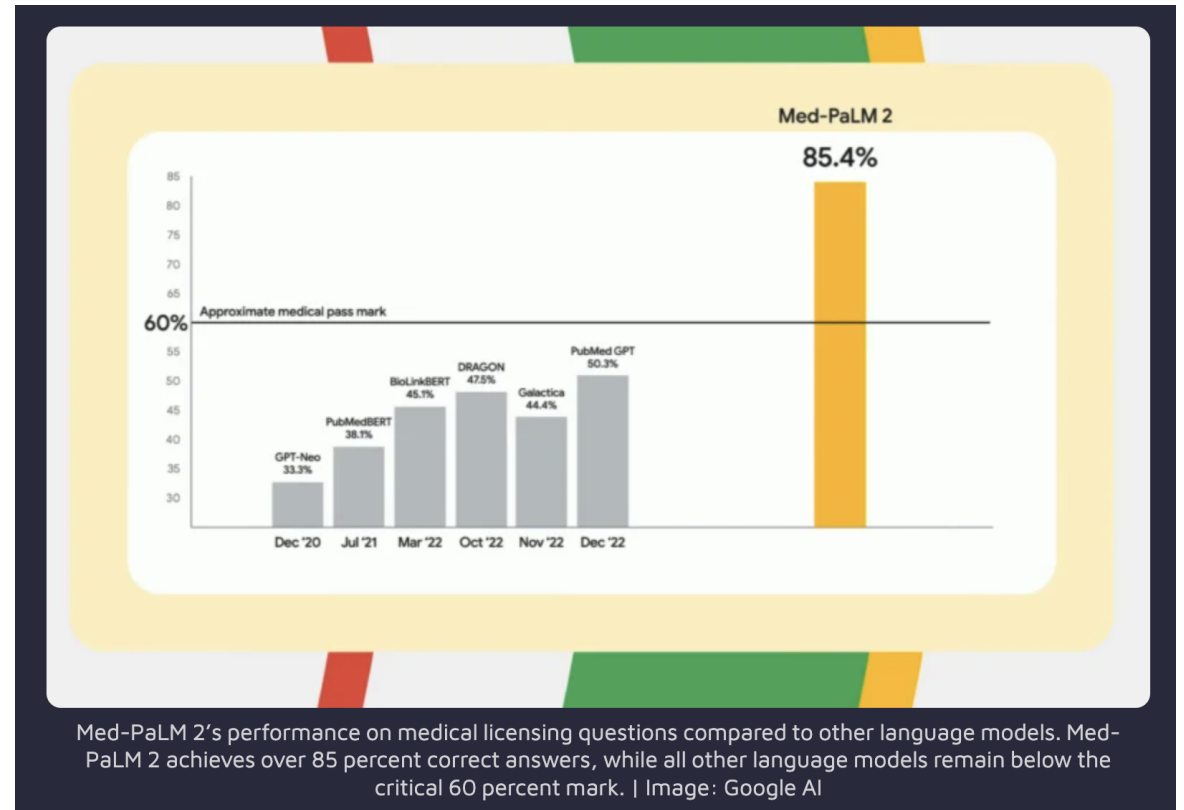


# New kids on the block are coming



## Google Releases PaLM, A ChatGPT-Like ChatBot For Healthcare

© Blockchain Council | December 30, 2022



Med-PaLM 2's performance on medical licensing questions compared to other language models. Med-PaLM 2 achieves over 85 percent correct answers, while all other language models remain below the critical 60 percent mark. | Image: Google AI

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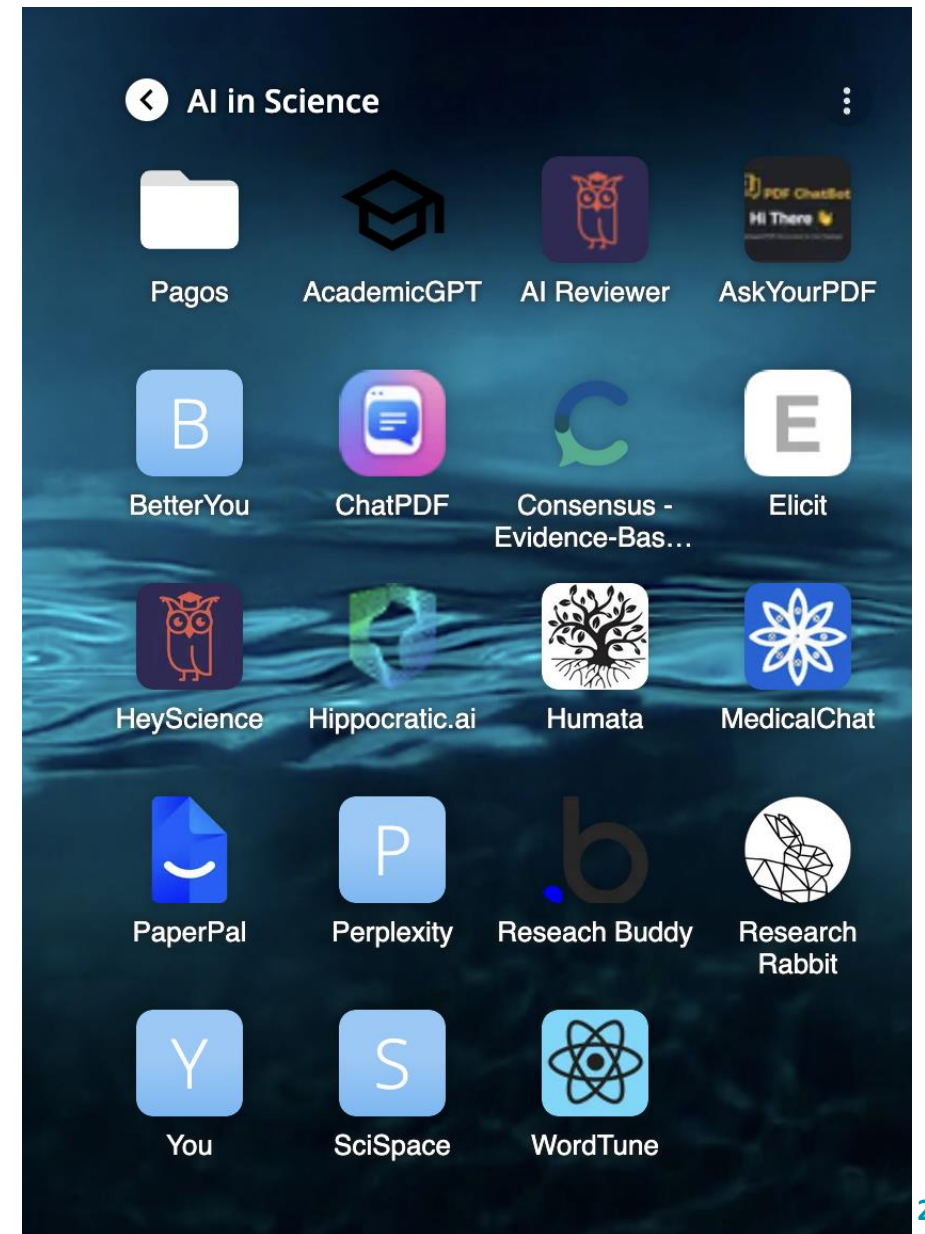
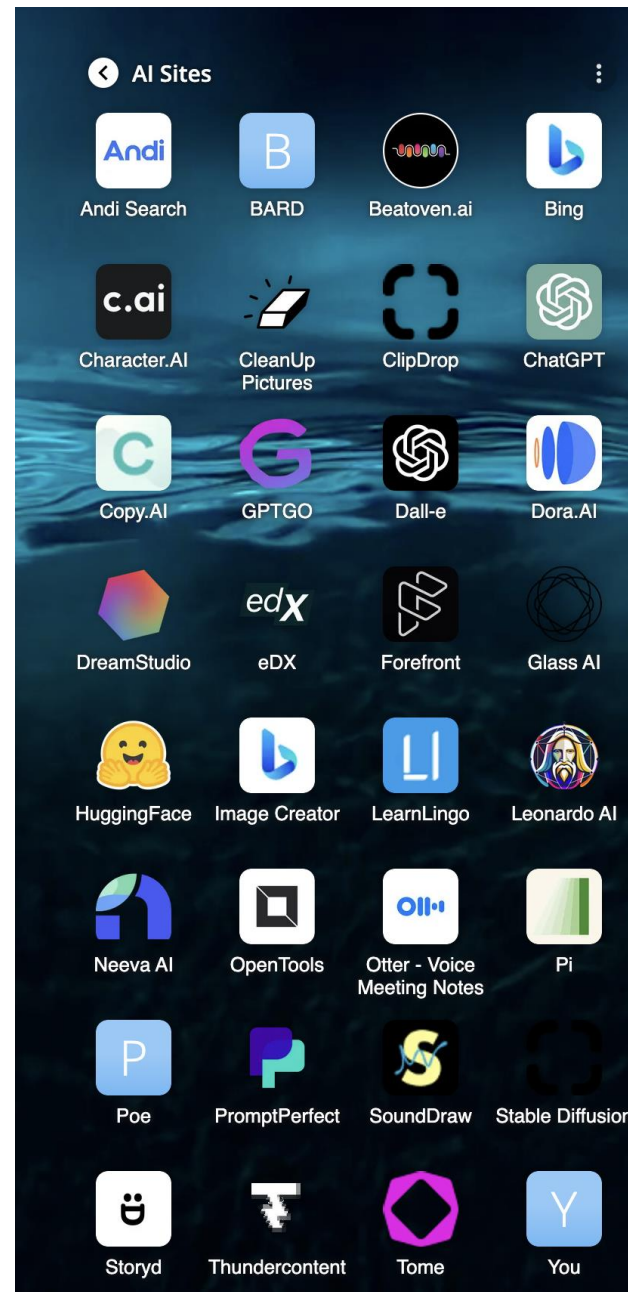
## Potential uses of GPT in medicine



- Potential uses range from administrative tasks to assisting in medical consultations.
- Provide context to images by analysing and classifying them.
- Used by patients to provide a general overview of medical conditions. It might not be as adept at the specifics but can serve as a primer for patient education.
- In the doctor's office, the tool could summarise a patient's medical history as well as provide an overview of available treatment pathways.
- Assist in summarising clinical notes for integration into electronic medical records.
- Enable physicians to stay up-to-date with medical research by summarising lengthy academic papers and highlighting the key takeaways.



# ChatGPT



2023







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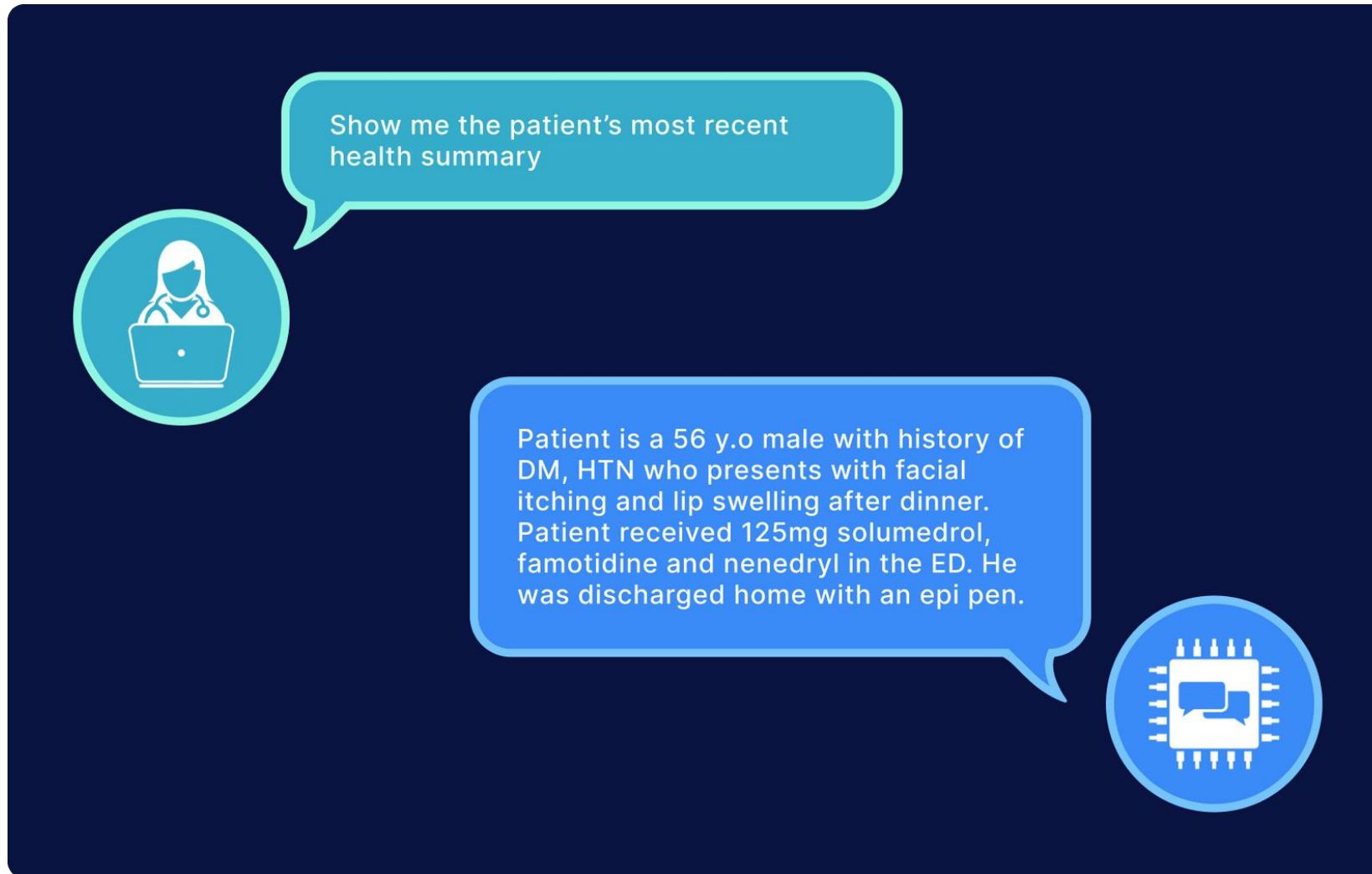
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## Potential uses of GPT in medicine





# Medical Chat

*Can you generate a discharge summary in a well formatted way. You can expand on the provided points based on your medical knowledge. Please make the summary detailed and professional*

*Admission Date: **[[admin date]]***

*Discharge Date: **[[discharge date]]***

*Date of Birth: **[[DOB]]***

*Gender: **[[gender]]***

*Name: **[[name]]***

*Reason for Admission: **[[reason]]***

*Diagnosis: **[[diagnosis]]***

*Procedures and Treatments Provided: **[[treatment]]***

*Hospital Course: **[[courses]]***

*Medication Reconciliation: **[[medicines]]***

*Follow-up Care Instructions: **[[followups]]***

*Pending Test Results and Future Investigations: **[[pending results]]***

*Appointments and Referrals: **[[referrals]]***

*Discharge Destination: **[[discharge destination]]***



**admin date** = 5/1/2023

**discharge date** = 5/4/2023

**DOB** = 1/1/1970

**gender** = Male

**name** = Jimmy Doe

**reason** = sudden onset severe chest pain, radiating to left arm, and accompanying shortness of breath.

**diagnosis** = admitted with symptoms suggesting a heart attack. confirmed by an ECG and elevated cardiac troponin levels, resulting in a diagnosis of STEMI.

**treatment** = underwent emergency PCI with stent placement for a 90% LAD blockage. He received medications (aspirin, clopidogrel, metoprolol, atorvastatin, lisinopril) and comprehensive care in the CCU, including monitoring, pain management, nutrition, and physical therapy.

**courses** = He had post-procedure complications like shortness of breath and heart issues. Medications were adjusted, and he improved with monitoring and physical therapy before discharge.

**medicines** = Aspirin 81mg daily – For heart attack prevention Clopidogrel 75mg daily – For stent patency Metoprolol 50mg twice daily – For blood pressure control and heart protection Atorvastatin 40mg at bedtime – For cholesterol management Lisinopril 10mg daily – For heart failure management

**followups** = Low-sodium, low-cholesterol diet, moderate exercise, seek help for chest pain or severe breathlessness.

**pending results** = No pending test results. need repeat lipid profile testing in 4 weeks to adjust atorvastatin dose as needed.

**referrals** = follow-up appointment with his cardiologist in two weeks. He's also referred to a dietitian for dietary advice and to a physical therapist for cardiac rehabilitation.

**discharge destination** = discharged to his home, with his spouse present to assist in his care.

*Admission Date: 5/1/2023 Discharge Date: 5/4/2023 Date of Birth: 1/1/1970 Gender: Male Name: Jimmy Doe*

*Reason for Admission: Jimmy Doe was admitted with sudden onset severe chest pain, radiating to the left arm, and accompanying shortness of breath.*

*Diagnosis: Jimmy Doe was admitted with symptoms suggesting a heart attack. This was confirmed by an ECG and elevated cardiac troponin levels, resulting in a diagnosis of ST-elevation myocardial infarction (STEMI).*

*Procedures and Treatments Provided: During his hospital stay, Jimmy underwent emergency percutaneous coronary intervention (PCI) with stent placement for a 90% blockage in the left anterior descending artery (LAD). He received the following medications:*

- Aspirin: 81mg daily for heart attack prevention*
- Clopidogrel: 75mg daily for stent patency*
- Metoprolol: 50mg twice daily for blood pressure control and heart protection*
- Atorvastatin: 40mg at bedtime for cholesterol management*
- Lisinopril: 10mg daily for heart failure management*

*In addition to the procedure and medications, Jimmy received comprehensive care in the Coronary Care Unit (CCU), including monitoring, pain management, nutrition, and physical therapy.*

*Hospital Course: Jimmy experienced post-procedure complications such as shortness of breath and heart issues. His medications were adjusted, and with monitoring and physical therapy, he showed improvement before discharge.*

*Medication Reconciliation: Upon discharge, Jimmy's medication regimen includes:*

- Aspirin: 81mg daily for heart attack prevention*
- Clopidogrel: 75mg daily for stent patency*
- Metoprolol: 50mg twice daily for blood pressure control and heart protection*
- Atorvastatin: 40mg at bedtime for cholesterol management*
- Lisinopril: 10mg daily for heart failure management*

*Follow-up Care Instructions: Jimmy is advised to follow these instructions after discharge:*

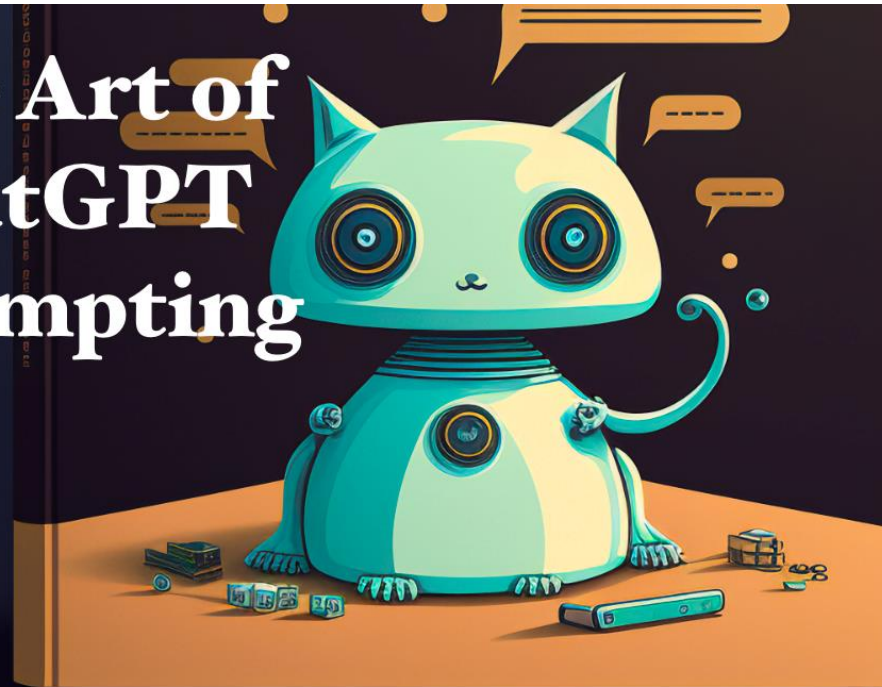
- Follow a low-sodium, low-cholesterol diet*
- Engage in moderate exercise*
- Seek medical help for chest pain or severe breathlessness*

*Pending Test Results and Future Investigations: There are no pending test results. However, Jimmy will need to undergo repeat lipid profile testing in 4 weeks to adjust the atorvastatin dose as needed.*

*Appointments and Referrals: Jimmy has a follow-up appointment scheduled with his cardiologist in two weeks. He has also been referred to a dietitian for dietary advice and to a physical therapist for cardiac rehabilitation.*

*Discharge Destination: Jimmy has been discharged to his home, with his spouse present to assist in his care.*

# The Art of ChatGPT Prompting





DF

Onde posso aprender a fazer prompts elaborados para o chatGPT



Daniel, você pode aprender a criar prompts mais elaborados para o ChatGPT praticando e experimentando diferentes abordagens. Aqui estão algumas dicas para ajudá-lo a melhorar suas habilidades na criação de prompts:



1. **Seja claro e específico:** Ao formular sua pergunta ou instrução, seja claro e específico sobre o que deseja obter como resposta. Quanto mais preciso for o seu prompt, mais útil será a resposta do ChatGPT.
2. **Use exemplos:** Em vez de pedir informações gerais, forneça exemplos ou cenários específicos relacionados ao seu campo de cardiologia ou aos tópicos de interesse, como digital health ou telemedicina. Isso ajuda a contextualizar sua pergunta e obter respostas mais relevantes.
3. **Experimente diferentes abordagens:** Não tenha medo de experimentar prompts de diferentes maneiras. Você pode começar com uma pergunta direta e, em seguida, tentar uma abordagem mais aberta ou pedir ao ChatGPT para elaborar sobre um tópico específico.
4. **Use detalhes técnicos quando apropriado:** Se você estiver buscando informações técnicas ou específicas sobre a cardiologia, é útil incluir detalhes técnicos relevantes em seu prompt.
5. **Revise e ajuste:** Após receber uma resposta do ChatGPT, revise-a e, se necessário, ajuste seu prompt para refinar a resposta. Você pode iterar várias vezes para obter a resposta desejada.
6. **Aproveite a capacidade de opinião do ChatGPT:** Se você estiver interessado em receber perspectivas ou opiniões sobre tópicos relacionados à medicina, você pode pedir ao ChatGPT para oferecer suas opiniões com base em evidências médicas.

Lembre-se de que a prática é fundamental para aprimorar suas habilidades na criação de prompts. À medida que você ganha experiência, poderá criar prompts mais eficazes e obter respostas mais úteis do ChatGPT para suas necessidades na área médica.

# ChatGPT

## PROMPTS FOR DOCTORS

OVER 2000 PROMPTS



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## 25 of the best AI and ChatGPT courses you can take online for free

Find a wide range of free online courses on Udemy.

By [Joseph Green](#) on September 2, 2023 

*All products featured here are independently selected by our editors and writers. If you buy something through links on our site, Mashable may earn an affiliate commission.*



Credit: Pexels

These are the best online AI and ChatGPT courses you can take for free in September 2023:


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- [AI Art Generation Guide: Create AI Images For Free](#)
- [AI-Powered SEO Mastery: How to Rank with AI SEO Tools](#)
- [Artificial Intelligence for Accountants](#)
- [Artificial Intelligence for Humans: AI Explained](#)
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# Learn the basics of AI

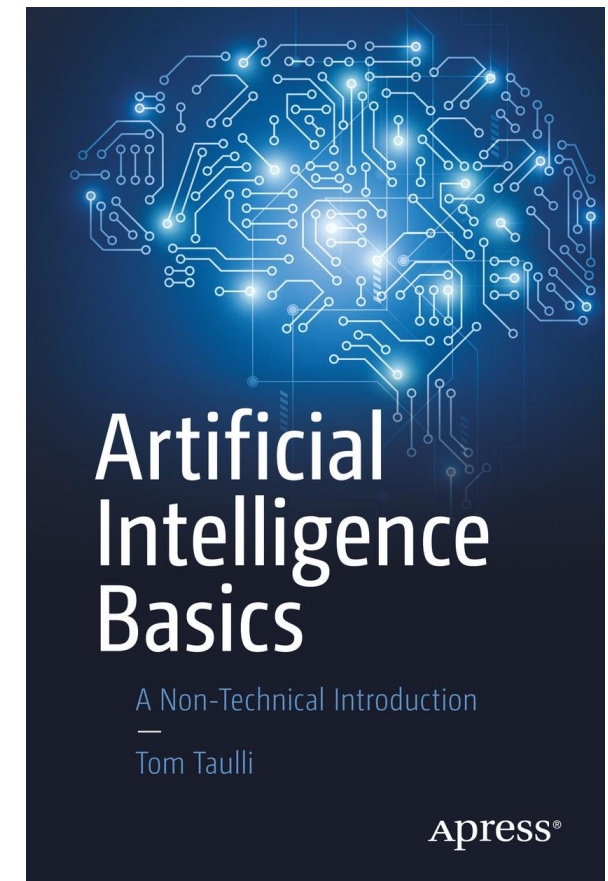
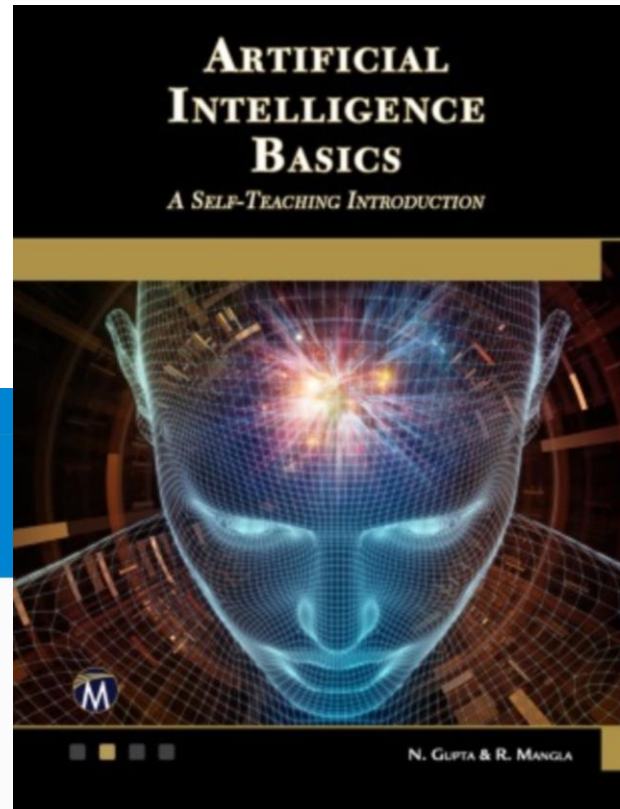


Module

## Generative AI Basics

Discover the capabilities of generative AI and the technology that powers it.

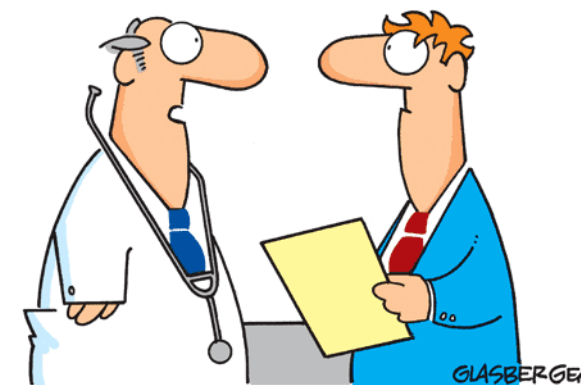
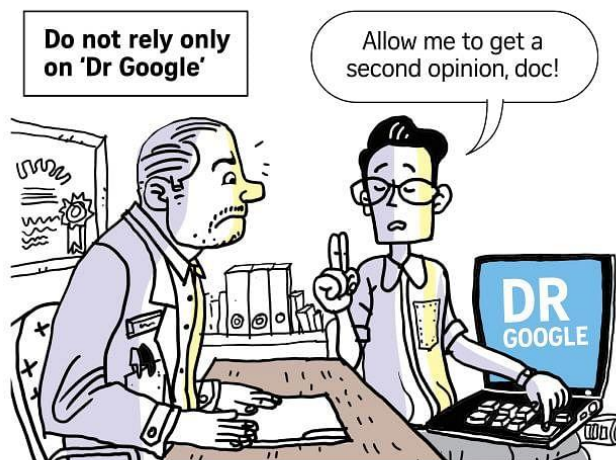
☆ + 📄



# Segunda Opinião Médica



"I already diagnosed myself on the Internet.  
I'm only here for a second opinion."



"More and more patients are going to the Internet  
for medical advice. To keep my practice going,  
I changed my name to Dr. Google."

NEVER ASK GOOGLE  
FOR MEDICAL ADVICE.



I HAVE GONE  
FROM MILD  
HEADACHE  
TO  
CLINICALLY  
DEAD IN  
THREE  
CLICKS.



Is eye twitching a sign of



- is eye twitching a sign of **stroke**
- is eye twitching a sign of **pregnancy**
- is eye twitching a sign of **stress**
- is eye twitching a sign of **anxiety**
- is eye twitching a sign of **bell's palsy**
- is eye twitching a sign of **cancer**
- is eye twitching a sign of **needing glasses**
- is eye twitching a sign of **lying**
- is eye twitching a sign of **als**
- is eye twitching a sign of **epilepsy**

Google Search

I'm Feeling Lucky





Google

**Dra. Virginia Cerutti**  
<https://drvirginiacerutti.com.br/palpitacao>

### O que é palpitação?

O que é palpitação? Palpitação é a percepção dos batimentos cardíacos. Normalmente não percebemos as batidas do coração, mas quando notamos ou sentimos os ...

**Tua Saúde**  
<https://www.tuasaude.com/DoencasCardiacas>

### Palpitação cardíaca: o que é, causas e como regular os ...

As palpitações aparecem quando a pessoa consegue perceber as próprias batidas do coração de forma irregular, ficando mais forte ou mais acelerado, ...

**MD.Saúde**  
<https://www.mdsaude.com>

### Palpitação no Coração: Taquicardia e Arritmias Cardíacas

16/04/2023 — A palpitação é uma anormal consciência do batimento do coração quando estamos em repouso. Pode ser um sinal de arritmia cardíaca.

**YouTube**  
<https://www.youtube.com/watch>

### Palpitações no coração: o que são, causas e diagnóstico

Chamamos de palpitações a percepção dos batimentos cardíacos, normalmente com desconforto e sensação de que o coração está batendo ...

YouTube · MD.Saúde · 13/04/2023

**Rede D'Or São Luiz**  
<https://www.rededorsaoluiz.com.br/Doencas>

### Palpitação: O que é, sintomas, tratamentos e causas.

29/06/2022 — As chamadas palpitações acontecem quando temos a sensação de que o coração acelerou e talvez a impressão de que não bate na cadência normal. As ...

**farmaciasaude.pt**  
<https://farmaciasaude.pt/Sintomas/Doenca>

### Palpitações cardíacas - Farmácia Saúde

As palpitações são batimentos cardíacos que dão a sensação de que o coração está a bater com violência ou que está acelerado. É possível que tenha ...

**cardio365.pt**  
<https://www.cardio365.pt/saber/palpitacoes-quand...>

DF O que são palpitações

**Palpitações** são a sensação de batimentos cardíacos anormais, fortes, rápidos ou irregulares no peito. Elas são percebidas como batimentos cardíacos que podem parecer mais fortes, mais acelerados ou fora do ritmo normal. Muitas pessoas descrevem as palpitações como uma sensação de "saltos" no peito.

As palpitações podem ser causadas por uma variedade de fatores, e nem sempre indicam um problema cardíaco grave. Alguns dos motivos mais comuns para palpitações incluem:

1. Estresse e ansiedade: O estresse emocional e a ansiedade podem desencadear palpitações, devido à liberação de hormônios do estresse, como a adrenalina.
2. Exercício físico intenso: Durante o exercício vigoroso, o coração bate mais rápido para fornecer mais oxigênio aos músculos, o que pode causar a sensação de palpitações.
3. Cafeína e estimulantes: O consumo excessivo de cafeína, chá, refrigerantes e outros estimulantes pode desencadear palpitações.
4. Consumo de álcool ou tabaco: O álcool e o tabaco podem afetar o ritmo cardíaco em algumas pessoas.
5. Desidratação: A falta de hidratação adequada pode levar a palpitações.
6. Distúrbios hormonais: Alterações nos níveis hormonais, como ocorrem durante a menopausa ou em condições como o hipertireoidismo, podem causar palpitações.
7. Problemas cardíacos: Embora menos comuns, problemas cardíacos, como arritmias cardíacas, válvulas cardíacas anormais ou doença coronariana, podem ser uma causa de palpitações.

É importante mencionar que, se você experimentar palpitações frequentes, intensas, prolongadas ou acompanhadas de outros sintomas preocupantes, como tonturas, falta de ar, dor no peito ou desmaio, é essencial procurar atendimento médico. Um cardiologista pode realizar exames, como um eletrocardiograma (ECG), para avaliar a saúde do seu coração e determinar a causa das palpitações, se houver. O tratamento dependerá da causa subjacente.

# CHATGPT AND HEALTHCARE

UNLOCKING THE POTENTIAL OF PATIENT  
EMPOWERMENT



HARVEY CASTRO MD, MBA

DF 2023



Default (GPT-3.5) ⓘ

DF

I'm scared about having a TAVI procedure. What questions should I ask my cardiologist about this procedure?







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### TOP STORIES

Teenager Sudiksha

## The AI will see you now: ChatGPT provides higher quality answers and is more empathetic than a real doctor, study finds

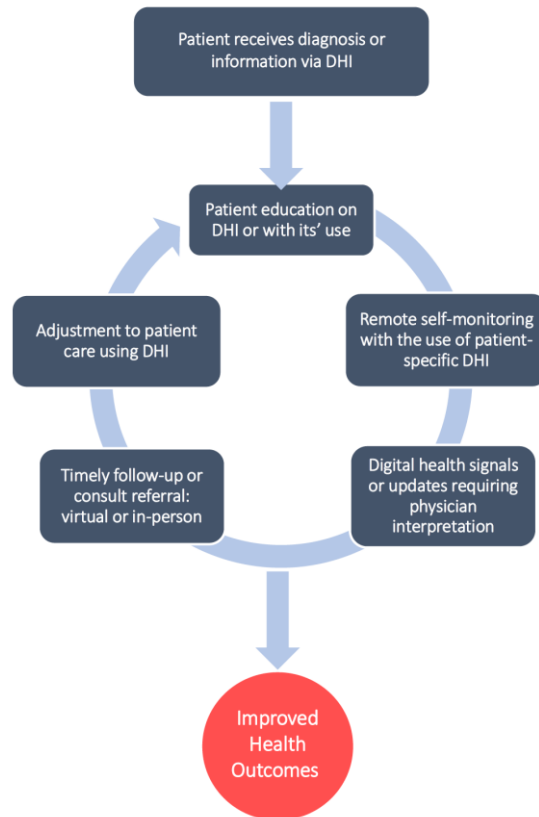
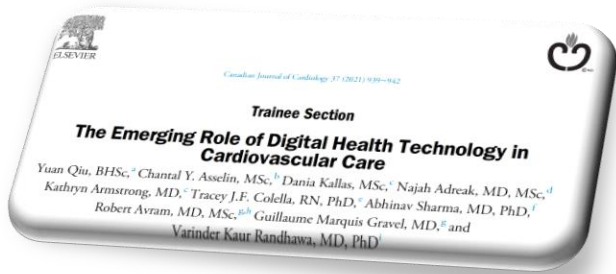
- Doctors rated responses to medical queries on Reddit's AskDoc forum
- ChatGPT outperformed physicians in their response to patients 80% of the time
- [READ MORE: ChatGPT passes gold-standard US medical exam](#)

By [CAITLIN TILLEY, HEALTH REPORTER FOR DAILYMAL.COM](#)

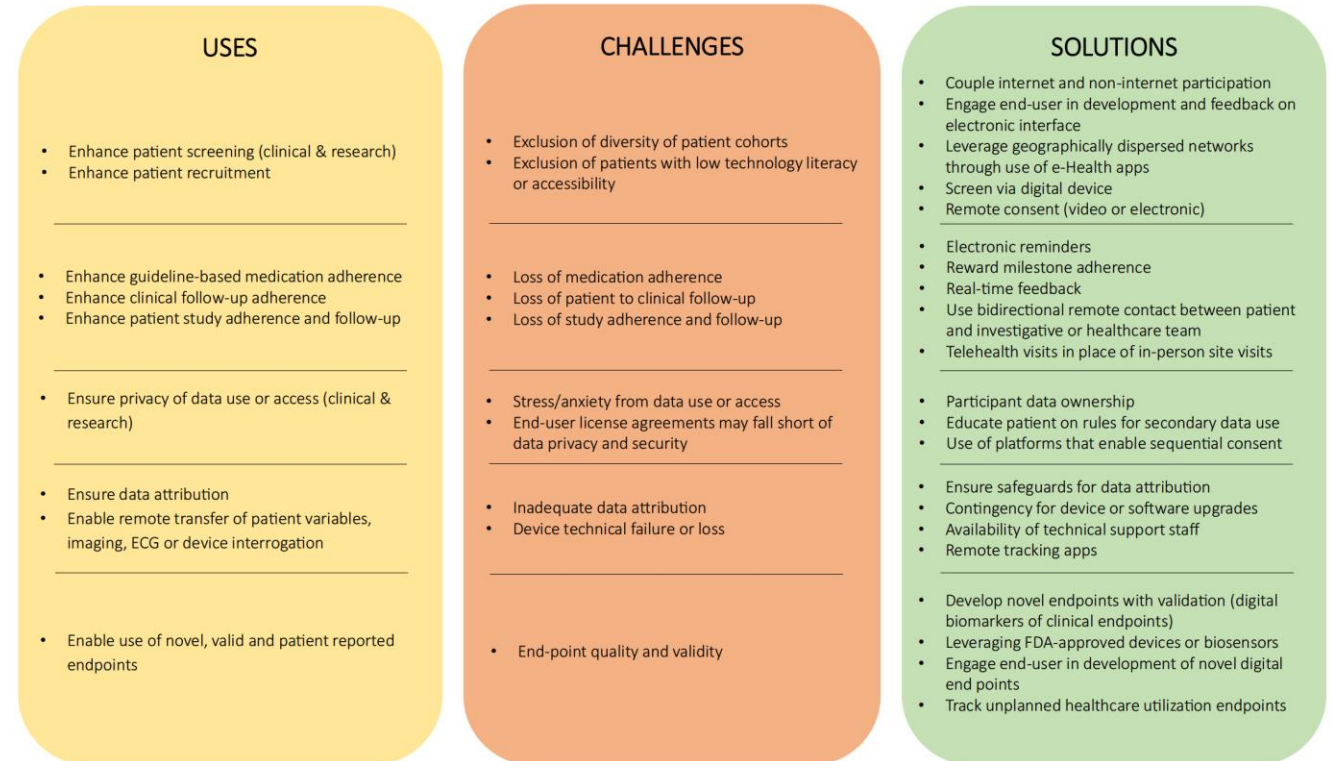
PUBLISHED: 16:18 BST, 28 April 2023 | UPDATED: 01:17 BST, 29 April 2023



# Emerging role of digital health in cardiovascular care






**Figure 1.** Use of digital health interventions (DHIs) in clinical care.



**Figure 2.** Potential uses and challenges of digital health technology and possible solutions. ECG, electrocardiogram; FDA, US Food and Drug Administration.

# Rapidly changing healthcare environment requires new PHC providers training solutions

<p><b>Medical Product</b> Equipment, Hardware, Consumables</p>  <p><b>Last Decade</b></p>	<p><b>Medical Platforms</b> Wearables, Big Data, Health Analytics</p>  <p><b>Current Decade</b></p>	<p><b>Medical Solutions</b> Robotics, AI, Augmented Reality</p>  <p><b>Next Decade</b></p>
<p>Differentiation is solely through product innovation. Focused on historic and evidence based-care</p>	<p>Differentiation by providing services to key stakeholders. Focused on real time outcome based-care</p>	<p>Differentiation via intelligent solutions for evidence/outcome based health. Focused on preventive care</p>



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Volume 04 Number 02 2023  
ISSN 2058-2999 (online)  
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

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ESC European Society of Cardiology

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NHS Digital Academy

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DF 2023

HOSPITAL DA LUZ DIGITAL



# New models of care provision



Telemedicine and Telehealth



Integrated and value based care



Access to care



More and better care





## Digital Transformation and the Future of Cardiology

Mar 04, 2023

ACC Scientific Session Newspaper



Print

Font Size A A A

**Digital transformation** is fundamental to improving efficiency and optimizing health and health outcomes. Advances in artificial intelligence (AI), digital health technology, mobile devices and other innovations – many of which are on display throughout [ACC.23/WCC](#) – provide a means to prevent and treat cardiovascular disease and may also hold the keys to addressing health equity and improving clinician well-being.

Examples of ways innovations in technology and society are impacting cardiovascular care, include telehealth and remote monitoring; the use of AI-based decision-support tools; and the prevalence and use of wearable technologies to aid in monitoring and prevention.



Review

# Telemedicine in Cardiology: Modern Technologies to Improve Cardiovascular Patients' Outcomes—A Narrative Review

Kamil Kędzierski <sup>1</sup>, Jadwiga Radziejewska <sup>2</sup>, Agnieszka Sławuta <sup>3</sup>, Magdalena Wawrzyńska <sup>4</sup>  
and Jacek Arkowski <sup>4,\*</sup>

Medicina 2022, 58, 210. <https://doi.org/10.3390/medicina58020210>

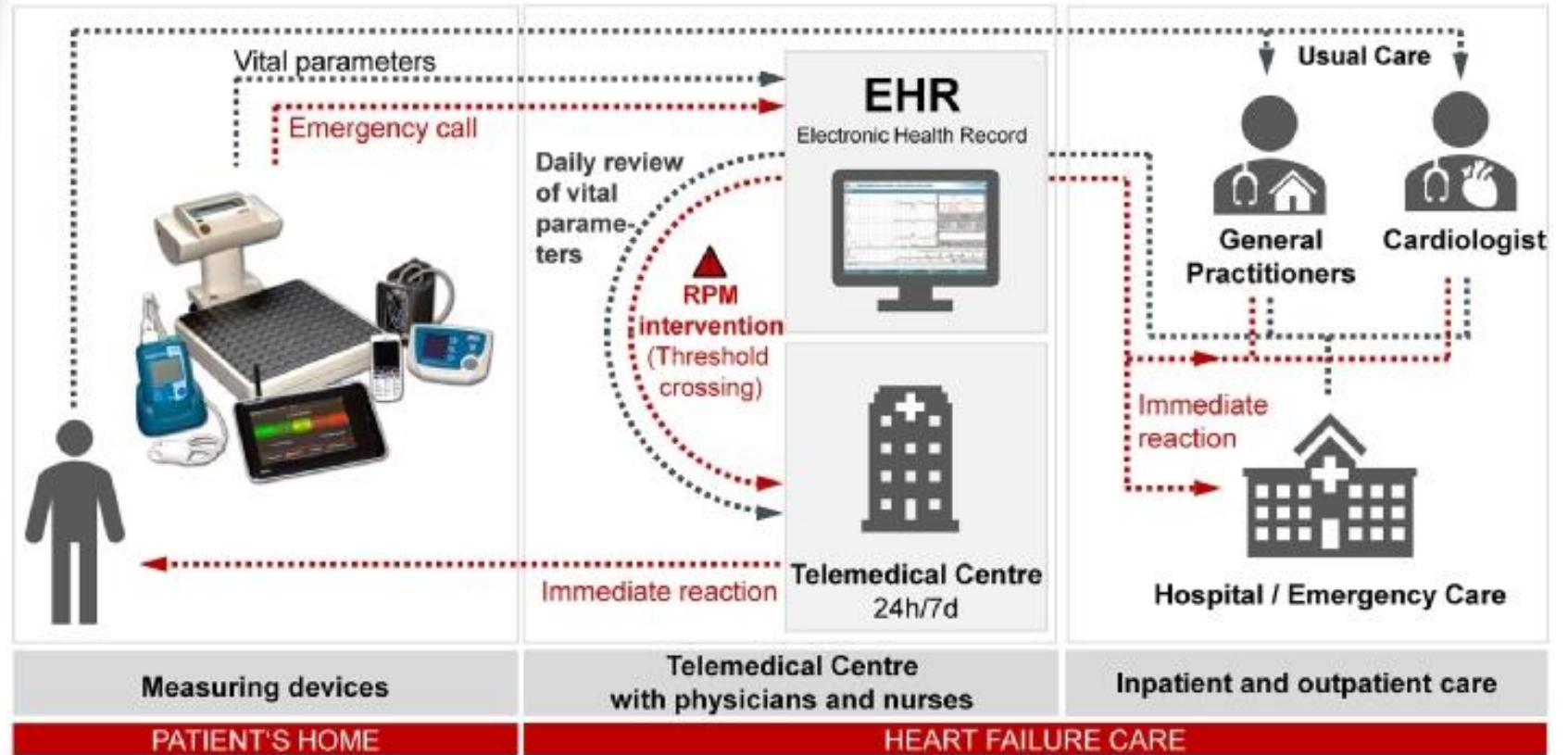
- Cardiac Implantable Electronic Devices
- Wearable Devices
- Smartphone-Based Systems
- Benefits of Remote Monitoring
  - Risk Factor Management
  - Arrhythmia Detection and Management
  - Monitoring Heart Failure Patients
- Devices and Programs for Prespecified Groups of Patients
- Practical Benefits
- Safety Concerns



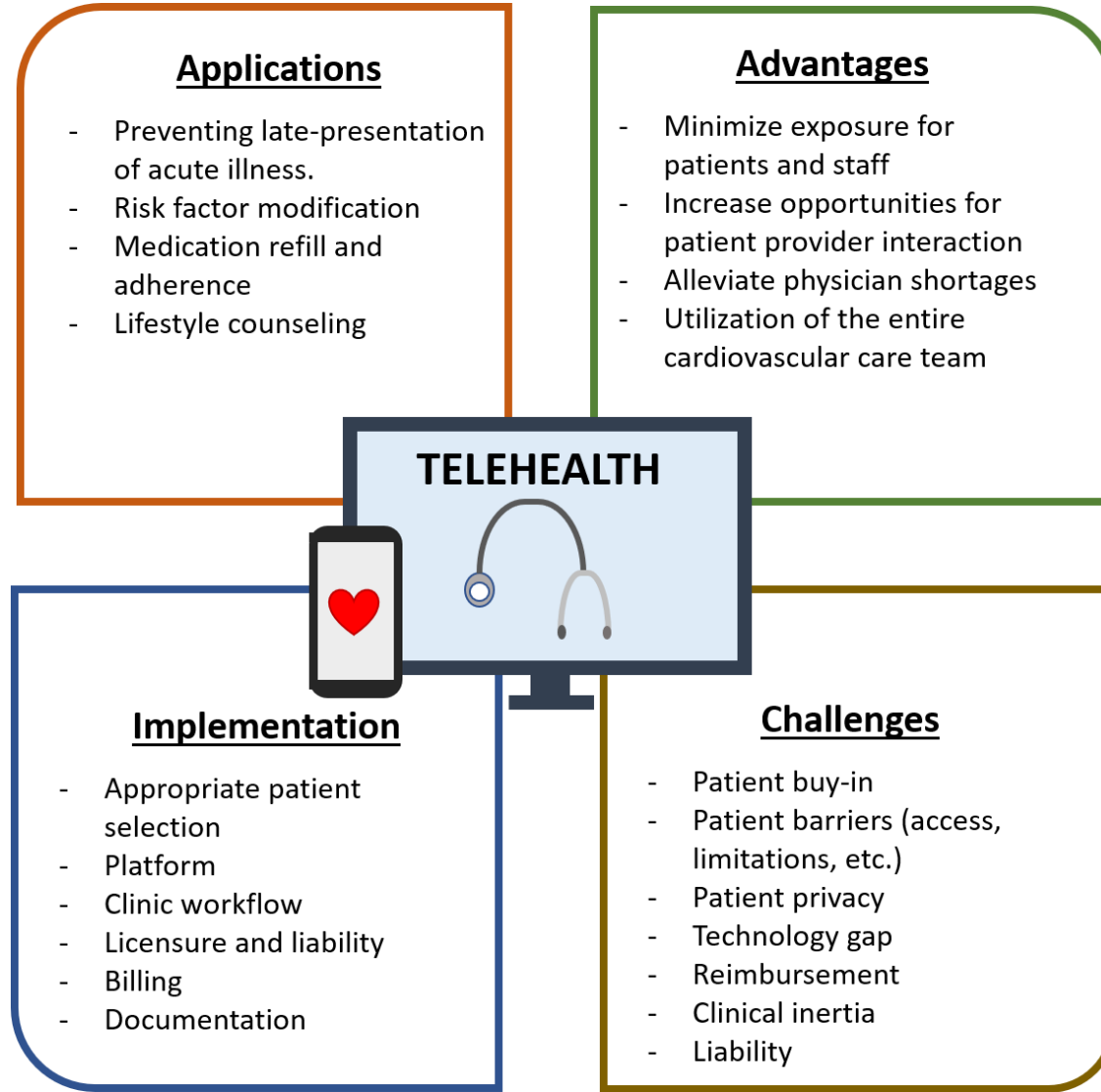
# Telemedicine boost with COVID pandemic



# Telehealth – Remote Patient Management

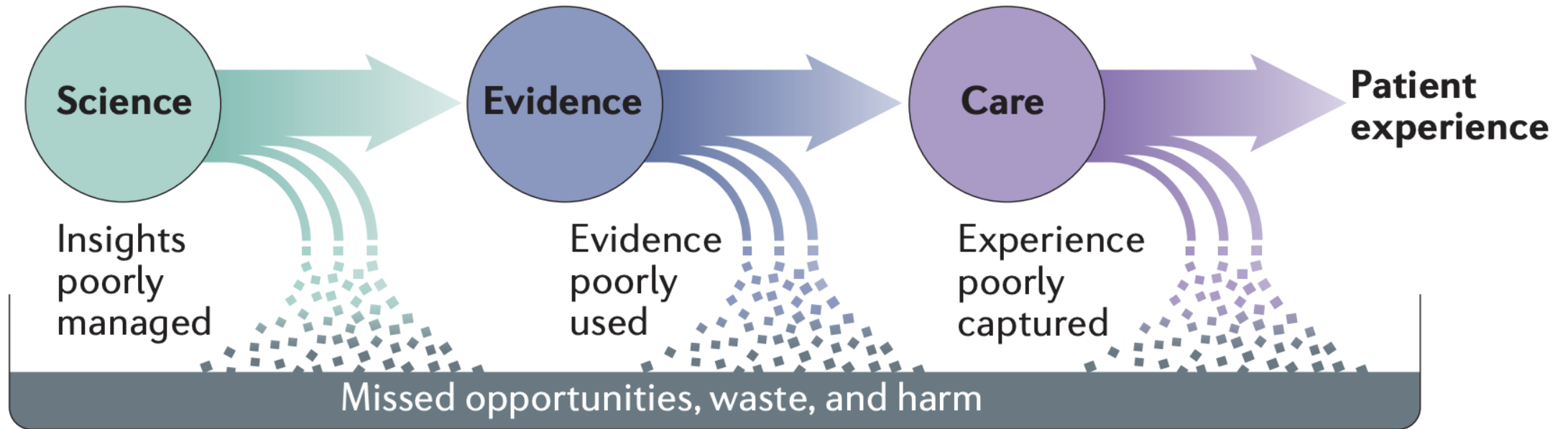


# Telehealth (pros and cons)

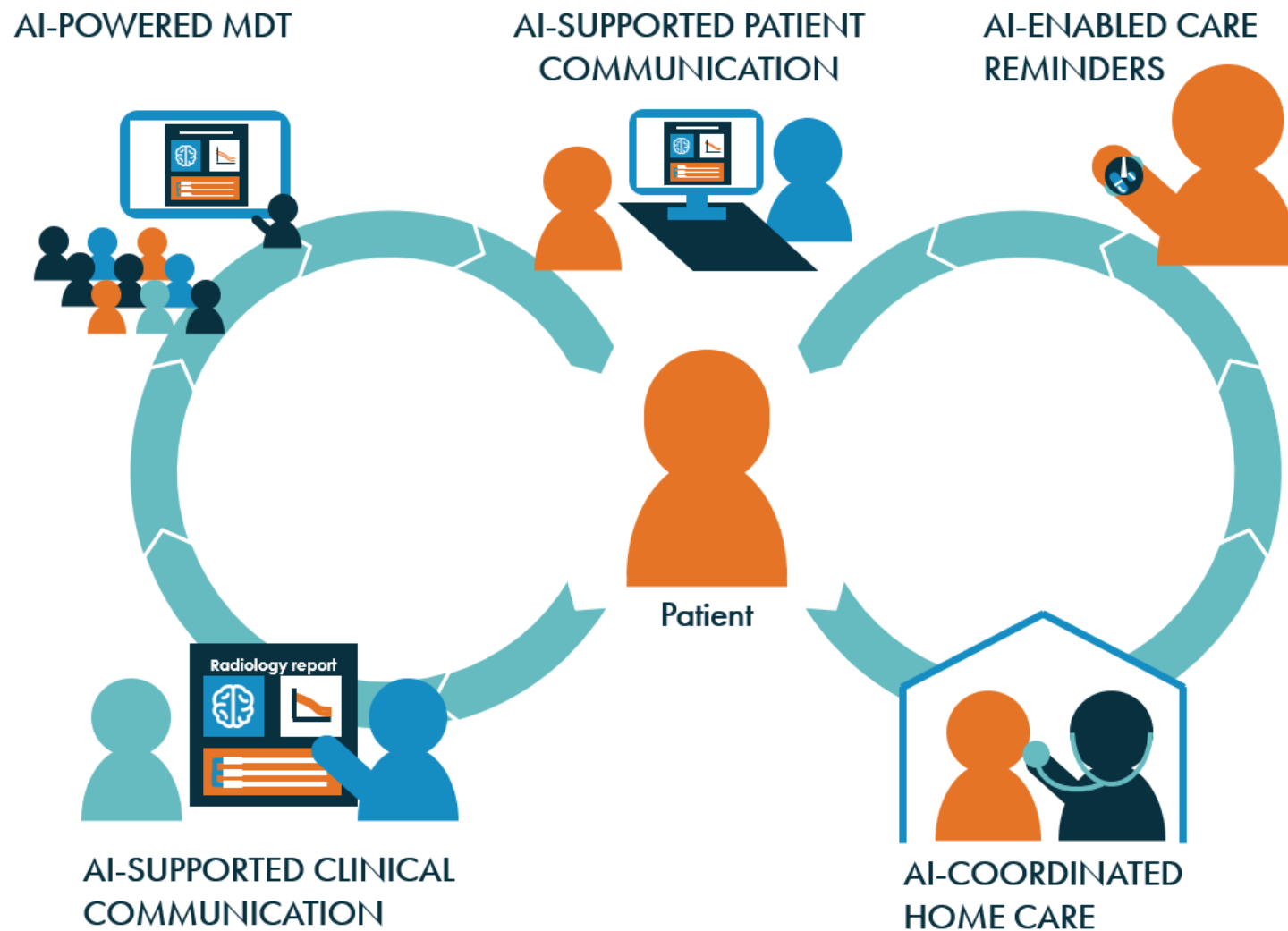




# Health-care system today



# Patient centeredness through AI powered coordination and integration of care



# Value Based Healthcare

was conceptualized by Prof. Michael Porter- 2006

## CRISIS

- Actual unbalanced Ecosystem must be led in a way in making value the overarching goal

by Michael E. Porter and Thomas H. Lee

## OPPORTUNITIES

- The arc of history is increasingly clear: health care is shifting focus from the volume of services delivered to the value created for patients, with “value” defined as the outcomes achieved relative to the costs
- Experience in other fields suggests that systematic outcomes measurement is the sine qua non of value improvement. It is also essential to all true value-based reimbursement models being discussed or implemented in health care.
- If we’re to unlock the potential of value-based health care for driving improvement, outcomes measurement must accelerate

Standardizing Patient Outcomes Measures; Porter- 2016

$$\text{Value} = \frac{\text{Health outcomes that matter to patients}}{\text{Costs of delivering the outcomes}}$$



*Value Based Healthcare conceptualized by Prof. Michael Porter*

### WHAT ARE PROM'S

*Is any report of the status of a patient's health condition that comes directly from the patient, without interpretation of the response by a clinician or anyone else. PROMs intend to improve clinicians' understanding of disease and treatment effect from the patients' perspective.*

$$\text{Value} = \frac{\text{Health outcomes that matter to patients}}{\text{Costs of delivering the outcomes}}$$

Source: Guidance for industry: patient-reported outcome measures: use in medical product development to support labeling claims: draft guidance. Health Qual Life Outcomes, 2006. 4: p. 79.

# The importance of measuring PROMS

## Beyond the Porter's equation...

PROMs capture important results and improve quality of care

### Five reasons why Patient Reported Outcome Measures are important:

- 1 Measure results that really matter to patients**  
*Example: Incontinence after prostate cancer surgery*
- 2 Some things can only be known by asking the patient**  
*Example: Pain level*
- 3 Can identify results and trends over time**  
*Enable improved care processes, such as faster and accurate diagnoses*
- 4 Increases the patient's understanding and responsibility of the disease**  
*Making the patient actively engaged in his/her improvement*
- 5 Improves communication and interaction between patient and provider**  
*Time can be used to discuss the results and implications*



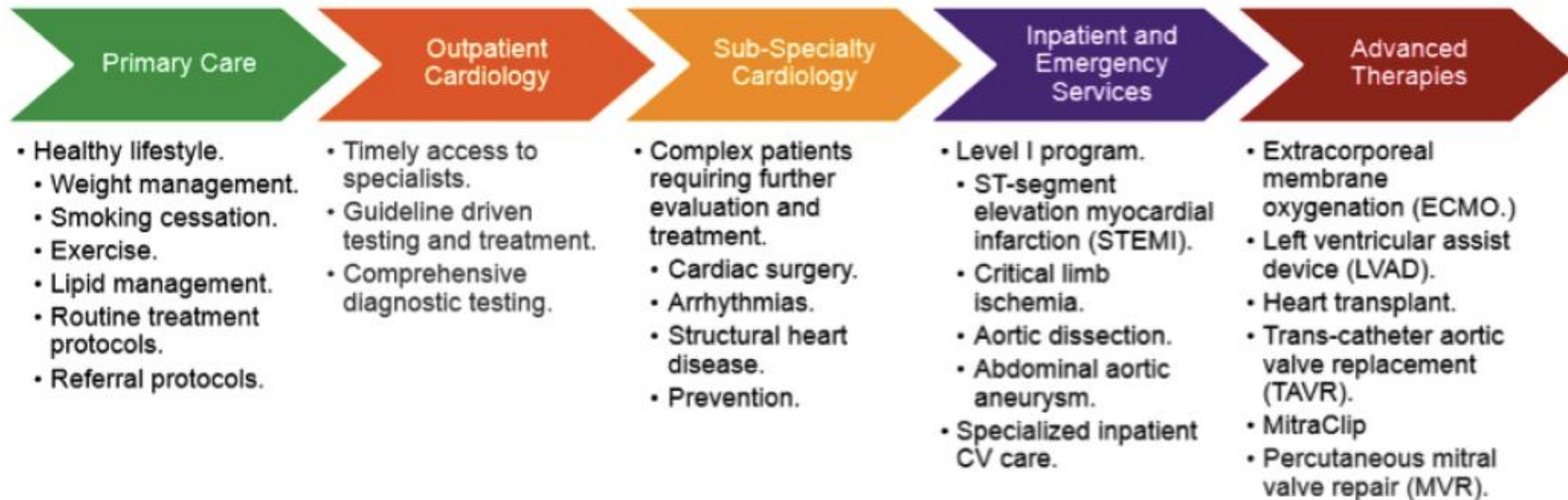
# PROMs are already being measured today

PROMs are one of the most important outcomes being measured and rapidly are moving from the ideas into patients' applications and health connection

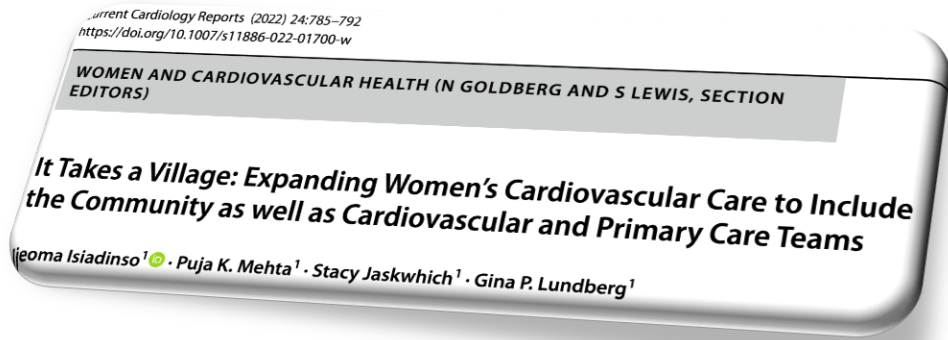


## Access to care must be improved

### Optimize Care Across the CV Continuum



# Patients, community and multidisciplinary teams are to be involved



# Challenges and opportunities



**Economic feasibility**



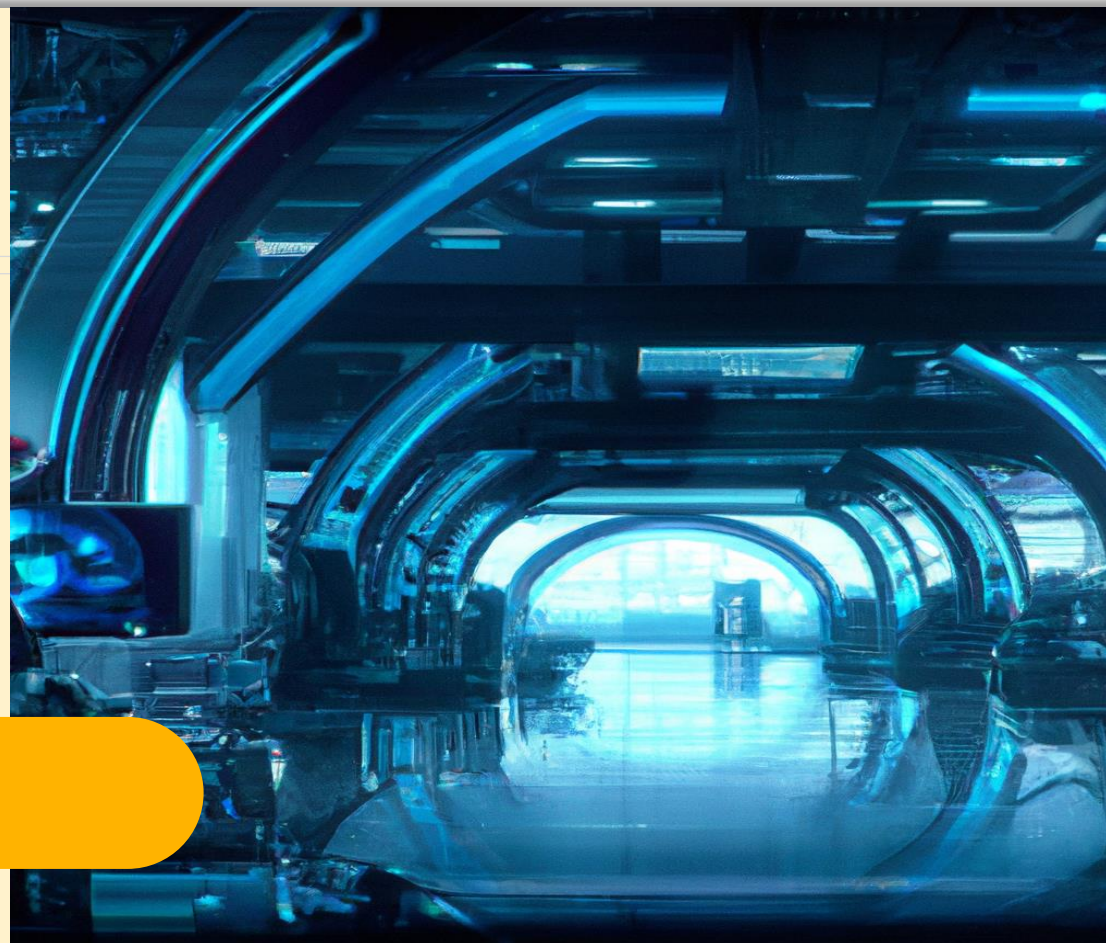
**Impact on public health**



**Ethical and regulatory aspects**

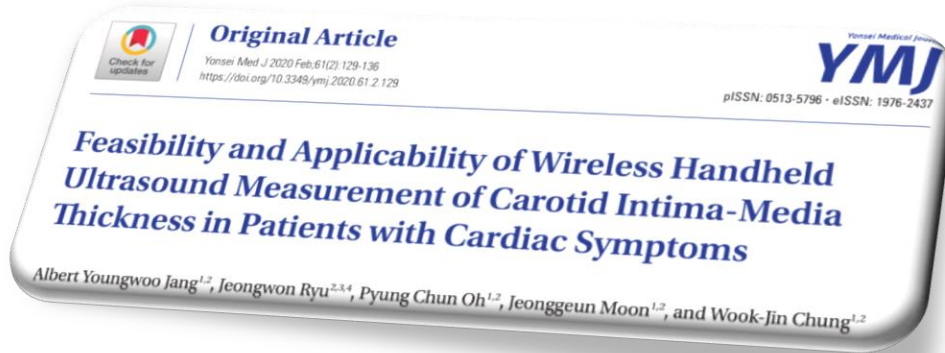
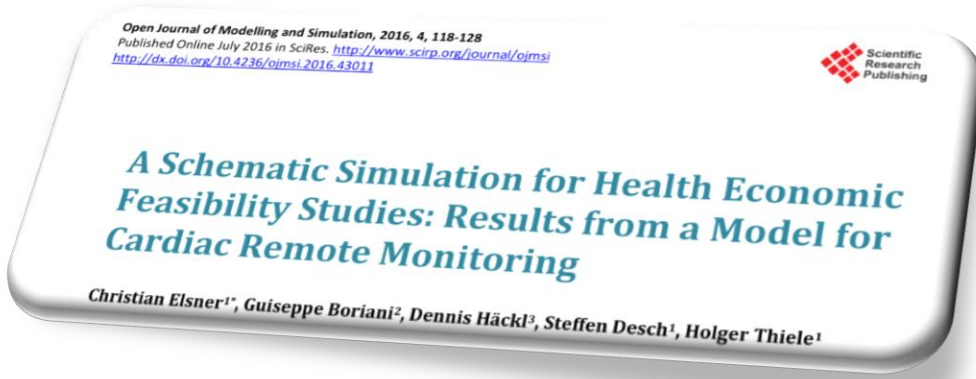


**Economic sustainability**

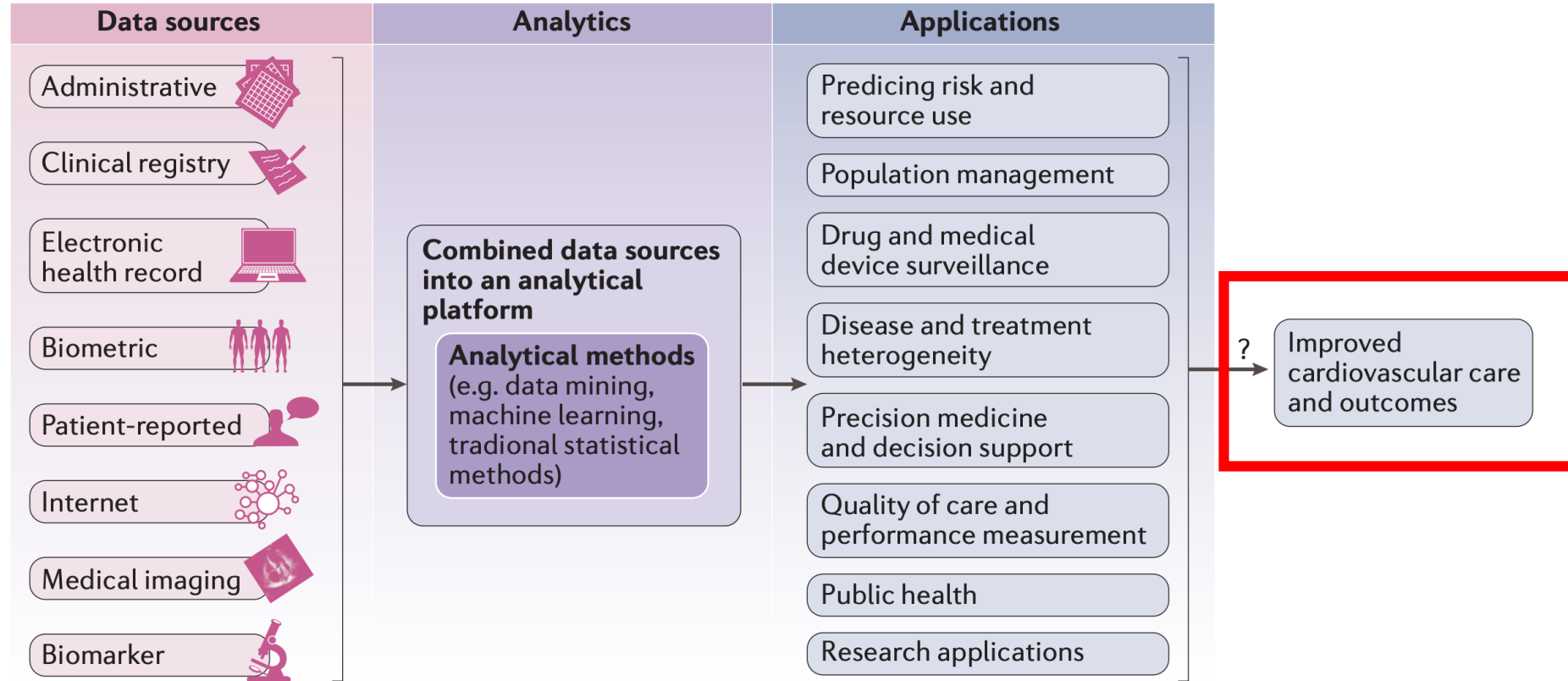




# Economic feasibility of new Technologies must be measured



# Overview of big data analytics and applications – Impact on public health



# New digital tools must be validated before widespread use



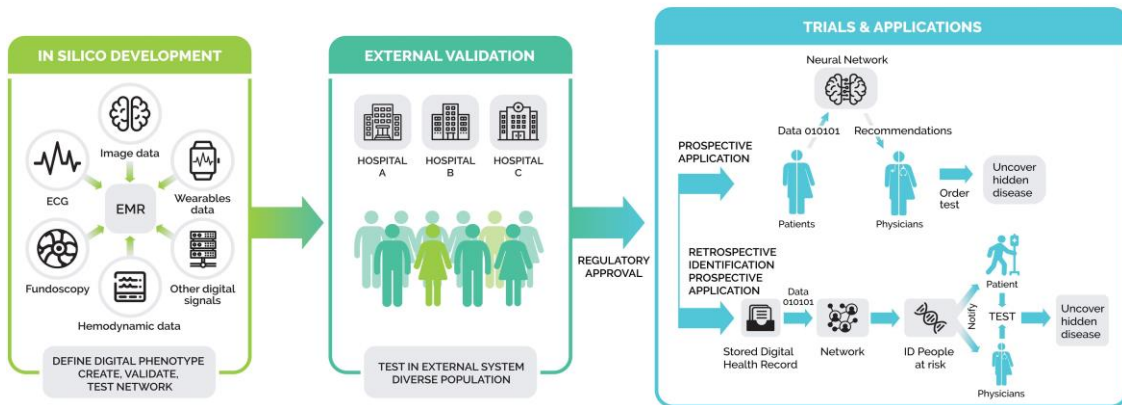
**Table 1** Factors to consider in evaluating artificial intelligence-electrocardiogram studies

- Data label accuracy: robustness of data labels used for training and testing
  - Proxy labels (EMR report of 'chest pain') vs. gold standard labels (physician-described angina, troponin levels, serial ECGs)
  - Number of subjects for whom labels available
  - Absence in labels of false distractors (e.g. all ECGs from patients with condition taken at one hospital, using an acquisition system different than that used in controls, so that network may identify differences in ECG machines rather than disease)
- Risk of bias: cohort creation and controls
  - Controls not identical to cases in all conditions except the desired AI differentiator; most commonly in demographics (example: using adult controls for paediatric ECGs with WPW to train a network)
  - Controls and cases taken from public data sets (difficult to know details regarding the absence/presence of conditions, poor phenotyping)
  - Use of only subsets of larger data sets, introducing potential bias—need for racial, ethnic, and geographic diversity in data sets (example: initial face recognition AI, trained using only Caucasians, mislabelled African Americans as primates).
  - Inappropriate exclusion of data at the patient or signal feature level will bias results (examples: exclusion of signals on the basis of artefact of those same exclusions will not be used in real-world implementation; or exclusion of patients with hypertension when creating an AI-ECG screen for hypertension)
  - Temporal shifts—training using data acquired in the remote past and application to recent data sets
  - Commercial interest, and backgrounds of engineers creating AI tools (potential bias)
- Overfitting/lack of generalizability
  - Overly complex AI-ECG network with a small number of samples (the results are not generalizable to other populations)
  - Most data sets for AI-ECG training number in the tens of thousands or more, although exceptions exist

**Table 2** Proposed categories of clinical trials to assess the artificial intelligence-electrocardiogram

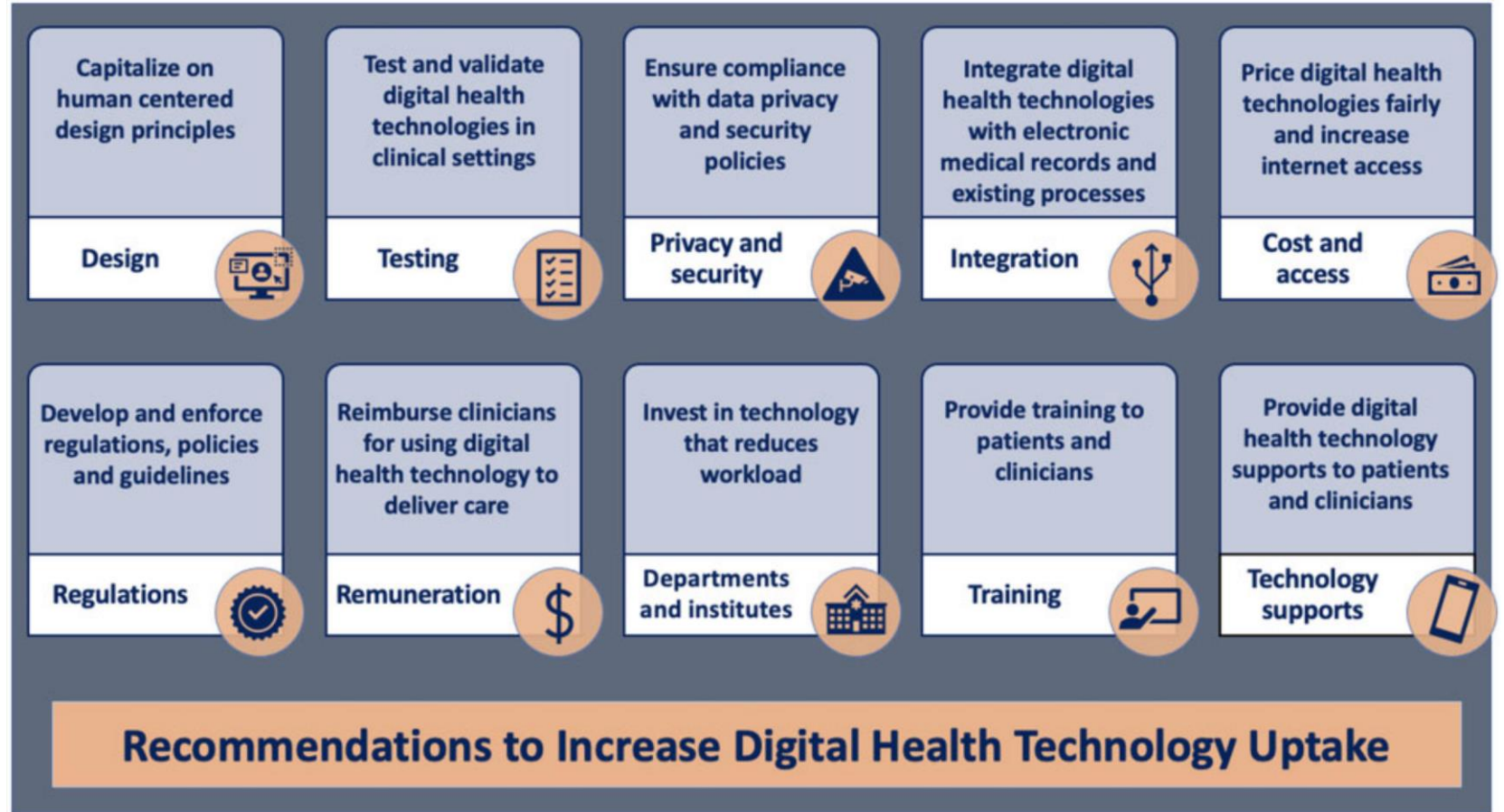
Study category	Description of population used to test an AI-ECG network	Study design	Strengths	Limitations
1	Public data set	Retrospective	Inexpensive, rapid	Unreliable phenotyping, high risk of bias, limited clinical utility
2	Single centre: same hospital/clinic used to acquire data, but different patients	Retrospective	Rich data sets to phenotype patients, rapid, relatively inexpensive, robust proof-of-concept approach	Risk of bias, under-representing important populations
3	Multicentre: different hospital systems used to test AI, than one used to create	Retrospective	Lower risk of bias, potential for greater diversity among subjects, test types, potential to rapidly and meaningfully assess tests	Need to confirm labels assessed in systematic, similar manner across sites (example: assessment of EF by echo)
4	Single centre: same hospital used to test AI, different patients	Prospective	Assesses AI, impact on workflow, adoption by clinicians, clinical impact	Greater technical infrastructure required, more expensive, greater time requirement
5	Multicentre	Prospective (may use retrospective ECGs to prospectively enrol patients)	Prospective trial but with accelerated enrolment, by screening large data set of stored ECGs; potential for portal/email study invitations and pragmatic design, statistical robust, potential to minimize bias	Greater technical requirements, time, expense

## DIGITAL TOOL DEVELOPMENT IN CV MEDICINE

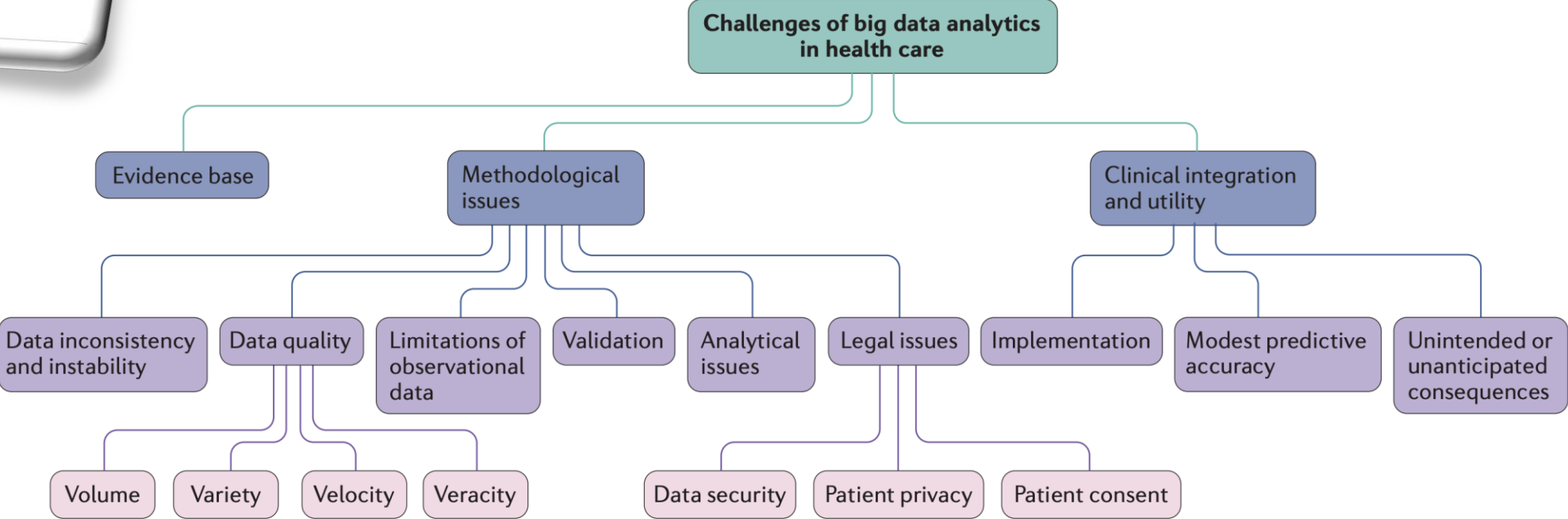




# Digital health technology uptake



# Challenges for big data applications in cardiovascular care

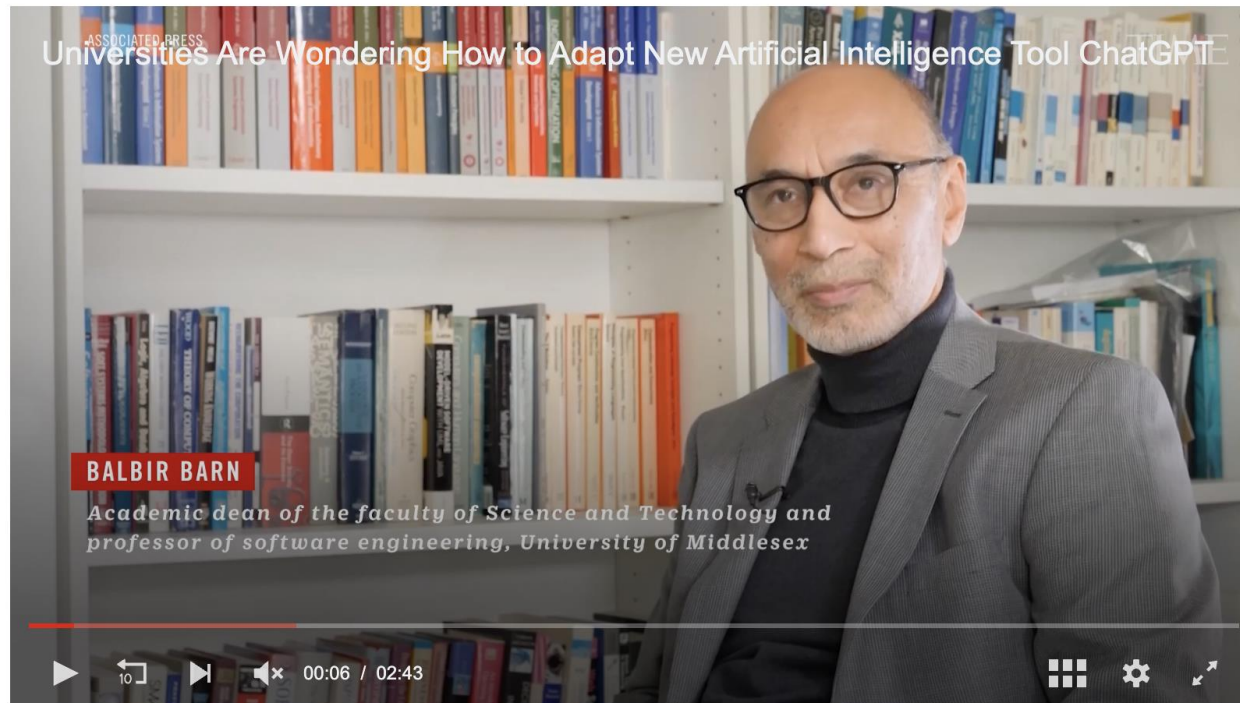


# AI needs to be regulated (especially in Medicine)

TIME

BUSINESS • THE LEADERSHIP BRIEF

## The Creator of ChatGPT Thinks AI Should Be Regulated



BY JOHN SIMONS FEBRUARY 5, 2023 9:00 AM EST

DF 2023





AI needs to be regulated (especially in Medicine)

SCIENTIFIC  
AMERICAN®

ARTIFICIAL INTELLIGENCE

# ChatGPT Explains Why AIs like ChatGPT Should Be Regulated

We asked the text-generating AI ChatGPT to talk about its own flaws

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By Sophie Bushwick, Madhusree Mukerjee on December 28, 2022

DF 2023



## IN CONCLUSION:

In the health sector, we operate today in a new world that intervenes with the disruption of the new digital and technological world

- Increase and aging of the population
- Exponential increase in the prevalence of chronic diseases and multi-morbidity
- Increased complexity of care delivery / infection control and antibiotic resistance
- Escalation of health spending and consequent pressure on providers to increase efficiency, lower prices and take risks
- Changing the focus of volume-based medicine to value-based medicine
- Digital Disruption - Cloud, mobile, IOT, Social Networks, Robotics, 3D Printing, Advanced Analytics and Science and ...
- Increasing importance of cybersecurity processes



“What if we don't change at all ...  
and something magical just happens?”

A MUDANÇA É  
**INEVITÁVEL**

O PROGRESSO É  
**OPCIONAL**

- TONY ROBBINS

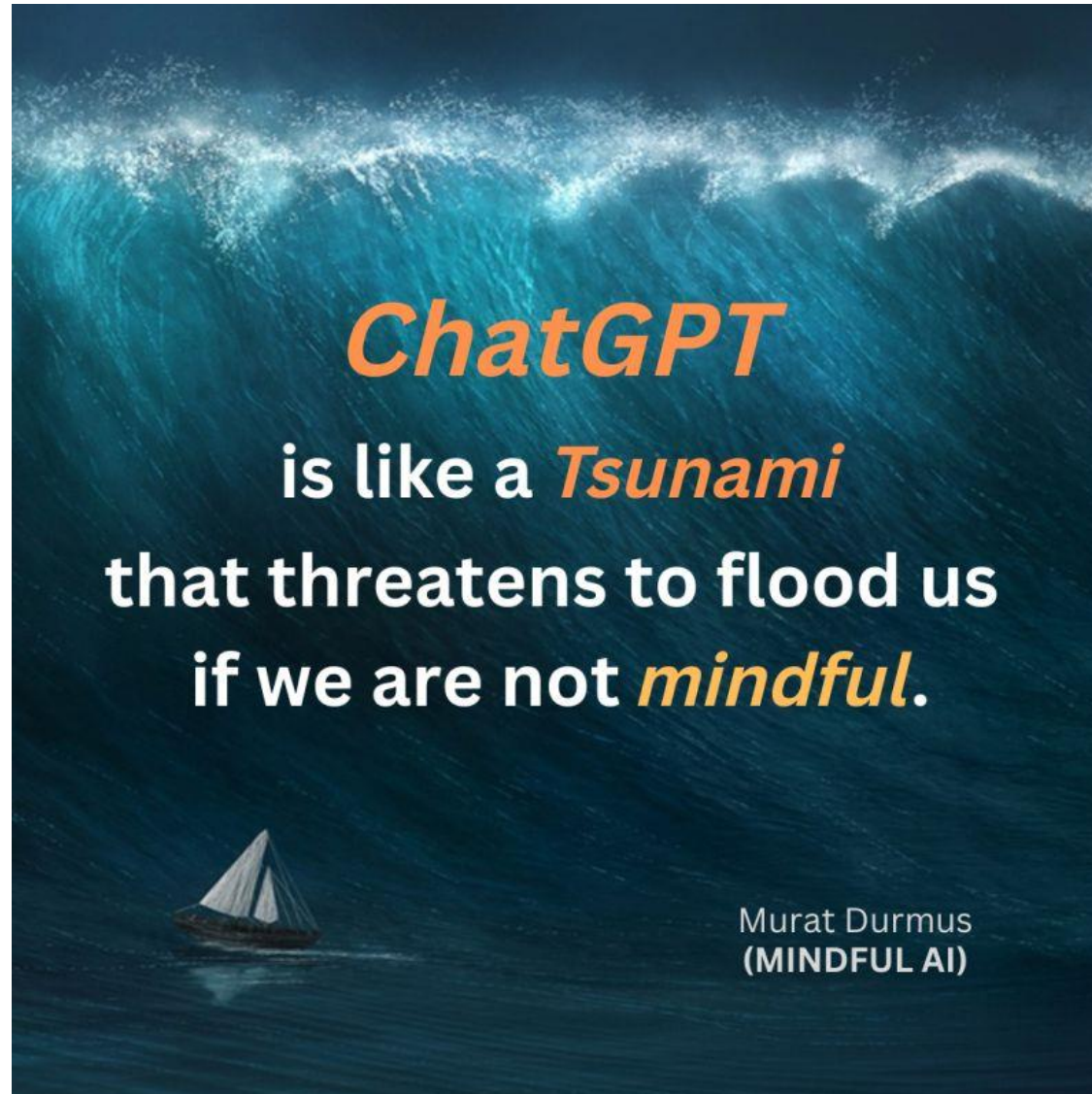


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HOSPITAL  
DA LUZ  
DIGITAL



Big changes are coming – You can ignore them ...



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Big changes are coming – You can deny them ...





Big changes are coming – or you can RIDE THE WAVE AND ENJOY



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# Thank you

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