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Care Anywhere: Changing landscape of Patient expectations in the era of AI & Cloud Technology

Powering Excellence at
Healthcare Touchpoints

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Agenda

Duration: 30 min's

- *COVID-19 : The fragmented healthcare delivery system worldwide*

- *Global telemedicine post Covid-19 market growing at 30% CAGR*

- *Increased Consumerism: catalyzing shift in care from Hospital centric to Care Anywhere and Value-Based Care*

- Remote Patient Management (RPM) : A Case Study in Chai Chee

- AI as a mindset

- IoT in healthcare systems

- When AI Meets IoT

- Edge-AI is the future of AI

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Innovative technology can optimise your digital front door strategy

Artificial Intelligence (AI) will drive customer delight by increasing patient engagement and experience.

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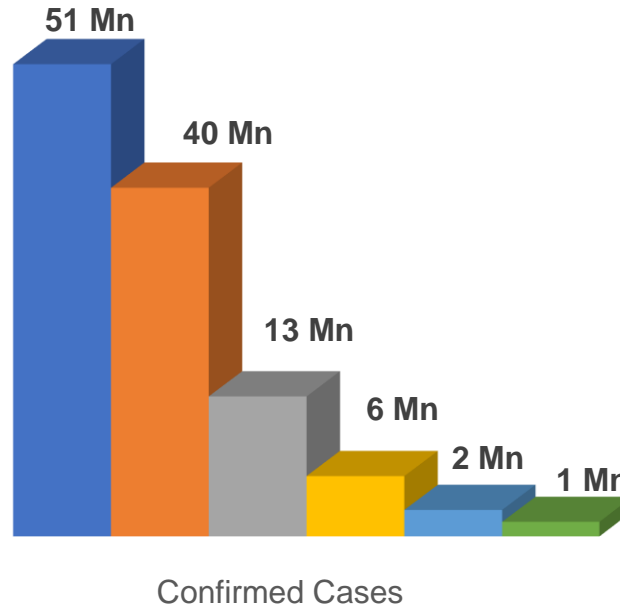# COVID-19 Pandemic: *exposed the fragmented healthcare delivery system worldwide*

Global Situation

116 Mn*
Confirmed COVID-19 cases

2Mn *
Deaths

As on 10th March 2021

Situation by WHO Region:
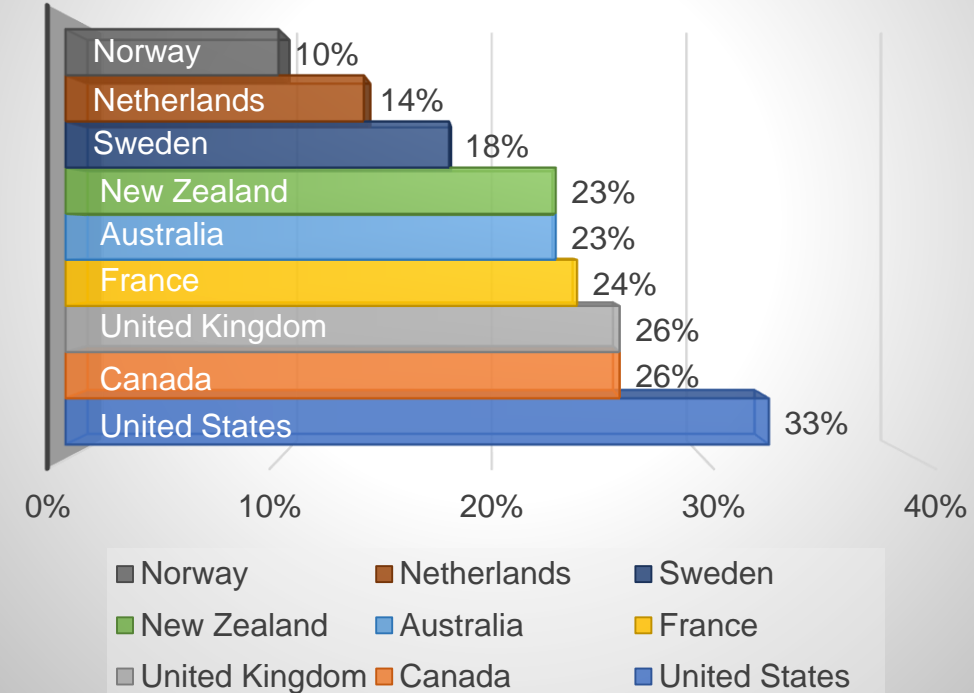(**confirmed cases**)

51 Mn
40 Mn
13 Mn
6 Mn
2 Mn
1 Mn

Confirmed Cases

- ■ Americas
- ■ Europe
- ■ SEA
- ■ Eastern Mediterranean
- ■ Africa
- ■ Western Pacific

Share of **adults** who experienced stress, anxiety or sadness that was difficult to cope alone during the pandemic
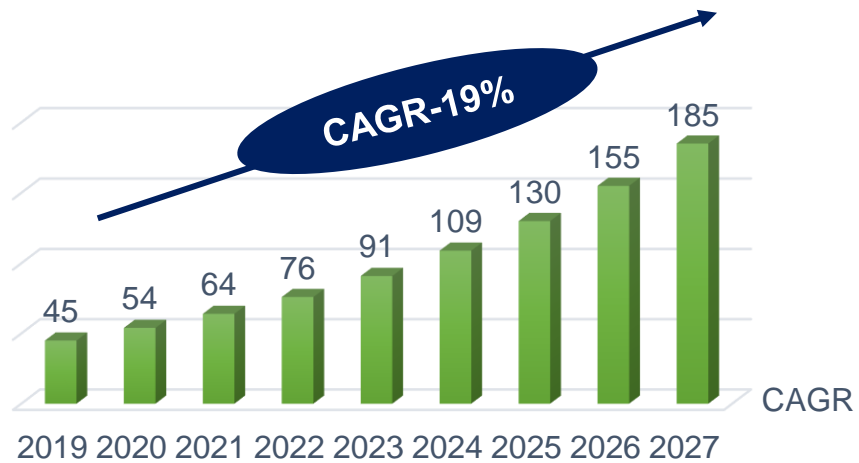

Norway	10%
Netherlands	14%
Sweden	18%
New Zealand	23%
Australia	23%
France	24%
United Kingdom	26%
Canada	26%
United States	33%

- ■ Norway
- ■ Netherlands
- ■ Sweden
- ■ New Zealand
- ■ Australia
- ■ France
- ■ United Kingdom
- ■ Canada
- ■ United States

Health systems worldwide realized the dire need for *interconnected* digital health system

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Global telemedicine market *post Covid-19:* *is projected to grow at 30% CAGR during 2021-27*

Global Market Prior to COVID-19 in Bn USD

CAGR-19%

2019	2020	2021	2022	2023	2024	2025	2026	2027
45	54	64	76	91	109	130	155	185

CAGR

Global Market Post COVID-19 in Bn USD

CAGR-30%

2019	2020	2021	2022	2023	2024	2025	2026	2027
45	59	76	99	129	167	217	282	367

CAGR

During March-April 2020:
Decline in *in-person doctor visits* were reported for adjoining segments leading to *favorable opportunities* for telehealth & telemedicine services

70% Decline:
Chronic respiratory & cardiac conditions

65% Decline:
Diabetes & cancer

55% Decline:
Respiratory infections & other chronic conditions

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Increased Consumerism:
catalyzing shift in care from Hospital centric to Care Anywhere and Value-Based Care

Now **patients** have more of a choice and a voice in

HOW
WHEN
WHERE

they receive their care

comfort of their Homes

out of hospital-setup

This has been reflected in

➤ shifts of surgical volume towards **ambulatory surgical centers**

➤ increased **urgent care utilization**

➤ the proliferation of **retail health clinics**

"In 2021, every company will learn to become a healthcare company, too, as safeguarding employees and customers becomes a core requirement of doing business" - Forbes

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Value-based care *is reinforcing the importance of innovation in healthcare delivery*

Innovative technologies now means <u>fewer instances</u> of over-or under treatment, better counsel to patients and greater personalized care

Top 3 newer technologies enabling Care Anywhere include

➢ *Remote Patient Monitoring*

➢ *Internet of Things (IoT's):*
  ▪ *Presence of Medical and device technology in living rooms of people including Home ICUs*

➢ *AI & Big Data Analytics:*

Health care disrupters are bringing <u>convenience and simplicity</u> into the health care arena

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Remote Patient Management (RPM) a popular use case of IoT in healthcare

RPM Case study: Chai Chee - *an elderly community in the east*

BACKGROUND

- **Infocomm Media Development Authority (IMDA)** commissioned Napier to undertake the RPM of 60 elderly individuals with chronic medical conditions.
- **Individuals recommended** by doctor or from DOW*/ Home care/ Community Partners

SERVICES OFFERED

- **Tele-health services:**
  - ✓ to 45 recruited patients (aged between 45 & 78 yrs) with a medical history of hypertension, diabetes mellitus or both.
- **Tele-rehabilitation services:**
  - ✓ to 15 elderly patients with degenerative joint diseases (such as osteoporosis and osteoarthritis)

EXPECTATION FROM THE COHORT

- **They were required to take, every day for each phase of the study, the following**:
  - ✓ blood pressure,
  - ✓ blood glucose level,
  - ✓ heart rate
  - ✓ weight

DURATION: August 1st 2016 to Feb 28th 2017

Study Findings

Care Anywhere

Tele-health services* improves overall health of elderly over time

- **Greatest impact of tele-health was on**:
  - ✓ **blood glucose level** and
  - ✓ **diastolic blood** *pressure—chances of improvements increased over a period of 6 months*

All of them learnt to use IoT within two weeks

- **77%** said they would recommend the tele-health program to families and friends
- **91%** said it was easy to use
- **> 95%** of patients were satisfied with the program

The elderly are most likely to want to continue using tele-health

- **For management** of their conditions after the brief initial period of adaptation

*Tele-health services includes tele-monitoring, Teleconsultation and tele-rehabilitation
*DOW: doctor on wheels

Source: https://www.napierhealthcare.com/advanced-tele-health-study-shows-improvement-health-elderly-smart-health-solution/
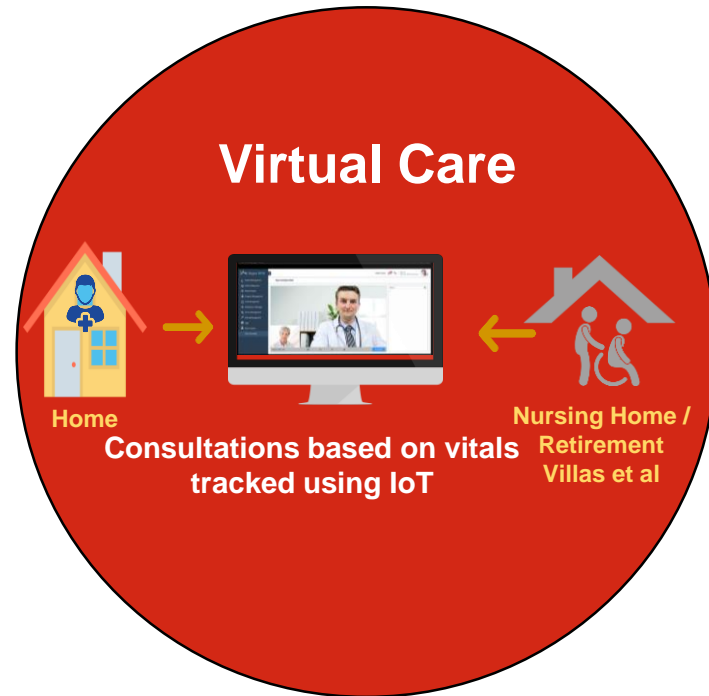
Care Anywhere: using data from IoT deliver *Care Anywhere*

COVID-19 is driving the shift from Hospital centered care to patient centered care and Care Anywhere

Virtual Care

Home

Consultations based on vitals tracked using IoT

Nursing Home / Retirement Villas et al

Benefits for Patient

- o Remotely triage patients
- o Alleviates the stress of an unfamiliar environment
- o Continual care without access barriers
- o Increased patient & family involvement in the care process

- o Well timed interventions, based on:
  - ✓ robust notification systems
  - ✓ patient health monitoring outcomes
- o Boosts patients confidence & trust through increased transparency in the care process
- o Increase patient satisfaction with technology-led interventions like alerts

Benefits for the physician:

- o Seeing a patient in a home or intermediate & long term care (ILTC) setting allows physician to understand the challenges the patient faces

- o Offer appropriate treatment options based on his or her observations.

Transportability of patient information across various settings acute care, long term care and home care –
- has become **paramount**

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AI as a mindset

The "**World Wide Web**" went public in the 90s

It has transformed our lives since then

Search Engine

E-commerce

Social Media

Email

Streaming

Today, the internet has become part of our everyday life. And we should apply AI in the same manner.
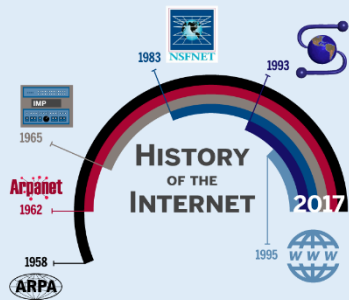
Infuse AI in everything we do

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AI as a mindset….Cont.

In the 2000s

In the 1990s

2021 & beyond

2002

Early 90s

- Sir Tim Berners-Lee invented the World Wide Web in 1989.
- 1991–1995: The Web goes public

1995

- By 1995, the release of Windows 95 and the popular Internet Explorer browser.
- Commercialization, dot-com boom

1996

On July 4, 1996, Hotmail launched the first free web-based email service.

Usage of fax and letter for communication are getting lesser.

1998-2000

The Wild Wild West era for DotComs. Companies that conduct a majority or all of its business via the internet.

The dotcom bubble burst in 2000. It popped when a majority of the technology startups that raised money and went public folded when capital went dry.

The Dotcom period marked the emergence of the widespread use and adoption of the internet from shopping online, communication, and a source of news.
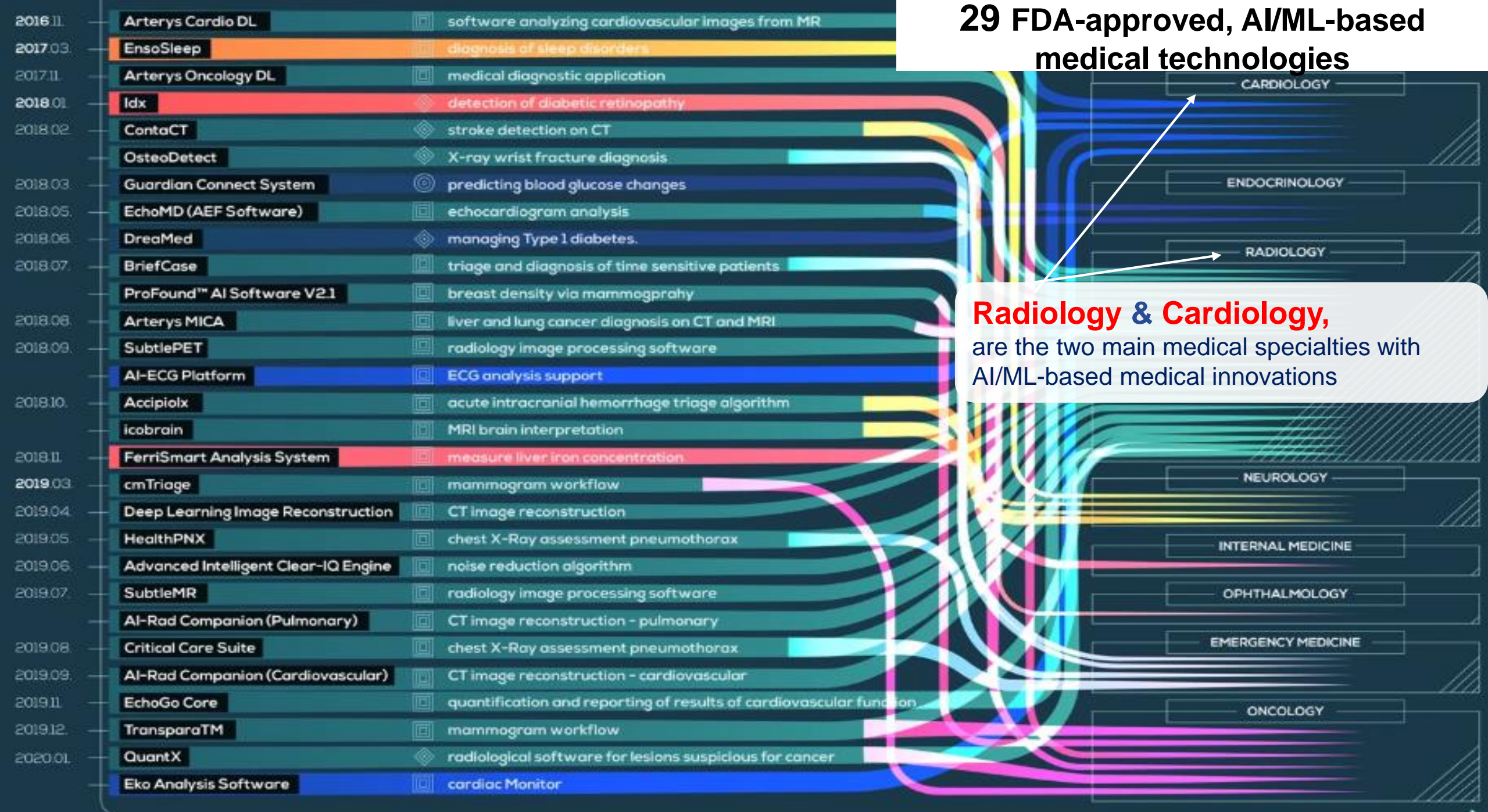
Today the Internet is ubiquitous, and we cannot imagine our lives without it.

It has transformed revolutionize the way we shop, socialize, learn, travel, and more.

AI is not part of a distant future, it has already begun to change our lives.

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29 FDA-approved, AI/ML-based medical technologies

Radiology & Cardiology, are the two main medical specialties with AI/ML-based medical innovations

Date	Technology		Description
2016.11	Arterys Cardio DL		software analyzing cardiovascular images from MR
2017.03	EnsoSleep		diagnosis of sleep disorders
2017.11	Arterys Oncology DL		medical diagnostic application
2018.01	Idx		detection of diabetic retinopathy
2018.02	ContaCT		stroke detection on CT
	OsteoDetect		X-ray wrist fracture diagnosis
2018.03	Guardian Connect System		predicting blood glucose changes
2018.05	EchoMD (AEF Software)		echocardiogram analysis
2018.06	DreaMed		managing Type 1 diabetes.
2018.07	BriefCase		triage and diagnosis of time sensitive patients
	ProFound™ AI Software V2.1		breast density via mammogprahy
2018.08	Arterys MICA		liver and lung cancer diagnosis on CT and MRI
2018.09	SubtlePET		radiology image processing software
	AI-ECG Platform		ECG analysis support
2018.10	Accipiolx		acute intracranial hemorrhage triage algorithm
	icobrain		MRI brain interpretation
2018.11	FerriSmart Analysis System		measure liver iron concentration
2019.03	cmTriage		mammogram workflow
2019.04	Deep Learning Image Reconstruction		CT image reconstruction
2019.05	HealthPNX		chest X-Ray assessment pneumothorax
2019.06	Advanced Intelligent Clear-IQ Engine		noise reduction algorithm
2019.07	SubtleMR		radiology image processing software
	AI-Rad Companion (Pulmonary)		CT image reconstruction - pulmonary
2019.08	Critical Care Suite		chest X-Ray assessment pneumothorax
2019.09	AI-Rad Companion (Cardiovascular)		CT image reconstruction - cardiovascular
2019.11	EchoGo Core		quantification and reporting of results of cardiovascular function
2019.12	TransparaTM		mammogram workflow
2020.01	QuantX		radiological software for lesions suspicious for cancer
	Eko Analysis Software		cardiac Monitor

Medical specialties: CARDIOLOGY, ENDOCRINOLOGY, RADIOLOGY, NEUROLOGY, INTERNAL MEDICINE, OPHTHALMOLOGY, EMERGENCY MEDICINE, ONCOLOGY

IoT* in healthcare systems: *IoTs are indispensable requirement for delivering quality healthcare*

Global IoT in healthcare market is projected to reach **USD 534 Bn** by 2025

CAGR-20%

$ 534 Bn

$180 Bn

2019 2020 2021 2022 2023 2024 2025

*IoT: Internet of Things

IoT relies on sensor technology to create information about things

- Refers to connected, smart devices that collect and exchange patient data like Heart Rate, Blood Pressure, Body weight etc. in real-time.

  - ✓ improve the patient experience:
    - o by eliminating the need for in-person medical visits,

  - ✓ the technology allows patients:
    - o to send their health information to doctors in order to better surveil diseases and track and prevent chronic illnesses.
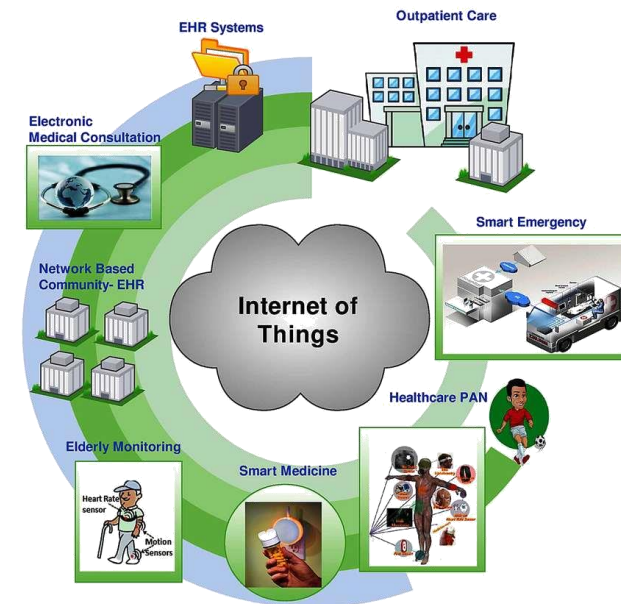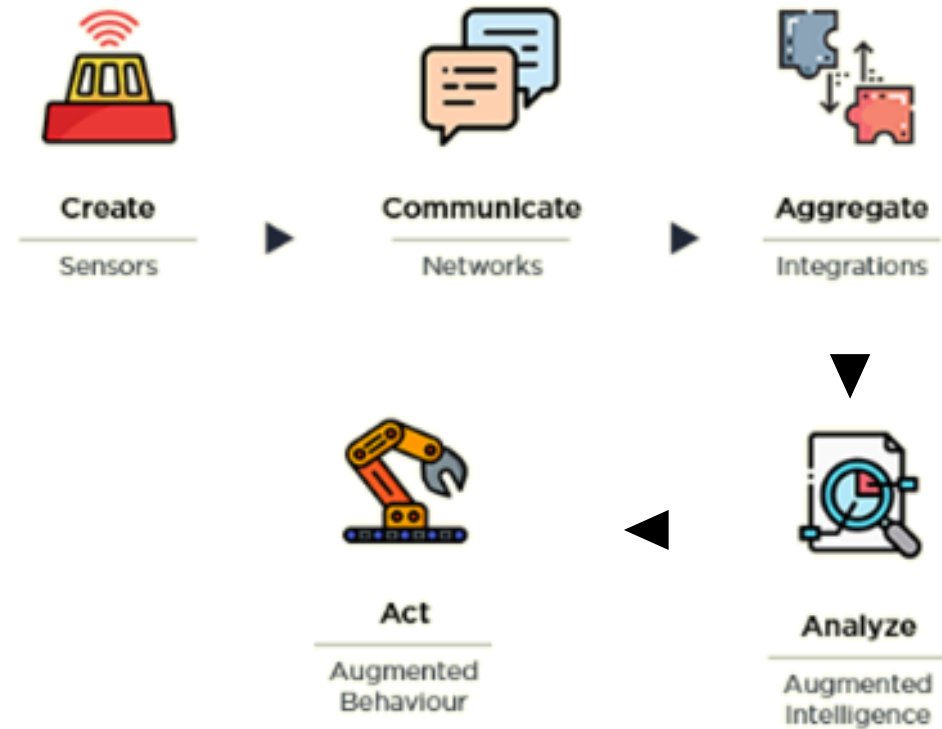
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What Is The Artificial Intelligence Of Things? When AI Meets IoT

**IoT and AI** are the popular technologies currently in use today

60% AI/ML

67% IoT

37% Edge Computing
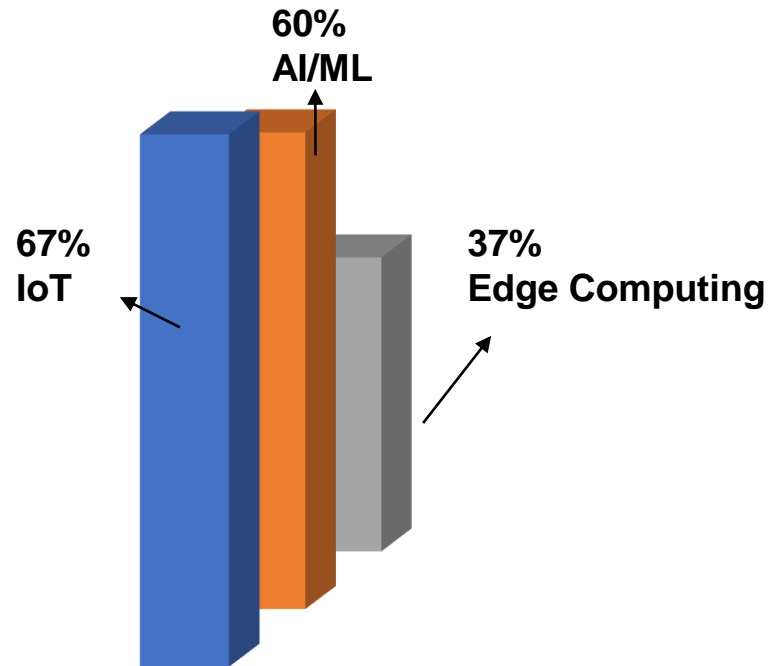
Source: *Tech trends*

AI & IoT Functional View

Create — Sensors

Communicate — Networks

Aggregate — Integrations

Act — Augmented Behaviour

Analyze — Augmented Intelligence

While IoT provides data, **artificial intelligence** acquires the power to unlock responses, **offering both creativity and context to drive smart actions quickly.**

Source: https://www.clariontech.com/blog/ai-and-iot-blended-what-it-is-and-why-it-matters

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Healthcare is on the cusp of a revolution *that will be driven by technologies like AI and edge computing*

On-device intelligence **is paramount**

Process data closest to the source, complement the cloud
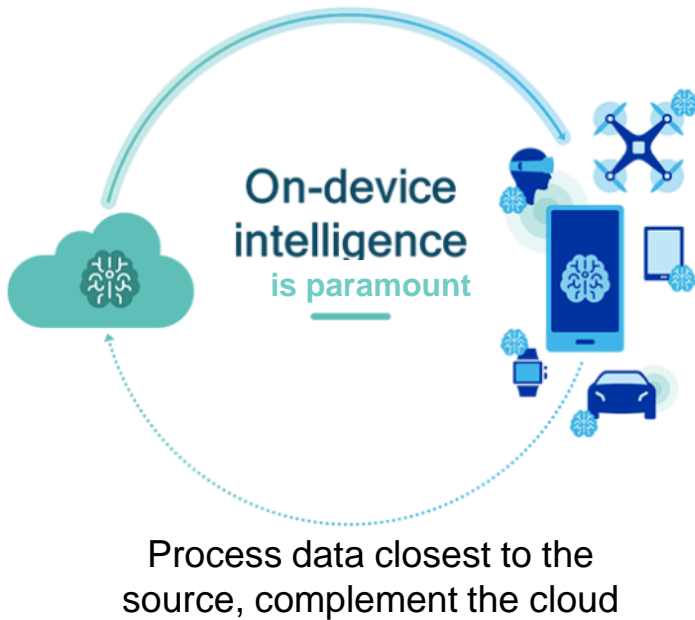
PRIVACY

Patient data can stay on premise of a healthcare provider and a model can be run on site rather than the cloud.
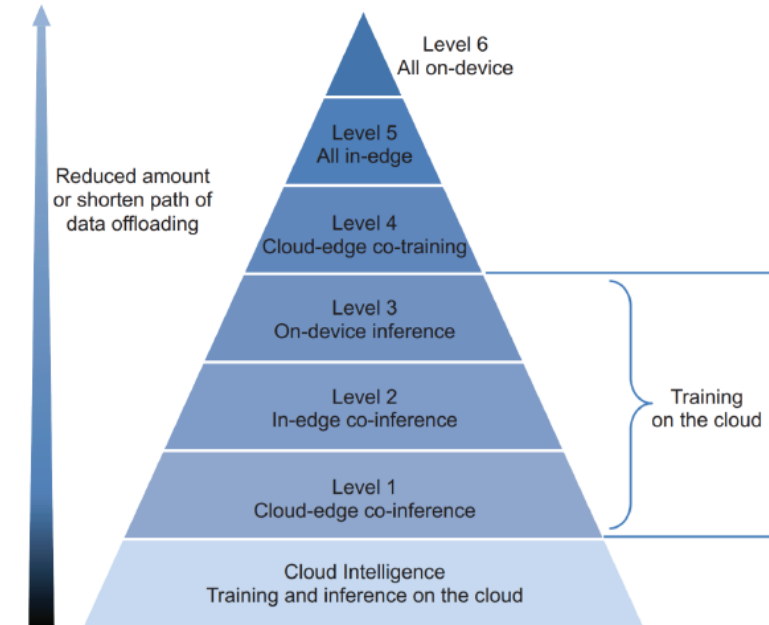- ✓ As a result, patient privacy and **HIPAA compliance** is maintained.

LOW LATENCY

Without an Edge network the response time would take seconds, with Edge the times are reduced to less than 400 milliseconds.

As the level of Edge Intelligence goes higher, the amount and path length of data loading reduce.
- ✓ As a result,
  - o the transmission latency of data loading decreases,
  - o the data privacy increases
  - o the WAN bandwidth cost reduces

LOWER COST

EFFICIENT USE OF NETWORK BANDWIDTH

Reduced amount or shorten path of data offloading

Level 6
All on-device

Level 5
All in-edge

Level 4
Cloud-edge co-training

Level 3
On-device inference

Level 2
In-edge co-inference

Level 1
Cloud-edge co-inference

Cloud Intelligence
Training and inference on the cloud

Training on the cloud

With edge-based AI, patient information is stored and **processed locally** on a device, rather than being sent to the cloud

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Edge-AI *is the future of AI*: *predictive analytics will rule, and preventive care will be the norm*

Use cases of Edge AI

FALL DETECTION

Detect falls in an **instant** and even alert caregivers. In most cases, this can be life-saving.

EARLY DETECTION: Stroke, Sepsis, Fall Risk

- Vital data from IoT devices can leverage AI to detect any abnormality in an instant.
- E.g. wearable health monitors such as ECG monitors and blood pressure monitors can collect and analyze data locally, which a patient can share with their doctor for an instant health evaluation

PREVENT WANDERING

Track movements of elderly especially suffering from **dementia** and let caregivers know if some one has wandered off

ASSISTED OR AUTOMATED SELF DIAGNOSIS & SUBSEQUENT PRESCRIPTION

Chatbots can help patients self diagnose or assist doctors in diagnosis.

PERSONALIZED MEDICATIONS & CARE

Find the best treatment plans according to patient data from IoT reducing cost and increasing effectiveness of care

The embedded AI in the edge sensor supports patients during emergencies and provides recommendations **either** for **self recovery** or the hospital visit as the **last resort**

Source: https://www.whatnextglobal.com/post/future-of-smart-hospitals-from-ai-powered-iot-sensors-to-edge-ai-solutions
https://healthtechmagazine.net/article/2019/08/will-edge-computing-transform-healthcare
https://research.aimultiple.com/healthcare-ai/
https://healthtechmagazine.net/article/2020/01/how-internet-medical-things-impacting-healthcare-perfcon

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Digital innovation will cater to the new challenge of delivering quality care while addressing the patient expectations
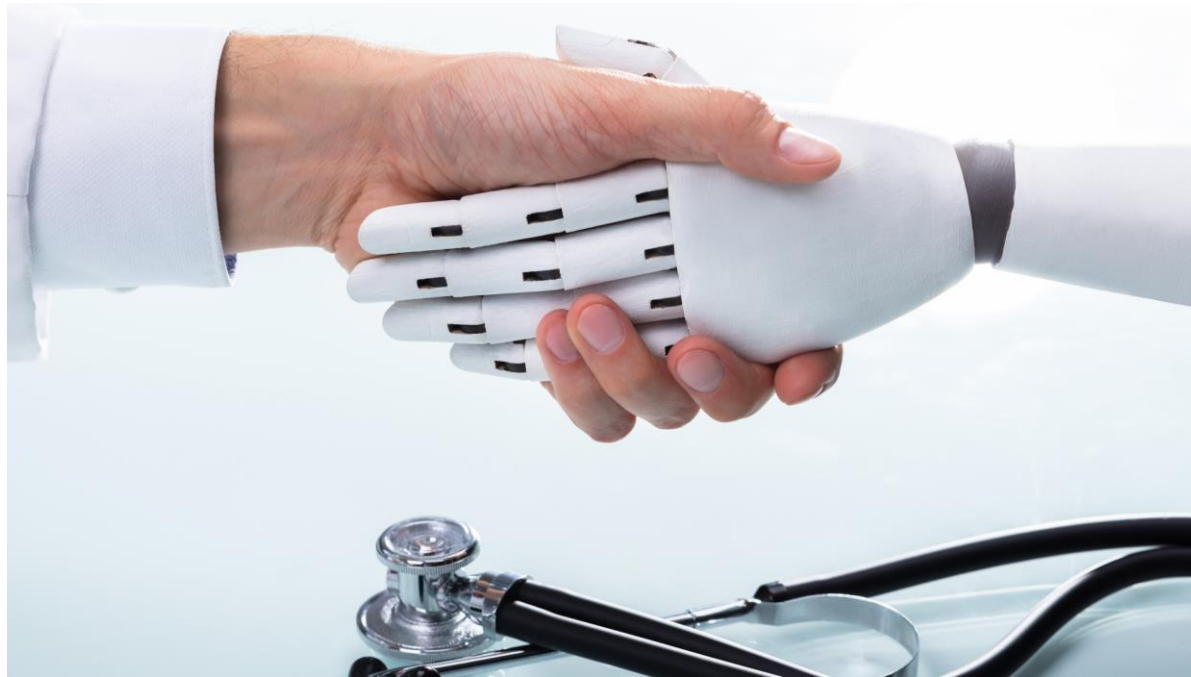
Let's **incorporate** technology in our lives and walk towards a **convergent healthcare system**!

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