

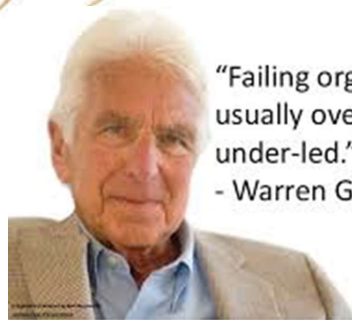
AN ENGINEER'S VIEW ON THE FUTURE OF HEALTHCARE

Prof. Pascal Verdonck, MSc CivEng, MScBME, MBA, PhD





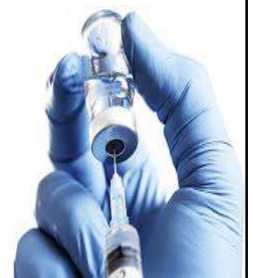
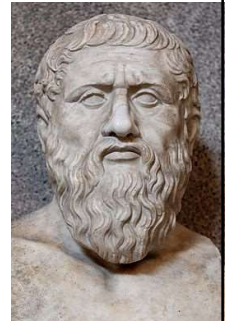
OUR HEALTHCARE SYSTEM “AS IS”



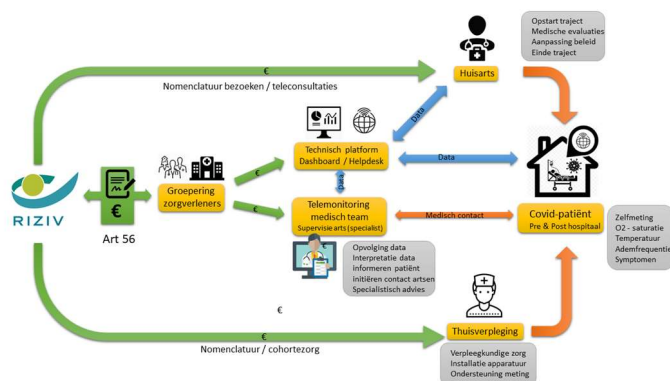
“Failing organizations are usually over-managed and under-led.”
- Warren G. Bennis

“COVID 19” IS A “GAME CHANGER”

- Covid-19 has *changed the world*!
- January 2021: the fight against the COVID is not won with a vaccine in sight!
- 2021 will be “*a year of transition*”
- But “*Necessity is the mother of invention*” °Plato
 - Bio-revolution (biopharma, biomolecules, biosystems, biomachines, Biocomputing)
 - “On line” customer service, remote working and telehealth,...



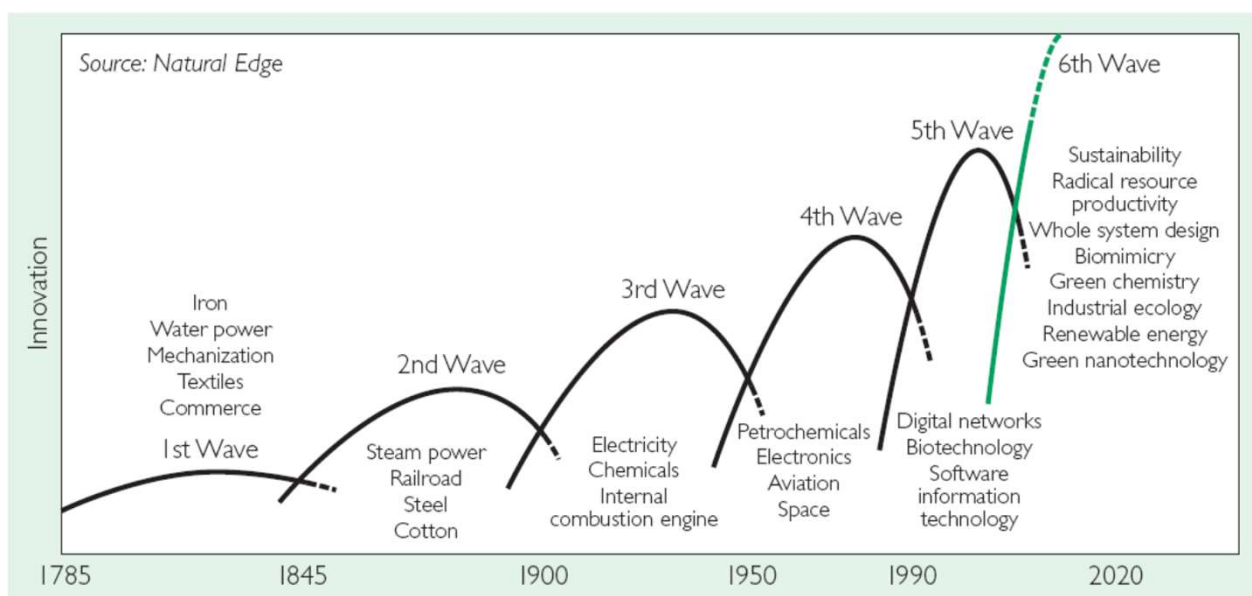
REMOTE MONITORING OF COVID-19 PATIENTS



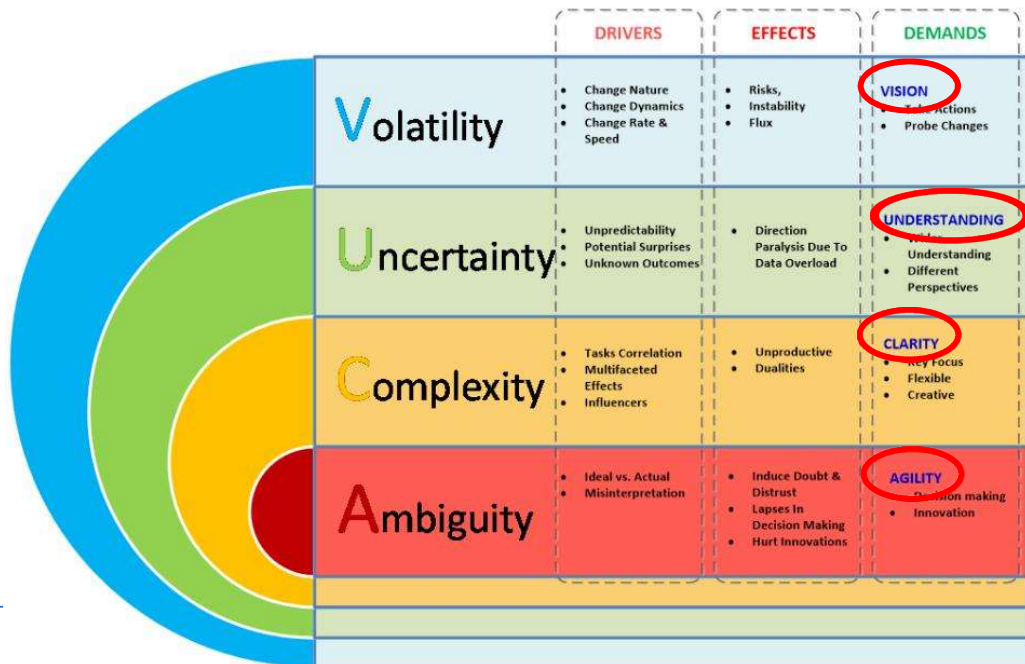
“COVID 19” IS A “DIGITAL HEALTHCARE ACCELERATOR”

- Inflow of patients versus the available hospital capacity (IC beds, materials, HR, ...)
- New generation of “health conscious” consumers & “tech-fan” healthcare providers
- Change in patient behavior, including “no show”, “shopping”, ...
- Real tsunamie to new medical technology (Industry 4.0)...

TECHNOLOGICAL INNOVATION WAVES



VUCA WORLD



HEALTHCARE

HEALTH

Health is a state of complete physical, mental and social well-being



Hygieia, goddess of health, daughter of Asclepius (god of medicine and healing) Wikipedia

BUILDING BLOCKS OF HEALTH

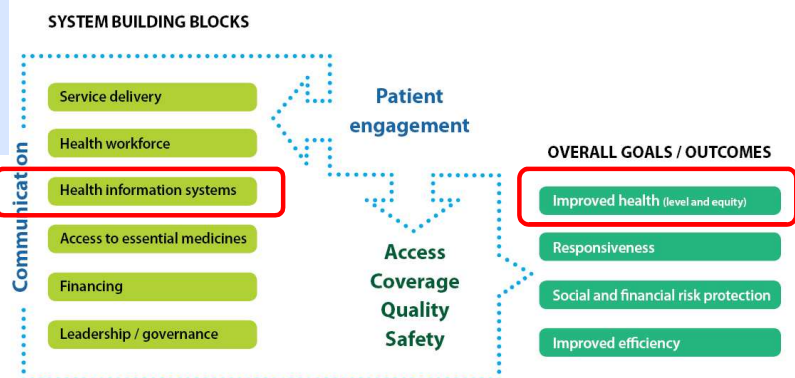
WHO Definition of Health

“Health is the state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity”

Source: United Nations World Health Organization⁵



Figure 2. Proposed modified WHO Health Systems Framework



DETERMINANTS OF HEALTH



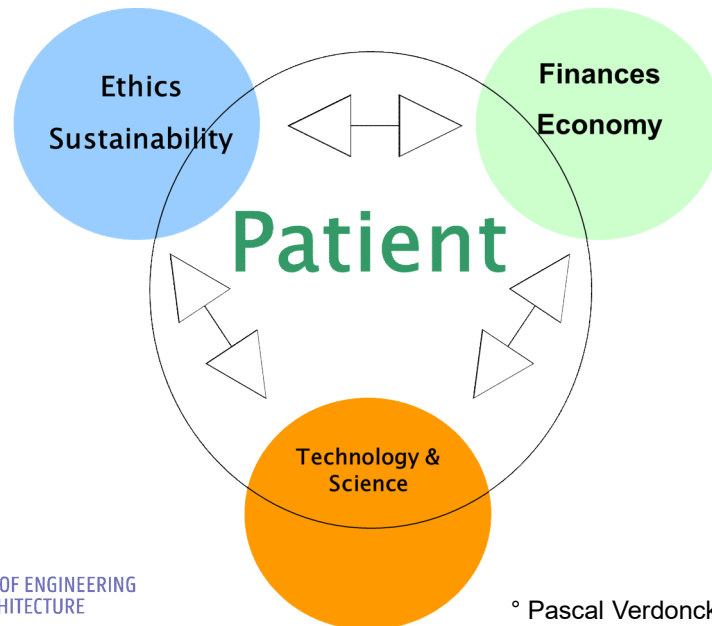
MISSION OF HEALTHCARE POLICY

The primary goal of health care policy is **to maximize the health** of the population within the limits of the **available resources**, and within an **ethical framework** built on “equity and solidarity principles”.

Report of the Belgian EU Presidency, adopted by the EU Council of Ministers of Health in Dec 2010



VISION “THE PATIENT FIRST”



THE PATIENT'S VIEW

Dimensión	%
Having a doctor who listens to them	85%
Having a doctor who is care and compassionate	71%
Having a doctor who explains well	69%
Having convenient and quick access to health care	47%
Having pleasant interactions with other staff in the doctor's office	41%
Being able to talk about the cost of care and the necessity of testing and treatment	29%
Ensuring doctors disclose financial conflicts of interest	22%
Having a doctor who provides holistic options to care	8%
Having doctors' office in charge of coordinating care	6%
Having a doctor of the same language and culture	4%
Having a doctor who provides choice	4%

FHMF Workshop

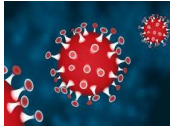
HEALTH TECHNOLOGY

HEALTH TECHNOLOGY

Health Technology, “Health Tech”, is defined as

"application of organized knowledge and skills in the form of devices, medicines, vaccines, procedures and systems developed to solve a health problem and improve quality of lives".

HEALTH TECHNOLOGY

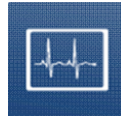


(Red) BioTech, is the use of living systems (cells, biomolecular processes) to develop technologies and products to help and heal people (°Bio 2020)



Digital Health means the use of information and communication technologies to help address the health problems and challenges faced by patients. The European Patient Forum defines it as health care practices supported by electronic processes & communication (°EPF 2020)

Medical Technology



MEDICAL TECHNOLOGY



Medical devices including surgical tools, implants, active devices and active implants



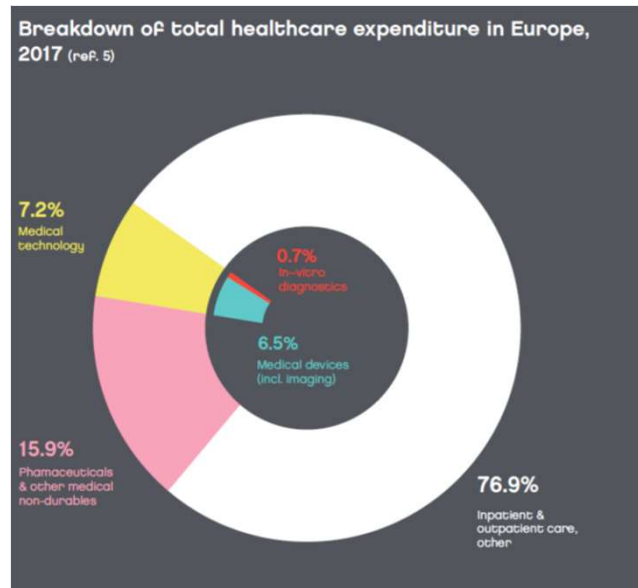
In-vitro diagnostics including self-test, bedside and laboratory equipments



Embedded or stand-alone **software**

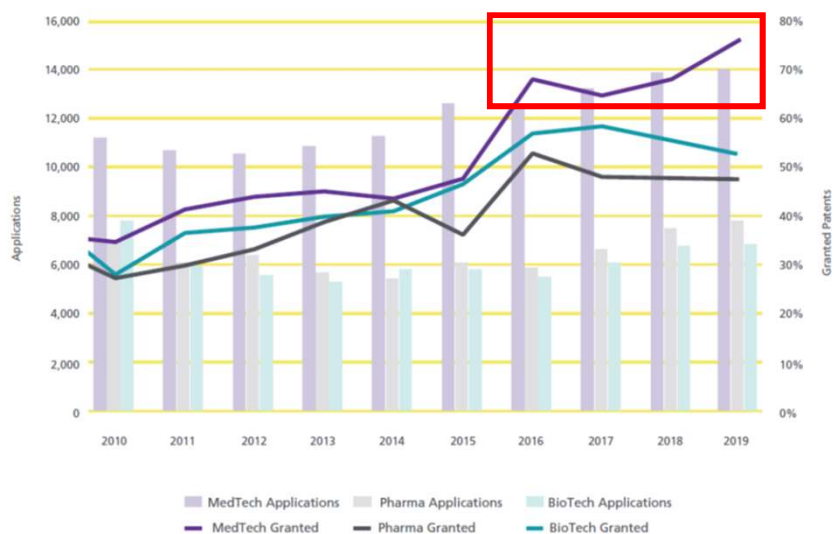
MEDTECH VERSUS PHARMA IN EU

- Pharmaceutical market represents over 20% of total healthcare expenditure
- Medical Technologies range from 7-10% of total healthcare expenditure



EUROPEAN MARKET: INNOVATION

Evolution of European patents by technical field



CHALLENGES

CHALLENGES OF HEALTHCARE

Healthcare, where the product is *a person*, is complex, chaotic and fragmented by an explosion of knowledge and technological progress!



CHALLENGES OF HEALTHCARE

Moreover, a hospital is an exceptionally complex company:

prevention (insurance), emergency (fire service), day clinic (retail), elective (automotive), cure (SME), care (maintenance), project (innovation),....

And particularly extremely complex in Belgium:

- Complex State Evolution: Sixth State Reform: “everybody is involved, nobody is accountable”
- Silo’s (political party, union, mutualities, ...)
- Not always unambiguous clear policy, vision and one command!



CHALLENGES OF HEALTHCARE

– **Social trend:**

- Double aging (living more and longer)
- More mentally illness
- More chronic diseases (cancer, ...)
- Demand for “transparency”

– **Changed healthcare demand of the patient:**

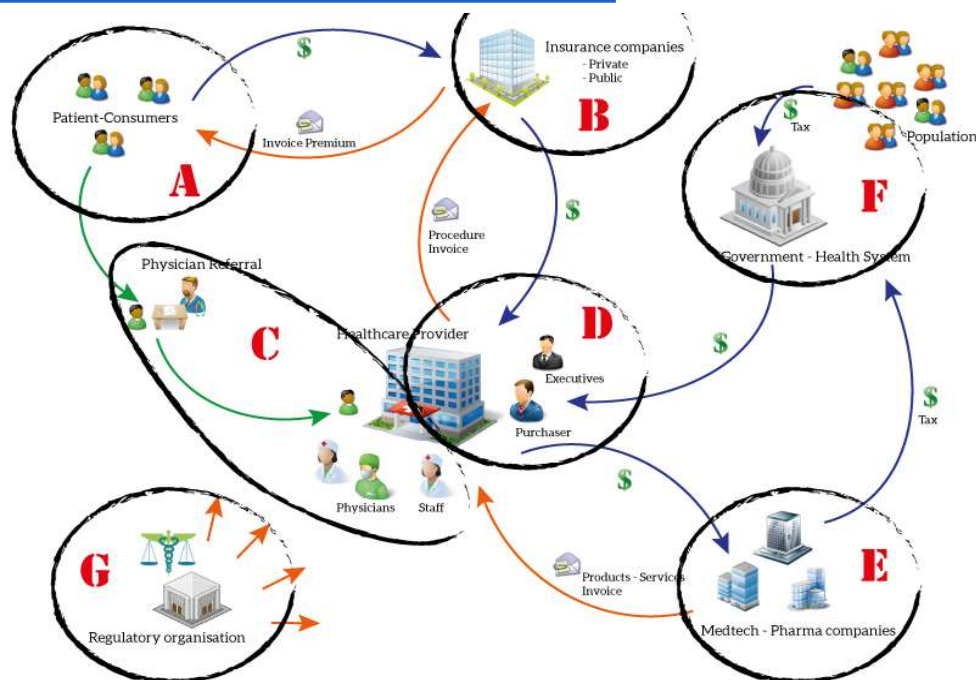
- From “supply-oriented care” to “demand-driven care
- The patient makes choices based on a combination of cost, the general practitioner, “outcome” of the hospital and information on the internet,...



CHALLENGES OF HEALTHCARE

- **Federal government**
 - more care outside the hospital (“expensive hotel”)
 - from best efforts to result obligation with public accountability
 - financing depending on result (P4P)
- **European regulations** but a **national health system**
 - Government Procurement Act
 - Cross-border healthcare
 - Free movement of patients, professionals, medicines
 - MDR Medical device Regulations,...
 - GDPR

HEALTHCARE ECOSYSTEM

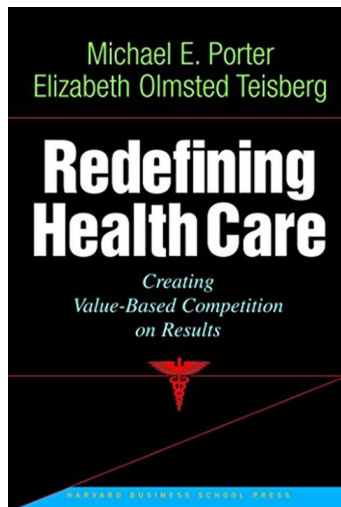


VISION

VALUE BASED HEALTHCARE

Prof. Pascal Verdonck

VALUE BASED HEALTH CARE



- The fundamental **goal and purpose** of health care is **to improve value for patients**

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

- Value is the only goal that can **unite the interests** of all system participants
- Value is created in caring for a patient's **medical condition** over the **full cycle of care**



The most powerful single lever for reducing cost and improving value is improving outcomes

Source: ICHOM 2019

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THE HEALTH CARE VALUE FORMULA

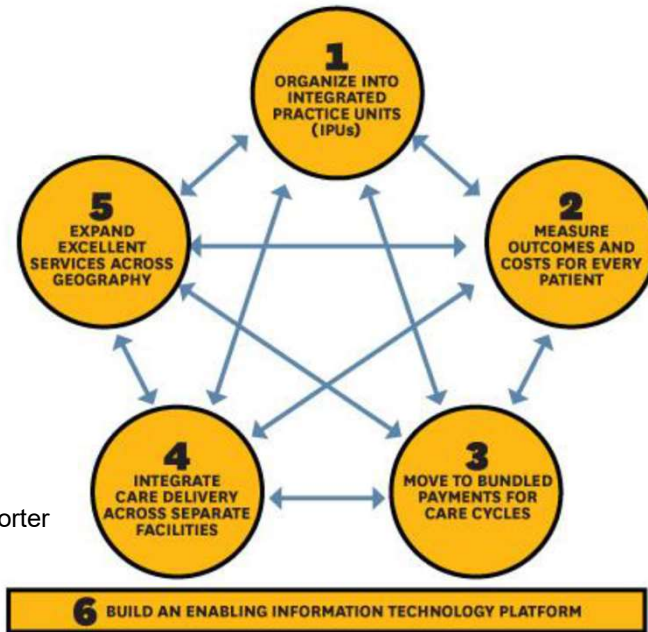
$$\text{VALUE} = \frac{\text{Quality}}{\text{Cost}} = \frac{\text{Outcomes} + \text{Patient Experience}}{\text{Direct Costs} + \text{Indirect Costs}}$$

° Perspectives in Healthcare in a joint publication ,Global Center for Health Innovation in Cleveland,.

VALUE BASED HEALTHCARE VBHC

Integration
EBP
PROMS
PREMS
DATA platform

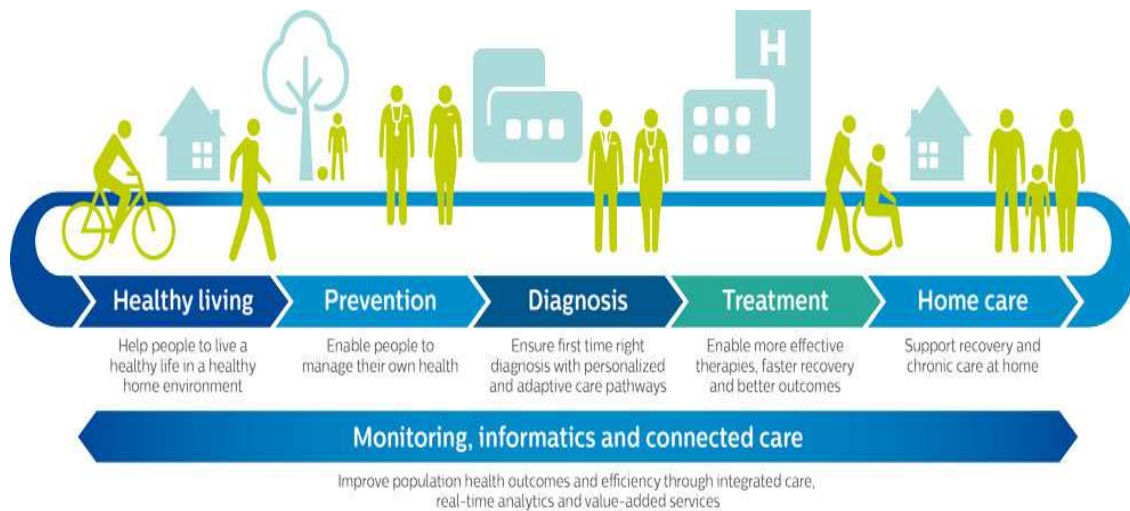
°Michael Porter



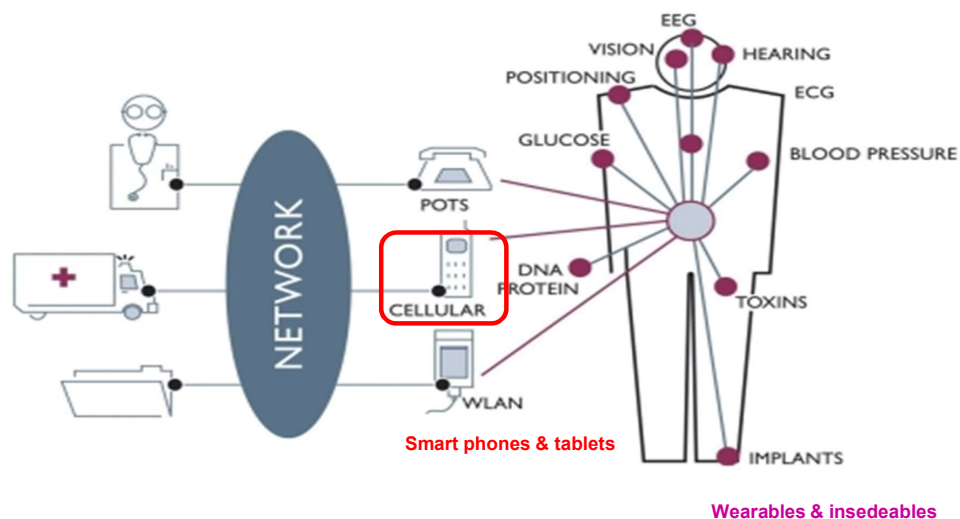
CONNECTED HEALTHCARE

Prof. Pascal Verdonck

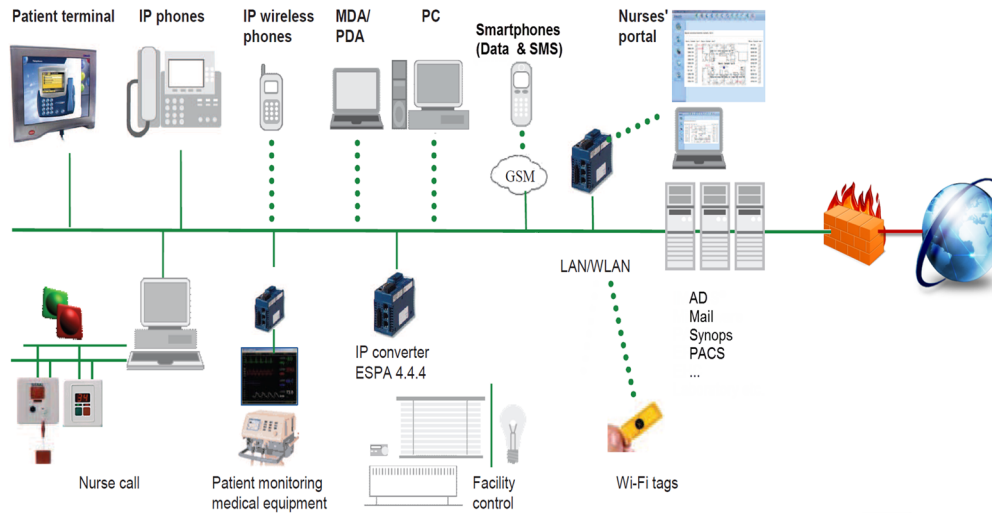
HEALTH CONTINUUM



OUR BODY IS A NETWORK



A SMART HOSPITAL IS A NETWORK



CONNECTED CARE

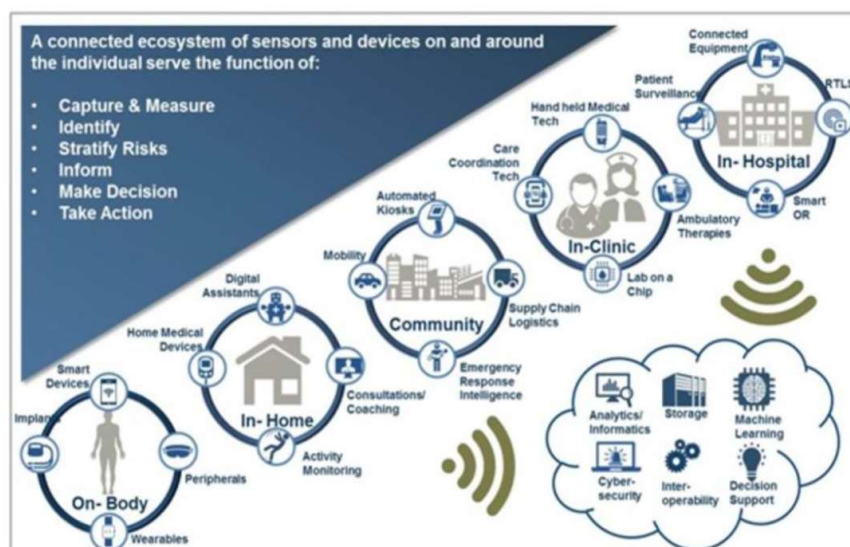


Figure 1: Healthcare World in 2025

Source: Frost & Sullivan

A FUTURE PROOF HOSPITAL

An Intervention center with a command tower:
*patient flow management for efficient and safe
 access and care for patients intra & extra muros*



TTSH C3 Operations Command Centre

INTEGRATED HEALTHCARE

Prof. Pascal Verdonck

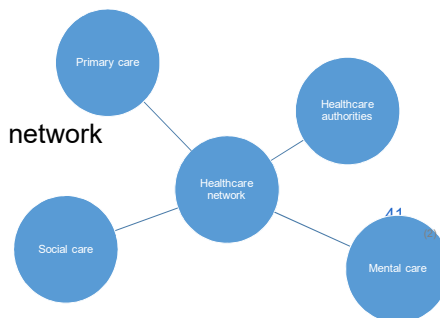
INTEGRATED CARE

World Health Organisation

"Integrated care is a concept bringing together inputs, delivery, management and organization of services related to diagnosis, treatment, care, rehabilitation and health promotion." (1)



A hospital becomes integrated in a healthcare network

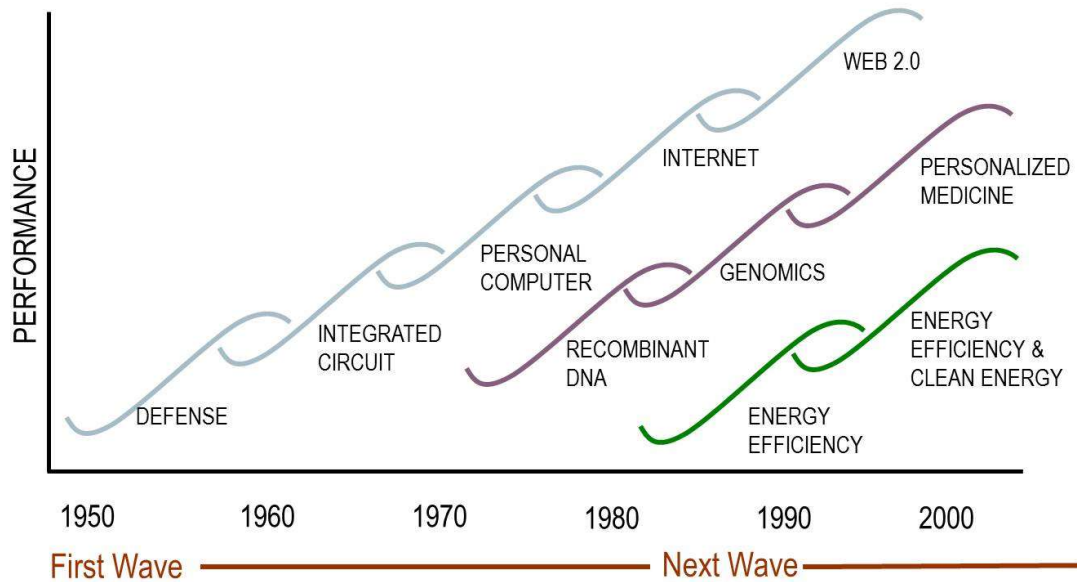


(1) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1525335/pdf/ijic2001-200121.pdf>
 (2) J. Ribera, Hospital of the Future, IESE.(p 24)

NEW MEDICINE

Prof. Pascal Verdonck

DISRUPTIVE INNOVATIONS



SCIENCE & TECHNOLOGY EVOLUTION

- From “tissue & instruments” to “information & energy”
- A disease is not on “organ” level but on “cellular” level
- The future is composed of intelligent instruments, non-invasive point-of-care therapy (cellular surgery,..)

TRENDS AND INNOVATIONS IN HEALTHCARE

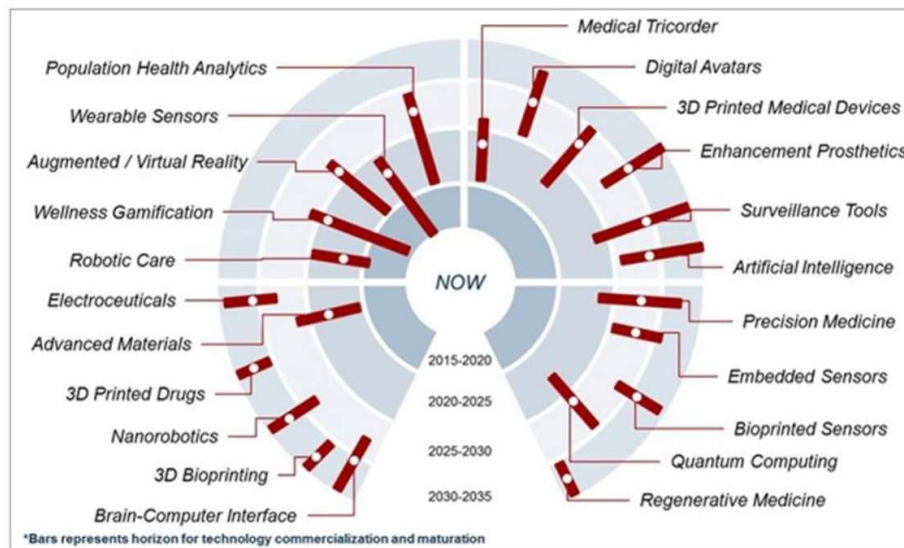
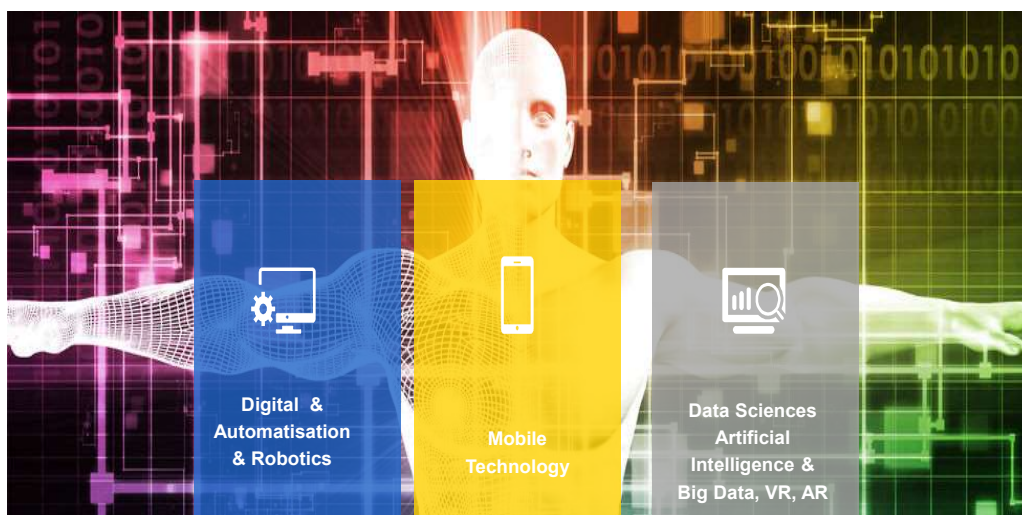


Figure 2: Timeframe for Commercialization and Maturation of Top 2025 Technologies

Source: Frost & Sullivan

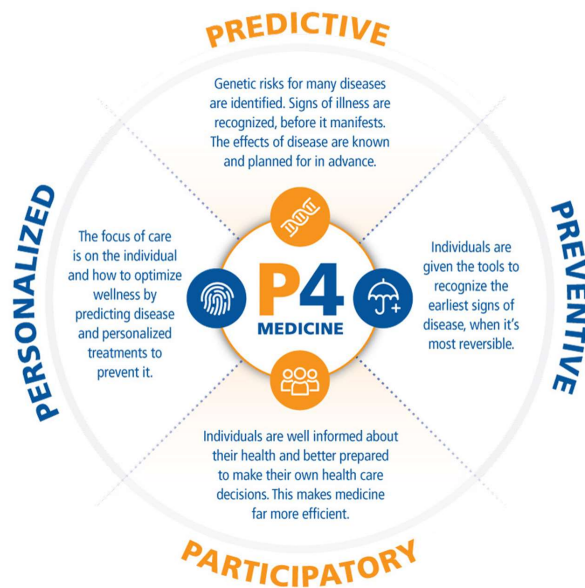
NEW MEDICAL TECHNOLOGY

















TECHNOLOGY IS THE “DRIVER”



HEALTH CARE TRANSFORMATION

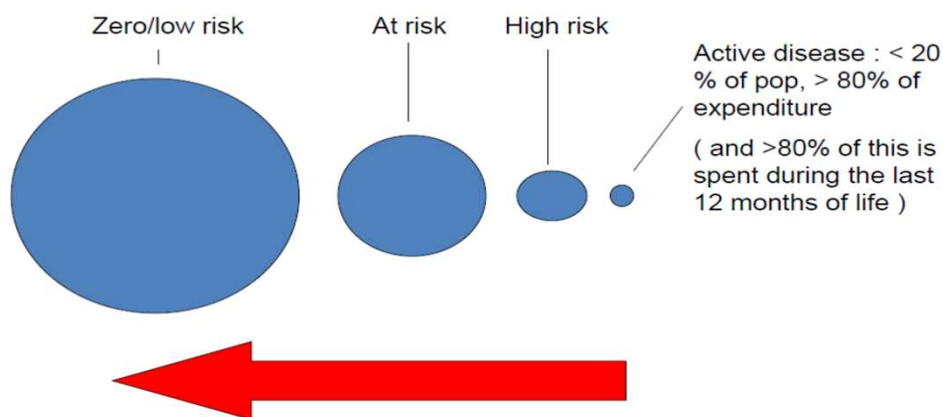


“4 P’s of the new medicine”

	TRADITIONAL MEDICINE	FUTURE MEDICINE
POINT-OF-CARE	Hospitals, clinics, labs 	Homes, workplace 
REFERENCE POINT	Population 	Individual 
ORGANISING PRINCIPLE	Hierarchy 	Partnership 
DATA OWNERSHIP	Institutions 	Patients 
PHYSICIAN'S ROLE	Authority 	Guide 
KNOWLEDGE BASE	Ivory tower of knowledge 	Social media/ crowdsourcing 
DIGITAL/PRECISION MEDICINE	Limited penetration One-size-fits-all 	Digital literacy is driving force for digital healthcare 

FROM SICKCARE TO HEALTHCARE

“Strange business model”...
Health-care or Sick-care ?



DUE TO SENSORS & DATA

Sensors *(source)*

Data Collection

(health, activity, location, emotions, temp, air...)

Data *(currency)*

Data is King!

(personal, population, environment...)

IoT

IoT

Connectivity *(medium)*

Data Transmission

(Bluetooth, Wifi, Cellular (3G/4G/5G), LORA...)

IoT

AI

Intelligence *(brain)*

Analysis, Insights & Actions

(timely, contextual & actionable insights)

5G networks

- **Superior:** speed, bandwidth, latency, power, reliability, ect.
- **Intelligent:** network slicing (separate custom network per application)

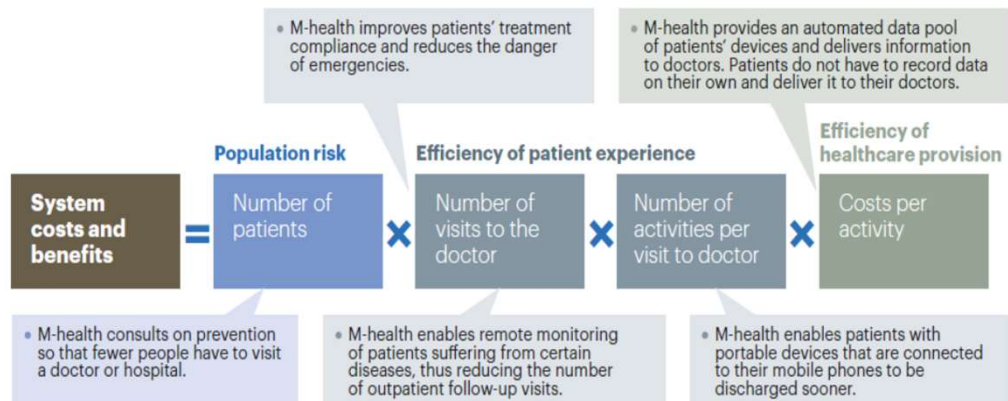
MHEALTH BELGIUM



BENEFIT OF MOBILE HEALTH

Popularity of mHealth

Innovation at a lower cost



A.T. Kearney analysis, 2014

mHealth

MHEALTH BELGIUM

- 2015: 20 e-health actions launched in e-health roadmap
- 2016: 24 projects selected from 98 submitted projects
- 2018: start of validation pyramid
- 2019: mhealth Belgium platform goes live



FACULTY OF ENGINEERING
AND ARCHITECTURE

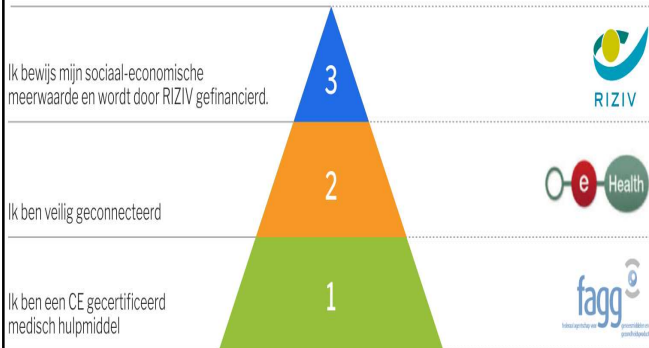


Minister van Volksgezondheid en Welzijnswaard
MARIEKE DE BLOK



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MHEALTH BELGIUM



M1

CE

Application & parent company must be in accordance with GDPR
Notification to the FAMHP

M2

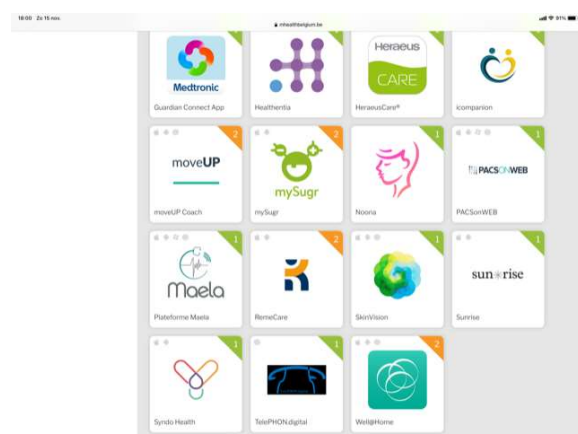
Interoperable with other mobile applications & ICT applications within healthcare and e-health platform (risk assessment)

M3

Socio-economic added value and positive advice Riziv

MHEALTH BELGIUM

- 23 validated applications of which 6 with label M2
- Healthcare Providers can integrate apps with M2 application into daily healthcare practice
- Start-up M3 category, including MoveUp

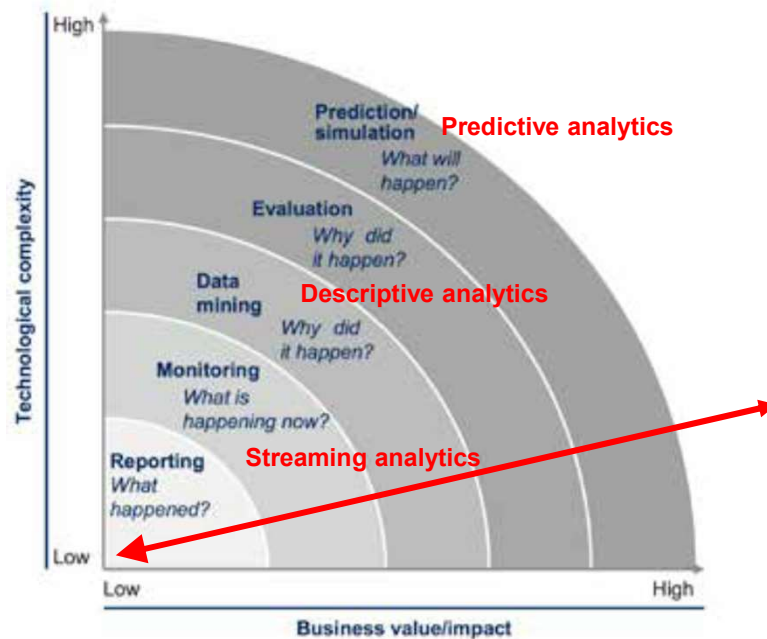


TECHNOLOGY IS THE DRIVER

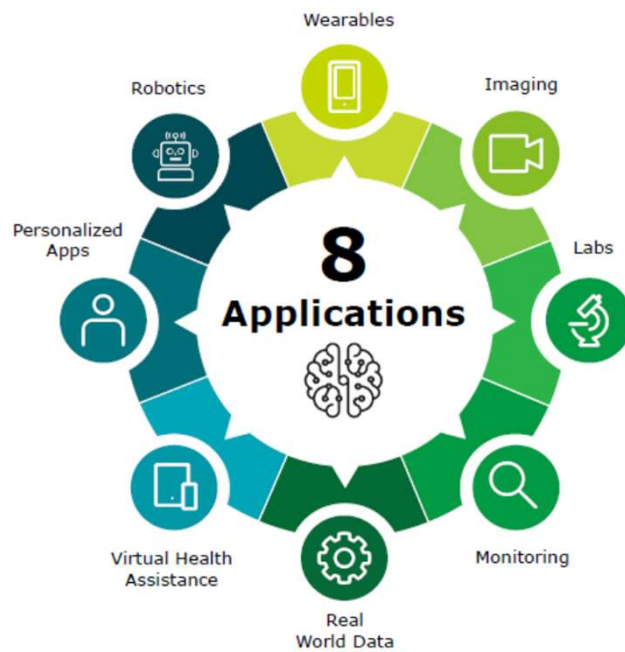


DATA SCIENCES

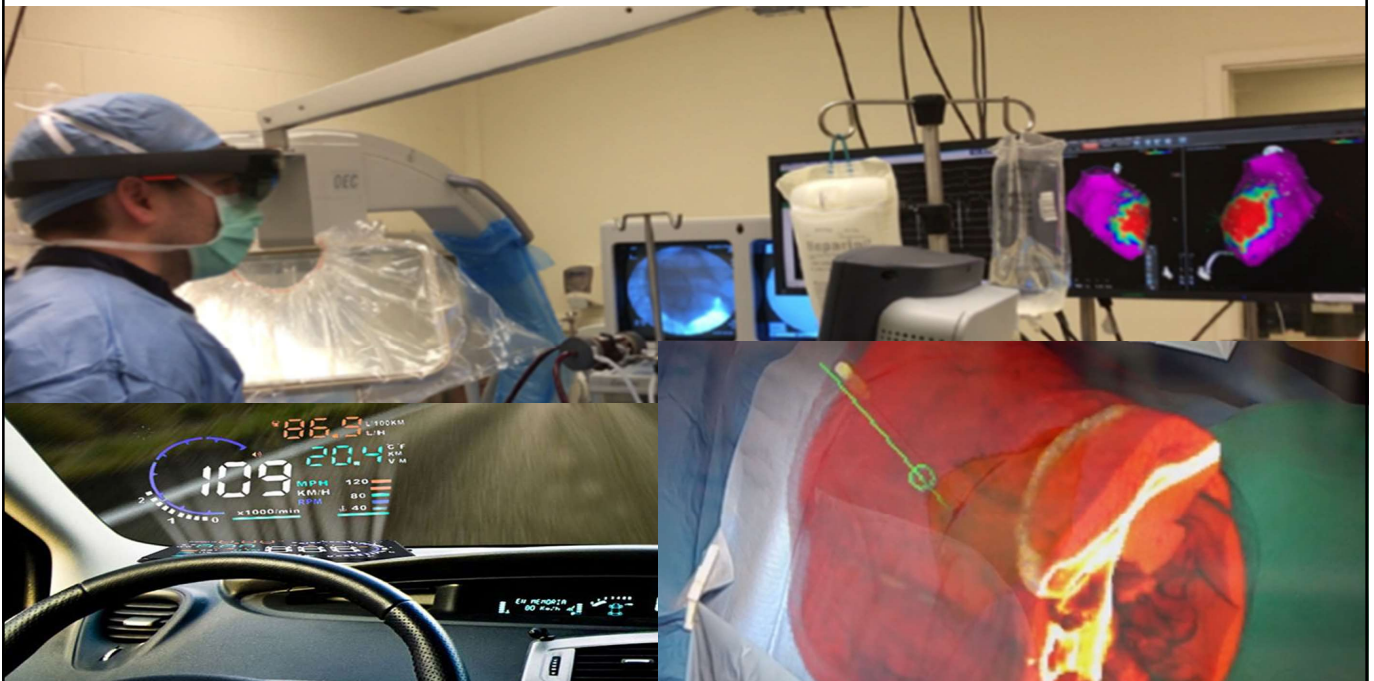
Personalized Health Care is P4/Systems Medicine



ARTIFICIAL INTELLIGENCE



AUGMENTED REALITY



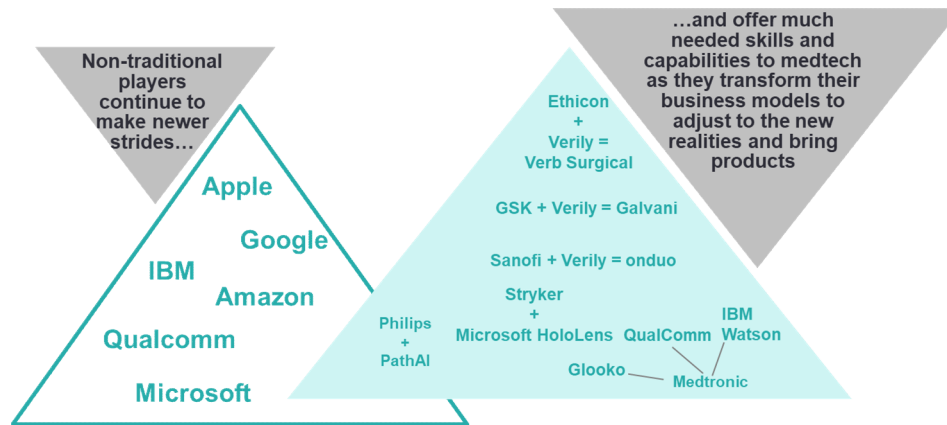
CONCLUSION

TRENDS IN EUROPEAN MARKET

- Value based healthcare aiming to optimize the value of care , value based procurement
- Connected care (digitalization of healthcare) , which helps service-oriented models and decentralised healthcare to cut healthcare costs
- Equilibrium in between “data driven” innovation & business and “General Data Protection Regulation”
- Collaborative management of innovation and better use of EU ecosystems through Public Private Partnerships (PPP)
- Sustainability, circular economy



KEY TRENDS IN MEDTECH

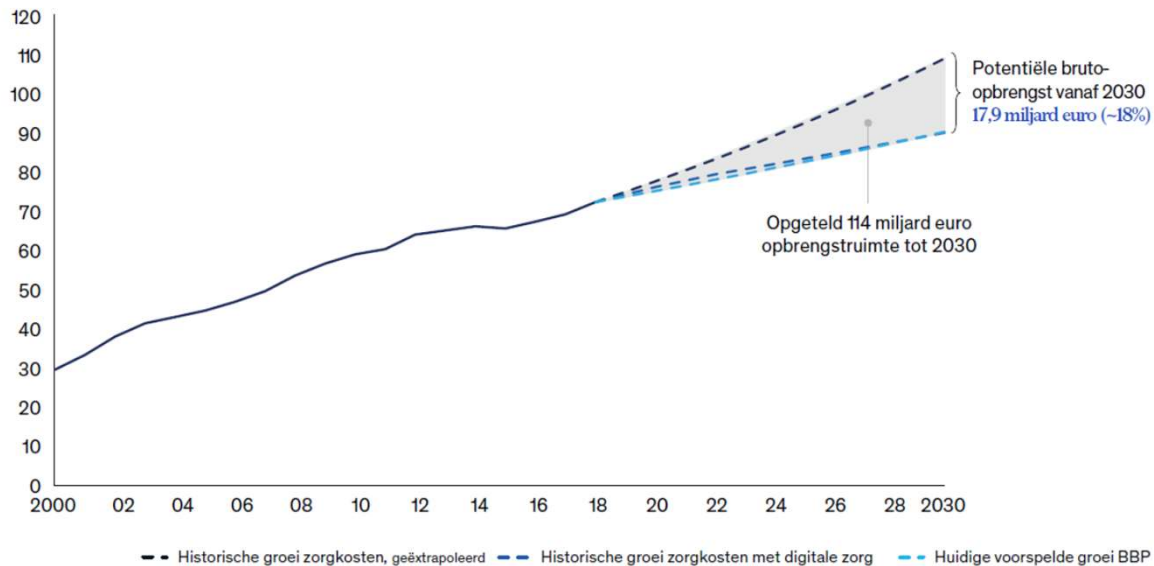


NEW BUSINESS ENVIRONMENT

- Health care budget restrictions
- Sector growth under pressure
- Complex regulatory framework & regulatory uncertainty (new directives & transition periods)
- Integrated health systems & clinical networks
- Group purchasing
- Value- based procurement

COST REDUCTION DIGITAL TRANSFORMATION

Kosten Nederlandse zorg, EUR miljard



COST REDUCTION DIGITAL TRANSFORMATION

Figuur 1

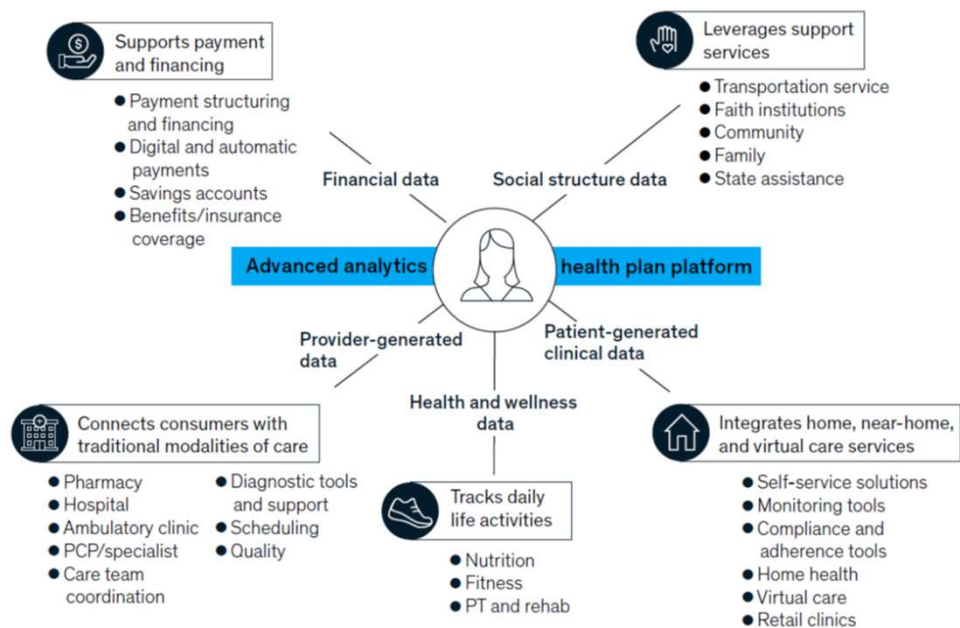
Opbrengsten in 2030 lopen op tot 18 miljard euro, meeste potentieel zit in technologie met een focus op connectiviteit



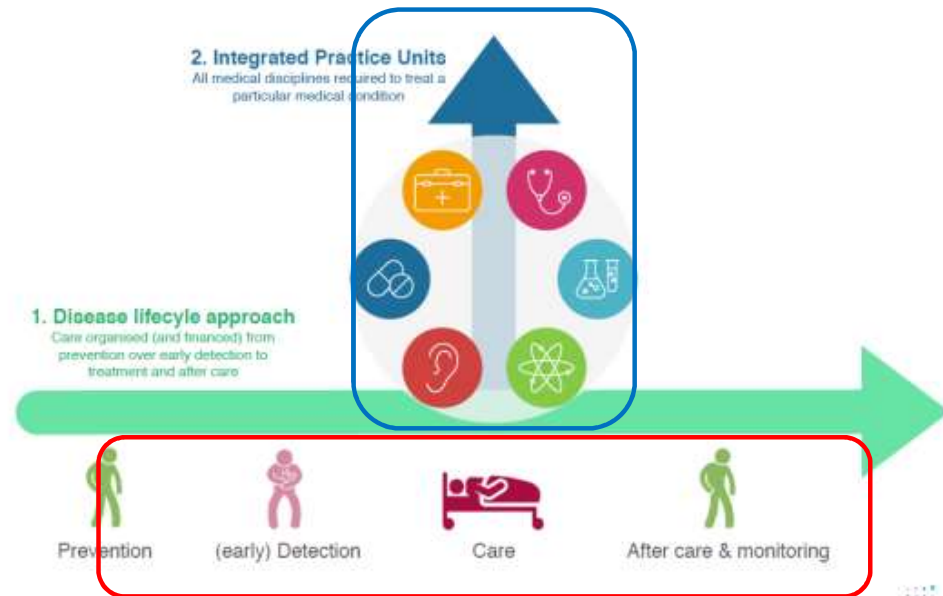
TAKE HOME MESSAGE

Prof. Pascal Verdonck

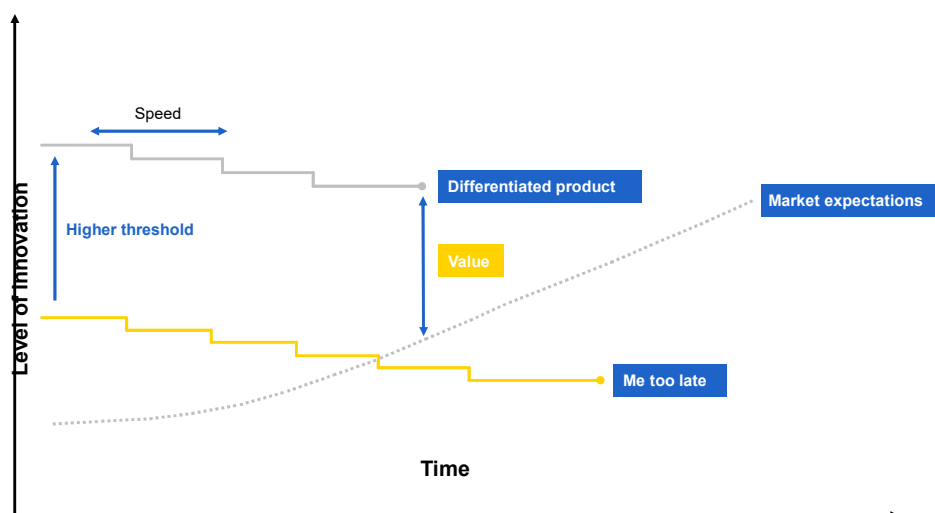
PATIENT CENTERED ECOSYSTEM



DATA DRIVEN HEALTHCARE



INNOVATION LEVEL MUST BE HIGH



°Paul Stoffels, CSO J&J

VALUE

Value = Innovation X Marketing

Johnson & Johnson
CORPORATE
CITIZENSHIP
TRUST



“Because the purpose of business is to create a customer. The business enterprise has two – and only two basic functions: *marketing* and *innovation*. Marketing and innovation produce results; all the rest are costs.”

*Peter Drucker,
Practice of Management (1954)*

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for the World

Innovating Health for Tomorrow
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2

FUTURE VALUE

$$FV = IP^D$$

Future
value

= [**Innovation**
Outcomes x Personalization]

Data

(Connect + Combine + Share)

For people
For physicians
For payers
For policymakers

Participatory
Precise
Predictive
Proactive

Date streams

Traditional and
non-traditional
partners

Platforms
of care

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°EY, 2019

SO OUR HEALTHCARE SYSTEM “WILL BE” ALIGNED



COMPASSIONATE CARE



