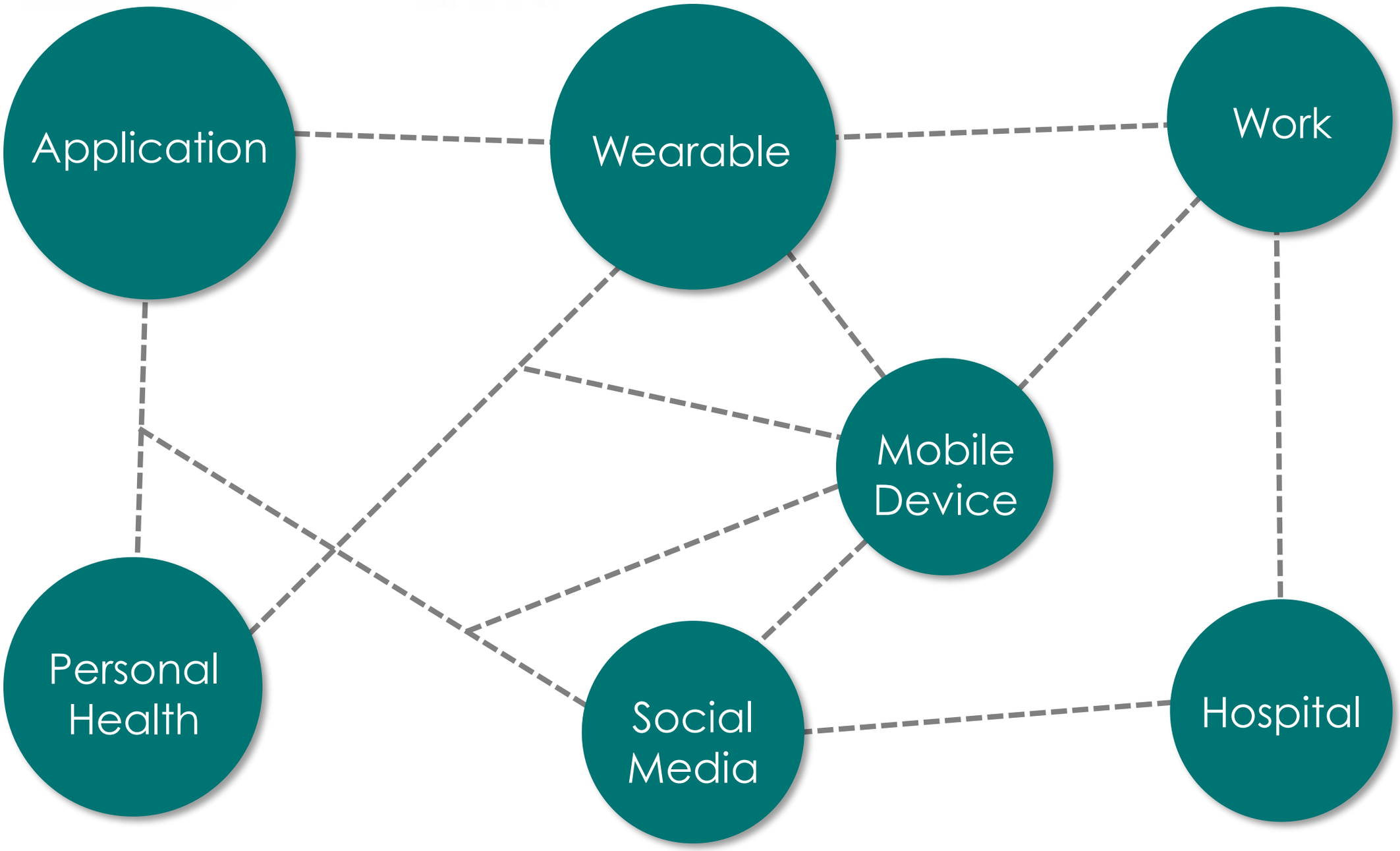
Digital Health 4.0

นพ. กฤษฎา ศิริชัยสิทธิ์
นายแพทย์เชี่ยวชาญ รพ. บึงกาฬ
15/05/2561

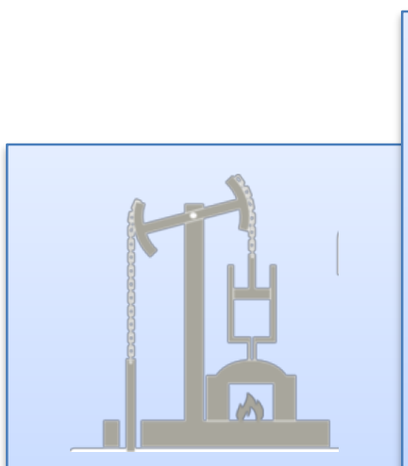
Scope

- AI IoT Robotics
- Patient-Doctor Smart Consultation
- Digital Heath for Prevention
  - Wearable
- The Future of Medicine
- Connected Health

Healthcare Digital Landscape

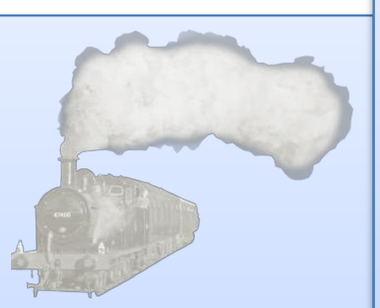


Technological Revolution Timeline



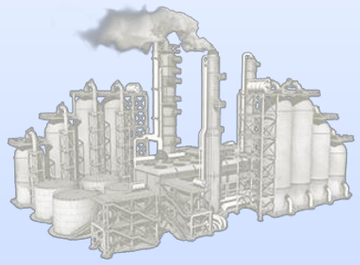
The Industrial Revolution

Big Bang Moment:
1771
Arkwright's mill opens in Cromford, England



Age of Steam & Railways

Big Bang Moment:
1829
Test of the "Rocket" steam engine for the Liverpool-Manchester railway (England)



Age of Steel, Electricity & Heavy Engineering

Big Bang Moment:
1875
The Carenegie Bessemer steel plant opens in Pittsburgh, PA

Age of Oil, The Automobile & Mass Production

Big Bang Moment:
1908
First Model T come out of the Ford plant in Detroit, MI

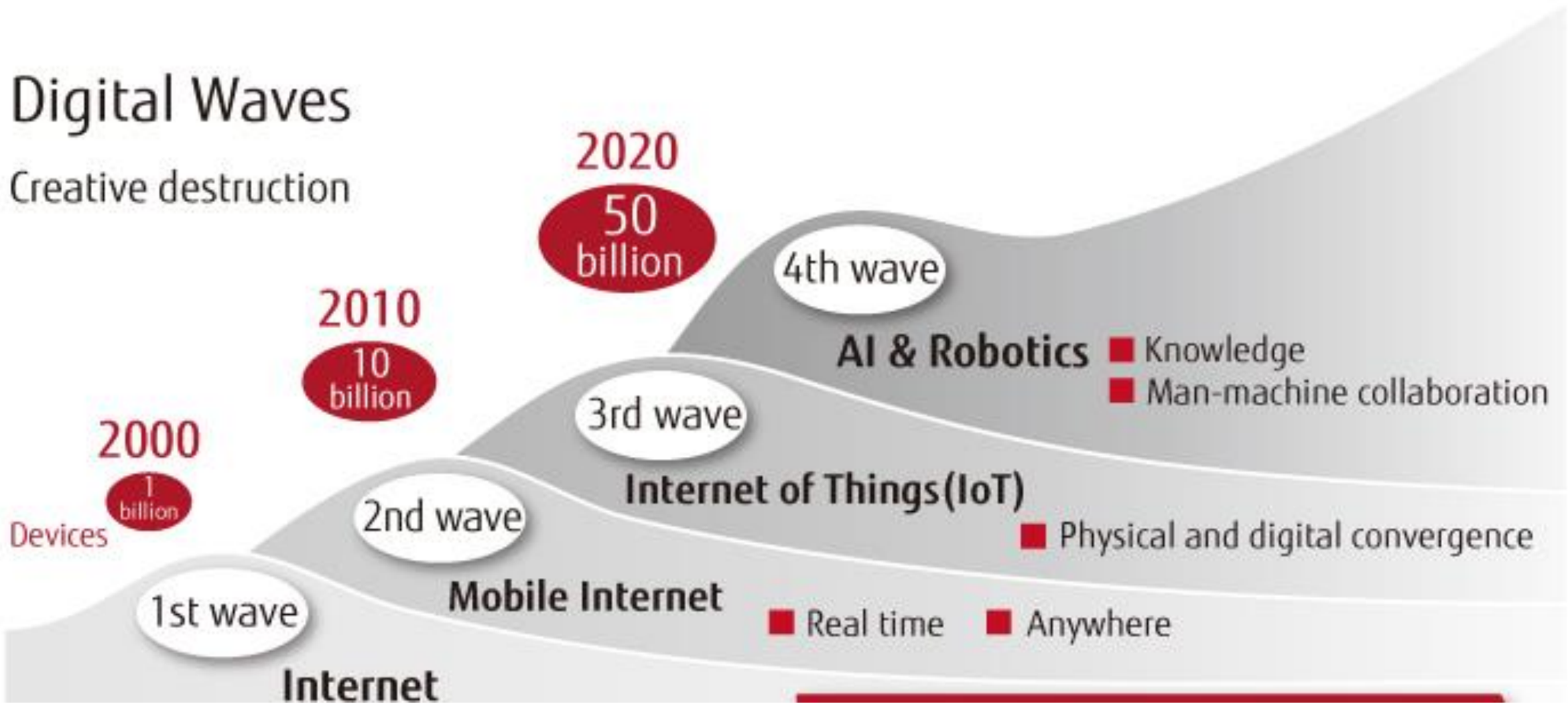
Age of Information & Telecommunications

Big Bang Moment:
1971
The Intel microprocessor is announced in Santa Clara, CA

Age of Artificial Intelligence?

Big Bang Moment:
2020
Machines, data and people connect in new era

Revolution



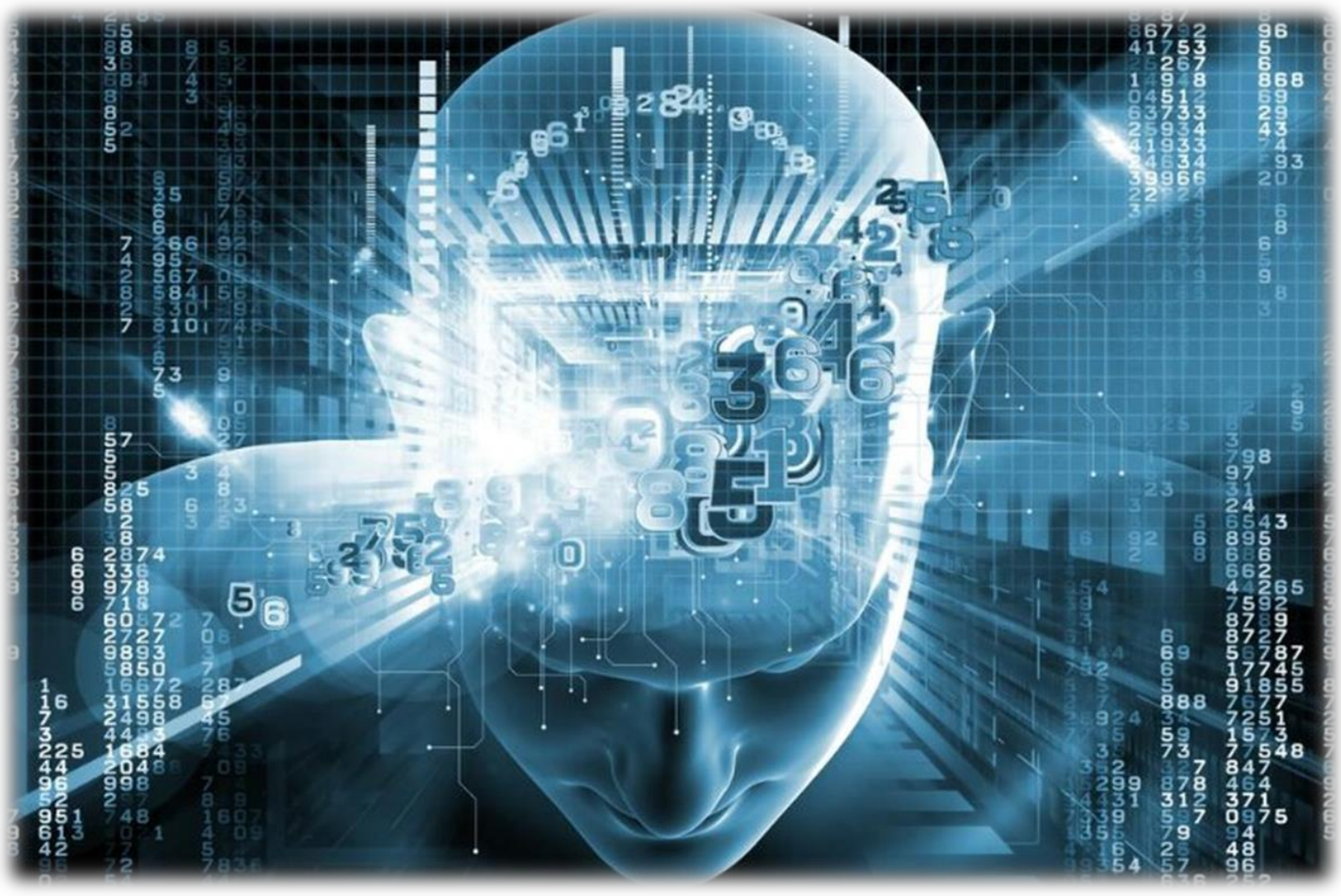
Source: *How Digital Technology Will Transform the World The Digital Transformation has arrived; Fujitsu Journal*

AI . IoT . Robotics

Artificial Intelligence (AI)

- Artificial Intelligence has an unimaginable potential

- The world of Big Data need Artificial Intelligence



The Need for AI in Healthcare

- "Too much information, too little time"
- Patients, health professionals and medical devices generate huge amounts of data.

The Need for AI in Healthcare

- Medical Data
  - Medical history (Electronic medical record)
  - Images (X-ray, MRI, CT, PET, EKG and etc)
  - Lab results
  - Pathology images and reports
  - Genome and family history
  - Other omics (Microbiome, Metabolome)

- Patient's health data
  - Health diaries
  - Quantified self device reports
  - Home diagnostics
  - Data from relatives, community care and other 3rd party services
  - Patient location internet sources

The Need for AI in Healthcare

- Guidelines & Research
  - Recommendation, guidelines and best practices
  - Current research
  - Ongoing clinical trials
  - New drug
  - Own experiences and patient similarity matching

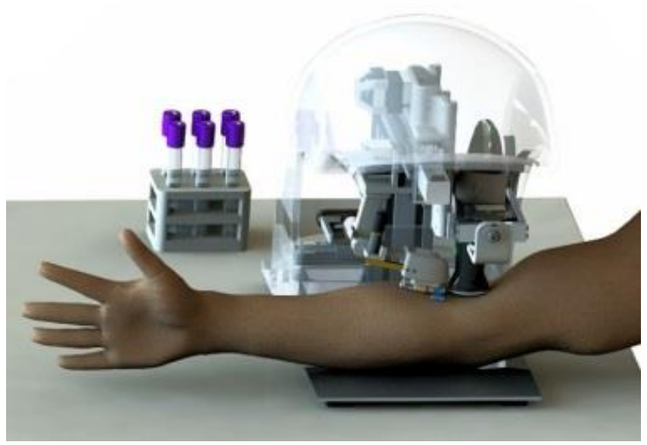
- Diagnose and plan
  - Diagnosis
  - Treatment Plan

How AI will Impact Healthcare

- Provide quick and accurate diagnoses (limitation of human intelligence alone)

- Clinical decision support
  - Reduce the mortality rates, and helping doctors to come up with faster treatments for serious illness.

- Limit errors made as a result of human fatigue



How AI will Impact Healthcare

- Increase productivity, improve transportation and enhance the quality of life for millions.

- Using an understanding of indi human genetics to create truly personalized treatment plans within the healthcare field.

- Improve cancer care
- Avoid wastage of resources

From Sep 2011 till Aug 2016

- A female patient suffering from leukemia had been baffling medical professionals from Japan after treatment and all previous treatment being prescribed for the condition was proving ineffective.
  - It was a mystery for doctors
  - IBM's Watson detected the rare leukemia in just 10 minutes

- August 8, 2016
  - http://www.ibtimes.co.uk/ibms-watson-cracks-medical-mystery-life-saving-diagnosis-patient-who-baffled-doctors-1574963

IBM's Watson cracks medical mystery with life-saving diagnosis for patient who baffled doctors

The super-computer powered by artificial intelligence prescribes leukemia treatment within minutes.

By James Billington

August 8, 2016 18:40 BST

2017 - 2018 : AI in Radiology

Stanford | News

MENU Search Stanford news...

NOVEMBER 15, 2017

Stanford algorithm can diagnose pneumonia better than radiologists

Stanford researchers have developed a deep learning algorithm that evaluates chest X-rays for signs of disease. In just over a month of development, their algorithm outperformed expert radiologists at diagnosing pneumonia.

BY TAYLOR KUBOTA

Stanford researchers have developed an algorithm that offers diagnoses based off chest X-ray images. It can diagnose up to 14 types of medical conditions and is able to diagnose pneumonia better than expert radiologists working alone. A paper about the algorithm, called CheXNet, was published Nov. 14 on

AI Is Continuing Its Assault on Radiologists

A new model can detect abnormalities in x-rays better than radiologists—in some parts of the body, anyway.

The results: Stanford researchers trained a convolutional neural network on a data set of 40,895 images from 14,982 studies. The paper documents how the algorithm detected abnormalities (like fractures, or bone degeneration) better than radiologists in finger and wrist radiographs. However, radiologists were still better at spotting issues in elbows, forearms, hands, upper arms, and shoulders.

The background: Radiologists keep getting put up against AI, and they usually don't fare even as well as this. Geoffrey Hinton, a prominent AI researcher, told the *New Yorker* that advances in AI mean that medical schools "should stop training radiologists now."

IMAGE CREDIT: HARLIE RAETHEL | UNSPLASH

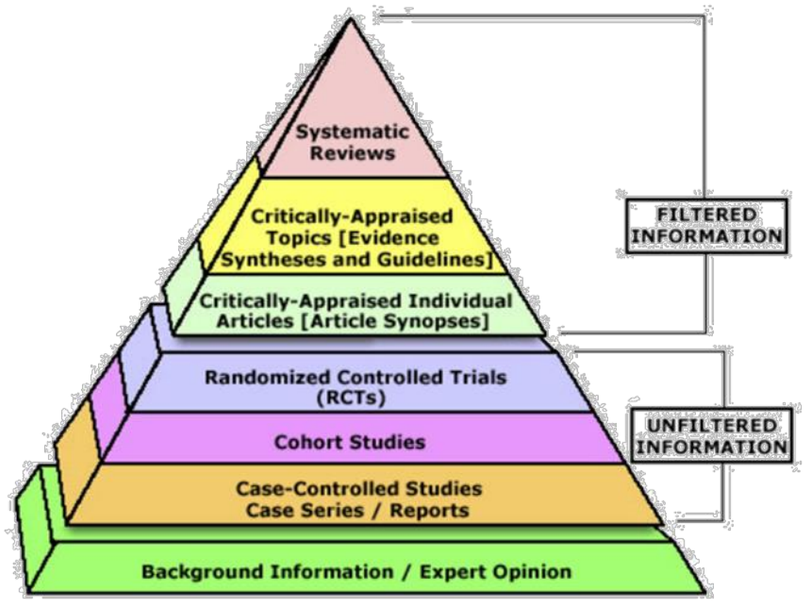
Posted by Jackie Snow
January 18th, 2018 1:57PM

www.MiniHI.net

How to evaluate AI for 'Adoption'

- Does it make medical decisions on its own?
  - FDA Approval

- Does it help improve patient care?
  - Evidence based Pyramid



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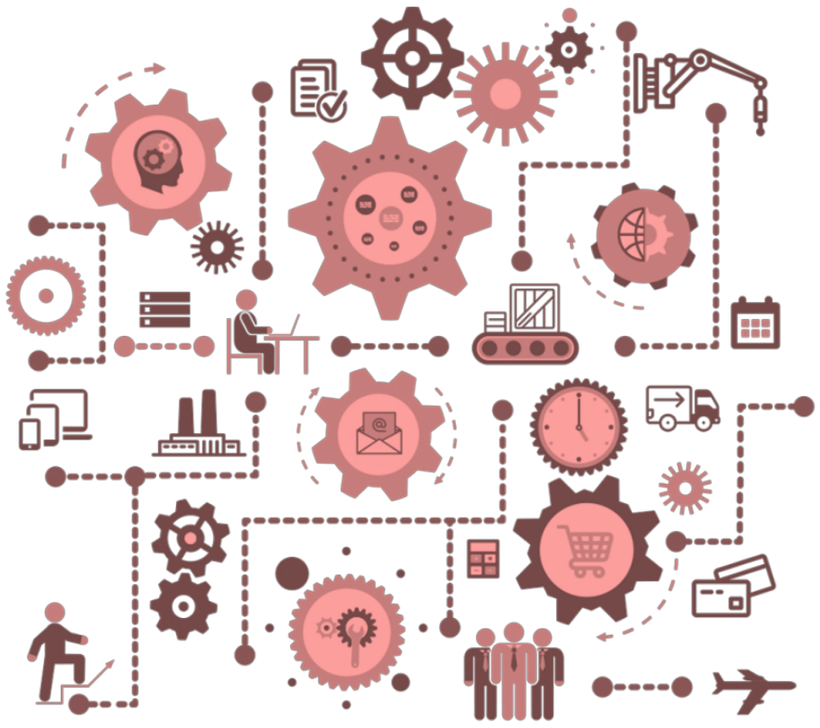
The Internet of Things (IoT)

- A system of interrelated computing devices, mechanical and digital machines, objects, animals or people.
- Ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.



The Internet of Things (IoT) in Healthcare

- Evolve patient care
  - Allow patients to receive care away from hospital, elsewhere around the world.
  - With wearable sensors and service solutions, doctors can reduce readmissions and enable proactive care.

- Monitor medical assets
  - Help staff spend less time searching and more time with patients by better tracking and managing supplies and medicine.

The Internet of Things (IoT) in Healthcare

- Maintain vital equipment
  - Ensure critical medical devices are ready to use when patient s need them most by fixing potential problems before it occur with predictive maintenance

- Track equipment usage.
  - Enhance the overall well-being of patients by tracking how equipment is used, from employing hospital bed sensors to monitoring room temperature and hand washing stations.

AI, IoT & Robotics

- AI as Augmented Intelligence
  - Automates the basic tasks in care giving through workflow.
  - Workflows can be triggered by alarms, other workflows or by the caregivers.
  - Accuvein – using AR technology to make vein puncture easier and less traumatic.
- AI as Automated Intelligence
  - Using wearable technology to improve patient outcome while is also reducing expenses.

- AI in Drug Development
  - Use deep learning technology (AI) and supercomputers to assess the potential efficiency of candidate drugs and predict with a high degree of accuracy, greatly reducing the time necessary for the development, testing and dissemination of new medicines.
- AI help as Cognitive Radiology Assistant
  - A tool with advanced multimodal analytics, superior reasoning capability and powered by a wide range of clinical knowledge offers precise clinical decision making in radiology and cardiology
  - Medical Sieve by IBM

Top Three Application

- Top three applications represent the greatest near-term value:-
  - Robot-assisted surgery ($40 billion)
  - Virtual nursing assistants ($20 billion)
  - Administrative workflow assistance ($ 18 billion)

- **Robot-Assisted Surgery**
  - Cognitive robotics can integrate information from pre-op medical record with real time operating metrics to physician guide and enhance the physician's instrument precision.
  - The technology incorporates data from actual surgical experiences to inform new, improved techniques and insights.

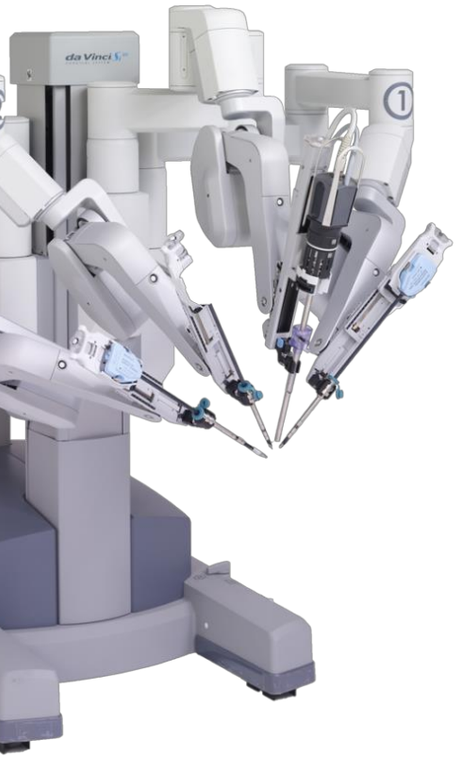
Top Three Application

- **Virtual Nursing Assistants**
  - When AI solutions remotely assess a patient's symptoms and deliver alerts to clinicians only when patient care is needed, it reduces unnecessary hospital visits.
  - Save 20% of registered nurse time through avoided unnecessary visits.

- **Patient Expectations**
  - Voice-to-text transcription helps to eliminate non-patient care activities including writing chart notes, prescriptions and ordering tests.
  - Work time saving 17% for doctors and 51% for registered nurses based on Accenture analysis.

Application of Robotics in Healthcare

- Surgery – reach to difficult areas
- Procedures – with high degree of precision
- Treatment (Pre & Post)
- Robotic Assistance for a better life
- Simulation & Guiding
- Disinfectant Robots in Healthcare
- Transportation Robots

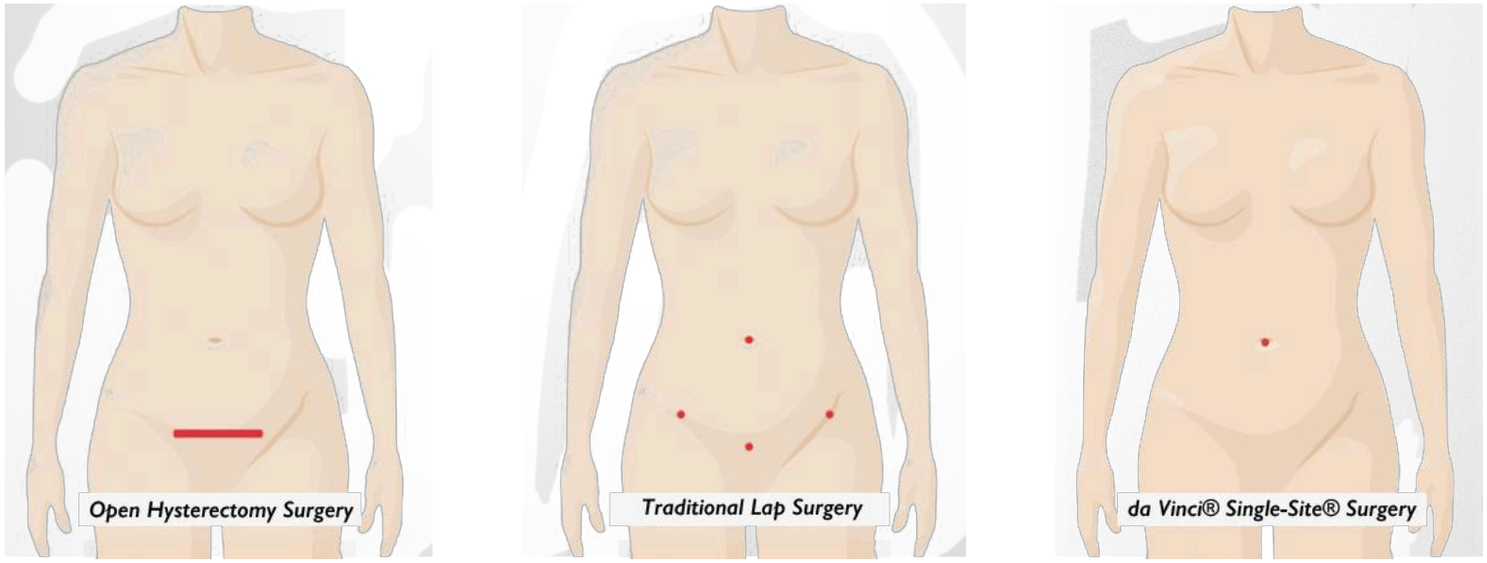


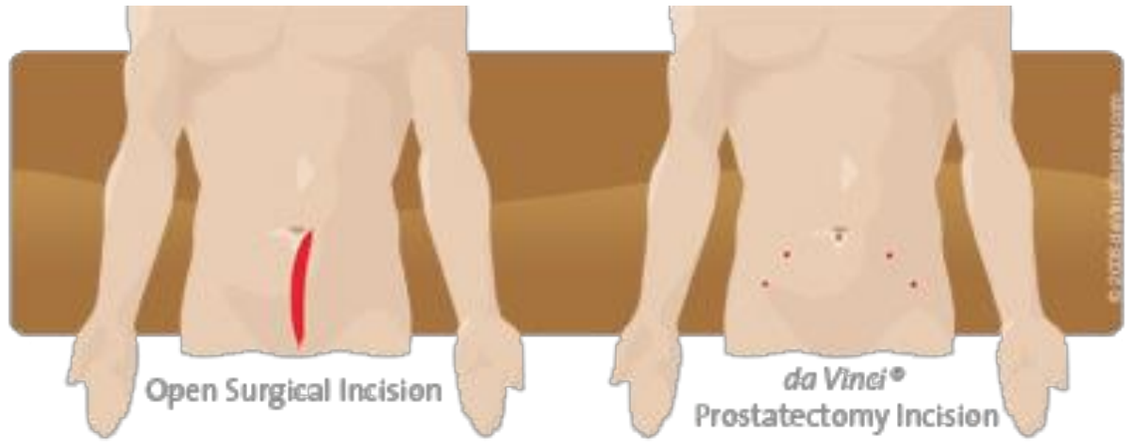
ManipalHospitals
LIFE'S ON

Robotics Today: Only an aid for delivering quality “care”

Robot is not a machine in the Operating Theatre – it is an information system with arms

- Accuracy
- Smaller Scars
- Less Blood Loss
- Less Pain
- Faster Recovery
- Reach to difficult areas
- Shorter Hospital Stay





How is Manipal moving with the Robotics Wave?

Manipal is one of pioneer in getting Robotic Surgery in 2010 at Manipal Hospitals Bangalore, India

No of surgeries	2015	2016	2017
Robotic Surgery	130	150	200

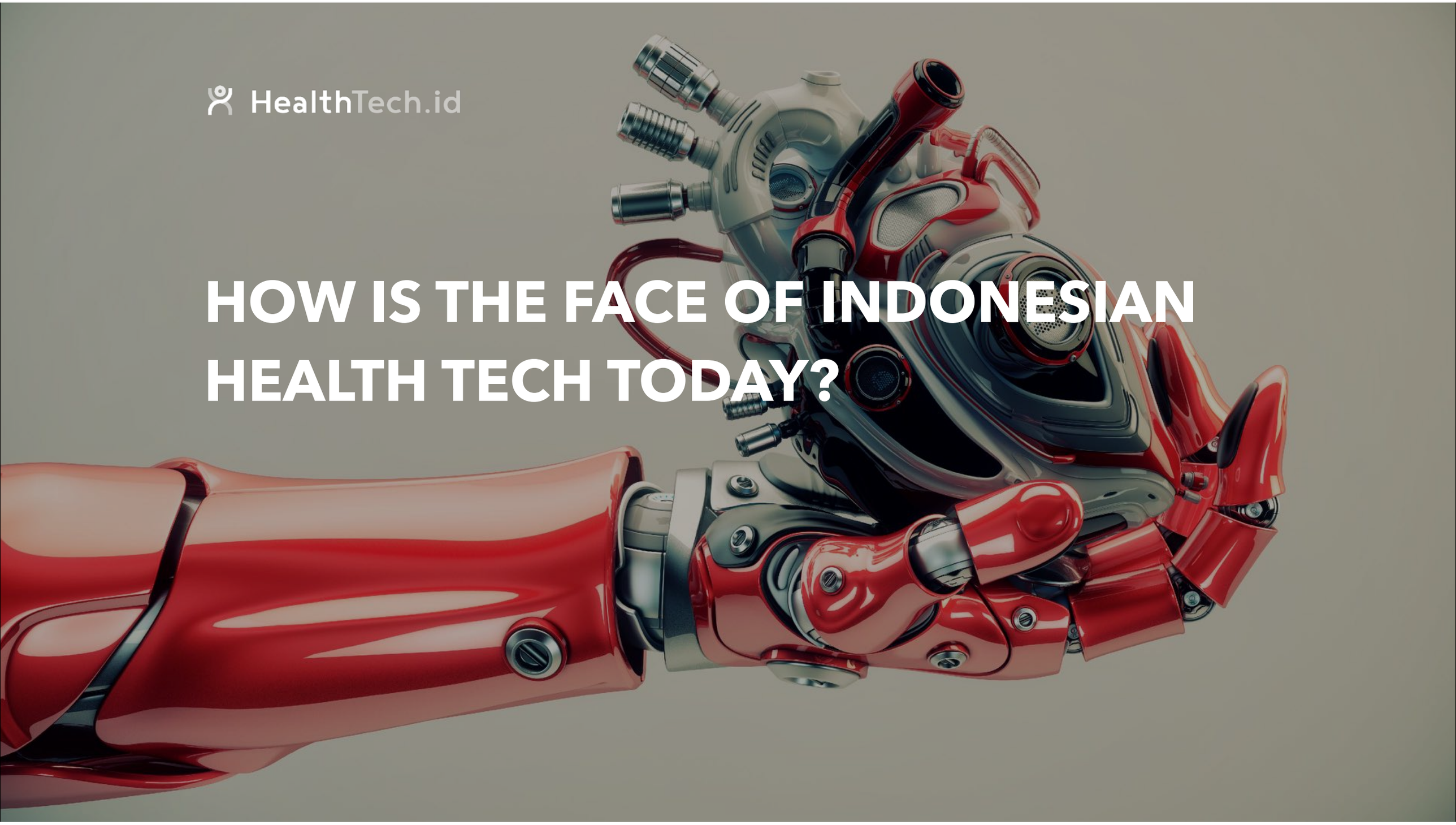
Total we have done 800+ Robotic surgeries in Manipal Hospitals since 2010.Mainly used in Oncology, Urology, OBG, Ocular Surgeries etc.

Now we have upgraded our robotic system to the Da Vinci X model.(A hybrid version this year)

Also we are investing in Robots for Transportation and Disinfectant Robots in our new hospital in Delhi this year.

HealthTech.id

HOW IS THE FACE OF INDONESIAN HEALTH TECH TODAY?



KEY POINTS :

➡potential in working with health tech start-up across Asia

➡use of integrated app in delivering on-demand healthcare

➡outreach underserved markets using mobile, chat and A.I.

➡improving PX (patient experience) with machine learning

ATOMA

PROSEHAT

Health App

GET IT ON Google Play

Download on the App Store

A mobile marketplace app
to help modern family
easily get trusted home services
from healthcare professional and
original health product

app
Installed 75K
MAU 5-7%

website
Monthly 30K
20% Recurring

Traction in Indonesia 2017

order
Growth 10X vs 2016

network
5K Doctor
in Medical Community

community
1M Health Aware
reached monthly

Represent Indonesia in Swiss 2016 seedstarsworld*

Media coverage KOMPAS.com JERNIH MELIHAT DUNIA · MI MEDIA INDONESIA mediaindonesia.com · Marketeers · Tribunnews.com · HEALTH

PROSEHAT

Health App

GET IT ON Google Play

Download on the App Store

ON-DEMAND HEALTHCARE

Now the doctor, nurse, lab, and more health services is coming to your home

HOME HEALTHCARE WITH PROFESSIONAL DOCTOR

All products are provided by official distribution from our clinic partner. Prepared by healthcare professional

Vaccinator / Doctor App

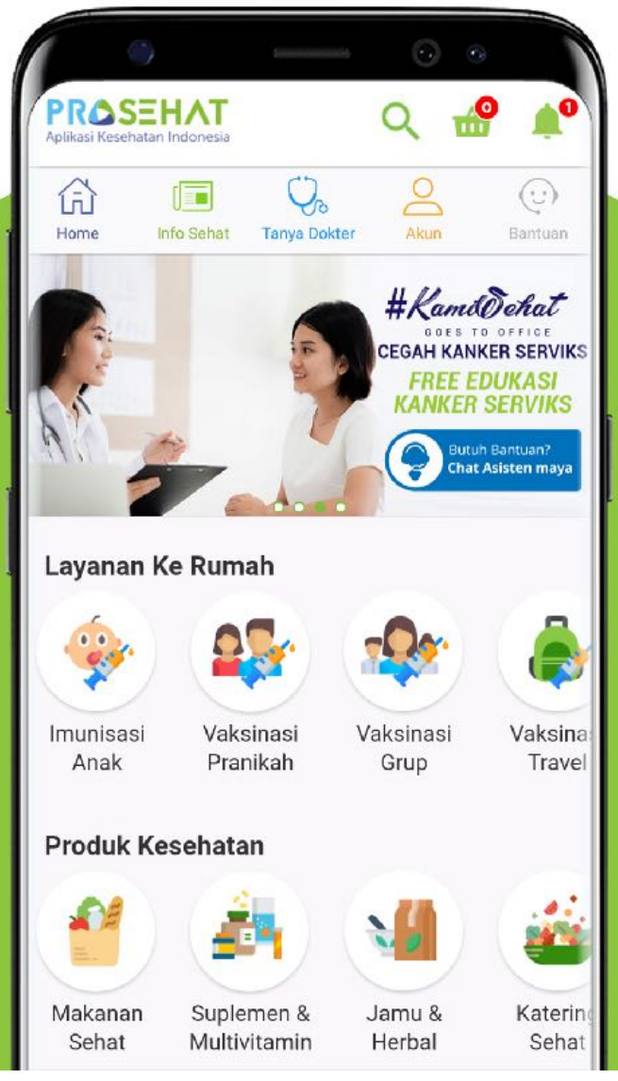
- Scheduling
- Checklist
- Maps and direction
- *Coming soon direct chat*
- Assistance

CERTIFIED AND PROFESSIONAL DOCTOR

- ✓ All doctors are certified, have their license and practice permit (STR & SIP)
- ✓ Special Vaccinator training
- ✓ App & Communication training
- ✓ Compliance to ethics and ProSehat code of conduct

Tampilan Mudah & Menarik

Tampilan Aplikasi ProSehat Yang
Lebih Mudah & Menarik



#VaccinEasy

Kini Vaksinasi Lebih Mudah
Dengan Install App Panggil Dokter

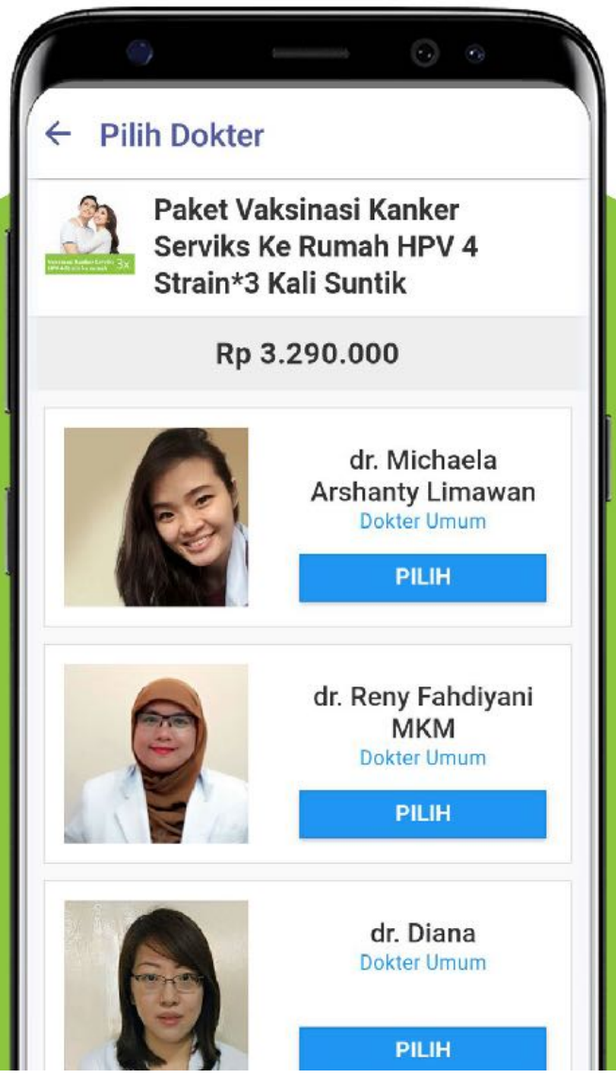
Tersedia untuk area Jakarta, Bekasi, Depok, Tangerang, Serpong

Produk Vaksinasi Sesuai Kebutuhan

Pilih Layanan Vaksinasi Ke Rumah
Yang Sahabat Butuhkan

Tentukan Dokter Pilihan

Pilih Langsung Dokter
Untuk Vaksinasi Ke Rumah



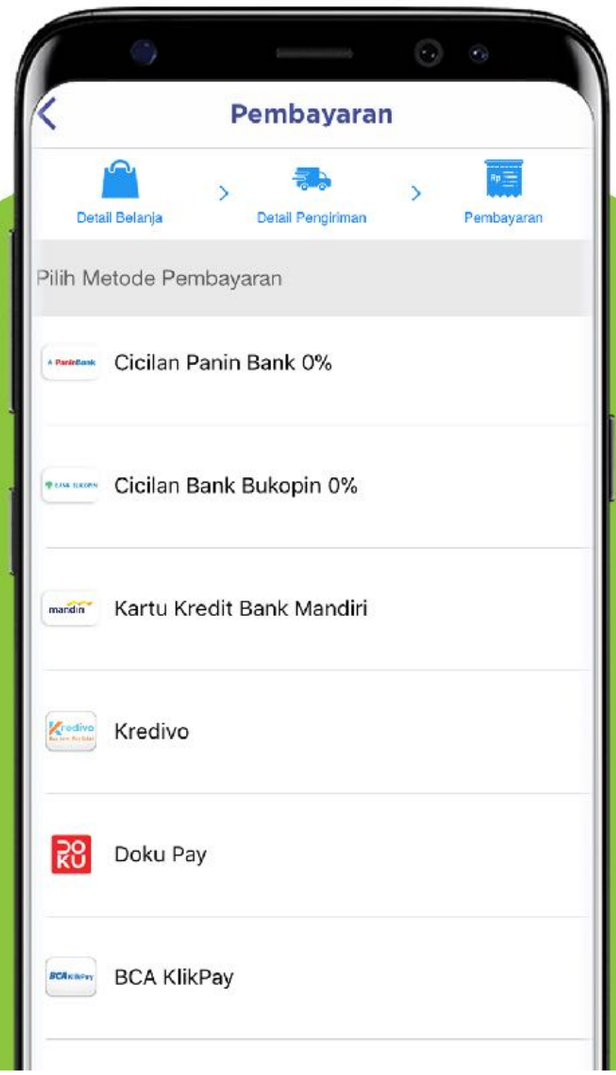
Jadwal Vaksinasi Fleksibel

Pilih Sendiri Jadwal
Vaksinasi Ke Rumah

Tersedia untuk area Jakarta, Bekasi, Depok, Tangerang, Serpong

Kemudahan Pembayaran

Online Dengan Transfer,
Kartu Kredit, Cicilan 0%, Sampai
Cicilan Tanpa Kartu

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HealthTech.id

INDONESIA UNDERSERVED HEALTH MARKET

1:2500 doctor to population ratio. Hard to get quality service

Health understanding is still low. Misleading in self-treatment

Healthcare availability & geo-problem with infrastructure

Reliable Content

Readable & credible health article information

Easy Access

To health education, consultation, daily tips & health care network

1.2 M	Total community
600K	Mobile subscriber
25K	Health content
300	Medical contributors

tanyadok.com

TanyaDok is a community based consumer health education portal with expert Q&A session. We partner with telco company to outreach underserved market in urban and remote area.

tanyadok.com Community mHealth

NEW MODEL FOR COMMUNITY AND CONTENT CHANNEL

Now, easier to see doctor on mobile

Providing access to doctor in real time chat, specific topic group chat and also video call on later stage

Not only 1-on-1 with doctor, this is a community

**Doctor can set their own price for chat, community and call*

Better, richer content

First information on illness comes from their family/ relatives, radio/television, and any untrusted broadcast.

Now with community channel we share better and richer content **to keep user engaged in mobile**

tanyadok.com

Nurse-bot to help you with all health needs. From finding health knowledge to symptoms checking

Assisted Intelligence help you with smarter choice

Location based healthcare for clinic, hospital, etc.

Integrating with BPJS Kesehatan to provide easier access and also specific homecare services

tanyadok.com

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ATOMA

Aplikasi Kesehatan Terlengkap

Cari Produk mulai dari obat bebas, obat resep, suplemen, alat kesehatan sampai kebutuhan bayi.

PROSEHAT
Aplikasi Kesehatan Indonesia

Google play | App Store

Cari Produk

Cari produk sesuai merk atau keluhan kesehatan Anda.

Promo Sehat

Temukan pula promo harga menarik setiap bulannya.

Langganan Produk

Dapatkan fitur berlangganan untuk obat rutin dan suplemen andalan Anda.

Tebus Resep Dokter

Foto resep Anda menggunakan aplikasi ProSehat

CS & Apoteker kami akan melakukan validasi resep dan cek ketersediaan produk

Produk diantar dengan ekspedisi atau kurir. Khusus area Jakarta untuk pembayaran COD.

Produk kesehatan asli disediakan oleh mitra dan Apotek berijin resmi.

PROSEHAT
Aplikasi Kesehatan Indonesia

Google play

App Store

Pesan Produk Kesehatan

Pastikan seluruh produk masuk di keranjang dan lengkapi data yang diperlukan.

CS Apoteker kami akan memverifikasi harga & ketersediaan produk

Produk kesehatan asli disediakan oleh mitra dan Apotek berijin resmi.

Produk diantar dengan ekspedisi atau kurir. Khusus area Jakarta untuk pembayaran COD.

PROSEHAT
Aplikasi Kesehatan Indonesia

Google play

App Store

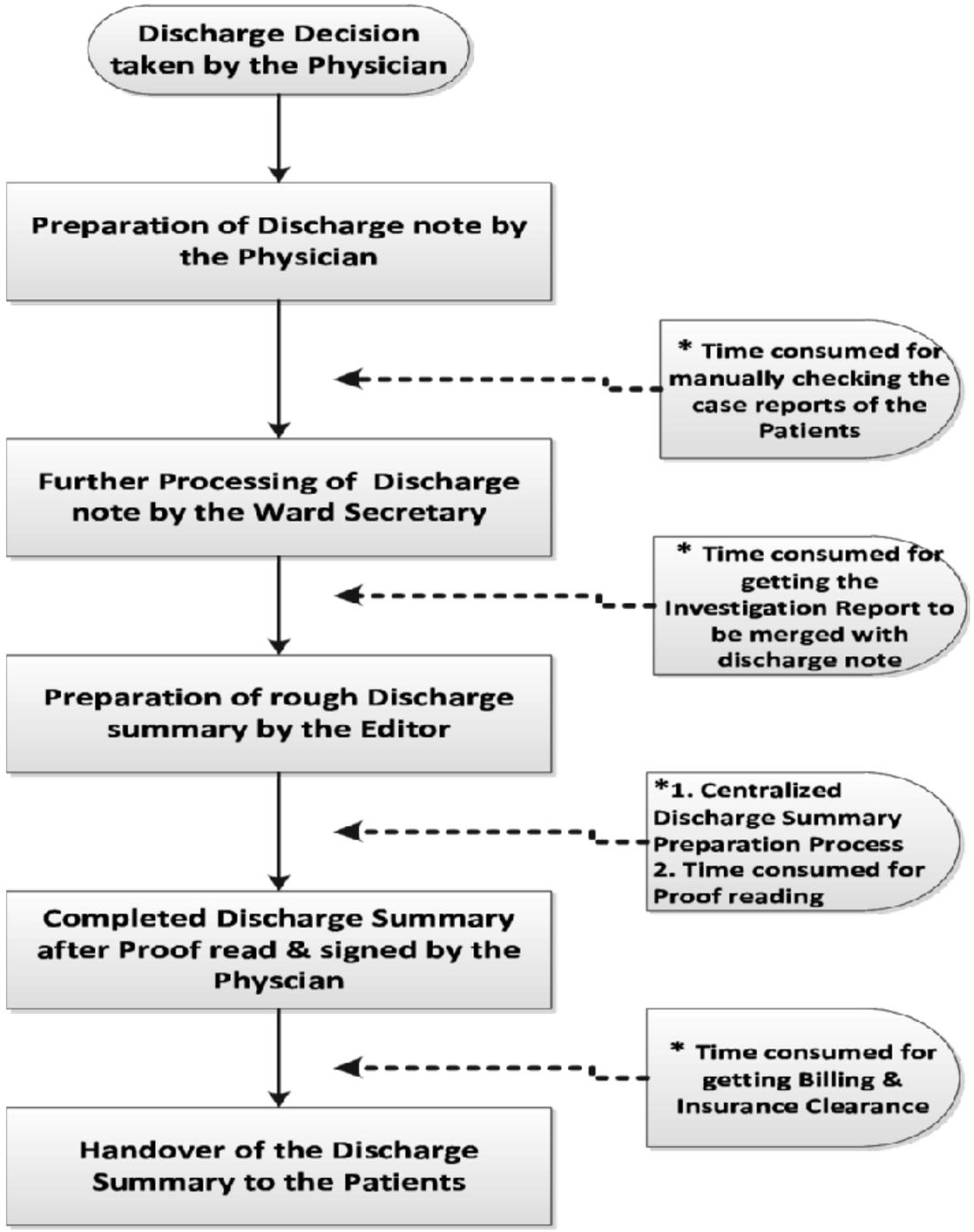
PROSEHAT

Health App

GET IT ON Google Play

Download on the App Store

COMMON DISCHARGE FLOW



Nothing include patients / family… we are just another diseases need to get rip off

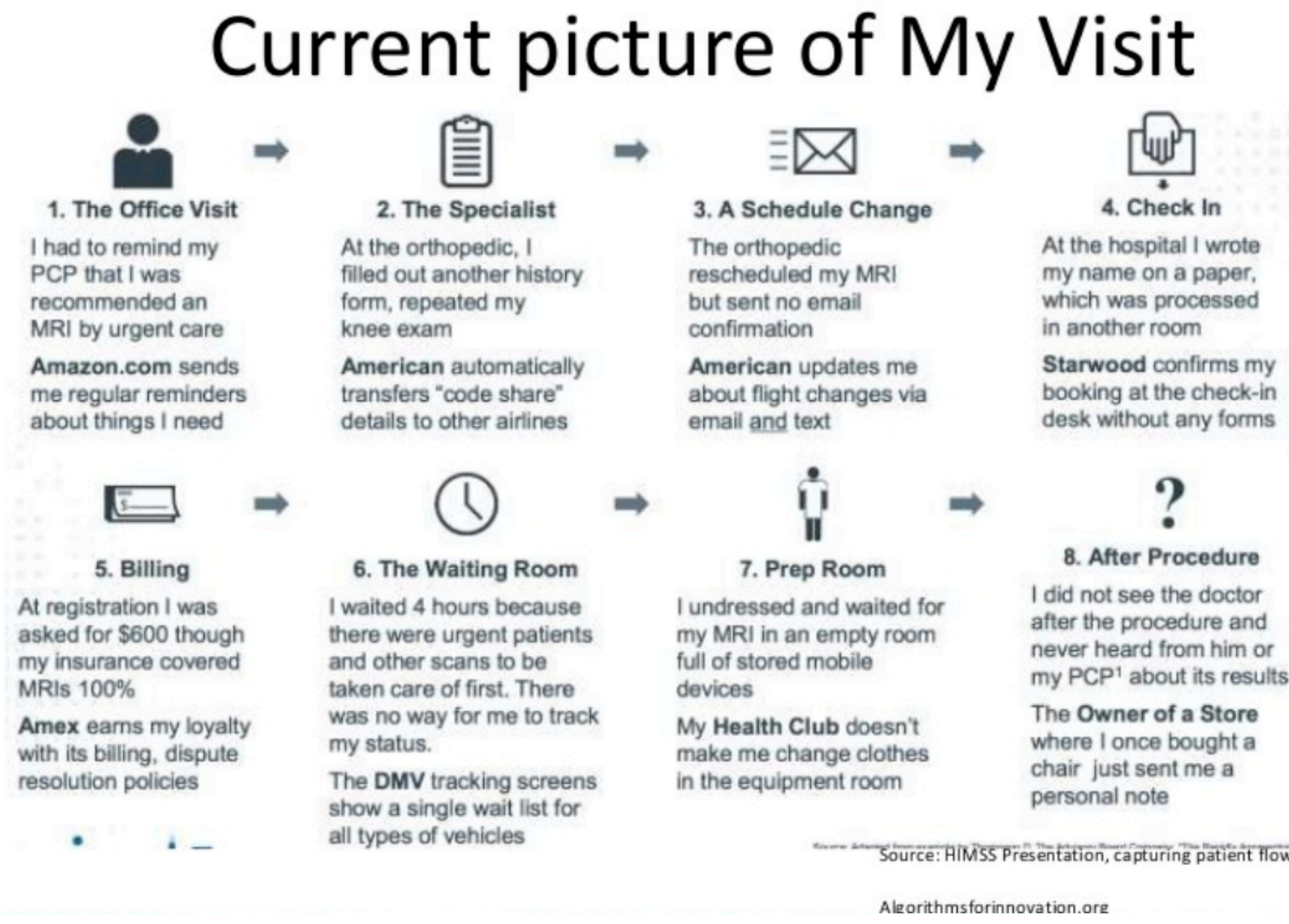
PROSEHAT

Health App

GET IT ON Google Play

Download on the App Store

ALSO OUTPATIENT IS NOT YET PATIENT CENTERED..

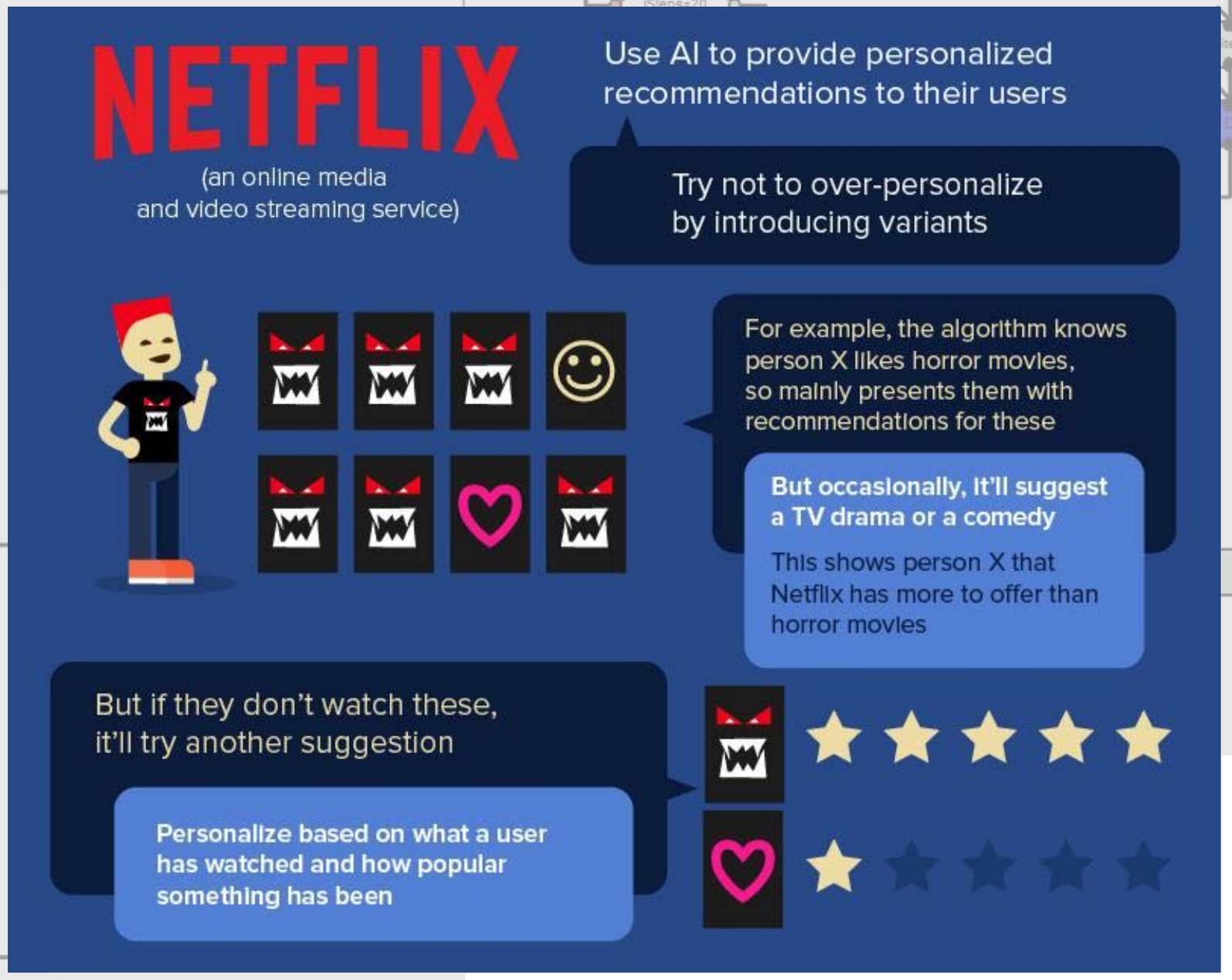


Source: HIMSS Presentation, capturing patient flow

Algorithmsforinnovation.org

PROSEHAT
Health App
GET IT ON Google Play
Download on the App Store

HOW IF WE ARE USING MACHINE LEARNING TO IMPROVE PX (PATIENT EXPERIENCE)



The Emergency Pathway Horned Gaussian - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/Flow-chart-of-the-patient-pathway-for-a-Bernoulli-process-with-optional-lead-time_fig1_259465512

GP2U

Australian Case Study

Patient Home Page

Mr Test Patient

1 Upcoming Appointments

2 Waiting Prescriptions

TUESDAY

27

JANUARY

General Practitioner

BOOK APPOINTMENT

My Appointments

My Prescriptions

Secure Login

Username

Password

Remember Me

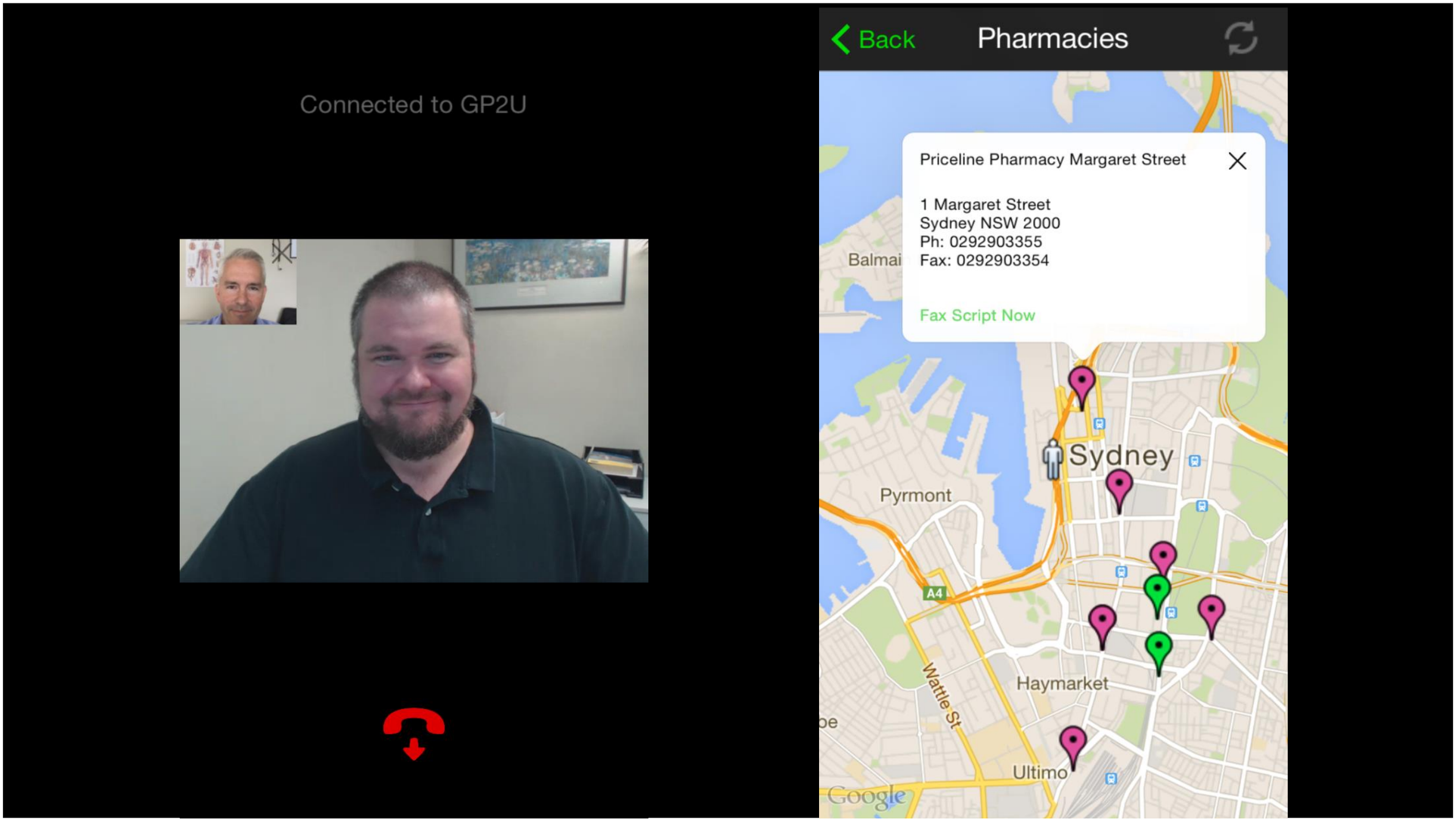
Sign In

Recover username or password

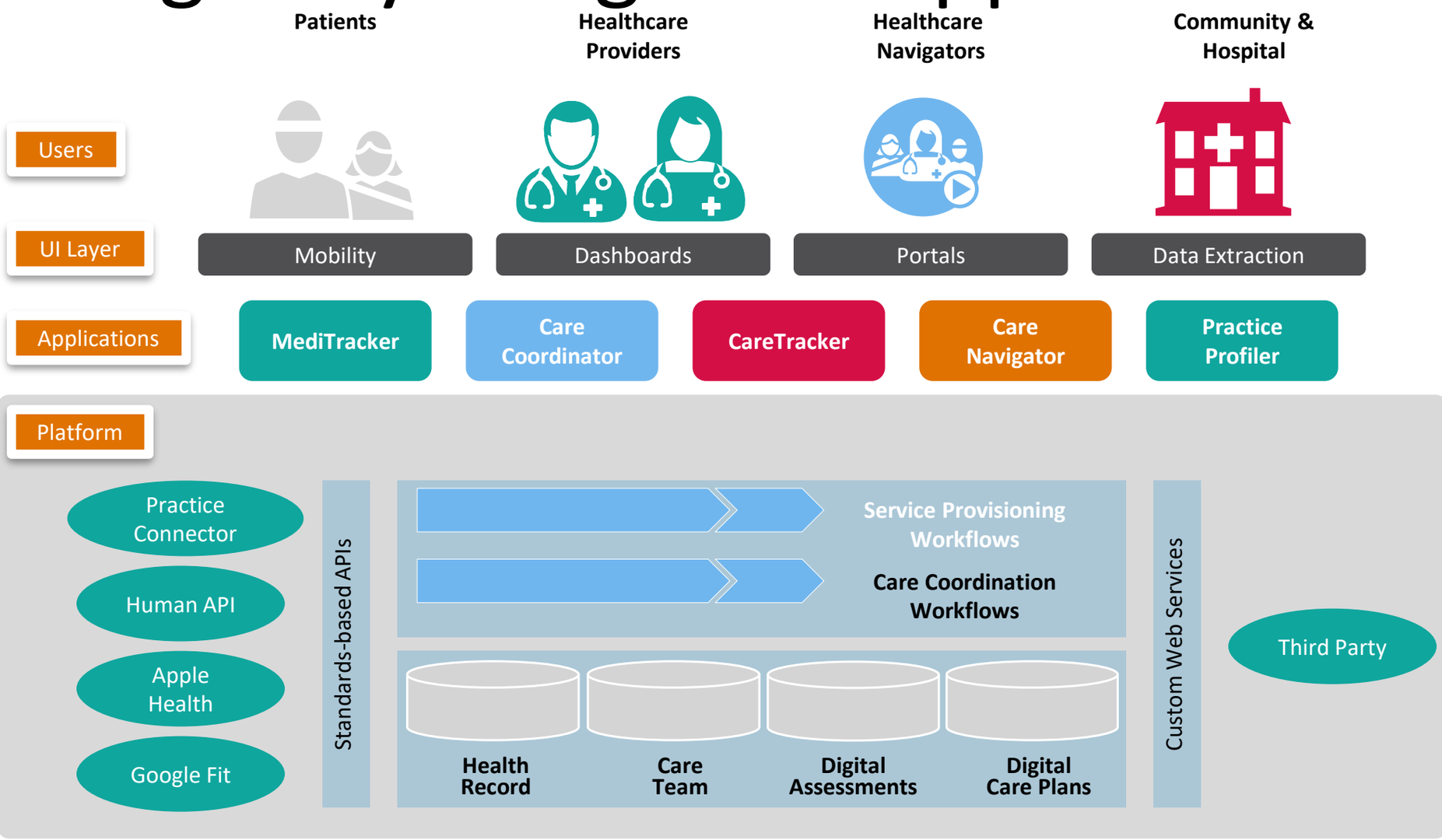
Sign in using:

Not Registered?

Register For Free Now


Connected to GP2U
Back
Pharmacies
Priceline Pharmacy Margaret Street
1 Margaret Street
Sydney NSW 2000
Ph: 0292903355
Fax: 0292903354
Fax Script Now
Balmai
Sydney
Pyrmont
A4
Wattle St
Haymarket
Ultimo
Google

Comprehensive Platform Architecture Supporting Fully Integrated Application Services



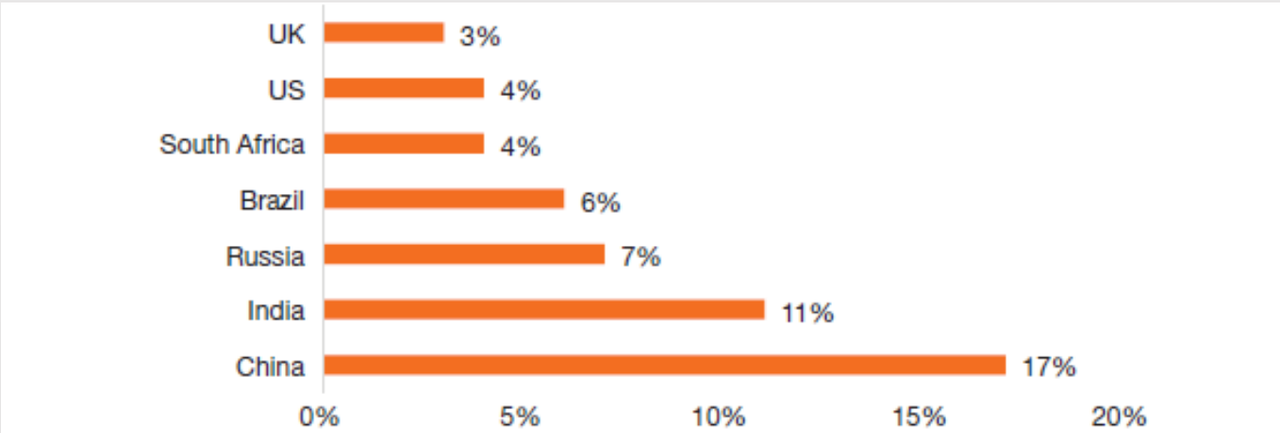
DIGITAL HEALTH as a preventive tool

- Manisha Kumar

10th May 2018

Statistics : Healthcare Trends

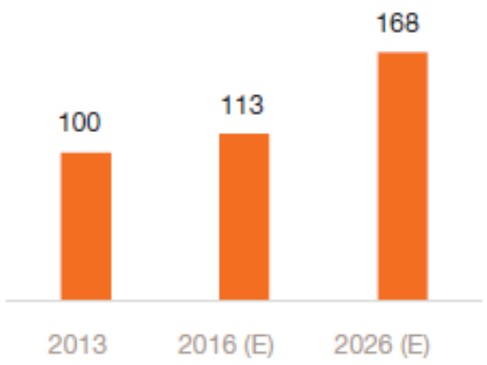
Healthcare CAGR : World Countries



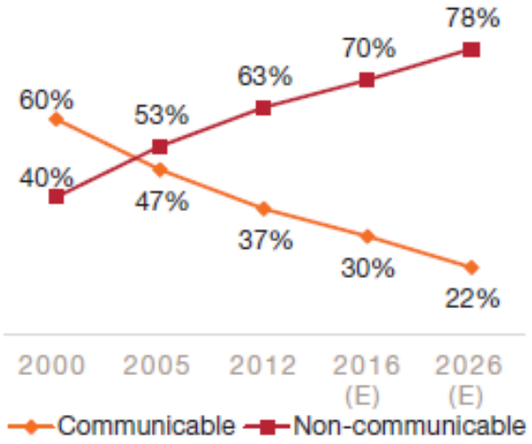
Source: World Bank data

Health Profile : Ageing Population, Shift in disease burden

Growing Geriatric Population



Source: NCBI, IBEF



Source: PwC analysis

Non Communicable disease burden on the rise : Lifestyle and Chronic diseases

Need of the Hour

38,000,000 people die of NCD every year globally

5,889,600 people die of NCD every year in India : 1 out of 6 globally

! WHY !

Lack of Awareness And Time	**No Holistic Data Or Analytics**	**Lack of Alerts and Recommendations**

WAY FORWARD

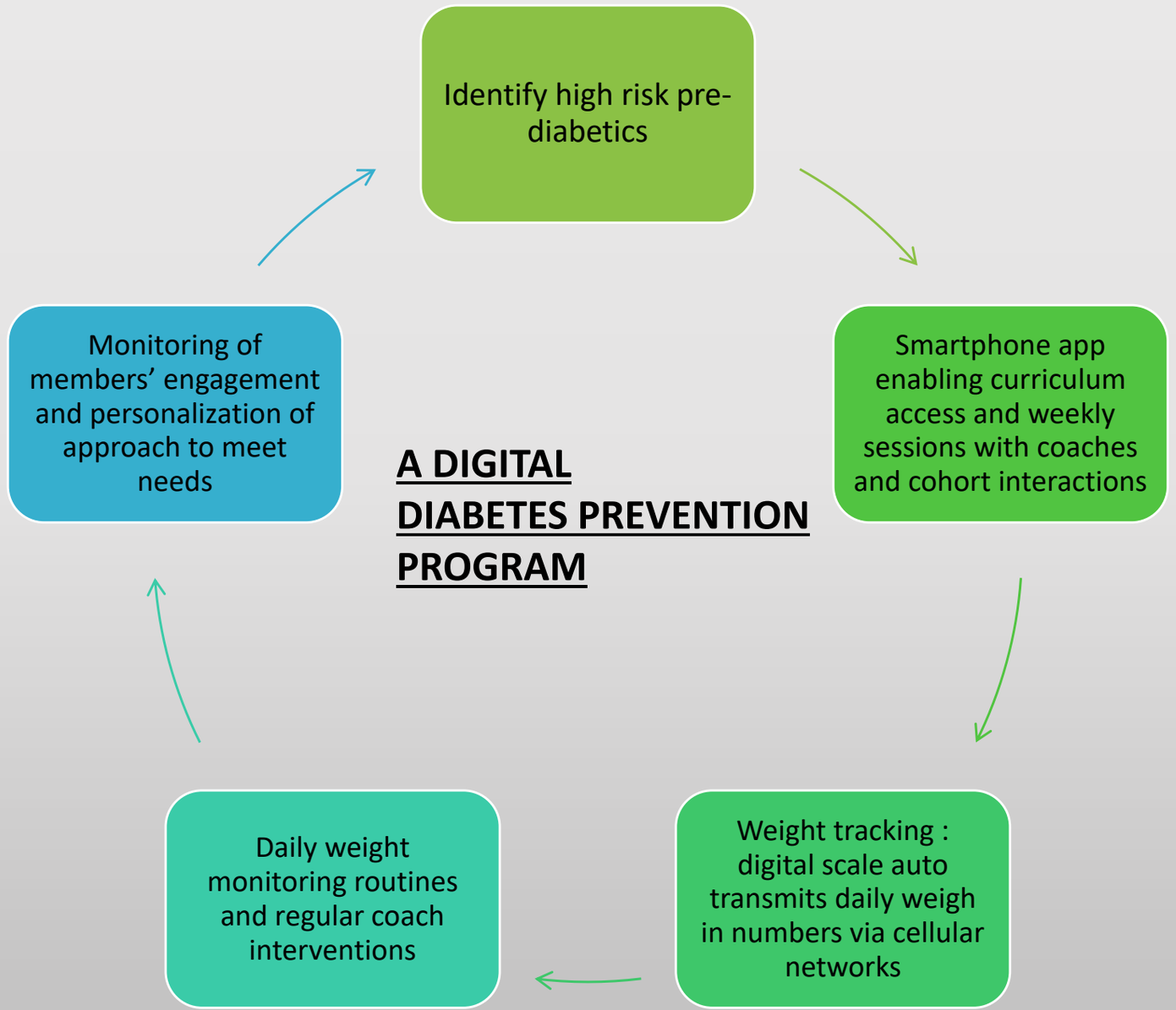
Detect and Monitor → **Predict and Prevent**

Digital Health Ecosystem

What it means to Healthcare :

- Improved Access
- Quality of Care
- Better information
- Preventive tool
- Better patient outcomes
- Reduced cost to patients, payers
- Increased patient engagement

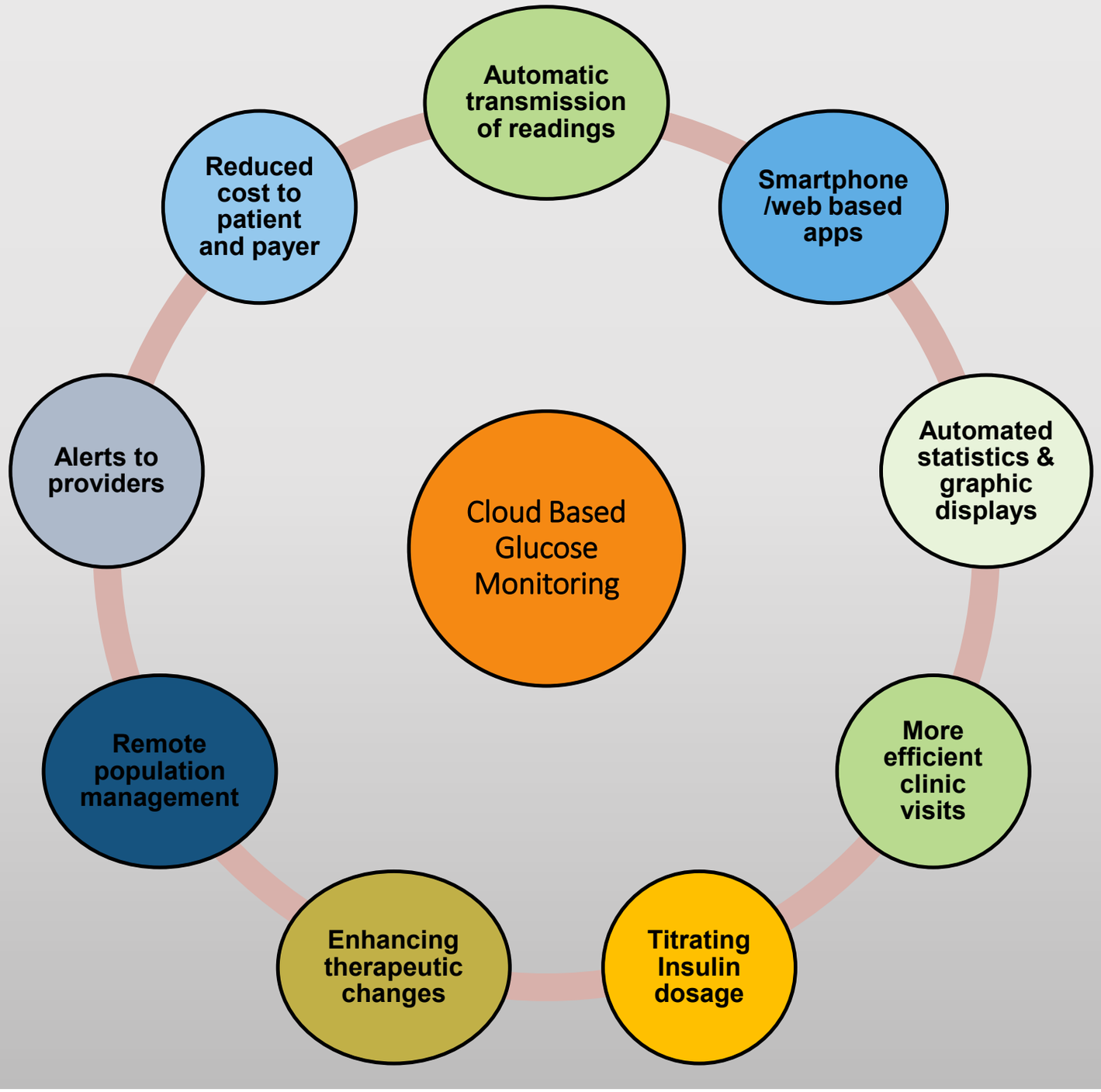
Digital Health for Prevention of DIABETES



KEY HIGHLIGHTS :

- Digitally delivered clinical interventions
- Interactive journey via social groups that is integrated in participant's everyday life
- Social networks offer real time feedback, support and accountability
- Real time data collection and transmission
- Value based system : App gets paid basis outcomes (ex: number of weigh ins done and weight loss achieved)

Digital Health for Management of DIABETES



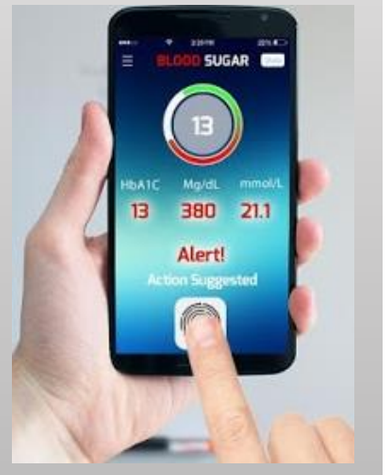
KEY HIGHLIGHTS :

- Improved clinical outcomes
- Reduced patient and payer costs
- Big data to make decision support algorithms
- Improves patient to provider ratios
- Reduces provider's burden

Technology for Diabetes Prevention

Diabetes

Associated symptoms	Relevant clinical manifestations	Emerging technologies	Traditional tools
Low blood sugar	Glucose levels in sweat	Wearable sweat sensors by Eccrine Systems*	
	Glucose Levels in beneath-the-skin fluids	Smart patches by Abbott	Finger prick test
	Glucose levels intears	Smart lenses by Novartis and Google*	
Obesity	Weight, BMI and fat mass	Smart scale with app by Nokia Health (Withings)	Analog and digital weighing scale
Neuropathy	Insufficient pressure of blood in an area	Smart Socks by Researchers at he Fraunhofer tInstitute in Germany*	Electromyography (EMG) and nerve conduction velocity (NCV) testing.
Hypertension	Blood pressure	World's smallest and lightest blood pressure monitor H2 by Htwo Care	Traditional BP monitor

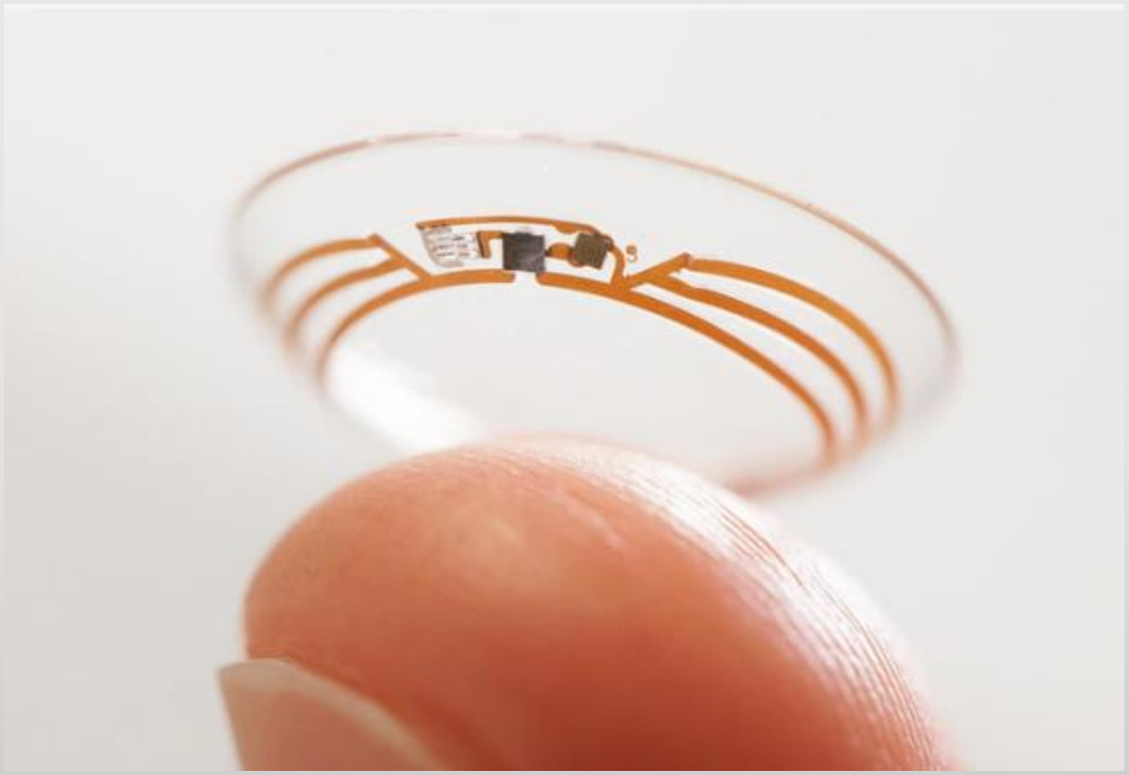


Wearable Sweat Sensors

Key Highlights :

- Continuously measure level of chemicals in the sweat
- Bluetooth transmitter in the bracelet transmits data to smartphone
- Measures sodium, glucose, potassium, lactate
- Measures stress levels
- Help in finalizing drug dosing
- Prevent dehydration in runners

Smart Contact Lenses



Key Highlights :

- Continuously measure level of sugar using tear fluid of eye
- Continuous data transmitted to smartphone
- No battery needed (static charge)

Smart Weighing Scale

Key Highlights :

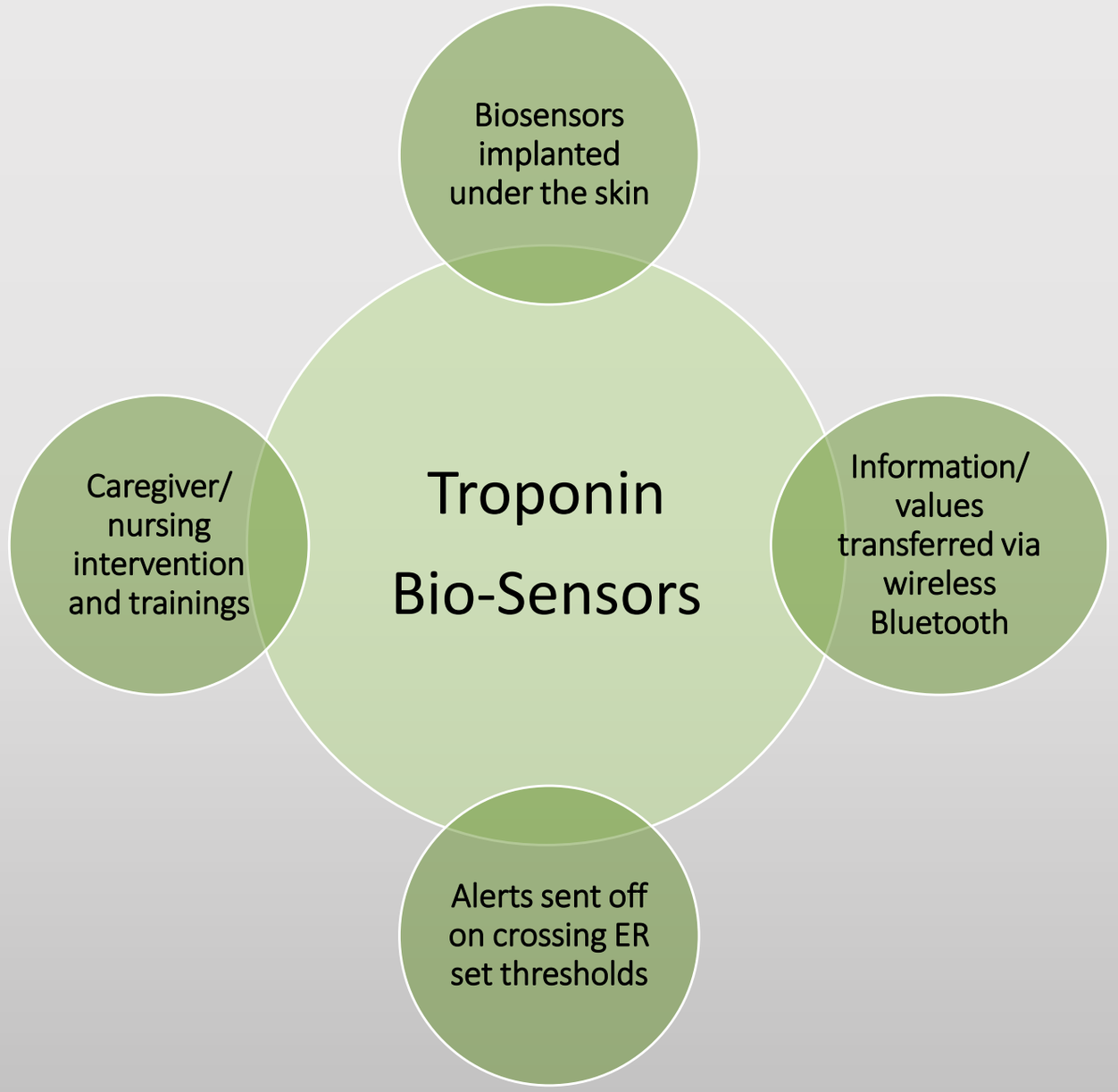
- Transmits Weight and BMI to smartphone app of choice via Wi-Fi/Bluetooth
- Helps to correlate work out and diet plan outcomes
- Measures heart rate and pulse
- Nokia app presents dashboard and analytical data on weight movement with sleep, exercise schedule

Smallest wearable BP monitor

Key Highlights :

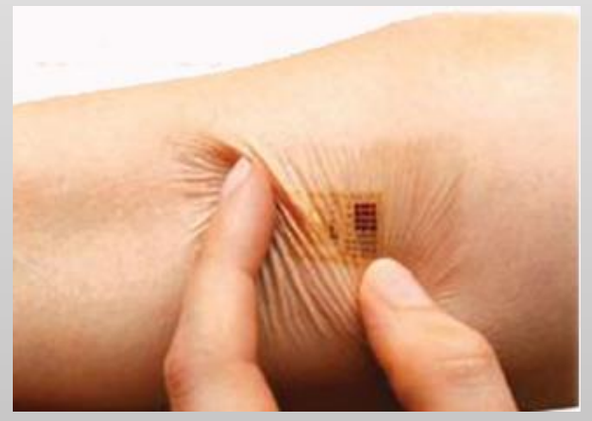
- Lightest wearable BP monitor
- Helps in drug dosing and management
- Syncs with smartphone and maintains dashboard in the app
- Helps prevent Hypertension, CVD and high risk diseases

Big Data Analytics in Prevention of CVD



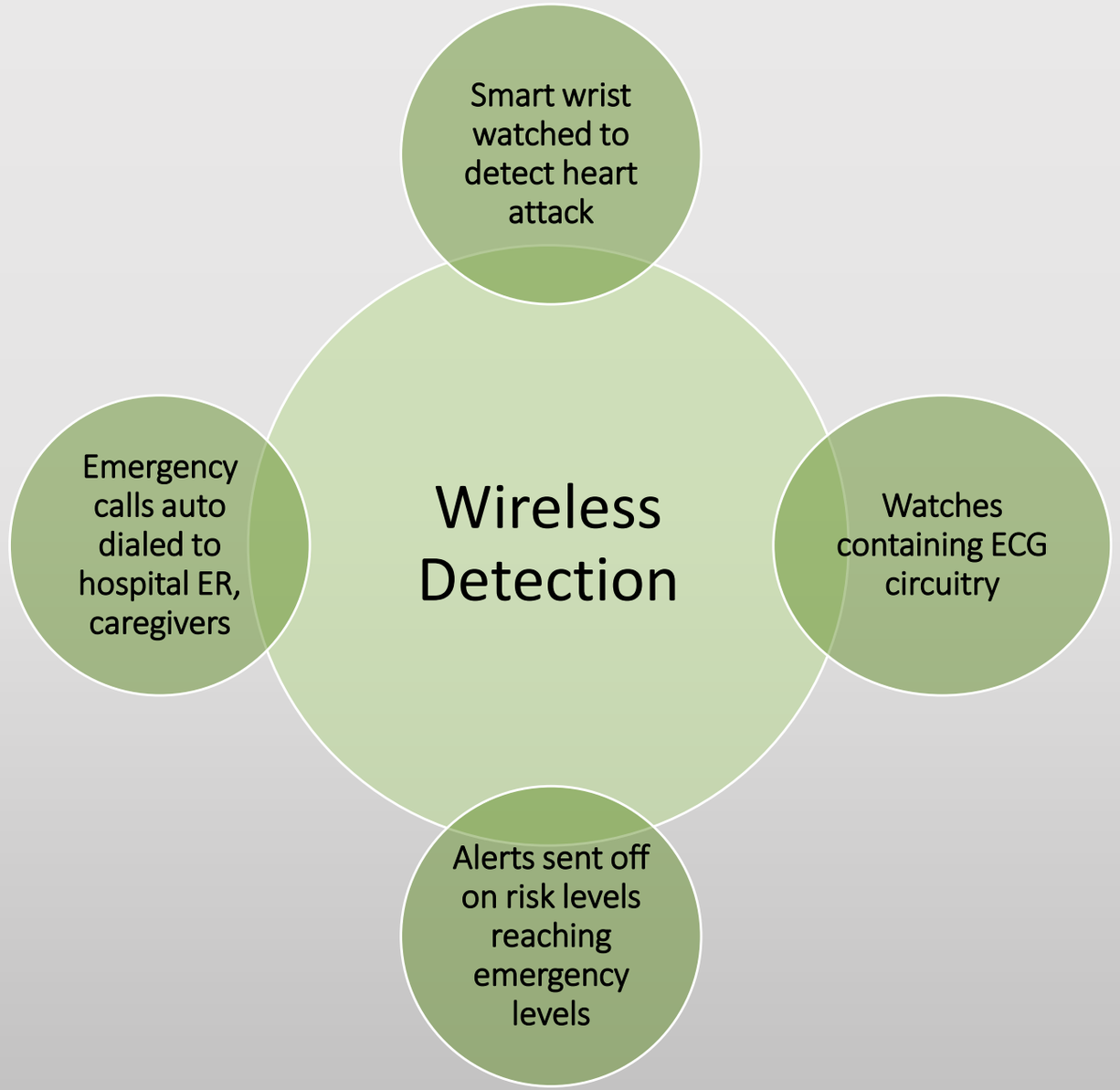
Studies to prove hypothesis :

- Study done on 409 patients
- 1 hr protocol for cardiac troponin assay to triage patients
- Studies show a diagnosis of AMI within 3 hours of the episode
- High speed of triage and prevention of MI



Source: Department Of Nursing : University of Phoenix
Source: Department of Engineering Technology : MIT, USA

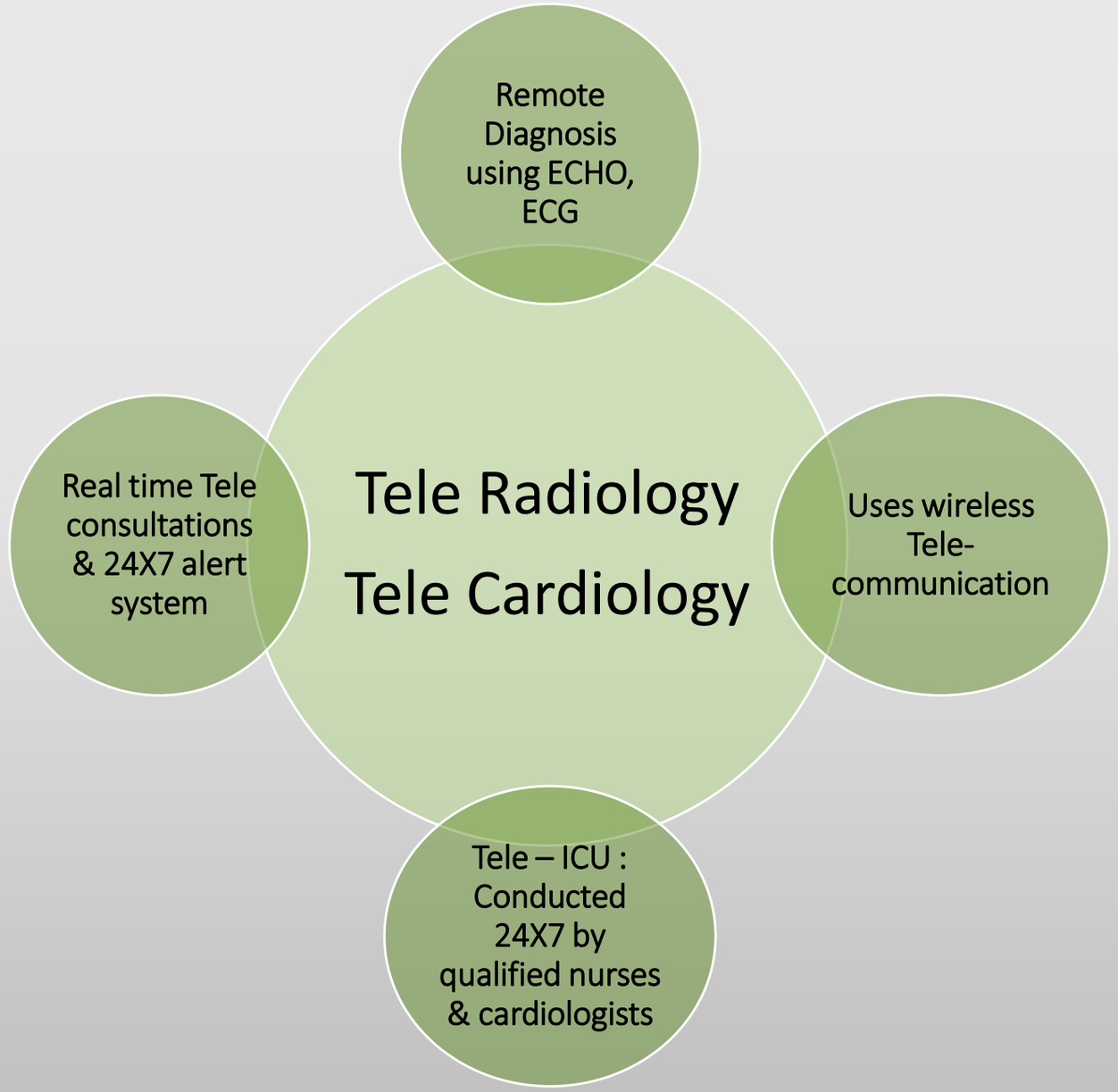
Big Data Analytics in Prevention of CVD



Key Features :

- Medical sensors constantly monitor pulse and heart activity
- In case of emergency send alerts to next of kin and 911
- Sleek and comfortable to wear

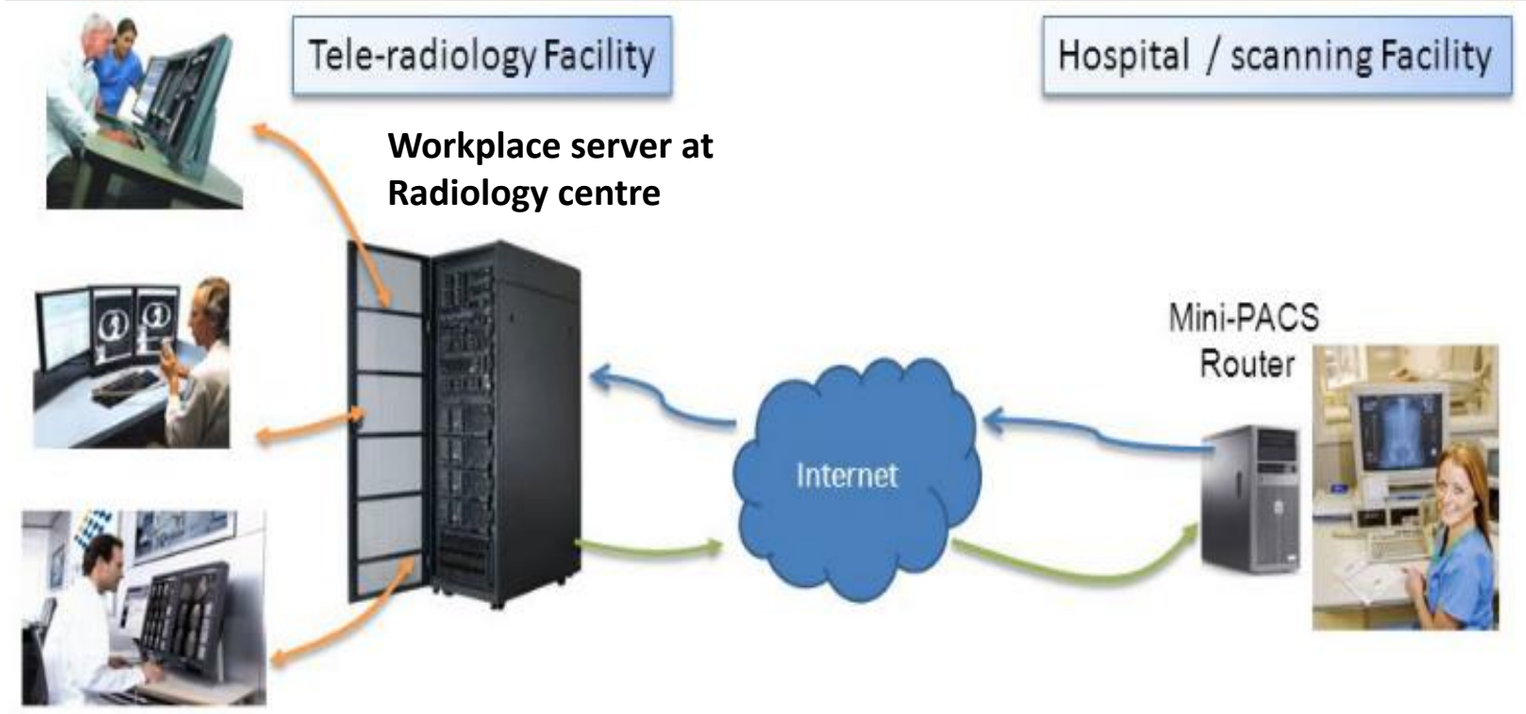
Tele Diagnosis and consultations



Tele Radiology in Hospitals

(Hub & Spoke)

Tele Radiology in Hospital



Advantages :

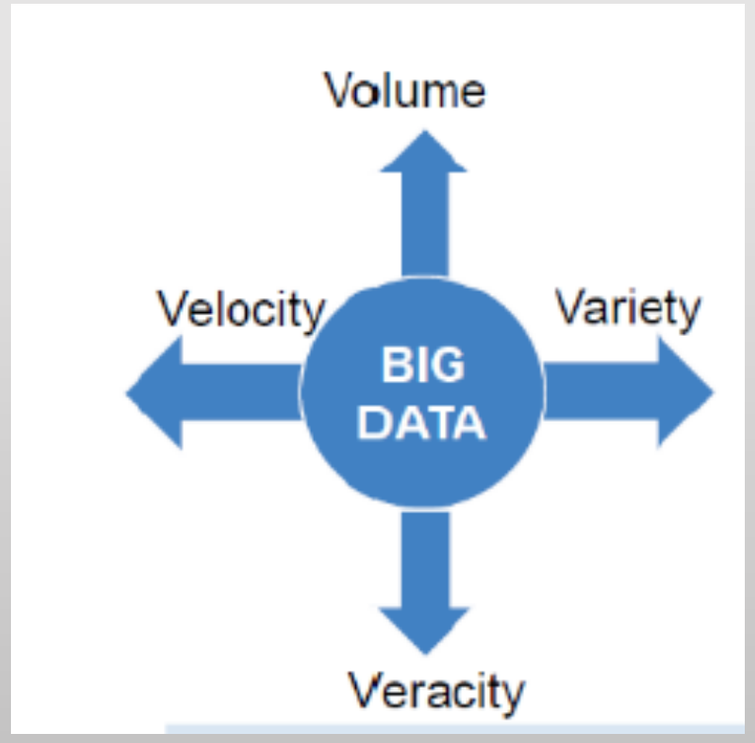
- Caters to all specialists and sub specialists ex: Neuro-radiologists, cardiac radiologists
- Rapid access in remote locations
- Quick TATs in diagnosis and prevention
- Reduced cost to patients
- Reduced capital expenditure cost to the hospital
- Reduced human capital cost to the hospital

- **11 hospitals connected to one centralized Tele Rad center**
- **24 X 7 diagnosis and reporting**

Big Data Analytics in Healthcare

What is BIG DATA :

- Data from EMRs, Medical equipment, medicine refillments, claim systems
- High speed of continuous generation
- 80% of the data rests in variable formats
- Unsure or vague data
- Analytics : systematic discovery of meaningful patterns & correlations

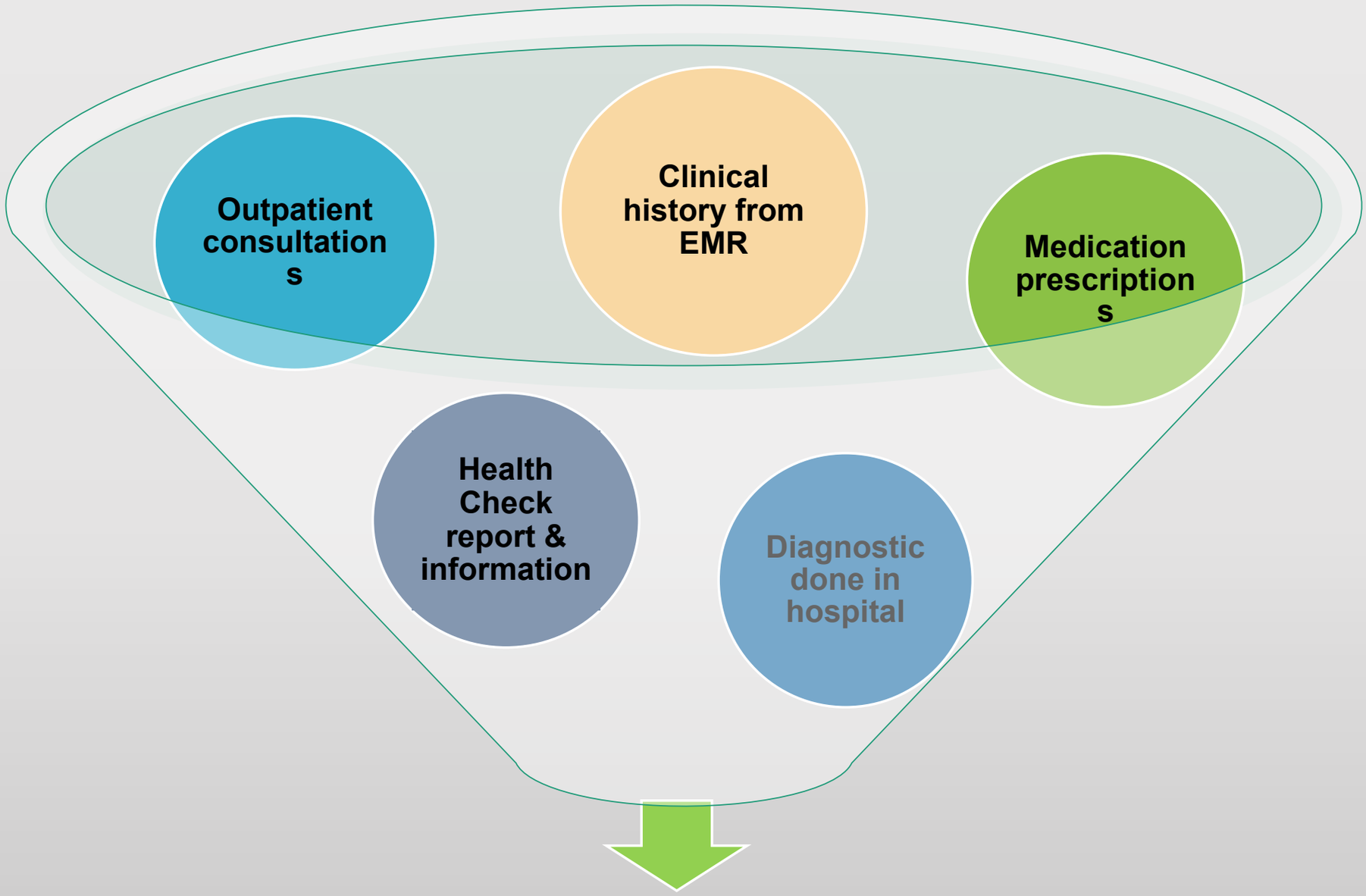


4 V's of Big Data

What it helps with :

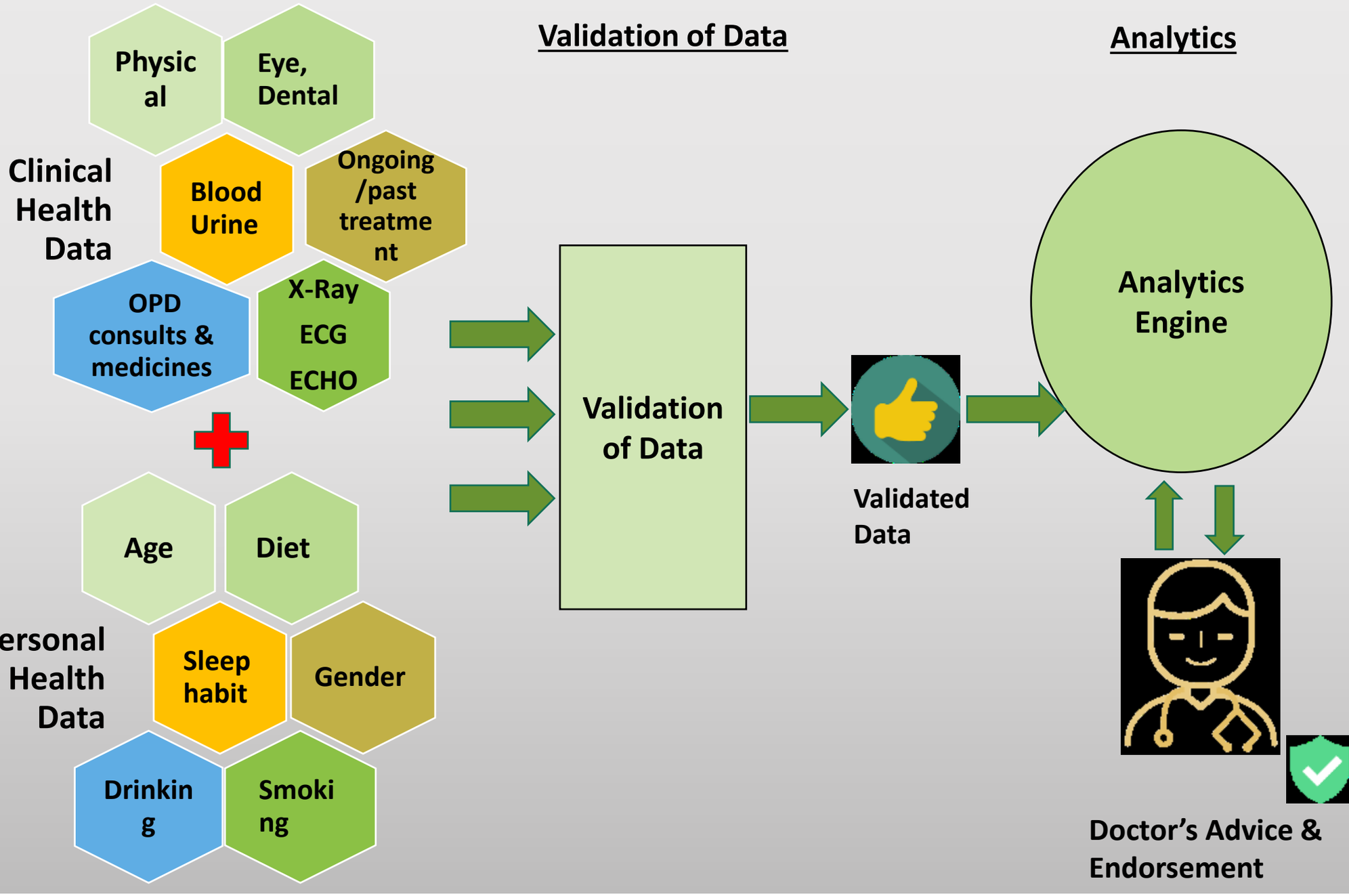
- Clinical Decision support systems
- Preventive Healthcare
- Tele- Medicine
- Personalized Medicine
- Healthcare Fraud Management

Patient Data for analysis

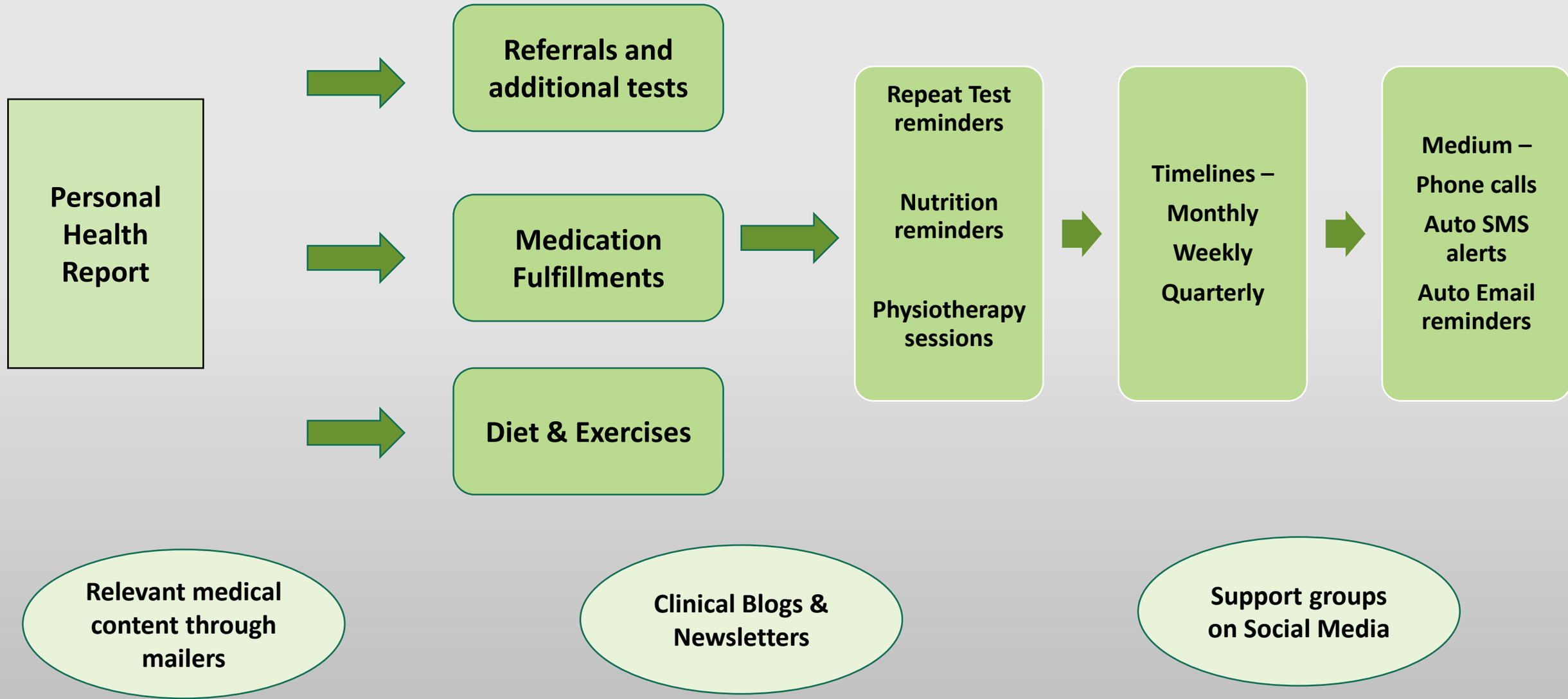


System data for analysis

Analytics in Data Mining and Predictive analytics



Follow ups and Patient Engagement



The Future of Medicine

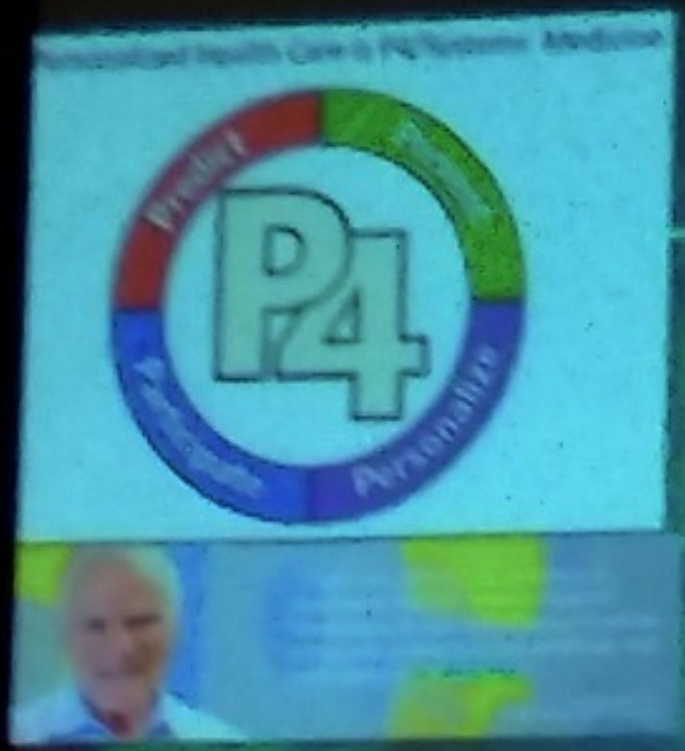
Traditionally

Medicine focused on **treating disease** AFTER it has occurred

Reactive medicine **VS** **Preventive medicine**

WL&H

The Future of Medicine



Transition into a new medical paradigm

P4 Medicine

Predictive

Preventive

Personalised

Participatory

Aim:

To avoid or postpone disease-onset proactively and shift the focus to earlier-at-risk detection so as to keep the individual healthier longer

Precision Health/Precision Wellness

WL&H

The Value of Interoperability and Adoption of Connected Health

Personal Connected Health Alliance

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SHIFTING FROM SILOED TO CONNECTED MODEL

SILOED PARADIGM

- "**Sick Care**"...exponential rising costs (aka "humpty-dumpty" care)
- Hospital
- Episodic, clinical transactional systems that handle a service event in a particular care domain
- Transactional (un-integrated clinical systems)
- Diagnosis & Treatment (reflecting importance of the provider, clinician)
- Pharma, Payer, Provider, Patient ("P4"...stand-alone sectors)

CONNECTED PARADIGM

- "**Health Care**"...improving quality & lowering costs
- Community and Home (with personal responsibility for one's health)
- *Always-On* (via remote monitoring platforms/devices) plus systems that support life long conditions across care domains e.g.: CD)
- Integrated with Data Analytics (trending, population, segmentation)
- Prediction & Prevention (reflecting importance of the patient/consumer)
- Human-Centric (including multi-sector: Retail, Telco, Insurance, Agriculture...)

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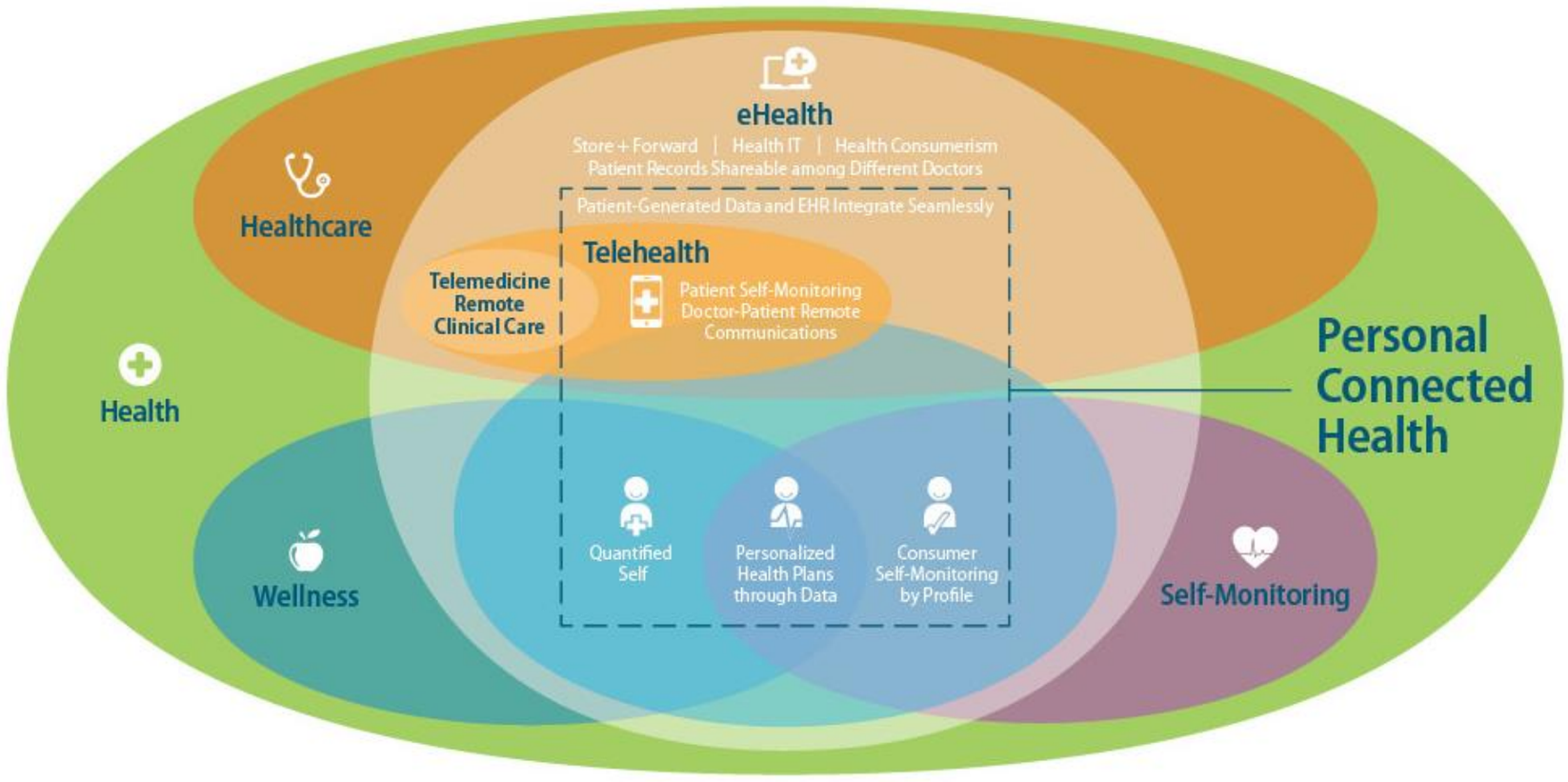
The Scope of the "Personal Connected Health" Space

After identifying the different terms and conducting market analysis, we arrived at these boundaries for the personal connected health space.



Personal Connected Health Alliance

BREAKING DOWN AN INTEROPERABILITY ARCHITECTURE ENABLING PCH AT THE INTERFACE

Personal Device

Pulse Oximeter

Thermometer

Weight Scale

Pulse / Blood Pressure

Cardio / Strength

Glucose Meter

Peak Flow

Independent Living Activity

Physical Activity

Medication Adherence

Electrocardiogram

Insulin Pump

Aggregation Manager

ISO

IEEE

Bluetooth

USB

ZigBee

Personal Area Network (PAN) Interface

Telehealth Service Center

IHE

W3C

HL7

WiFi, 2G, 3G & 4G

Wide Area Network (WAN) Interface

Health Record Network (HRN) Interface

Health Records/ Networks

PHR

EHR

NHIN

HIE

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Digital Health 4.0

Facility Sharing

Epidermic

Predict to Prevention

Social

Patient

Wearable

Smart Phone

Personnel Heath Dashboard

Appointment

IoT

AI

Consultation

P

F

S

A

Data Integration

HIS

ERP

One ID One regional health care

AI

Robotics

PCC

HHC

DOT

NCD

CD

TIME

Transport

Digital Health 4.0

- Vision / Direction
- Value
  - Health Outcome, QoL, Disease Control, etc
- Safety / Low Risk
- Improve treatment quality
- People Focus