

# Global Healthcare Trends and the Transformative Future of the Industry

Singapore Healthcare Management Congress

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# *Agenda*

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Regional outlook

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Global trends

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Transformative future & the importance of innovation and collaboration

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Challenges

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An ode to the future

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*“We are living in one of the most transformational times in human history...”*

**Change<sup>2</sup>**

- Futurist, Gerd Leonhard

# *Regional outlook of the healthcare industry*



# Public and private healthcare spending are growing in Southeast Asia as demand for healthcare services increases across the region

## Market Drivers



### Adoption of Universal Healthcare

- Healthcare is a priority sector across ASEAN
- Public spending growing as the demand for accessible healthcare increases
- Private sector playing a greater role due to under-developed public healthcare system



### Expanding medical tourism

- Singapore, Malaysia, and Thailand's private healthcare players offer quality medical services to patients from all around the world
- Singapore is a regional hub for surgery, medicine and specialist services
- Malaysia and Thailand have attracted tourists looking for affordable healthcare



### Increasing penetration of medical devices

- Current penetration of is low but market sale is expected to double by 2019 to US\$9bn
- Inexpensive medical devices, such as prosthetic and diagnostic tools are researched and manufactured in the region for the region
- Lack of domestic competition in the region

## Healthcare Spending and Growth

Spending: 2014 and CAGR: 2014-19



### Thailand

- Spending: US\$17.9bn
- CAGR: 6.5%



### Vietnam

- Spending: US\$11.1bn
- CAGR: 8.8%



### Myanmar

- Spending: US\$1.1bn
- CAGR: 6.2%



### Cambodia

- Spending: US\$1.3bn
- CAGR: 10.8%



### Malaysia

- Spending: US\$13.0bn
- CAGR: 4.5%



### Philippines

- Spending: US\$12.7bn
- CAGR: 8.7%



### Singapore

- Spending: US\$14.4bn
- CAGR: 7.2%

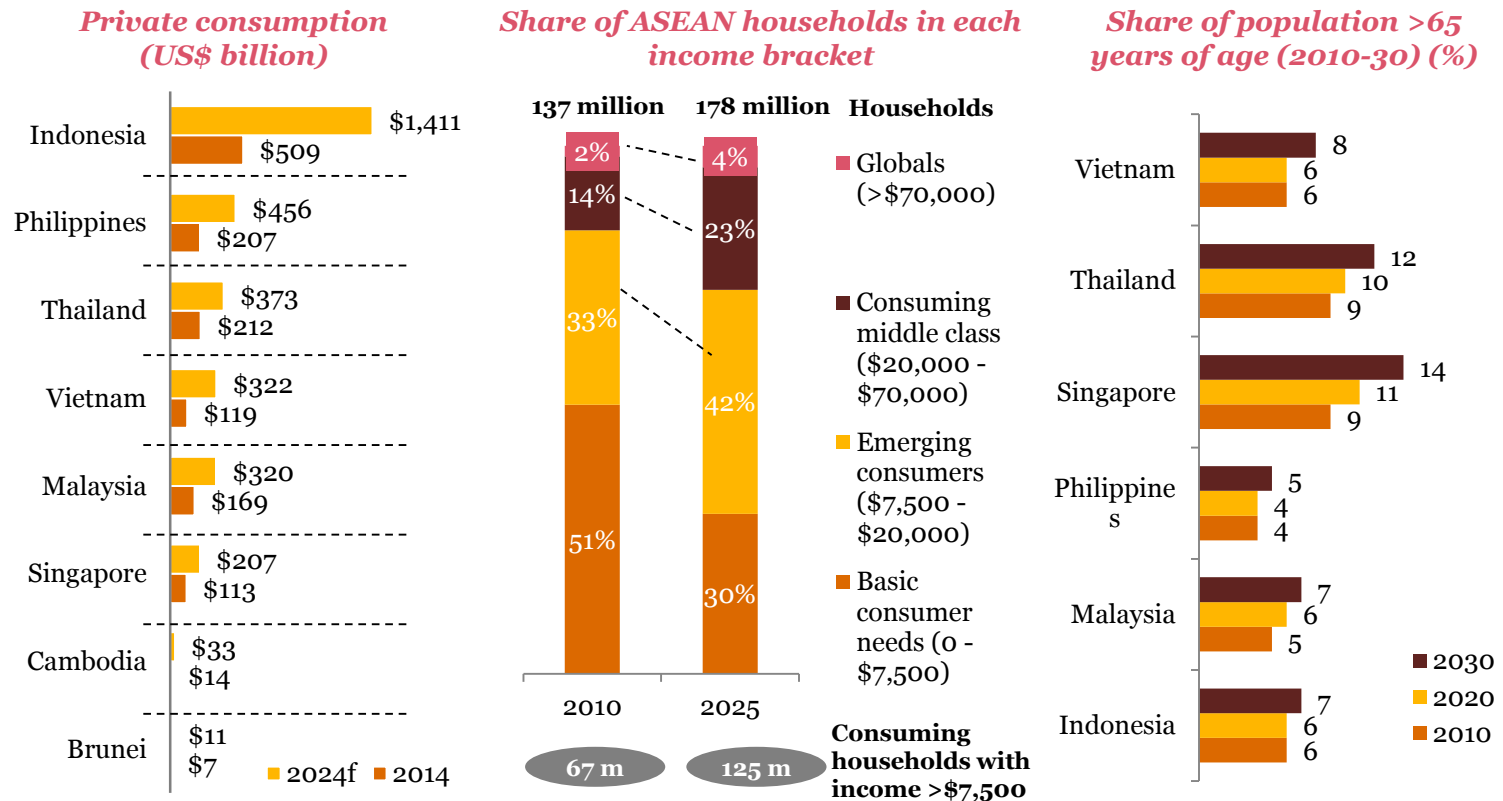


### Indonesia

- Spending: US\$26.2bn
- CAGR: 9.6%

Source: BMI Research; PwC Analysis

# Increasing disposable income, rising middle class, and ageing populations are driving demand



Source: BMI Research; McKinsey Global Institute Cityscope database, McKinsey Global Institute analysis

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June 2017

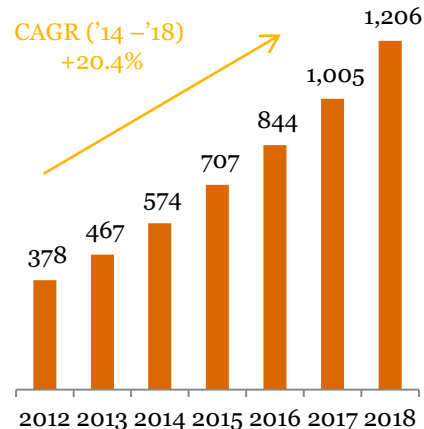
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# The outlook for private healthcare in Southeast Asia is thus positive, driven by a high demand for private provision

## Revenue growth

Forecasts estimate over 20% growth in revenues for private hospitals in APAC up to 2018

### Private hospital revenues APAC (2012-18) (US\$b)



## Growing demand

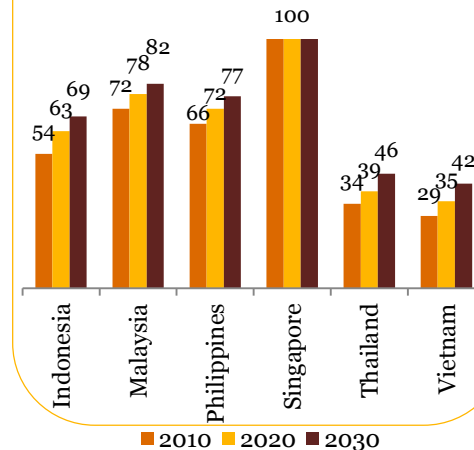
It is estimated that 180m new hospital beds will be needed over the next decade to satisfy demand in APAC, with 40% expected to be fulfilled by private healthcare providers



## Rising urbanisation

An influx of population into the cities, where most of the hospitals are concentrated, will increase demand for services

### Urban population as a share of total population (%)



Source: Frost & Sullivan; The Guardian; PwC Analysis

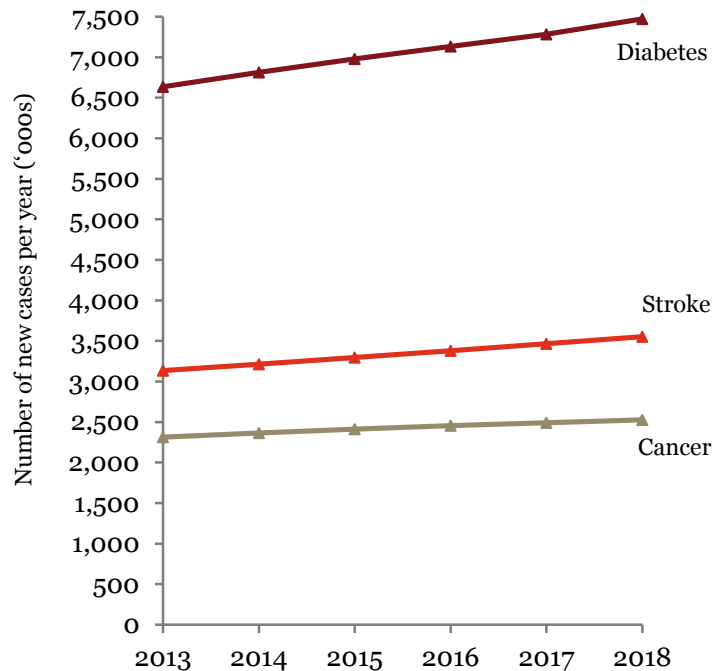
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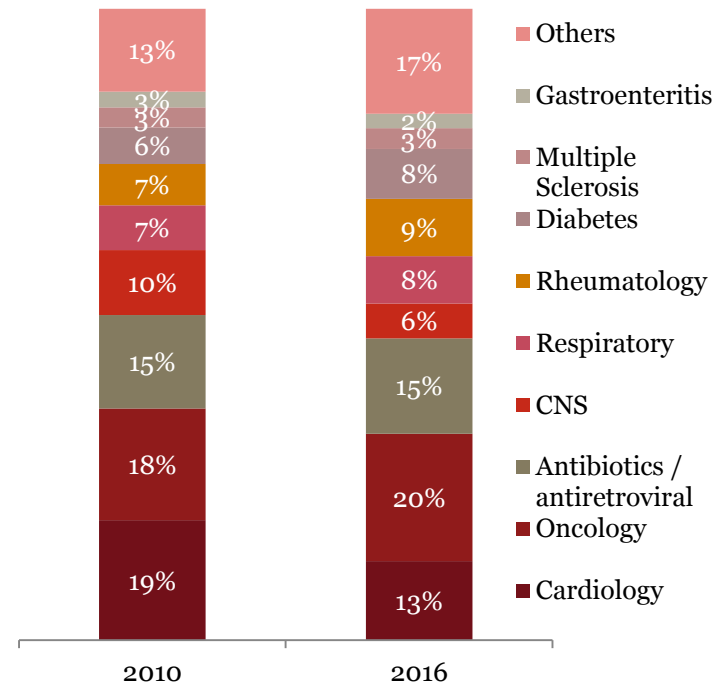
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# Rapid epidemiological transition is also shifting the burden of disease from infectious to chronic and lifestyle-related diseases

**Incidence of chronic diseases in Asia Pacific**



**SEA Therapeutic Category Breakdown (2010 and 2016)**



Source: Frost and Sullivan; Cowen Therapeutic Categories Outlook



# *Commitments to regional integration and SEA governments' aspirations to grow medical tourism have resulted in a relaxation of regulatory restrictions to attract foreign investment, making growth opportunities in SEA numerous*

- **ASEAN Economic Community 2015** aims to establish an **integrated region and market**, with a free flow of goods services, investment, skilled labour and freer flow of capital
- **Healthcare** and **tourism** are two of the **priority service sectors** targeted for **removal of all restrictions by 2015**
- **Thailand** government policy since 2004 to become **the medical hub of Asia**
- **Malaysia** established the Malaysia Healthcare Travel Council to **promote medical tourism** and **encourage foreign investment**
- Various **tax and non-tax incentives** are offered across the region, including import-duty exemptions for medical supplies and equipment and work permit facilitation



## **Promoting the healthcare industry**

## **Investment opportunities**

- AEC commitments made by **Malaysia**, and **Singapore** **permit foreign equity ownership in private hospitals up to 70%**
- In **Malaysia**, there are additional restrictions prescribing a **joint venture**
- In **Thailand**, foreign equity participation is through **JV only** and limits vary between **51% and 70%** (or up to 49%, as long as foreign shareholders make up less than half of the total number of shareholders)
- **Indonesia** has also raised its ceiling for foreign ownership in hospitals to **67%** and opened up access to investment opportunities **across the country**
- **Vietnam** and **Cambodia** allow **100% foreign-invested hospitals**
- **Foreign equity ownership** for hospitals is capped at **40%** in the **Philippines**

Source: Thai Board of Investment; ASEAN website; C. Herberholz and S. Supankankunti 'Medical Tourism in Malaysia, Singapore and Thailand, Chulalongkorn University, 2013; Wall Street Journal; Manila Bulletin

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# *Regional outlook of the healthcare industry*



# *Global healthcare trends*



*“The goal is to turn data into information, and information into insight.”*

*- Carly Fiorina  
Former CEO HP*

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## ***At PwC, we have defined what we refer to as the New Health Economy***

*The traditional healthcare delivery model continues to evolve into an ecosystem of collaborators with interrelated value drivers*

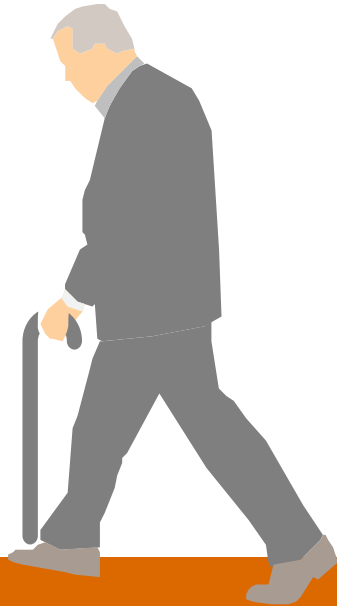


In the New Health Economy, “patients” will be “consumers” first, with both the freedom and responsibility that come with making more decisions and spending their own money. These consumers will demand a continuum of well-being, rewarding the trusted advisers that can help achieve that.

*The healthcare industry has been slow to deliver customer-centered value. But the ground is shifting rapidly.*

## *How does the world look today ?*

*Older*



**2 Billion**  
*people aged 60+ in 2050*

*Fatter*



**~3 mn**  
*deaths due to obesity*

*Sicker*



**60%**  
*of all deaths due to  
non-communicable  
diseases*

## A triple burden of disease: Acute, Chronic and now the Pandemics

**1.5 million**  
people died of  
AIDS related  
illnesses till  
2013



Malaria  
**450,000** deaths a  
year

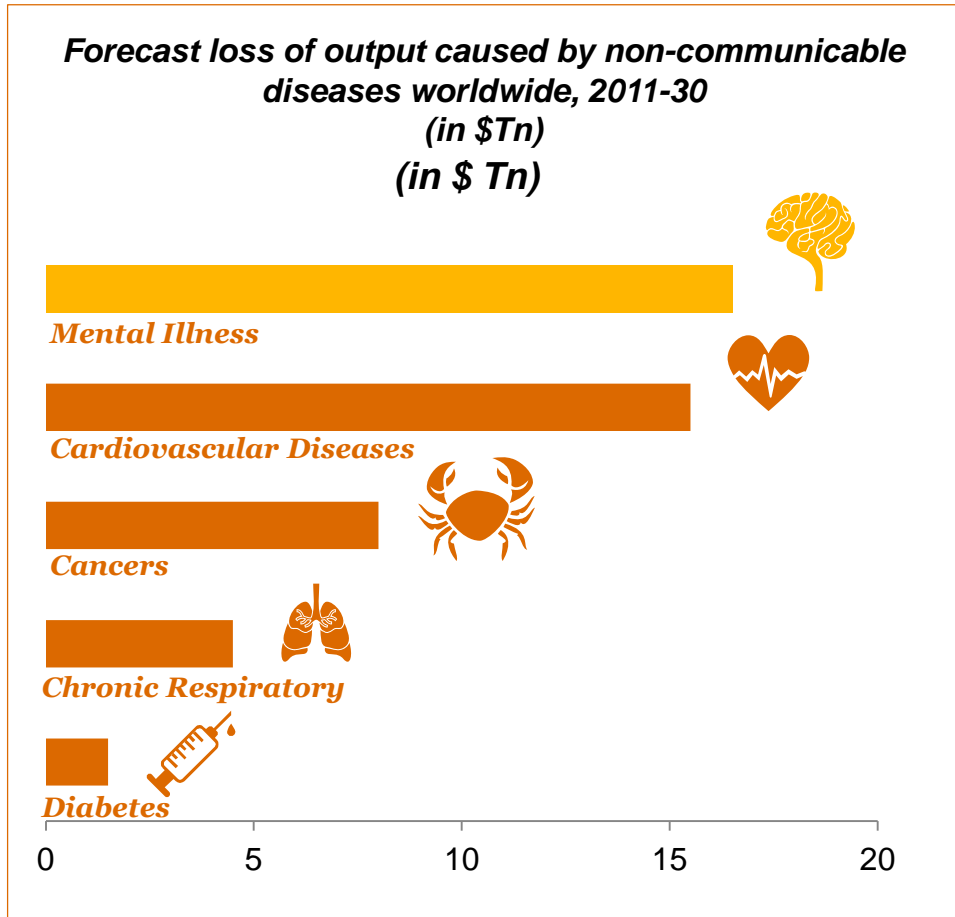
Ebola **10,000**  
deaths till date



**Eradicating 7\* epidemics would save a yearly total of  
1.2 mn lives**

\*7 Epidemics include measles, mumps, rubella, filarisis, pork tapeworm, malaria and hepatitis C

# If diseases don't kill us, we will kill ourselves!



Source: World Economic Forum, Harvard School of Public Health; Mental Health Atlas; WHO; *The Economist*

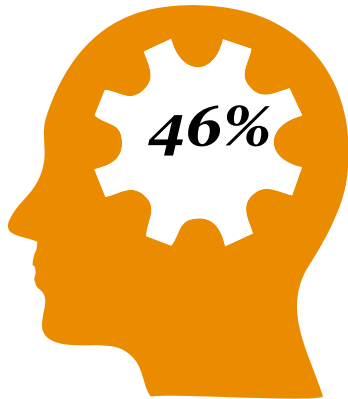
## *Mental illness is still a stigma but is being addressed with a number of solutions driven by technology*



- What qualifies as *mental illness* and what does not ?
- Who gets *treated* and who does not?
- Who finally *pays* ?



## *Doctors are victims, too!*



*Medical interns have met with **depression** criterion at some point in their lives*

*Physicians are facing symptoms of **burnout***



## ***Fatigue and burnout are not the only reasons doctors are wanting to leave the profession en masse***

February 7 2016

cybermednews.com

### **THE DROP- OUT DOC: WHY NOT RESIDENCY?**



It might surprise many to hear medicine referred to as the **most miserable career**. A recent **survey** found 9 out of 10 physicians wouldn't recommend it to a

**“Doximity, a professional network for physicians, reported in 2011 that only 68% of Stanford medical students go on to pursue clinical residency, a lower share than all but six medical schools in the country.”**

<http://www.latimes.com/opinion/op-ed/la-oe-1223-joseph-med-school-brain-drain-20151223-story.html>

December 23 2015

## ***This exodus could be crippling to the industry***

The dropout club thousands of doctors want to join

By Parija Kavilanz

Updated 7:23 AM EDT, Fri October 30, 2015



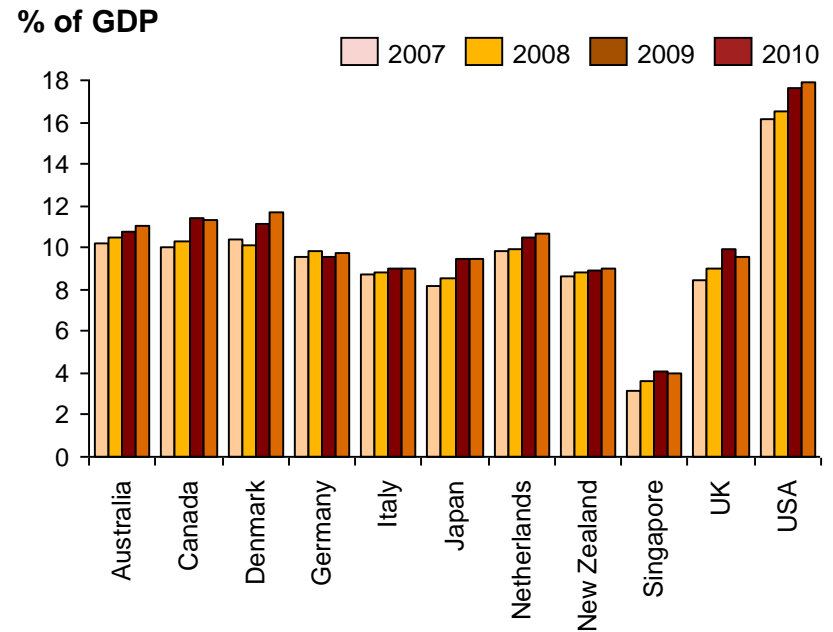
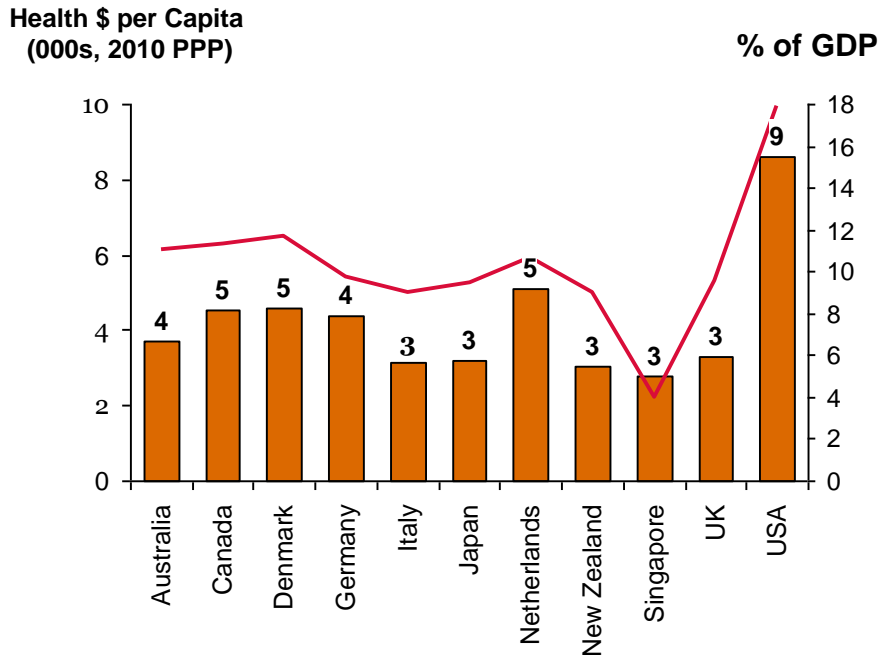
(CNMMoney) — The name is telling, but its members will surprise you. The Drop Out Club is an online networking platform that's helping doctors find careers outside of medicine

**“Today, the platform has more than 23,000 members in 102 countries and has expanded its parameters to include science PhDs.”**

# Rising healthcare costs continue to challenge national agendas globally

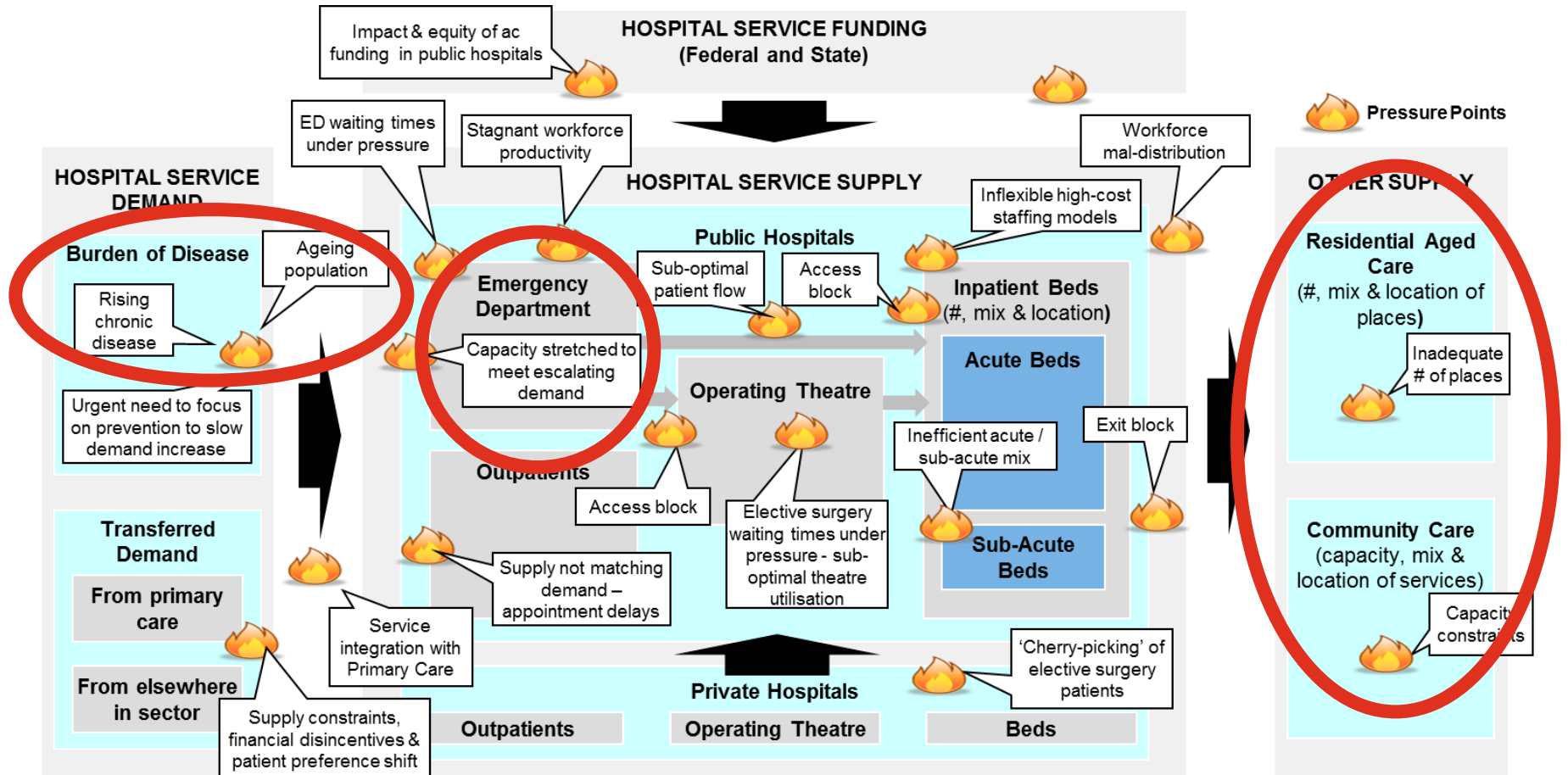
Spend on health is a high % of GDP in many developed countries...

...and has been growing over time



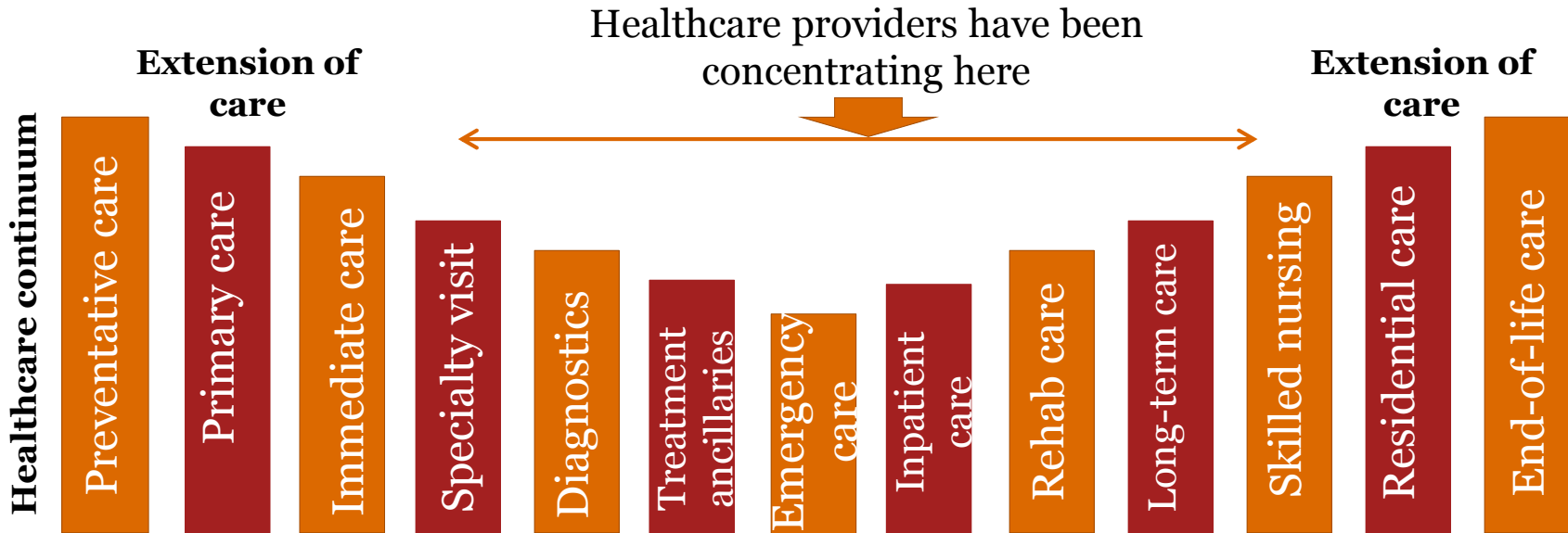
Source: Economist Intelligence Unit, October 2013; OECD Health Statistics 2014

# Countries are seeing system pressure points arise from a supply and demand mismatch and silo'd fragmentation



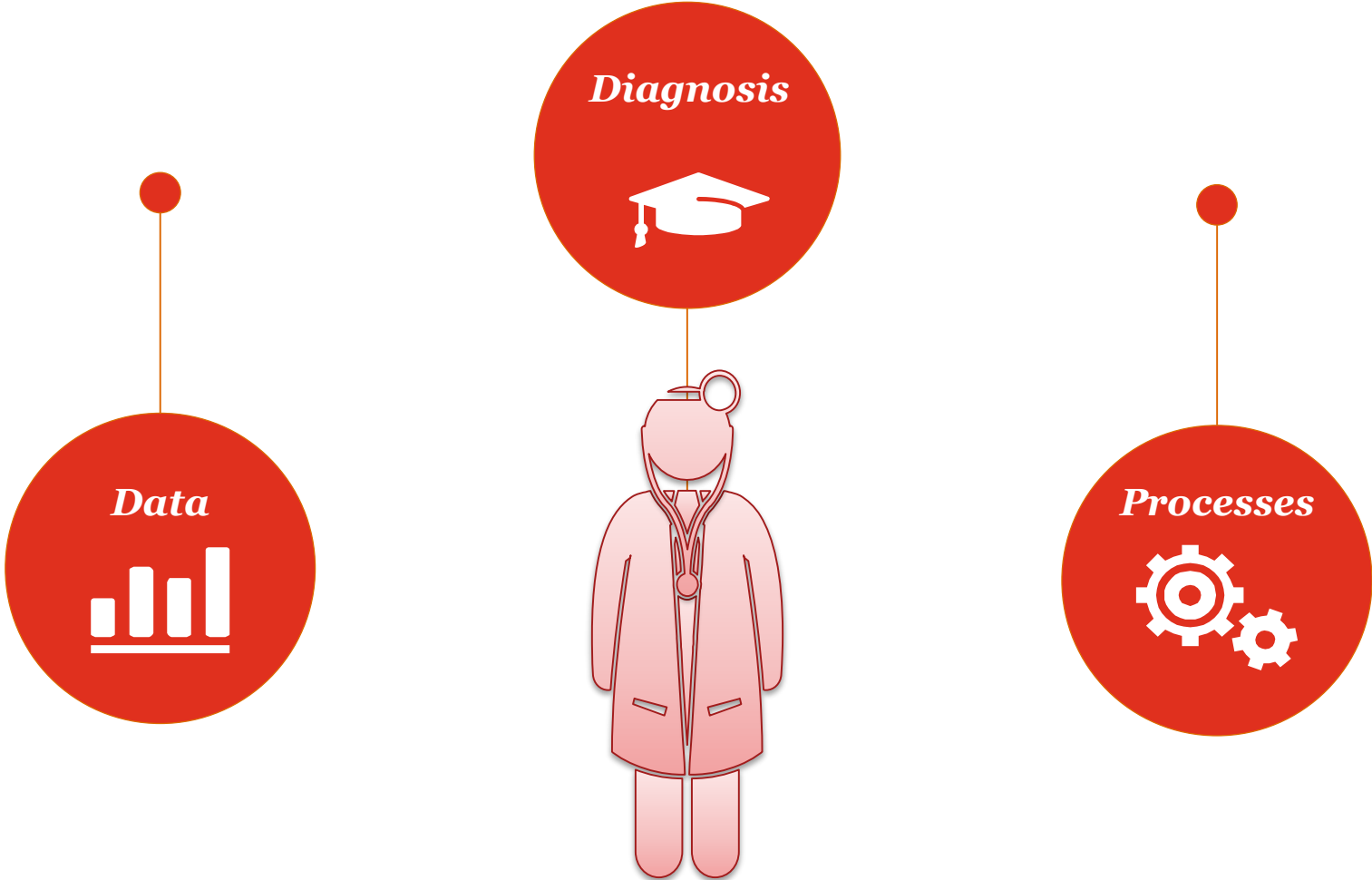
Source: Booz & Company analysis.

# *A general move from fragmented to integrated care across the continuum is much needed and occurring*



Source: PwC Analysis

**Complexity is now, “Institutionalized,” with ICD 10 having 70,000 ways to get sick, hurt or mortally injured**



## *Therapies are having deleterious effects*



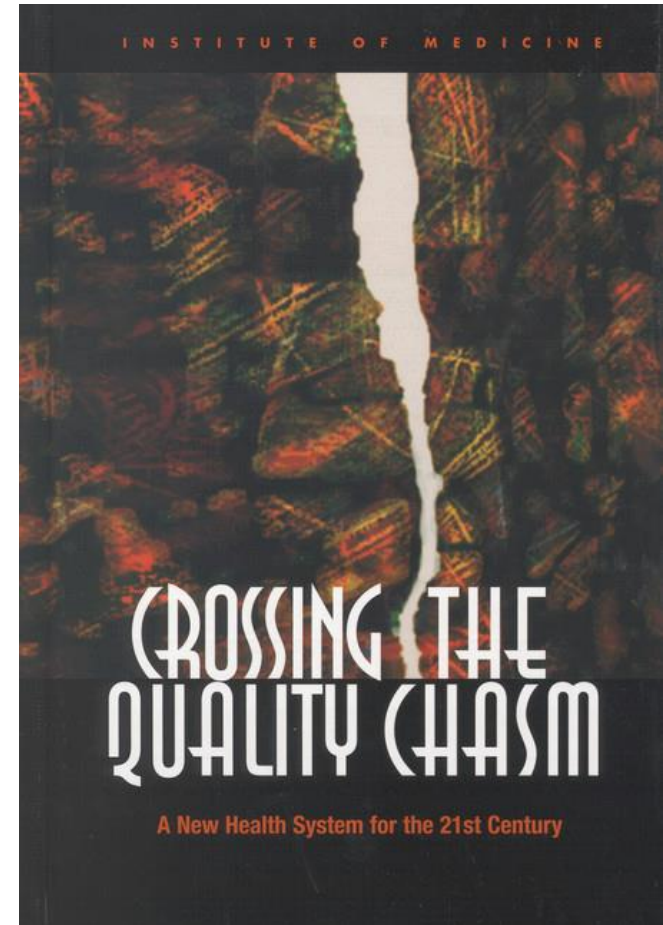
*Survival rates are not improving*

*Aggressive treatments have unforeseen and often devastating consequences*

*Cancer has a **language** problem*



## *Emphasis on patient safety has evolved*



***‘Quality’ care consists of six crucial components...***



***...with 'safe' care really being the foundation of care provision***



Source: Institute of Medicine, American Hospital Association

# The World Health Assembly first passed a resolution urging countries to prioritize patient safety in 2002

Surgical Safety Checklist		
World Health Organization		Patient Safety
<b>Before induction of anaesthesia</b>	<b>Before skin incision</b>	<b>Before patient leaves operating room</b>
(with at least nurse and anaesthetist) → (with nurse, anaesthetist and surgeon) → (with nurse, anaesthetist and surgeon)		
<p>Has the patient confirmed his/her identity, site, procedure, and consent?</p> <input type="checkbox"/> Yes	<p>Confirm all team members have introduced themselves by name and role.</p> <input type="checkbox"/> Confirm the patient's name, procedure, and where the incision will be made.	<p><b>Nurse Verbally Confirms:</b></p> <input type="checkbox"/> The name of the procedure <input type="checkbox"/> Completion of instrument, sponge and needle counts <input type="checkbox"/> Specimen labelling (load specimen labels aloud, including patient name) <input type="checkbox"/> Whether there are any equipment problems to be addressed
<p>Is the site marked?</p> <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable	<p>Has antibiotic prophylaxis been given within the last 60 minutes?</p> <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable	<p><b>To Surgeon, Anaesthetist and Nurse:</b></p> <input type="checkbox"/> What are the key concerns for recovery and management of this patient?
<p>Is the anaesthesia machine and medication check complete?</p> <input type="checkbox"/> Yes	<p><b>Anticipated Critical Events</b></p> <p><b>To Surgeon:</b></p> <input type="checkbox"/> What are the critical or non routine steps? <input type="checkbox"/> How long will the case take? <input type="checkbox"/> What is the anticipated blood loss?	
<p>Is the pulse oximeter on the patient and functioning?</p> <input type="checkbox"/> Yes	<p><b>To Anaesthetist:</b></p> <input type="checkbox"/> Are there any patient-specific concerns?	
<p>Does the patient have a:</p> <p>Known allergy?</p> <input type="checkbox"/> No <input type="checkbox"/> Yes	<p><b>To Nursing Team:</b></p> <input type="checkbox"/> Has sterility (including indicator results) been confirmed? <input type="checkbox"/> Are there equipment issues or any concerns?	
<p>Difficult airway or aspiration risk?</p> <input type="checkbox"/> No <input type="checkbox"/> Yes, and equipment/assistance available	<p><b>Is essential imaging displayed?</b></p> <input type="checkbox"/> Yes <input type="checkbox"/> Not applicable	
<p>Risk of &gt;500ml blood loss (7ml/kg in children)?</p> <input type="checkbox"/> No <input type="checkbox"/> Yes, and two IV/central access and fluids planned		
<p>This checklist is not intended to be comprehensive. Additions and modifications to fit local practice are encouraged.</p>		
	Revised 1 / 2009	© WHO, 2009



***Traditionally, the patient safety conversation has revolved around the following questions***

How can we leverage technology for safer care?

What are the approaches to improve safe care?

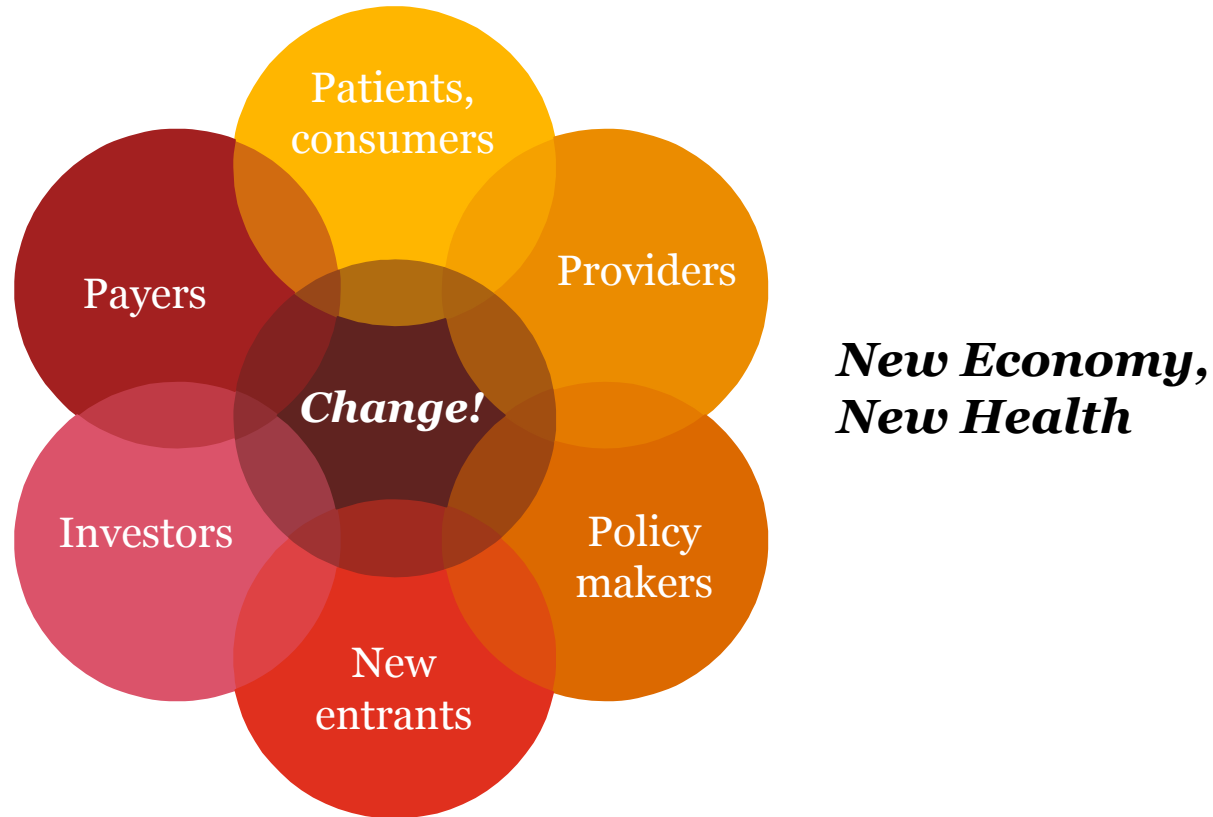
What are the common errors in medical care?

What are the common types of avoidable lapses in safe care that these errors can lead to?

In what settings of care can these lapses occur?

Can we empower patients to take charge of their own safety?

***But how will the concept and delivery of safe care evolve under the reshaping trends plaguing the world's health industry?***



***In the New Health Economy, our patient safety conversation will revolve around slightly different questions***

How do we effectively complement technology for safer care?

What new approaches should we seek to improve safe care?

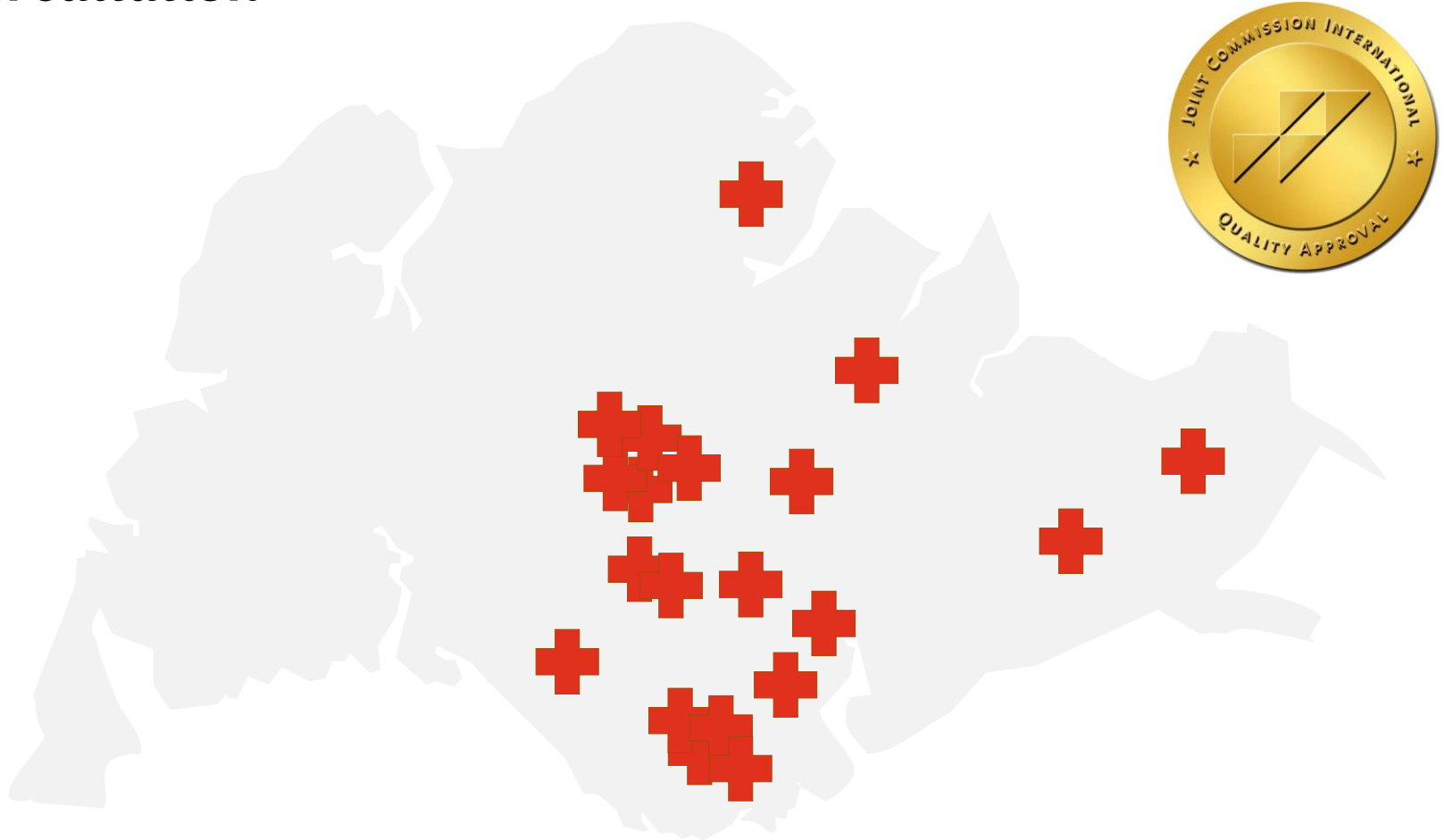
What may be the emerging errors in medical care?

What are the common types of lapses in safe care that these errors can lead to?

In what settings of care can these lapses occur?

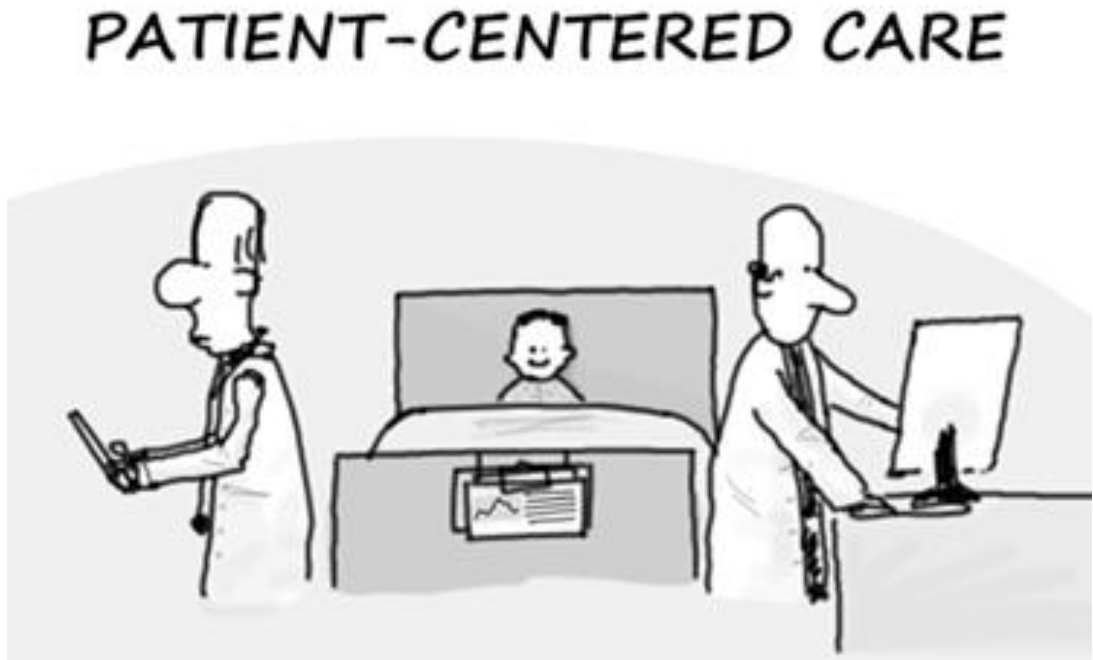
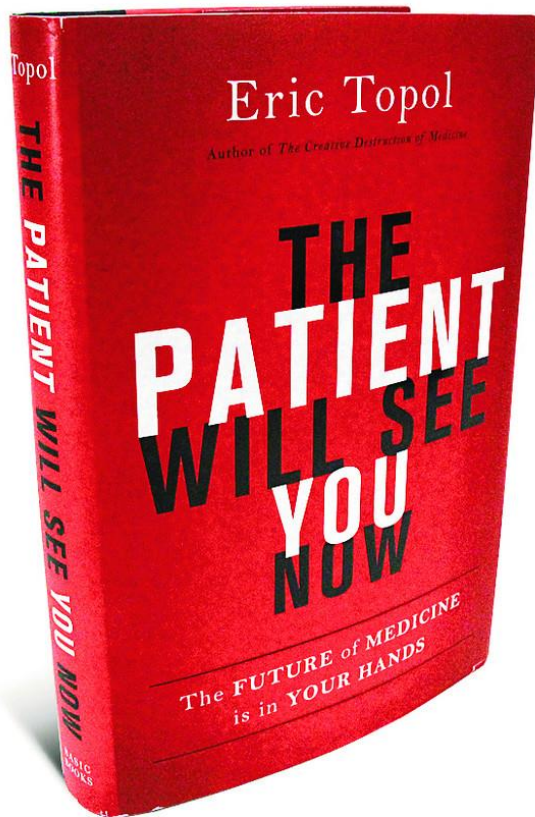
Can we empower patients to take charge of their own safety?

***Several hospitals, academic medical centres, ambulatory care centres and primary care centres are achieving JCI accreditation***





***We are living in a more patient-centric era where patients are empowered and make their own decisions on whom they see, when they see them and even where or how***



***Patients are demanding more value, convenience, and personal experiences in health***



**82%** are open to new, non-traditional ways of getting medical attention

**74%** are open to virtual doctor visit

**43%** want to shop for healthcare

Source: PwC Health Research Institute, April 2014, "Healthcare's New Entrants: Who will be the industry's Amazon.com?", PwC's Customer Experience Survey, Cisco Connected Customer Experience Report

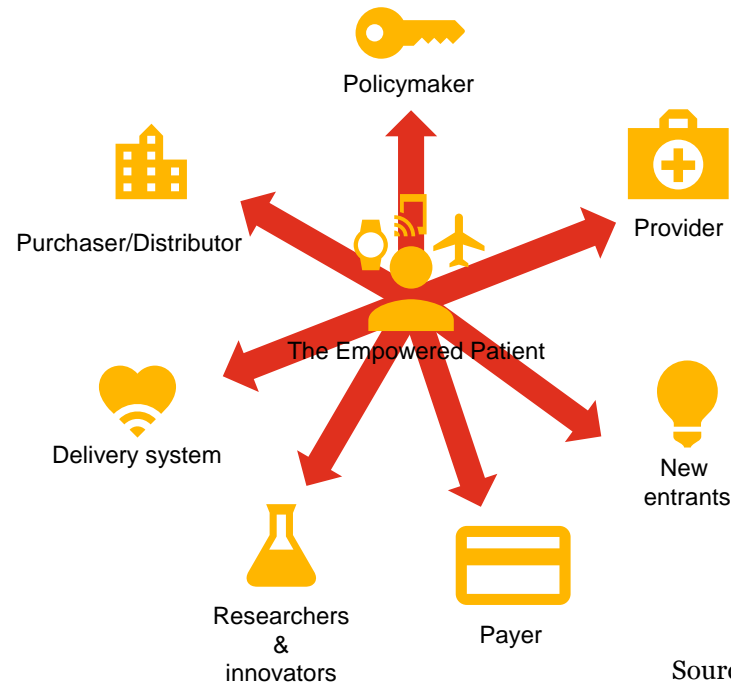
## *Patients' confidence is at an all time low*



**55%** of patients trust the Internet more than the doctor

**75%** want to move from informed consent to shared decision making

***Digital disruption to the healthcare industry is the driver of this paradigm shift to patient-centric, value-based care...***



Source: PwC Analysis

## ...with the patient behaving as an always “on” consumer



Expects a connected experience

Consumers compare experiences across industries and think “if I can do that on Amazon, why can’t I do this with you?”



Wants to participate

Consumers expect to be able to find reviews and give feedback, have their views taken into account and collaborate with their favorite brands.



Brings an innovative appetite

The rapid evolution of personal technology has created consumer thirst for innovative new services and products.



Can make smarter decisions

Consumers are better informed than ever, which means they make smarter decisions that lead to better personal outcomes.



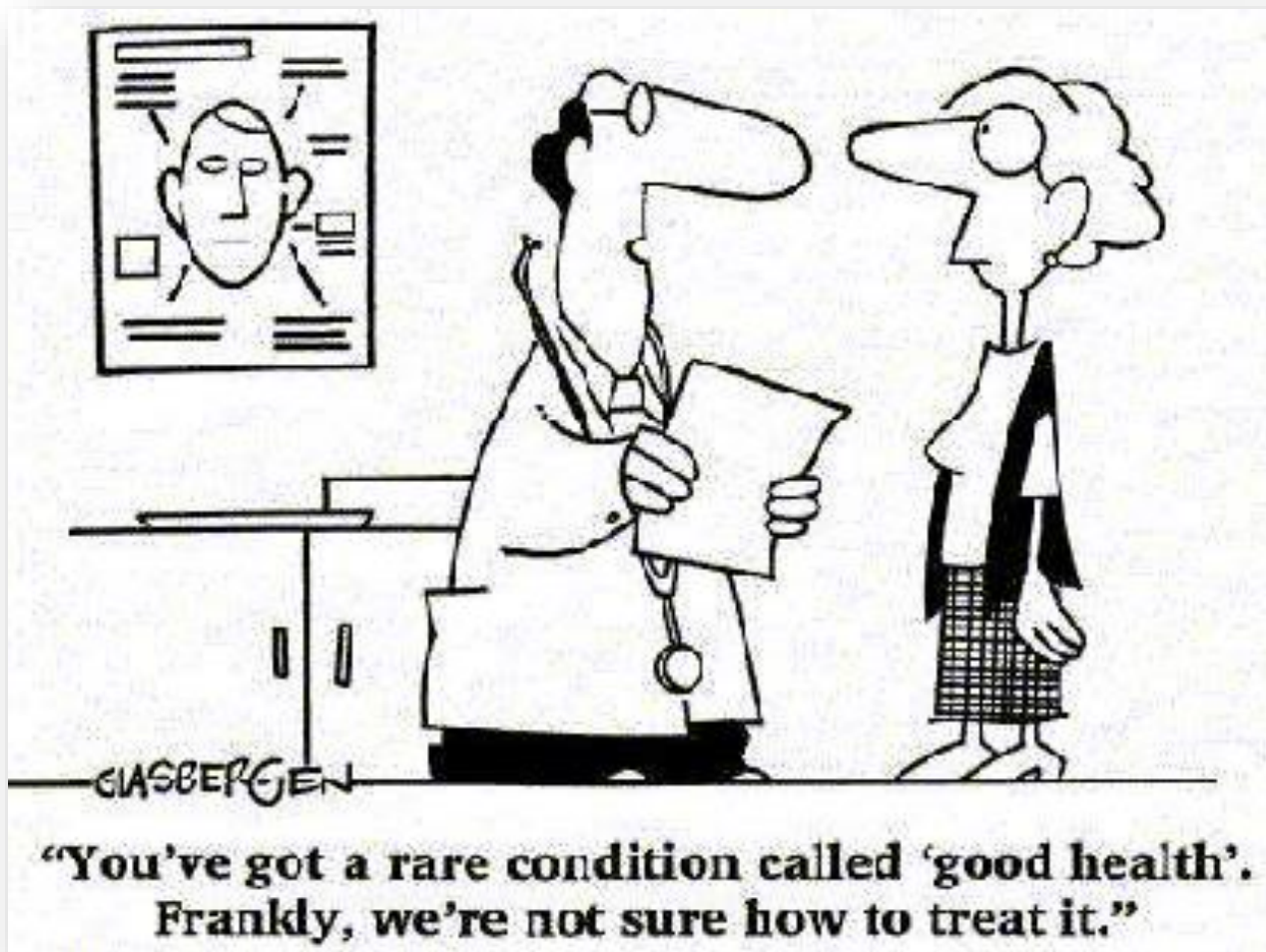
Image from: Vigyanix

***But value-based care is just one of three major themes of the paradigm shift we are seeing, well articulated by Singapore's Health Minister, Gan Kim Yong on 13 April 2016***

**“A 'paradigm shift' needed in approach to ageing and health: Gan Kim Yong”**

**To move beyond the hospital to the community, to move beyond quality to value, and to move beyond healthcare to health.**

**Read more at <http://www.channelnewsasia.com/news/singapore/a-paradigm-shift-needed-in-approach-to-ageing-and-health-gan-kim-8110692>**







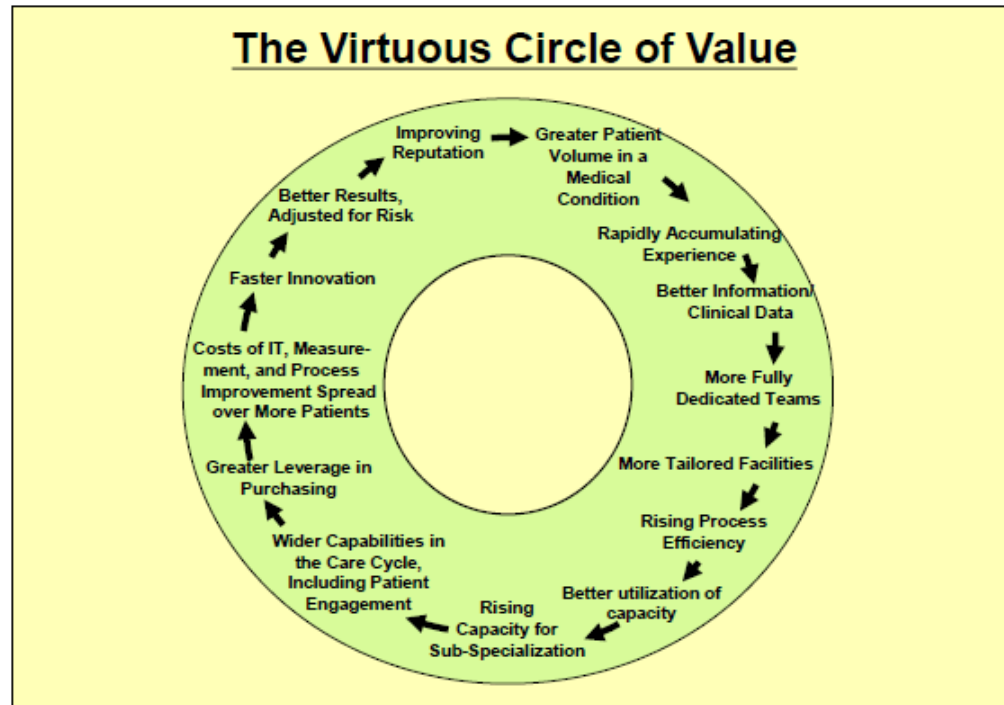
# +hospital to Home

## ***One of the most key of all global healthcare trends***

- Reduces costs
- Lowers hospital admissions
- Minimizes/removes hospital-acquired infections
- Provides better patient comfort
- Caters to both the physical as well as emotional wellbeing

***According to Professor Michael E. Porter, the fundamental goal of health care is maximizing value for patients***

- A value-based model is one where care is organized into Integrated Practice Units around medical conditions



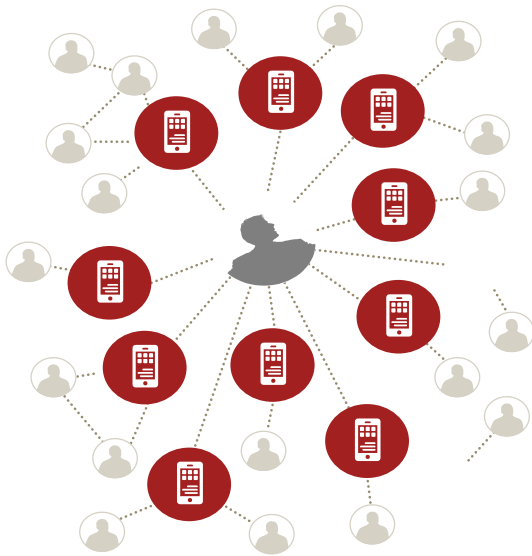
## ***The Key to Transitioning from Fee-for-Service to Value-Based Reimbursement***

- According to Bobbi Brown and Jared Crapo from Health Catalyst, the switch to value-based reimbursement turned the traditional model of healthcare reimbursement on its head, causing providers to change the way they bill for care
- Instead of being paid by the number of visits and tests they order (fee-for-service), providers' payments are now based on the value of care they deliver
- This change is driving improvements to the delivery of care by mandating better care at a lower cost

Source: <https://www.healthcatalyst.com/hospital-transitioning-fee-for-service-value-based-reimbursements>

## *We are living in a very connected world*

Three billion people around the world are connected to the Internet



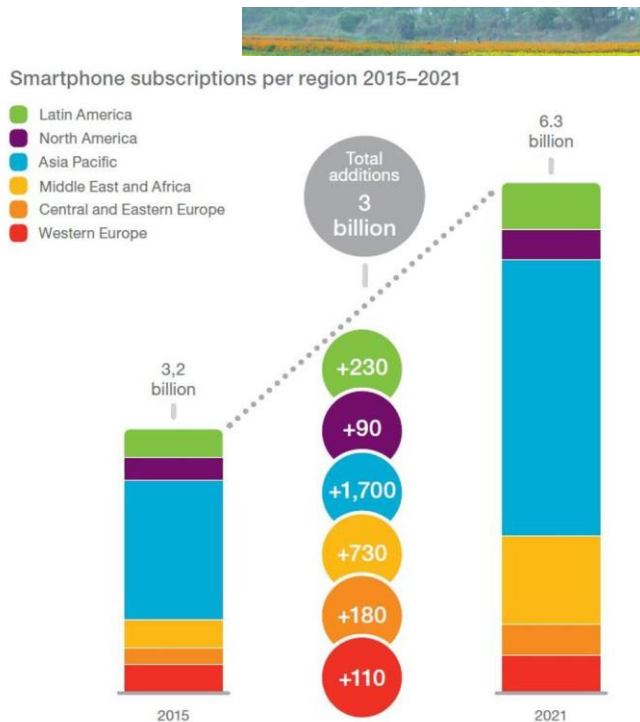
For every person on the planet there will be close to ten connected devices by 2020

# Hopping onto the digital connectivity bandwagon will be the key to solving healthcare access challenges

JAN 6, 2016 @ 03:52 AM 21,267 VIEWS

The Little Black Book of Bill

## India Just Crossed 1 Billion Mobile Subscribers Milestone And The Excitement's Just Beginning



Images from: Forbes, Indian news articles

### SPENDING ON SERVICES IN RURAL HOUSEHOLDS

- Mobile phones (communication services): **25.33%**
- Beauty services: **11.07%**
- TV & radio services: **10.58%**
- Repair & maintenance: **10.27%**
- Tailoring: **10.18%**

In terms of monthly per capita expenditure (MPCE) also, highest expenditure was found on communication services, amounting to ₹36.35 in rural areas.

*“...wearable tech will change your life – like it or not”*



## What is wearable technology?

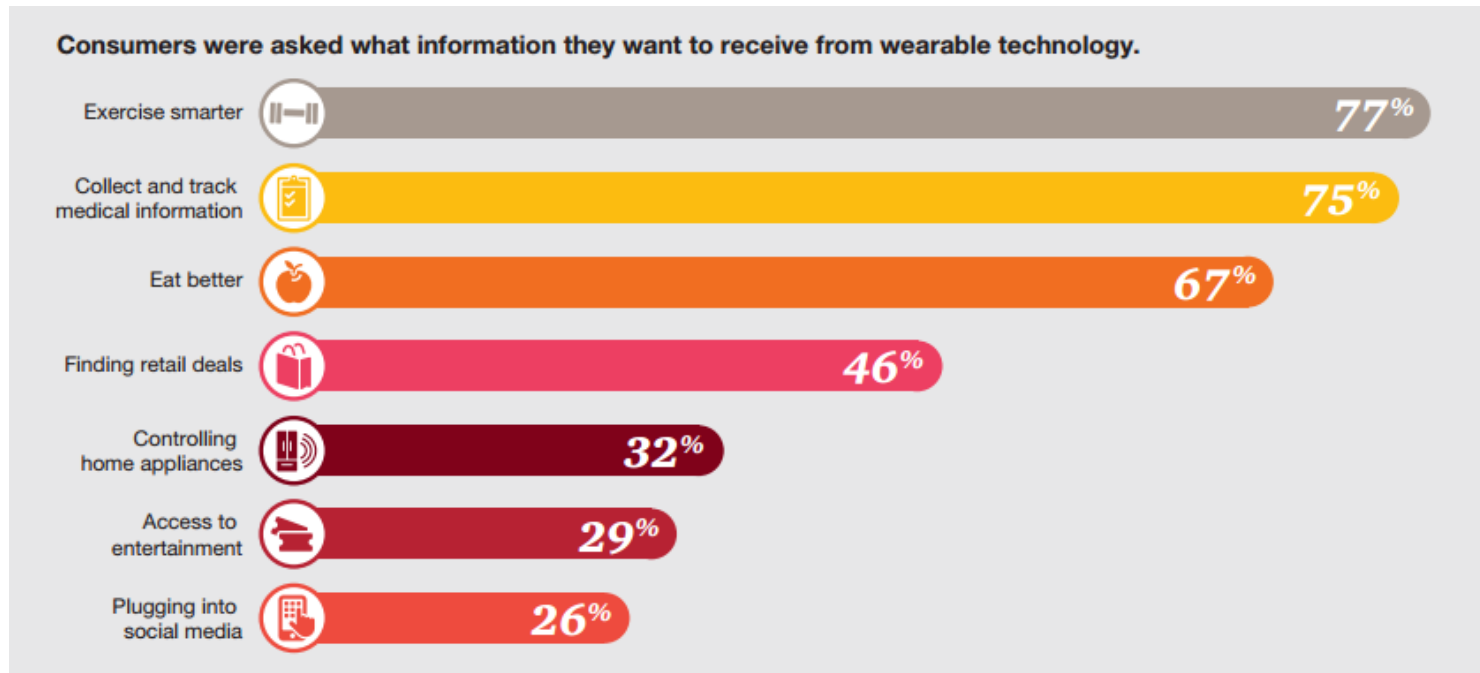


**Wearable technology** includes items, such as jewellery, glasses and clothing – worn on, in and around the body – incorporating sensors and other electronic technologies





# Health tops the list of information that US consumers want from their wearables



# Consumers were shown to trust clinicians the most with their wearable data



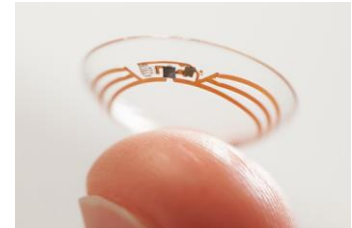
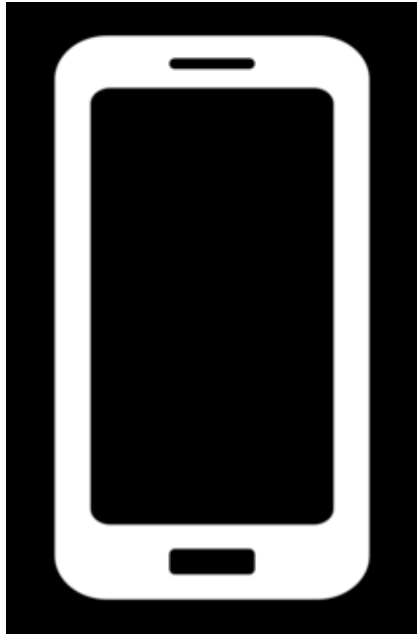
Source: PwC CIS Wearables consumer survey 2014

# *US consumers were asked how likely each of the following is to come about as a result of widespread use of wearable technology*



Source: HRI/CIS Wearables consumer survey 2014

# The wearable device market is in the billions



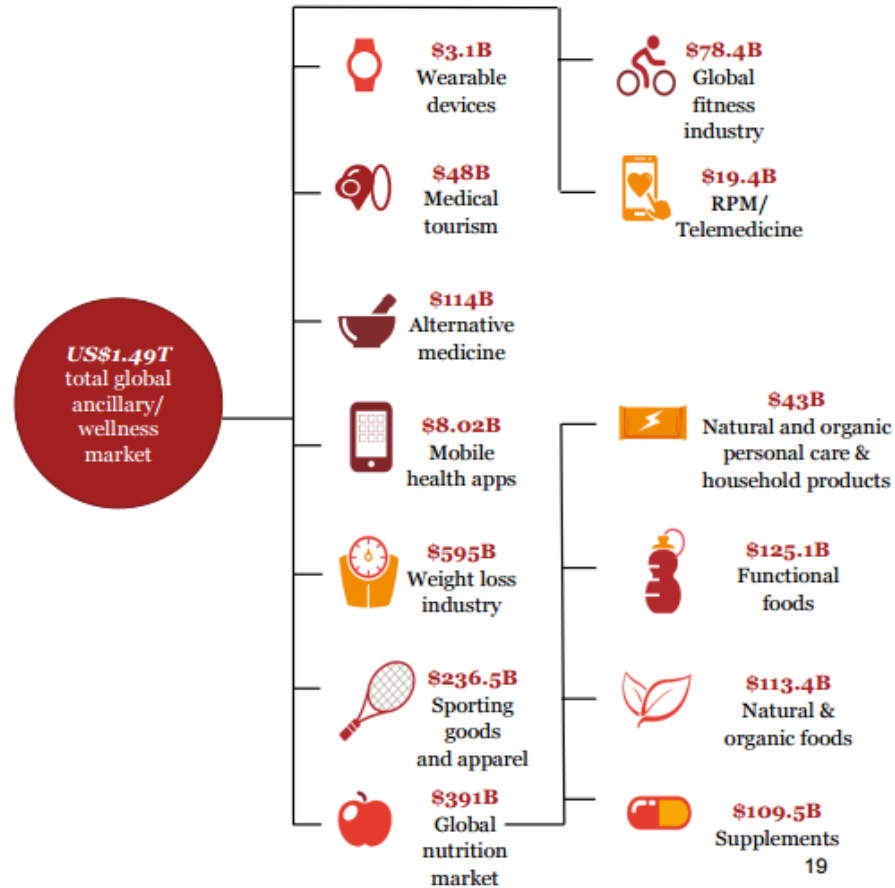
Penetration of **mobile phones** continues to rise, driving **widespread internet connectivity**, and **transforming consumer behaviour**



By 2018, **wearable devices** are forecast to reach a market value of **USD\$12.6 billion**



# Wearable devices make up \$3.1b of the entire wellness and fitness market



## ***Health wearables – fast facts***

- 61% of all wearable devices are health, fitness or activity trackers
- 46% of people who track their health say it has changed their overall approach to maintaining wellness
- Google, Apple and Samsung have all been exploring how to incorporate health IT features into wearable devices and existing mobile devices
- It has been predicted that by 2020, wearables will be central to healthcare, business and personal systems

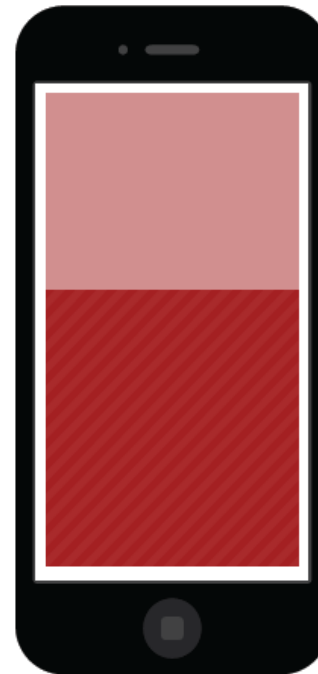
# Health wearables – fast facts

## The future of healthcare is mobile



Today, only **27%** of physicians are encouraging patients to use mobile health applications.

But **59%** of physicians and insurers believe that widespread adoption of mobile health applications in the near future is unavoidable.



Source: Economist Intelligence Unit mHealth Survey (commissioned by PwC), 2012

# While just one in five US consumers in 2014 said they owned a wearable device...

**21%**

of US consumers currently own a wearable technology product

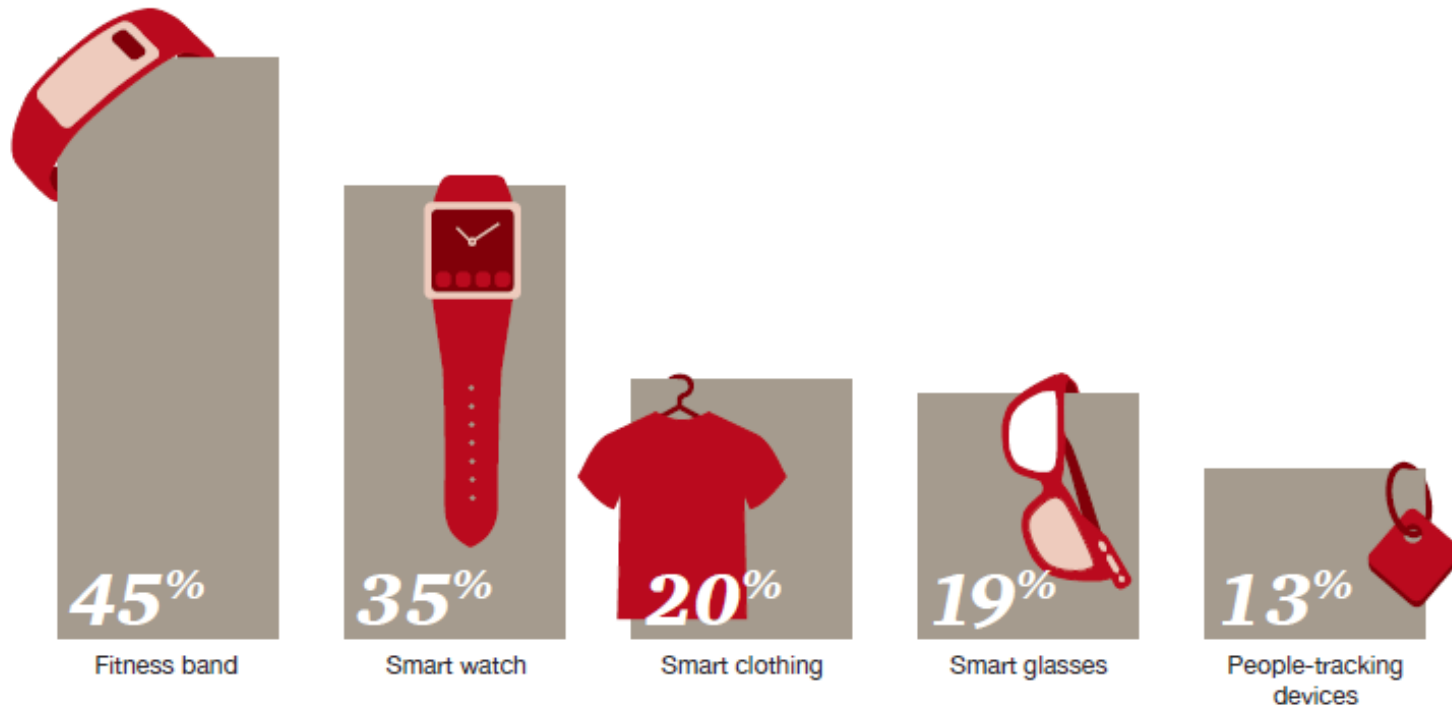


- 2% no longer use it
- 2% wear it a few times a month
- 7% wear it a few times a week
- 10% wear it everyday

Source: HRI/CIS Wearables consumer survey 2014



***...when asked as to how likely they were to purchase the following wearable technology devices in the next 12 months, the results spoke for themselves***



Source: HRI/CIS Wearables consumer survey 2014

\* Note: This survey was conducted before the announcement of the Apple Watch.

*Integral components for wearable technology to be successful in healthcare exist*



**Intelligent**



**Social**



**Interoperable**



**Engaging**



**Integrated**



**Outcomes-based**

***For maximum uptake however, cost of wearables will have to be kept minimum***

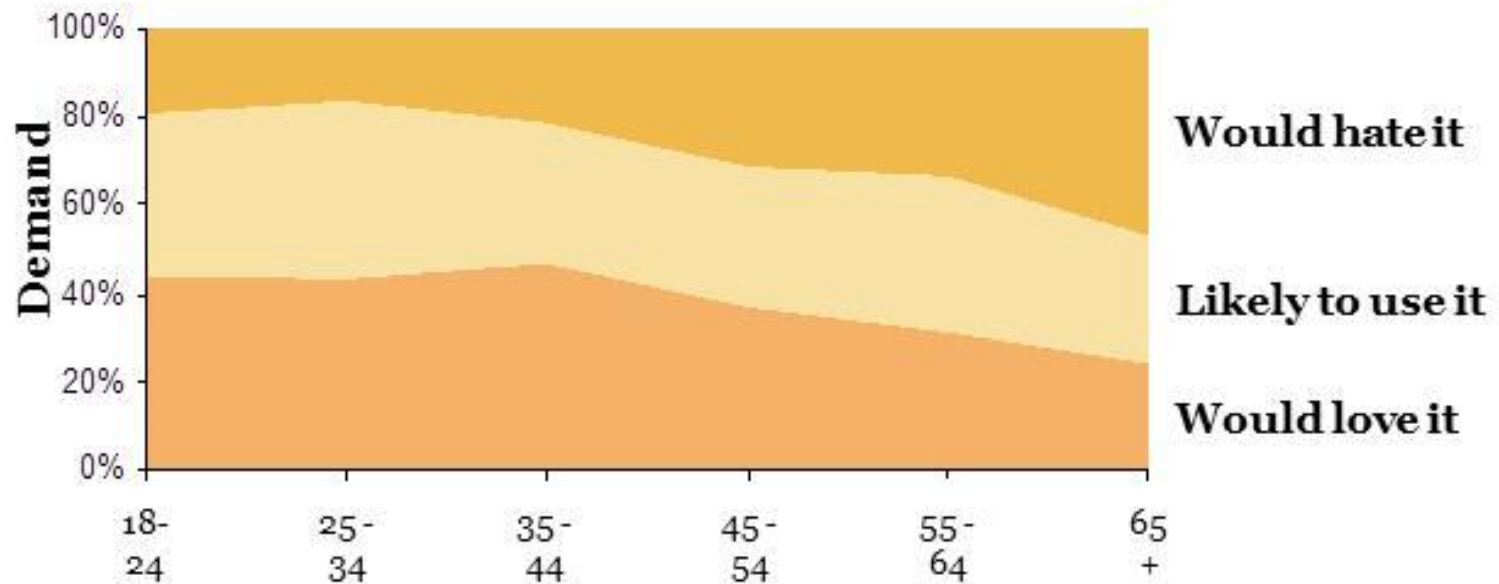


***Just as the trend of hospital to home is built on the foundation of patient-centricity and empowerment, so too is point of care diagnostics***

- Greater convenience
- More control
- Improved ease-of-use
- “Lab-on-a-chip” and, “Nanobots swimming in our blood”
- Will labs even exist in the future?

# *Would you be willing to access care virtually? How do you rate compared to 2339 people surveyed?*

## Willingness to Access Care Virtually



Source: Strategy & Consumer Survey 2014

## *Technology is allowing HCPs to provide telemedicine consults from thousands of miles away*



*The room was packed with doctors, renowned specialists who had come for the annual consultants' dinner of the Chelsea and Westminster Hospital, one of Britain's leading medical establishments.*

*As waiters set down plates of lamb and risotto, Nott checked his phone and found a series of text messages. "Hi David," it began. "This is an urgent consultation from inside Syria."*

*Attached was a photograph of a man who had been shot in the throat and the stomach.*

# Technological advances are creating new care delivery models – and consumers are responding...



**59%** say mHealth has changed how they seek information on health issues



**49%** expect mHealth to change how they manage their overall health



***...and also leveraging these new technologies to self-manage their care***

**59%**

*of patients say that mHealth services have replaced some visits to doctors or nurses*

In the next three years, patients agree mHealth applications/services will:

**52%**  
make healthcare substantially **more convenient** for me

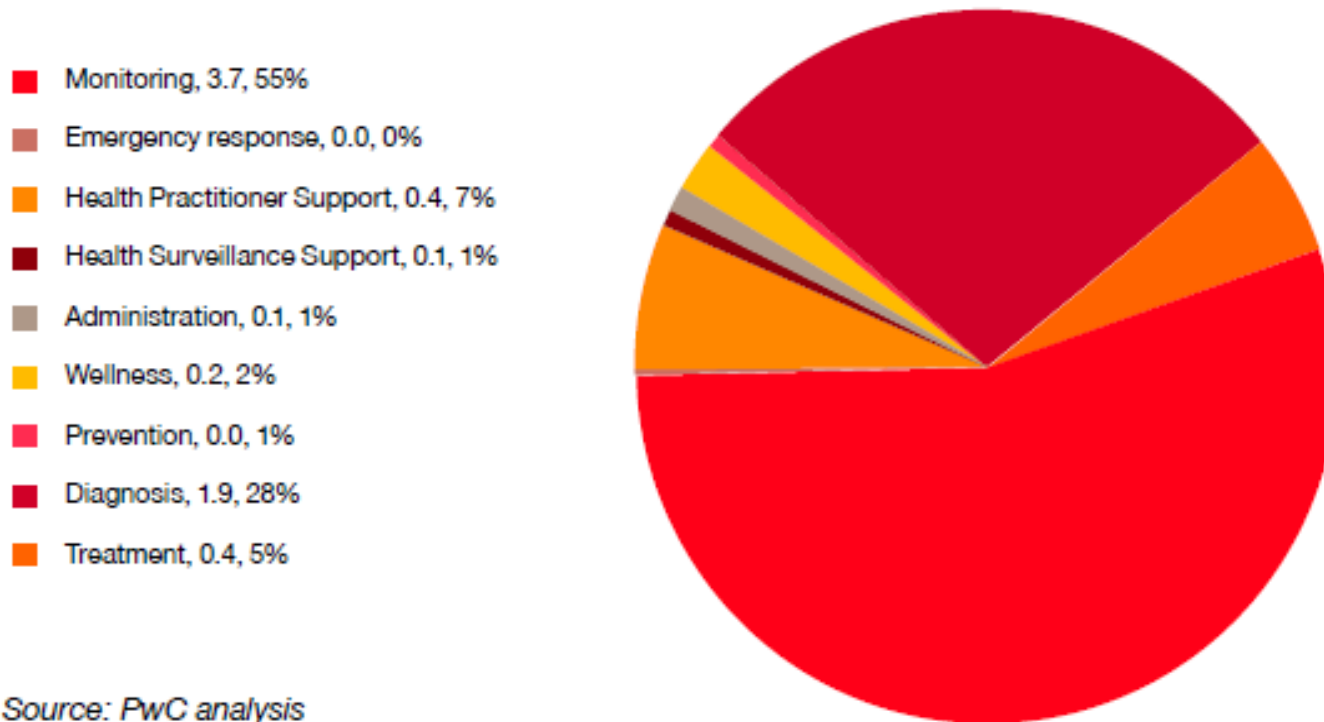
**48%**  
improve the **quality** of healthcare I receive

**46%**  
substantially **reduce my healthcare costs**



# Mobile health has multiple applications in the disease lifecycle from diagnosis to treatment and monitoring

Mobile health market opportunity by service categories in APAC, US\$ billion, 2017



Source: PwC analysis



# From “flying ambulances” to remote care delivery



Source: Protomag



Source: USA Today



Source: International Business Times




# *Drones are increasingly being put to use in medical emergencies in remote areas*



MACH JAN 12 2017, 6:31 PM ET

## **One of These Drones Could Save Your Life**

by STEVEN ASHLEY

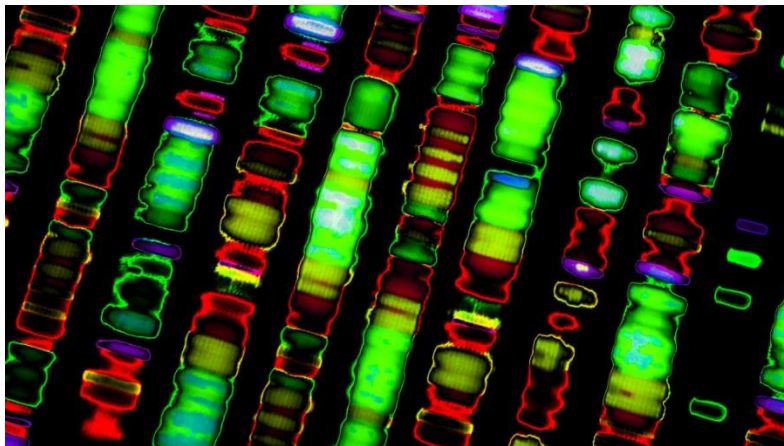
A delivery drops from a Zipline drone.  Zipline



Source: NBC News, IFL Science

## *The cost of genome sequencing is getting lower and lower...*

- On January 9 2017, “Illumina says it can deliver a \$100 genome – soon”

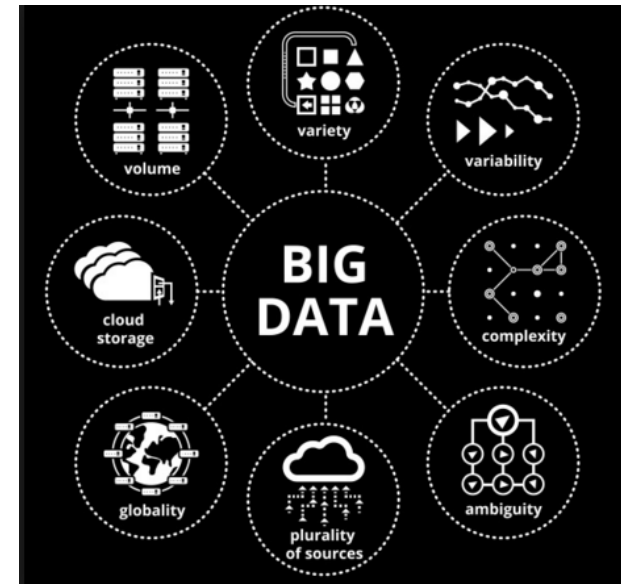


***...with direct-to-consumer genetic tests getting more and more in demand***

- On Thursday 6 April 2017, “The FDA gave 23andMe permission to market its Personal Genome Service genetic health risk tests for 10 diseases, (being) the first direct-to-consumer genetic test the FDA has allowed to provide that information”



Big data is growing at a rate of 50 per cent per year – providing rich opportunities to target and personalise engagement with products and services



# O2O

In the world of retail the notion of online-to-offline, is increasingly important, but the lines between physical and virtual channels are blurring even in healthcare

### *Internet of Things*

A proposed development of the Internet in which everyday objects have network connectivity, allowing them to send and receive data.

### *iBeacons*

Apple's technology which allows Mobile Apps to listen for signals from beacons in the physical world and react accordingly.

*And this is just the technology that is within our reach, what about those technologies that are yet to become mainstream?*

### *Augmented Reality*

A technology that superimposes a computer-generated image on a user's view of the real world, thus providing a composite view.

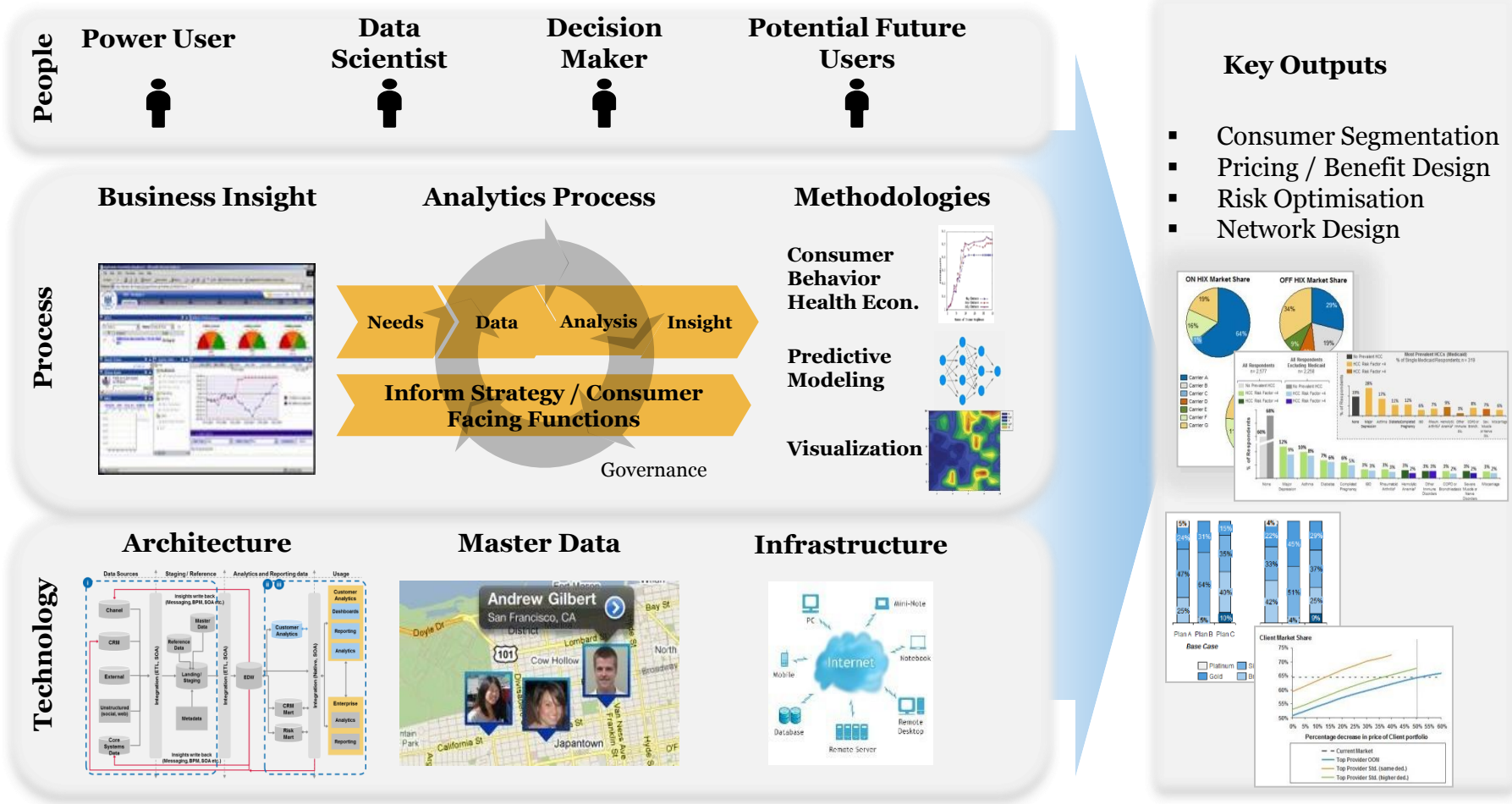
### *3D Printing*

A process for making a physical object from a three-dimensional digital model, typically by laying down many successive thin layers of a material.



# All this data provides clinical as well as non-clinical information to allow the provision of deep analytics

## Consumer Analytics Capability System



# Whether artificial intelligence (AI) will really redesign healthcare is debatable, but it certainly has started to revolutionize our lives

**Machine Learning-Gen (96 Companies)**  
 Digital Reasoning, bigml, IActive, ONDUCTRICS, GRIDSPACE, tryo-labs, Predictry, MetaMind, pramatica, sentient, Popego, SI, cYcorp, SKYTREE, GraphLab, Textnomics

**Machine Learning-App (201 Companies)**  
 siftscience, is, AdSteps, IPONWEB, arago, VOLTARI, Sense Networks, Oony, Symplicity, DigitalBMR

**Computer Vision-Gen (97 Companies)**  
 cortica, rbeut, Cognitive NETWORKS, DIGITAL SIGNAL, AlchemyAPI, image metrics, clarifai, EMOTIENT, FACE++, blippAR, imaggA, HUYNTECH, ImageSunder, HV

**Computer Vision-App (73 Companies)**  
 flyby, jetpac, quikkly, percipio, SNAP FASHION, Paletty, sension, face.com, NYCTM

**Smart Robots (52 Companies)**  
 neato robotics, anti, jibo, MR, MONSIEUR, ALDEBARAN, iRobot, IXY, PLAY, hands

**Virtual Personal Assistants (71 Companies)**  
 Vlingo, sherpa, tempo, Siri, appforma, MALUUBA, medwhat, aivo, eJenta, LBM, Incredible

**NLP-Speech Recog. (65 Companies)**  
 VoiceBase, VS, yap, m, speech, verbio

**NLP-Gen (127 Companies)**  
 SwifKey, cortical.io, digital trowel, DataRPM, SYNAPSIFY, NarrativeScience, CLEARFOREST, inbenta, COGNITION, DELVER, typemart

**Speech to Speech Trans. (15 Companies)**  
 Raytheon, BBN Technologies, Aptek, exifone, T. with you, my Language

**Context Aware Comp. (28 Companies)**  
 APPEAR, grokr, semuSI, cleversense, Kimera Systems, trolion inc., EnFind, origo, Overlay, Zandoo

**Gesture Control (30 Companies)**  
 GestureLink, 3DiVi, eyeSight, omek, LOOTWORKS, gestigon, playmobot, ZenGlove, cube26, laINTUIGINE, connovate, PlayFresco, 4tiitoo

**Recommendation Eng. (54 Companies)**  
 Utrip, figoo, h, DE/TI, nara, snapsort, b, loop, Tipiflore, exenSa

**Video ACR (14 Companies)**  
 ENSWERS, am audible, WESEE, ueronica, digitalrecognition, VisionSmart, VTAG, everig, Vision, Cognitive

## Artificial Intelligence

Contact [info@venturescanner.com](mailto:info@venturescanner.com) to see all 826 companies





Digital disruption:

Ready or not, here it comes.

*How long did it take the telephone to get to 50 million users?*

- A. 15 years
- B. 35 years
- C. 55 years
- D. 75 years



***How long did it take the television to get to 50 million users?***

- A. 3 years
- B. 13 years
- C. 23 years
- D. 33 years



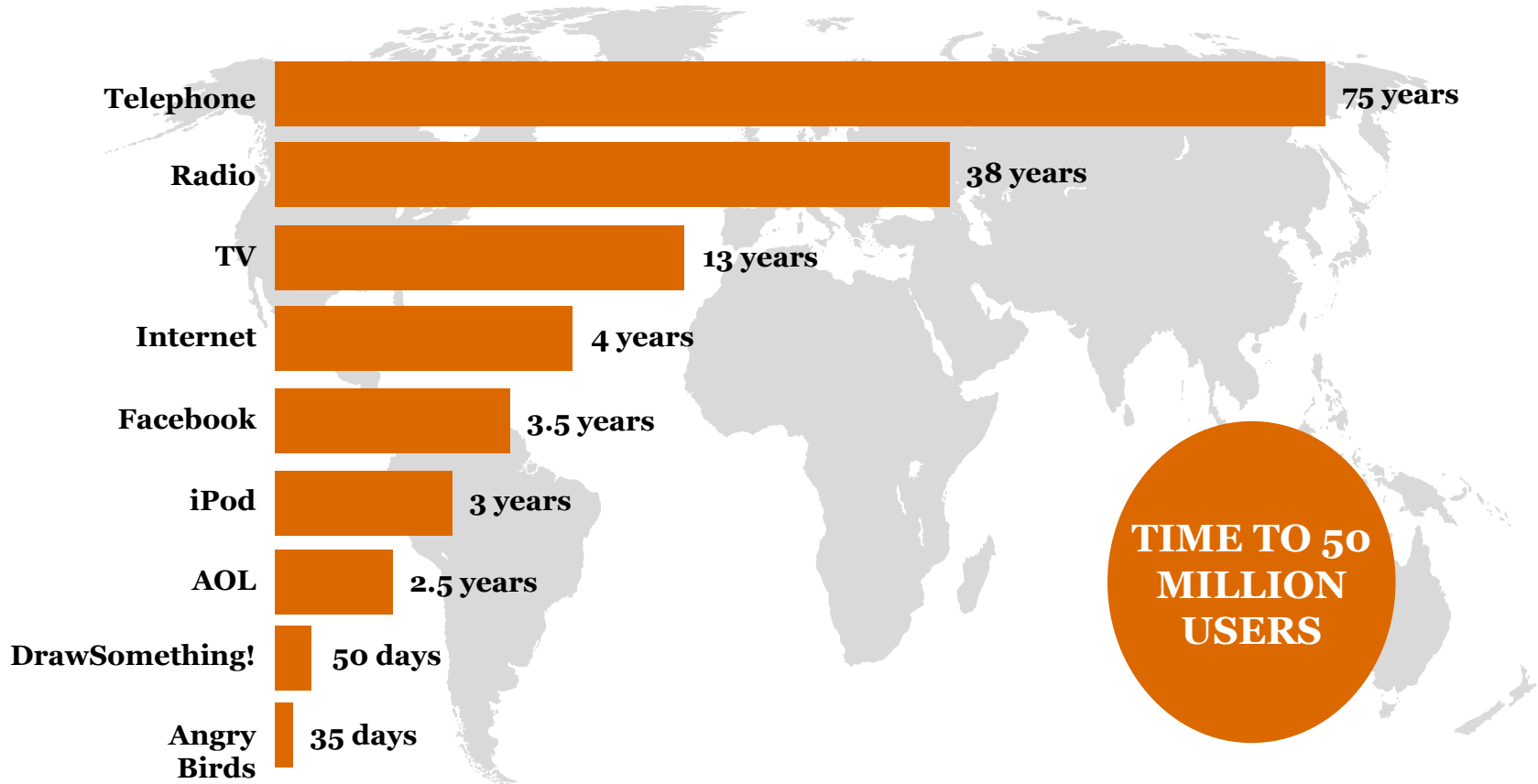
***How long did it take Angry Birds to get to 50 million users?***

- A. 1 year
- B. 1/2 year
- C. 3 months
- D. 1 month



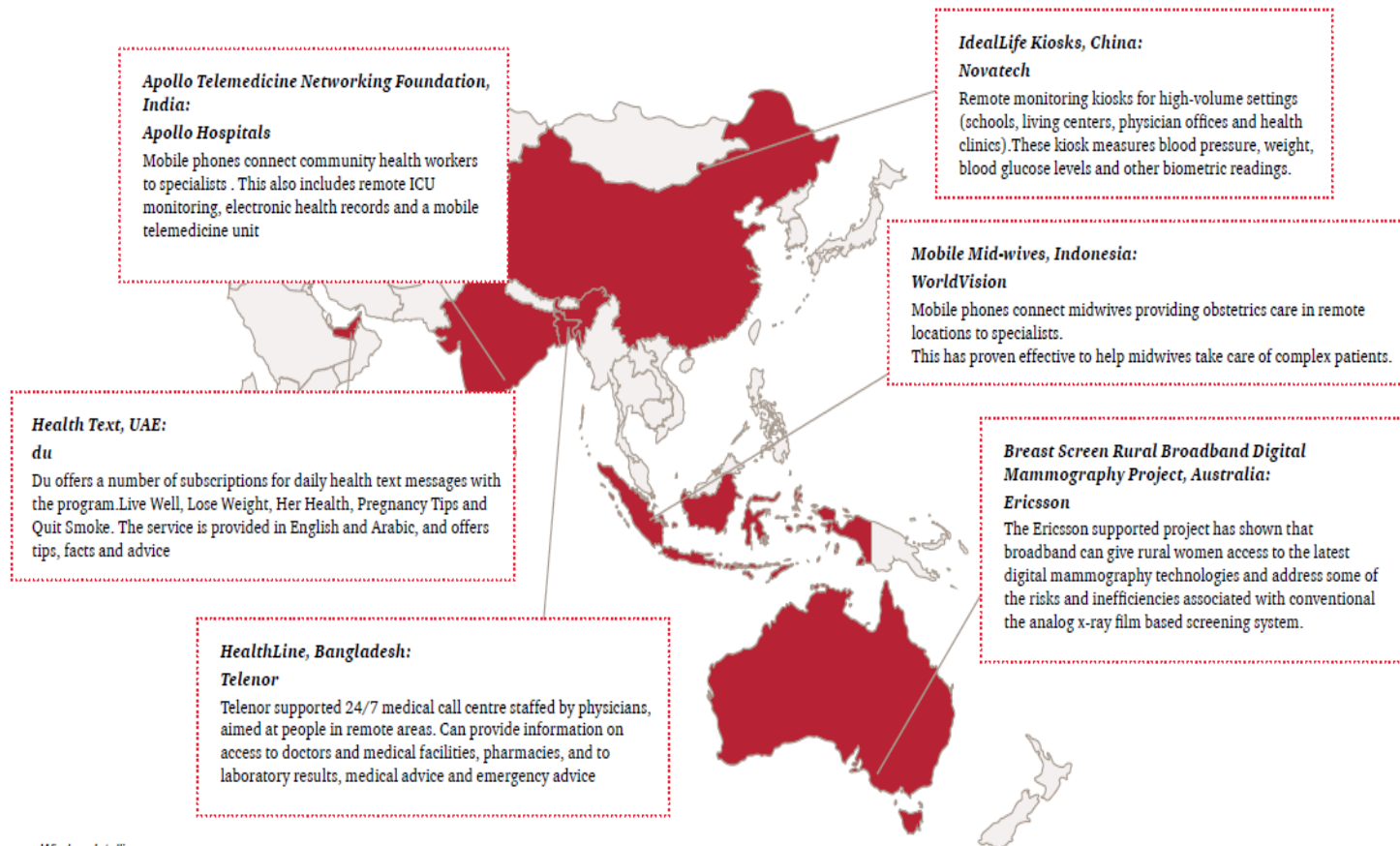
# The pace of digitization is exponentially increasing; years to days

## Digitalization Adoption



Source: visual.ly.com

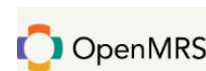
# Across APAC, there are numerous examples of mobile health deployments



Source: Wireless Intelligence



*Even across emerging markets, there are countless new digital health models being developed, many of which have already revolutionized the way care is delivered*



## ***What about the new kids on the block?***

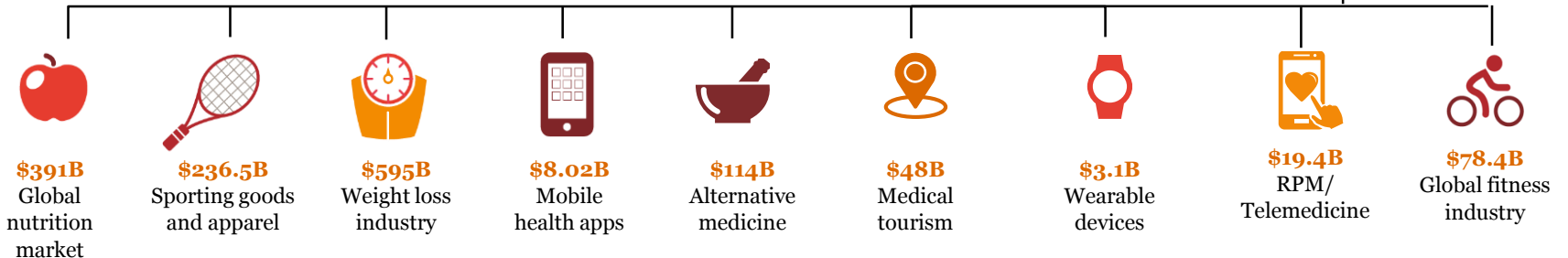
*A disruptive, recent arrival to a market or industry. It may include companies whose core businesses reside entirely outside of the new industry, or looking to expand into new roles.*

# Disrupting what's "static" will be the cornerstone of the new entrants' business models...

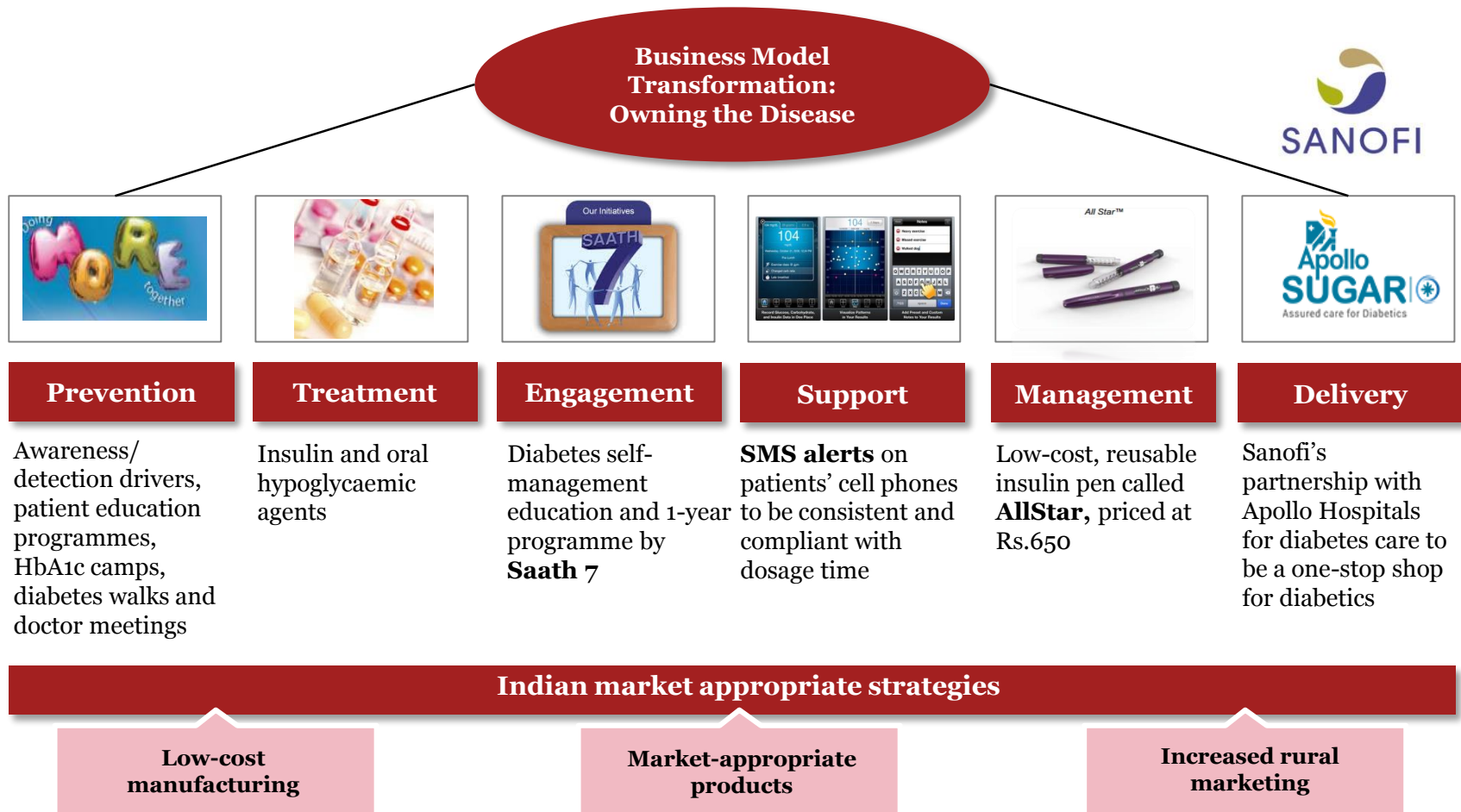
Disruption is not going to come from traditional healthcare sources, but rather from the **new entrants willing to play around the conventional modalities**

Government & private providers: USD 8.1 Trillion

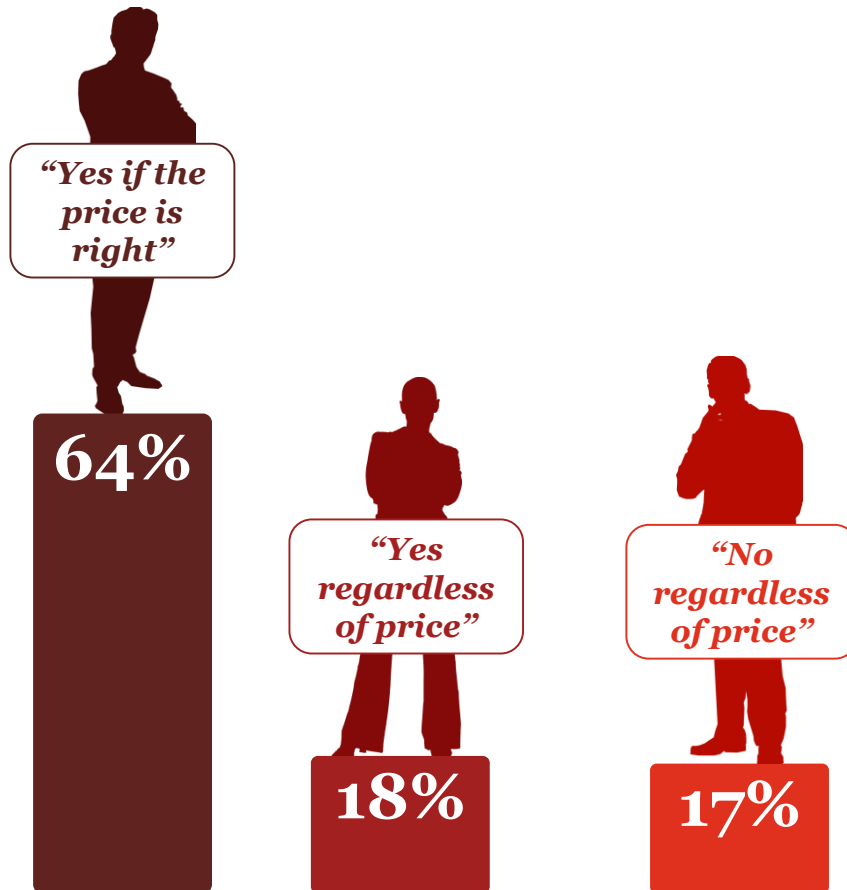
Global ancillary & wellness market: USD 1.49 Trillion



# ...with the lines between various stakeholders increasingly blurring



**Health systems are starting to recognize that consumers are ready to receive care in new ways from these new entrants**



82%

of survey respondents said they were open to trying **new, non-traditional** ways of seeking medical attention or treatment.

# *Disruptive trends are revolutionising the industry, and impacting the delivery and financing of care*



**Demographic shifts & social change**



**Shift in global economic power**



**Technological advances**



**The empowered consumer**



**Globalisation**

...resulting in:



**The emergence of new business models**



**New entrants expanding and reshaping the health system**



**A rebalance of the public and private sectors in the financing and delivery of care**



**A greater focus to reward for outcomes instead of volume of activity**



**A trend from inpatient care to outpatient services**



**The healthcare sector industrialising**

# ***Business models are already exhibiting the various elements of successful disruptors in other industries***

*Our daily lives have been overhauled owing to multiple disruptive innovations*



*Stay*



*Exercise*



*Travel*



*Connect*



*Buy*

*Home  
healthcare*

*Continuous  
vitals  
monitoring*

*Remote  
access*

*Patients  
feedback  
mechanism*

*Value-based  
outcomes*

***A disruptive healthcare business model must include all the above elements***

# *The clock is already ticking...Is the time ripe for healthcare?*

The world's most popular media owner, ***creates no content***



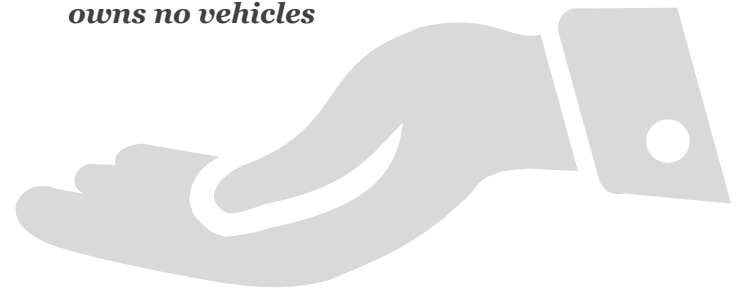
The most valuable retailer, ***owns no inventory***



The world's largest accommodation provider, ***owns no real estate***



The world's largest taxi company, ***owns no vehicles***

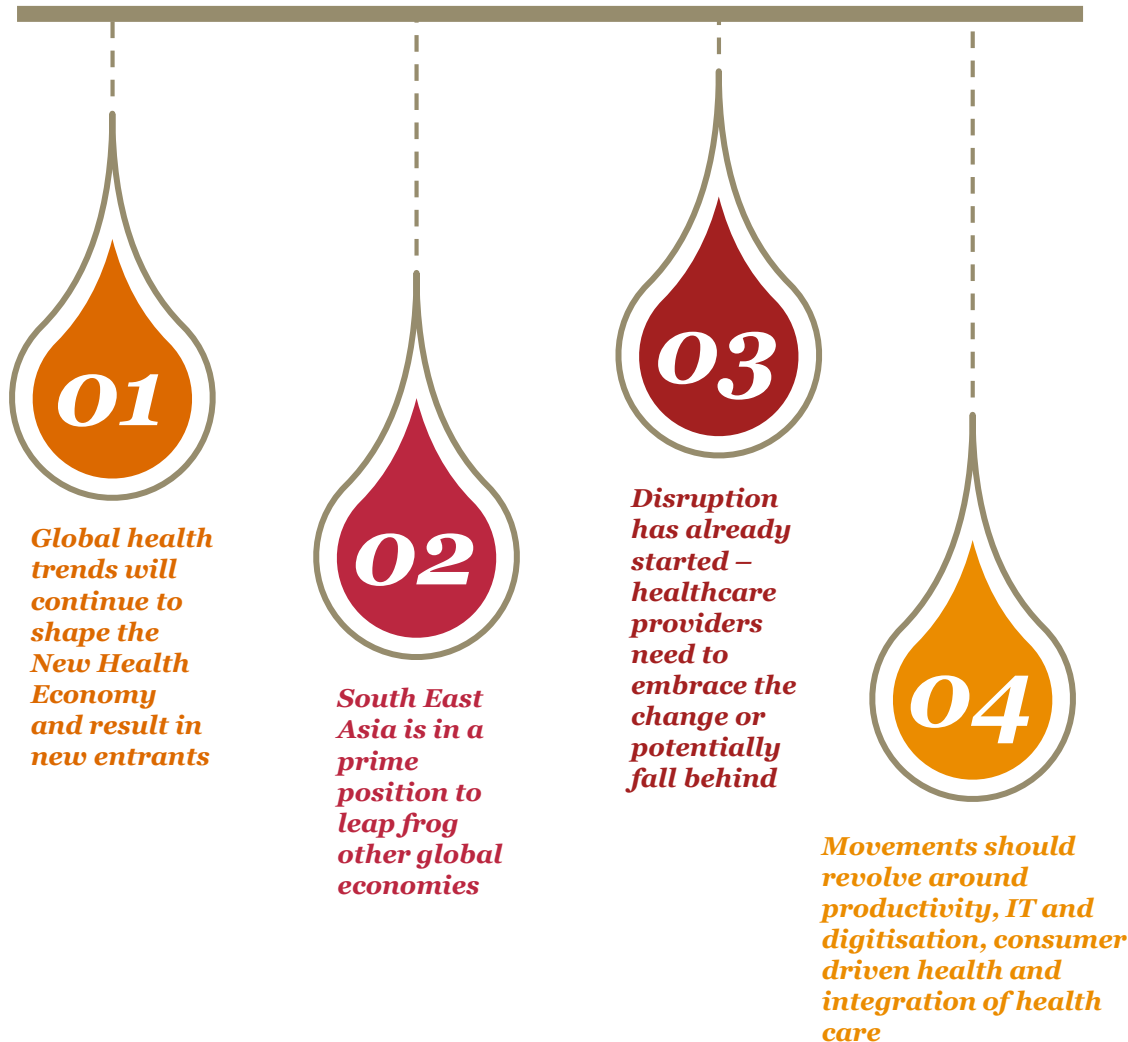




***A new era of health is upon us...Are we ready for a hospital which has no patients?***



## *Takeaways based on global healthcare trends*



# *Transformative future of the industry & the importance of innovation and collaboration*



# Case Study: Verily and Alcon – Digital contact lenses for diabetes management

1 

Sensors are embedded between two soft layers of lens material and a pinhole in the lens allows tear fluid to seep into the sensor and be used to measure blood sugar levels.



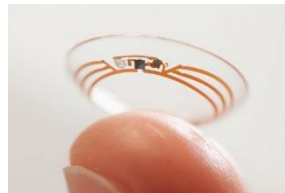
2 

A microscopic wireless antenna then communicates this data to a wireless device, which transmits it to external receiver devices (users, care givers, providers etc.)



3 

Continuous glucose data is also sent to an associated app on the user's smartphone which prompts the user to act and make decisions



4 

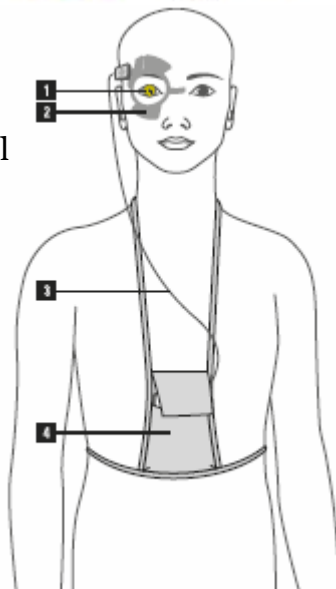
Providers can predict adverse events caused by diagnosis based on continuous glucose monitoring data

# Case Study: SENSIMED Triggerfish® – Smart contact lenses to tackle glaucoma



**1** SENSIMED Triggerfish® Sensor is a soft disposable silicone contact lens embedding a micro-sensor that captures spontaneous circumferential changes at the corneoscleral area

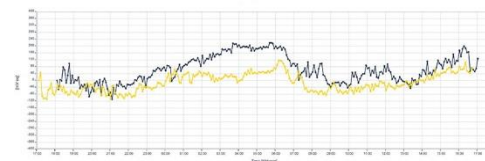
**2** The adhesive SENSIMED Triggerfish® Antenna, which is placed around the eye, receives wirelessly the information from the contact lens



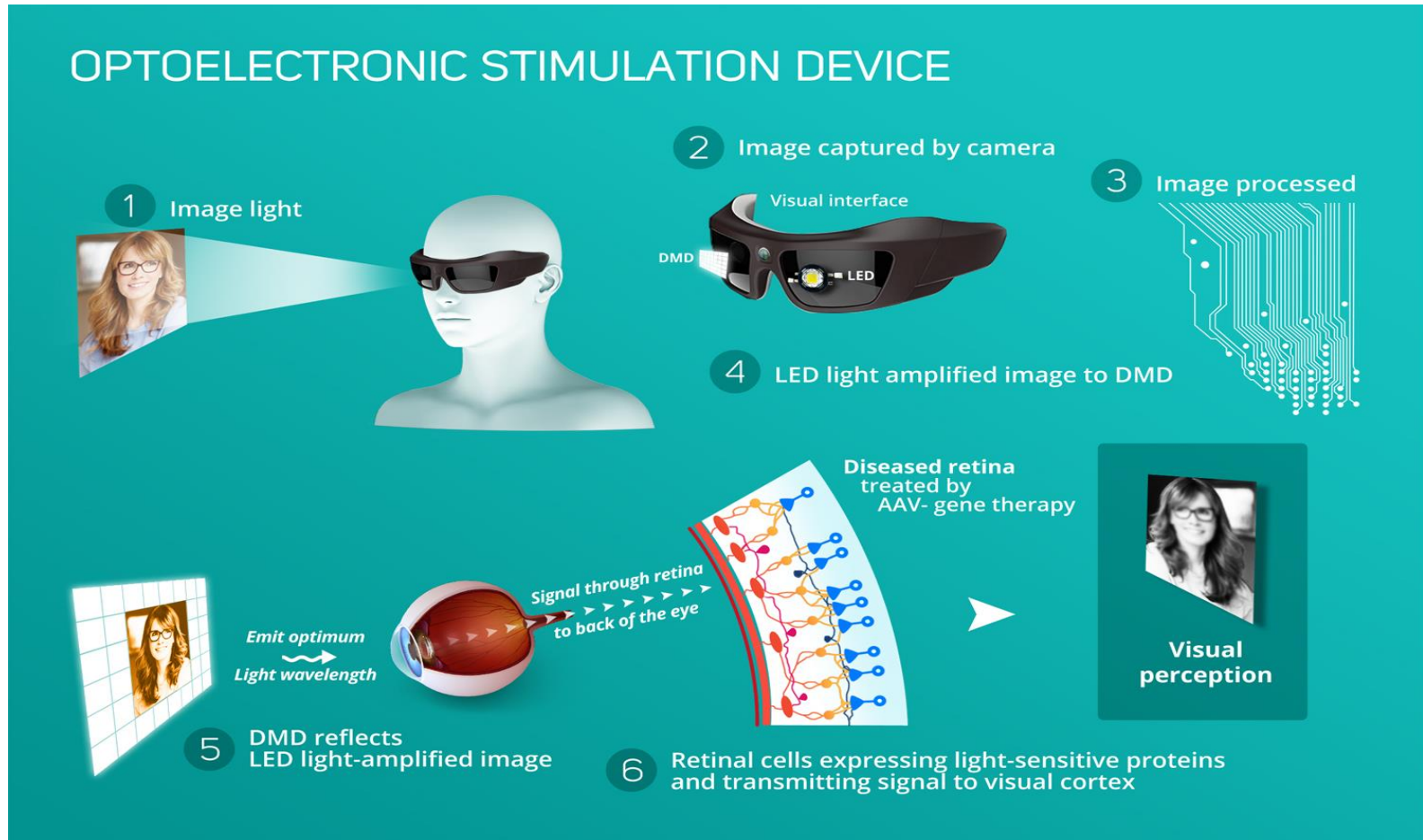
**3** The data is transmitted through a thin flexible cable from the Antenna to the portable recorder

**4** The portable recorder, worn by the patient, stores the acquired data during the monitoring session. At the end of the recording period, the data is transferred via Bluetooth from the recorder to the software previously installed on the practitioner's computer

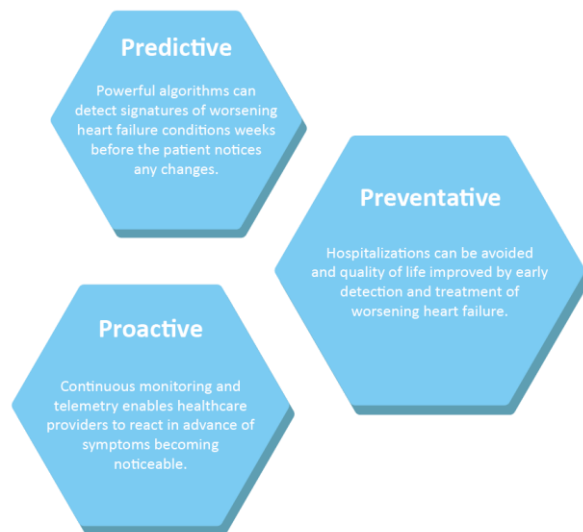
- Provides information on continuous natural changes to the eye to ophthalmologists including intraocular pressure
- Allows improved glaucoma management and faster intervention



# Case Study: GenSight Biologics – Biomimetic goggles to treat faulty retina with a goal to preserve or restore vision



## Case Study: ReThink Medical – Heart failure prediction



- Raised \$3m for a wearable that predicts and prevents heart failure
- Algorithms can detect signatures of worsening heart conditions weeks before patient senses them; usually a month of worsening conditions and heart failure
- Data transmitted via WiFi hub to a provider, who intervenes if problems detected
- Partnership with Japanese device company Terumo

## Companies driving innovations in smart clothing



Shirts and shorts for improved workouts and training

Focused on professional athletes  
 Uses EMG (electromyography), as well as heart rate and acceleration, to track muscle use, which is then sent to a companion app  
 \$50.7M raised



OMbra is a sensor-equipped, fitness tracking smart bra

OMbox snaps onto back of bra to read heart rate, respiration, movement, and steps via the bra's sensors  
 Bra-only retails for \$60, or available as a package with the OMbox and USB cable for \$143  
 \$21M raised



Biometric shirt that tracks steps, distance, heart rate and more

Pairs with third-party running apps like Strava, Runkeeper and MapMyRun, as well as GPS-enabled smart watches  
 Grant from Department of Homeland Security for research on monitoring first responders  
 Retailers for \$399



Smart sock maker has moved into upper garments

Funded a Kickstarter project for new app and garments that synch with a heart rate monitor and can text a friend or family member if a user is experiencing cardiac irregularities  
 Partnerships with Renault and Microsoft, the latter of which previously employed the company's three founders



Smart sock monitors a baby's heart rate and oxygen level

Uses pulse oximetry to measure heart rate and oxygen level and sends an alert if baby stops breathing  
 100,000 hours of testing; 100 billion heartbeats monitored  
 Retailers for \$249  
 \$25M raised



Powered suit to aid the elderly in strength and mobility

Will aid in complementing strength during the act of standing up, sitting down or staying upright  
 Developed for a DARPA-funded program to reduce injury risk and enhance soldier endurance while carrying heavy loads  
 \$9.6M raised



## Other wearable examples by Pharma and MedTech



NEC



**NEC/Gunze Ltd.** - Developed an intelligent undershirt that can be connected to a smartphone and provide data on the health of the person wearing it. The shirt has an ultra-fine and flexible sensor (which can be removed before the shirt is washed) that can monitor posture, heart rate, and calories consumed and burned.



**Kyocera** - announced that it will collaborate with The Association for Preventive Medicine of Japan in the field of healthcare to offer a new service, Daily Support®, which aims to assist with continuous lifestyle habit improvements through the use of a smartphone and wearable device combined with individual guidance from healthcare professionals. Planned to launch in fall 2015 in Japan, the service will be provided to companies, health insurance unions and healthcare service providers seeking better health management for employees and clients.

## TOSHIBA

**Toshiba** - rolling out two activity trackers that can help caregivers monitor seniors remotely. Through an analysis of sensor data, the Silmee W20 and W21 wristbands can help track the amount of time a user spends eating as well as conversing with others. The bands can compile the data into life logs to be shared with caregivers



**Takeda** – Getting serious about digital Takeda walks the walk with its digital accelerator model The company has also launched iBData, a wearable digital technology pilot program to support patients and physicians with the management of inflammatory bowel disease (IBD). The program is a partnership with Texas Digestive Disease Consultants and Vanderbilt University Medical Center and is designed for IBD patients to track their symptoms and lifestyle factors with wearable watch technology

## Case Study: eyeNETRA – Point of care diagnostics and VR



Mobile Clinic Kit with Printer



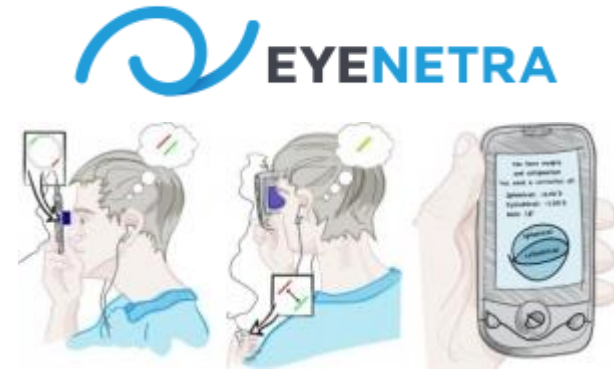
Smart Phone Autorefractor



Smart Phone Lensometer

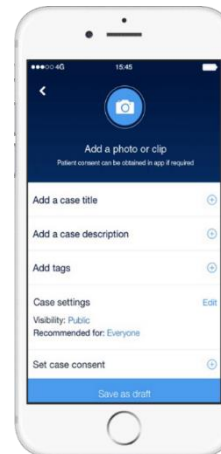
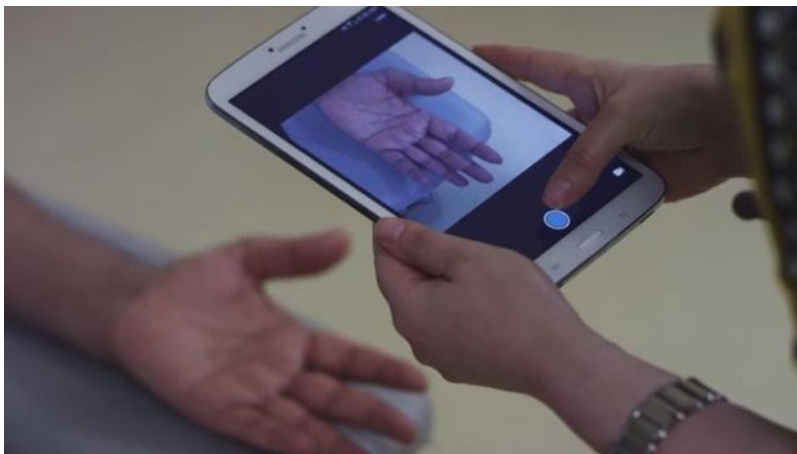


Smart Phone Lensometer

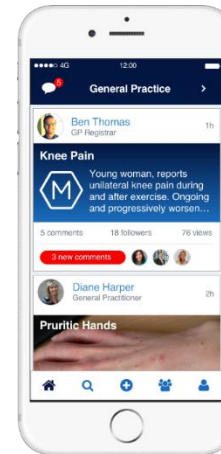


- MIT-incubated start-up that offers a series of Point of Care diagnostic tests for refractive errors (near and far sightedness)
- The equipment easily plugs into smartphones and has supporting applications which enable easy diagnosis, recording and transmission of test results
- The company is now seeking partners to create prescription Virtual Reality Screens

# Case Studies: MedShr and MyDoc – Smart phone apps that can be used to seek second opinions via affordable and accessible teleconsults



Create cases

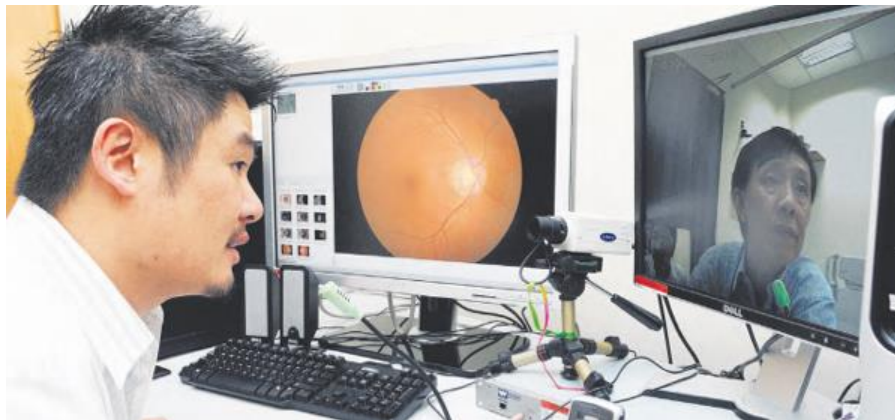


Share & Discuss



Connect & Network

## Case Study: Tan Tock Seng Hospital, Singapore – Improving eye care with tele-ophthalmology



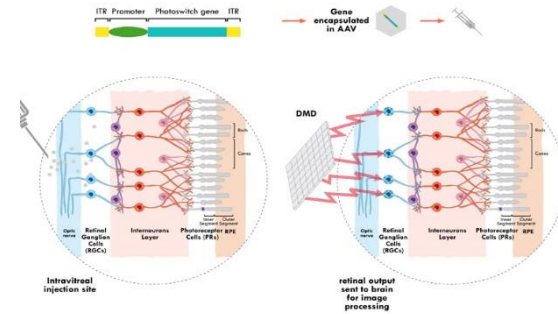
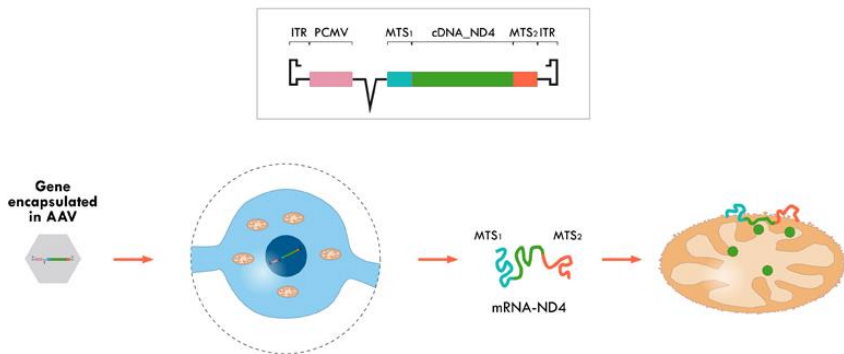
- Modified teleconferencing system to enable patients and specialists to see and speak to each other
- System is set up at easily accessible neighborhood polyclinics and uses portable cameras and multiple computer screens
- Clinic does a pre-consultation assessment and results are shared with specialists ahead of the consultation
- Initiative found to reduce the load of acute care institutions and is now being extended to multiple polyclinics

## ***Case Study: Deft University of Technology – Ambulance drone with cardiac defibrillator***



- Ambulance drone in-built with a cardiac defibrillator that can reach patients during a cardiac arrest within 12 square km in less than 1 minute
- Via telemedicine and an in-built camera, an emergency operator can give instructions and observe for correct application by the civilian responder
- Survival rate from a cardiac arrest could be increased to 80% under the quick arrival response of the ambulance drones, rising even to 90% when an untrained responder is given accurate instructions by the emergency operator.

# Case Study: GenSight Biologics – Genetic engineering-based novel therapies for neurodegenerative diseases of the eye



The proprietary **Mitochondrial Targeting Sequence (MTS)** permits missing mitochondrial proteins to be shuttled into the mitochondrion, enabling restoration of mitochondrial function

**Optogenetics** uses gene therapy to introduce a gene encoding for a light-sensitive protein into specific target cells in the retina enabling them to respond to light stimulation in place of damaged photoreceptor cells

Leber Hereditary Optic Neuropathy (LHON)

Retinitis Pigmentosa (RP)

Geographic Atrophy in dry-AMD

# Case Study: Intelligent Research in Sight (IRIS™) – Registry for ophthalmology cases

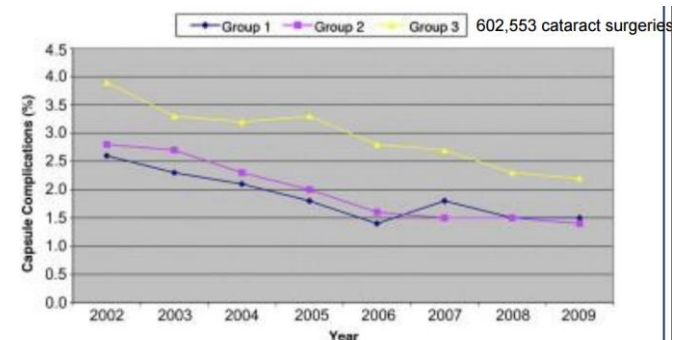
## What is IRIS™?

- First comprehensive eye disease clinical database
- Captured data from 10,800 ophthalmologists covering more than 48 million patients (2015 estimate)
- Uses HIPAA-compliant methods to collect data from EHRs
- Provides real-time feedback and drives improvements in quality and outcomes



## What does IRIS™ offer?

- Consistent quality reporting standards and outcome measures for eye diseases
- Measures efficacy of various therapy options
- Identifies areas for further research and validation



- Multivariate analysis: age, poor preop visual acuity, glaucoma diagnosis,

## Case Study: Google's Deep Mind – AI to diagnose diabetic retinopathy and AMD



### NHS to use Google DeepMind AI app to help treat patients

The Streams app will alert clinicians when a patient is at risk of acute kidney injury.

Jamie Rigg, @jmerigg  
11.22.16 in Medicine

Comments

454  
Shares



streams

MEET YOUR MOBILE DEVICES' NEW *Best* FRIENDS! Top rated apps available on all devices

Sponsored Links by Taboola

Now You Can Track Your Car Use Your Smartphone

Tiny Device Transforms Old Car Into a Blazingly Fast PC

Google and the Royal Free London NHS Foundation Trust have announced a fresh five-year collaboration today, which will see the former's DeepMind AI used to improve patient care across the trust's various hospital sites.



- Google's Deep Mind team is partnering with UK's NHS to develop a machine learning algorithm that can scan millions of retinal images and detect diabetic retinopathy and age-related macular degeneration (AMD)
- Physicians currently diagnose using physical medical charts and interviewing patients but the error rates are 10-20% on average

### Development and Validation of a Deep Learning Algorithm for Detection of Diabetic Retinopathy in Retinal Fundus Photographs

Varun Gulshan, PhD<sup>1</sup>; Lily Peng, MD, PhD<sup>1</sup>; Marc Coram, PhD<sup>1</sup>; [et al](#)

[» Author Affiliations](#) | [Article Information](#)

JAMA. 2016;316(22):2402-2410. doi:10.1001/jama.2016.17216



## Some other examples of AI in healthcare



FDNA collaborates with pair of genomics testing labs on Face2Gene

FDNA will team with GeneDx and Blueprint Genetics on Face2Gene LABS, with FDNA sharing phenotypic data with the labs in real time

Face2Gene aims to accelerate rare disease diagnosis by evaluating a patient's clinical signs through artificial intelligence and facial analysis

One in 10 people worldwide suffer from a rare genetic disease



Cera launches AI chatbot for UK home care decision support

It targets assisting carers with recommendations for home care of people with conditions such as dementia

Today, the bot, Martha, recommends care packages to potential customers

It's relying on social care workers to generate the underlying data to train the AI

Raised \$3.4m to date



Sunrise is an AI-guarded group chat for mental health

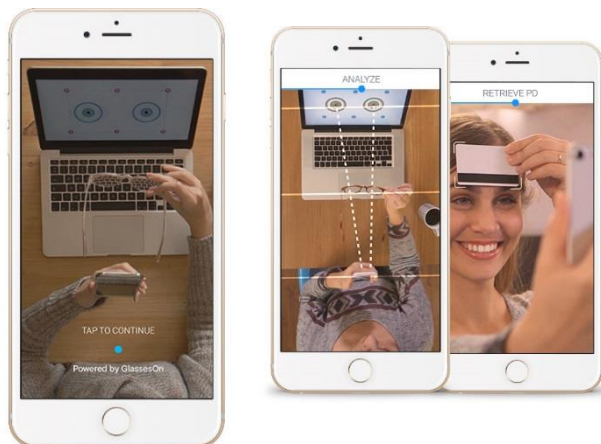
Sunrise is text group therapy integrated with natural language processing

Support for PTSD, depression, grief and substance abuse

One-on-one chat with a pro precedes placement in a group with 12 others with the same condition

VoIP phone calls are also provided to better simulate in person sessions

## Case Study: 6 over 6 – Digital optometry tools for consumers



### GlassesOn

- Mobile-based digital optometric tools to check eyesight and buy glasses online
- Uses a patent technique involving manipulation of light; registered as a Class 1 Exempt Medical Device with the FDA
- Provides a spontaneous, fashion-centric experience

### GlassesOn Eyes

- Currently under development
- Manipulates optical and perceptual phenomena to give full measurement of refractive errors

## ***Case Study: Novartis and TicTrac – Patient engagement platform for people with multiple sclerosis***



- Partnership with patient engagement platform for multiple sclerosis patients to record data from wearables and social media
- The campaign prompts participants to track different aspects of their lifestyle including weight, activity, mood, and workload
- This data is used to create visualizations of their day-to-day life. Participants can sync various platforms and devices with Tictrac's platform including Fitbit, Jawbone UP, Withings, Gmail, Facebook, and Runkeeper

## Case Study: Mount Sinai – Healthcare information access



Mount Sinai Hospital and Apple co-developed an app which connects healthcare professionals.

App provides healthcare professionals with anywhere access to data from 66 applications used in the hospital.

Data includes clinical data, reference materials and patient information. Passwords and VPN certificates provide the appropriate levels of security



# Case Study: Ningbo – Digital and cloud hospital in China



## Case Study: A futuristic combination to replace hospitals?

06.21.17

### Who Needs A Hospital, When This Self-Driving Doctor Comes To You?

A new concept called Aim brings the doctor to you, in a self-driving car.



1/8 [Image: courtesy Artefact]

**BY MARK WILSON**

3 MINUTE READ

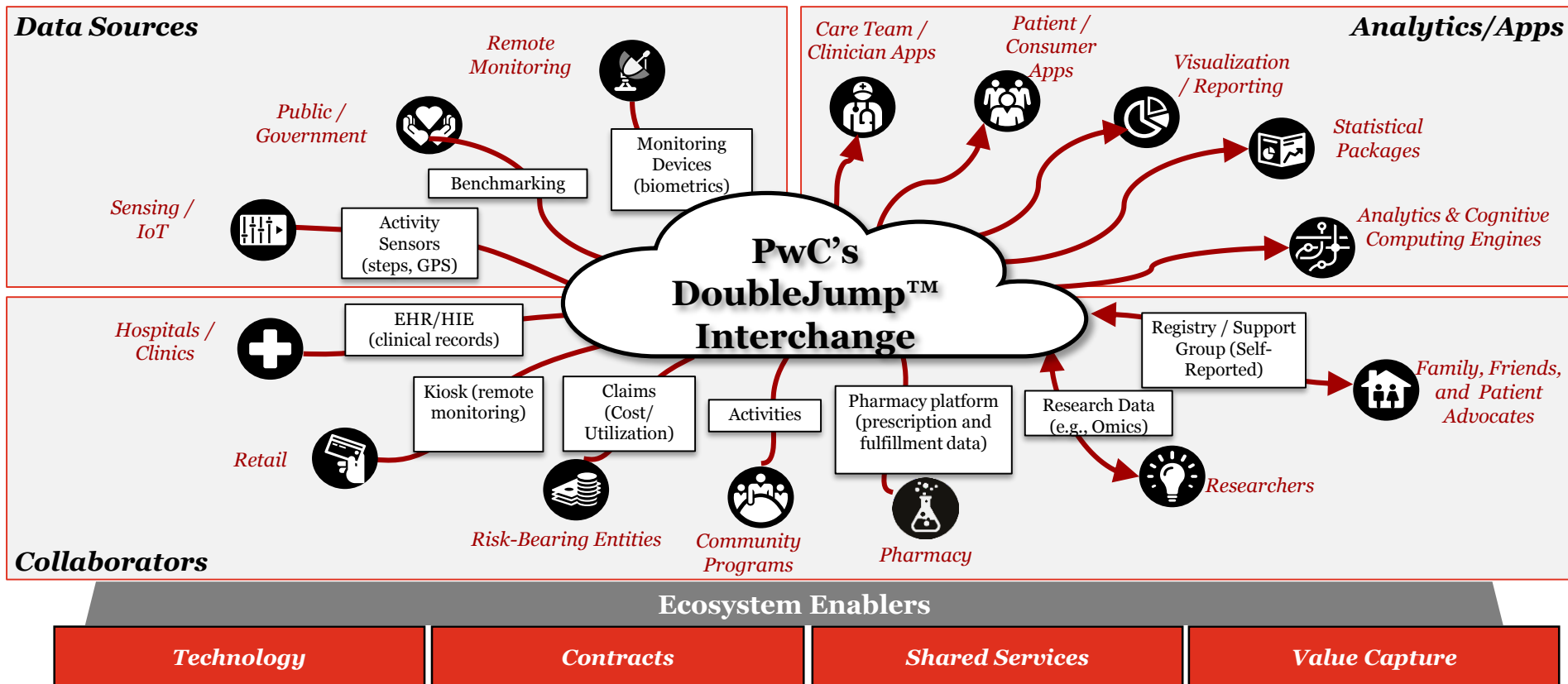
Even those of us fortunate enough to have good health insurance will often put off seeing a doctor when we probably should. Often it's



3/8 [Image: courtesy Artefact]

# Case Study: Are telcos the perfect medium?

PwC's DoubleJump™ Interchange supports collaboration across an ecosystem with telcos being ideal partners



# Case Study: Insurance

## Health Insurance Has Changed

**FROM**

Your employer defines your health benefits

Cost based on employer negotiated rates

Limited correlation between health services and cost

**TO**

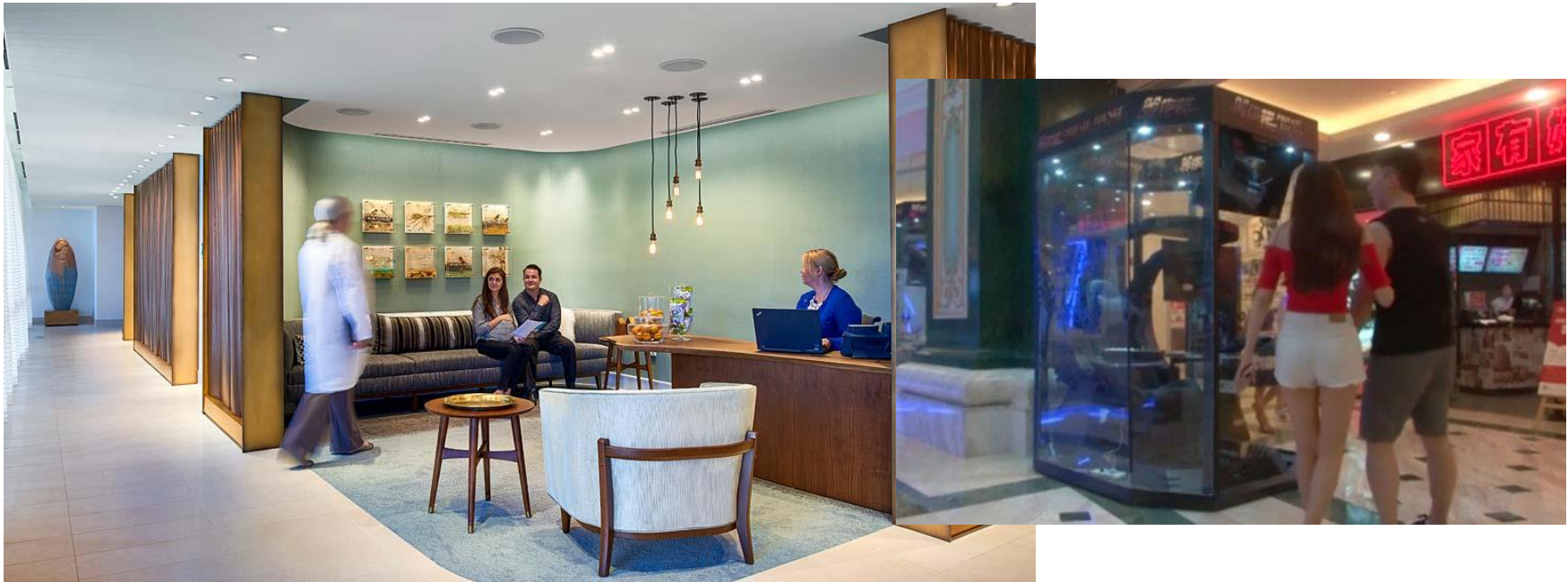
Health benefits defined by personal choice and health needs

Cost based on market rates via health exchanges

Increased sensitivity as cost is personalized via high deductible plans



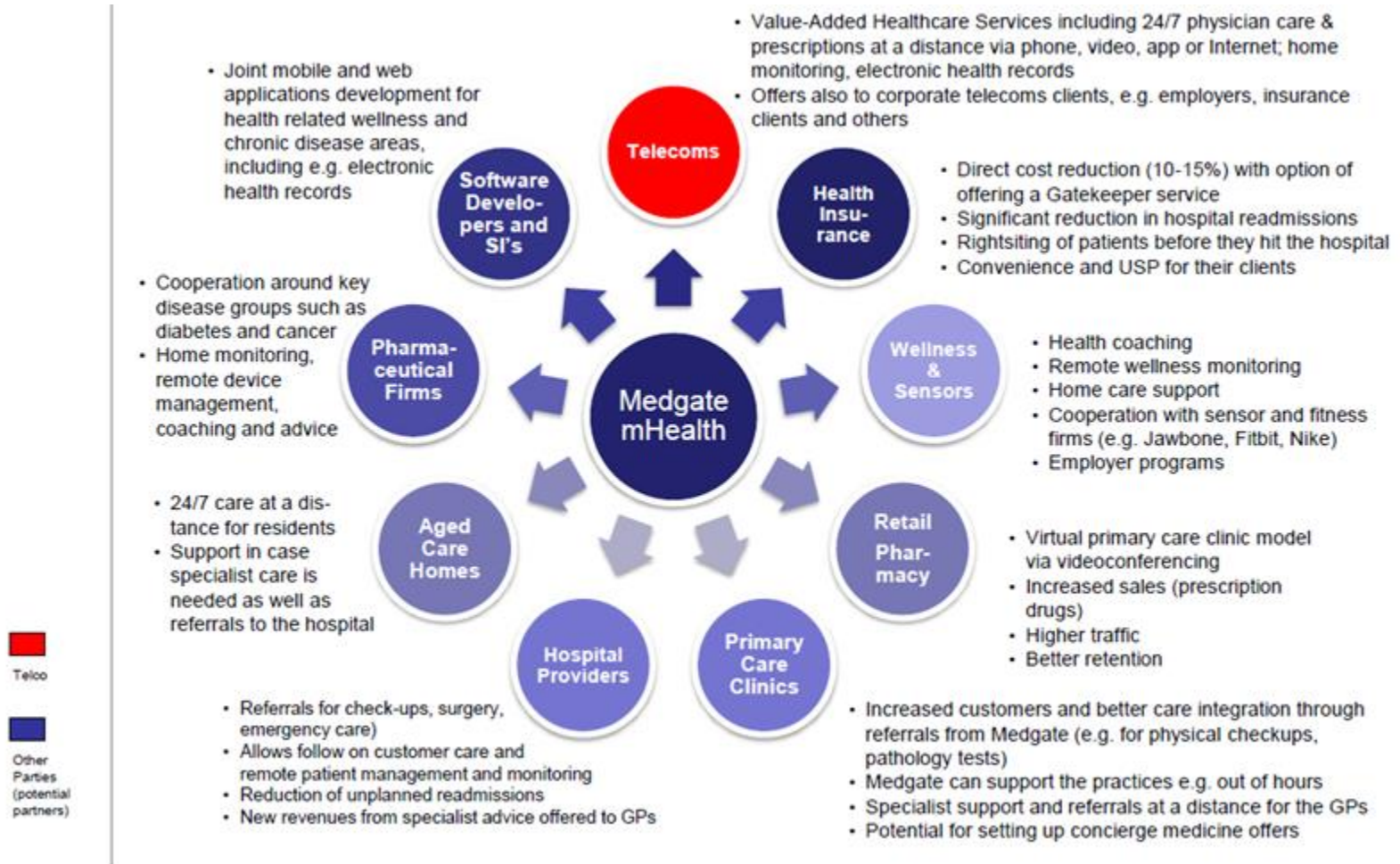
## Case Study: Retail



### **Retail Health, Retail Medicine and the New Healthcare Experience**

People expect convenience, quality and transparency when choosing how to spend time and money – and increasingly they seek the same from healthcare providers. Retail health is emerging as a means of delivering quality, convenient care to millions of consumers, as well as a model for healthcare systems to consider when providing services to new and existing patient populations.

# Examples of various industry sectors using telemedicine service offerings



# *Challenges*



***As a clinician, I've always believed we should use technology to complement our clinical practices, not replace them***

***Are we losing the healing 'touch' of medicine?***



Image from: Philips / [www.usa.philips.com](http://www.usa.philips.com)



Image from: <http://medicalfuturist.com/why-people-should-not-fear-digital-health/>



Accessibility  
Affordability  
A+ Care



Interoperability  
Integration



New entrants



Security (Cyber)  
Safety



# New Health Economy



People  
Privacy



Technology  
Transformation



Engagement  
Experience  
Expertise



Transparency  
Treatment

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# PATIENTS

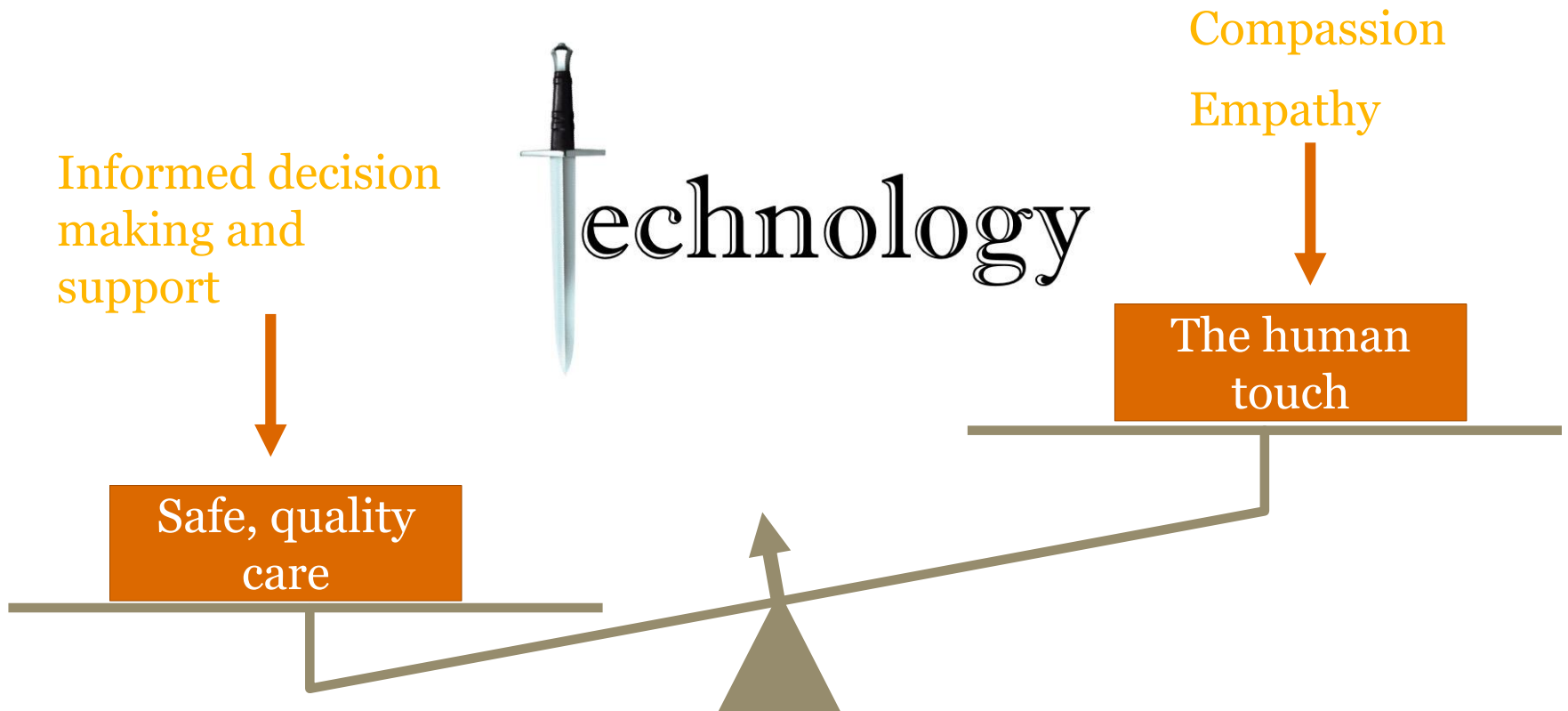
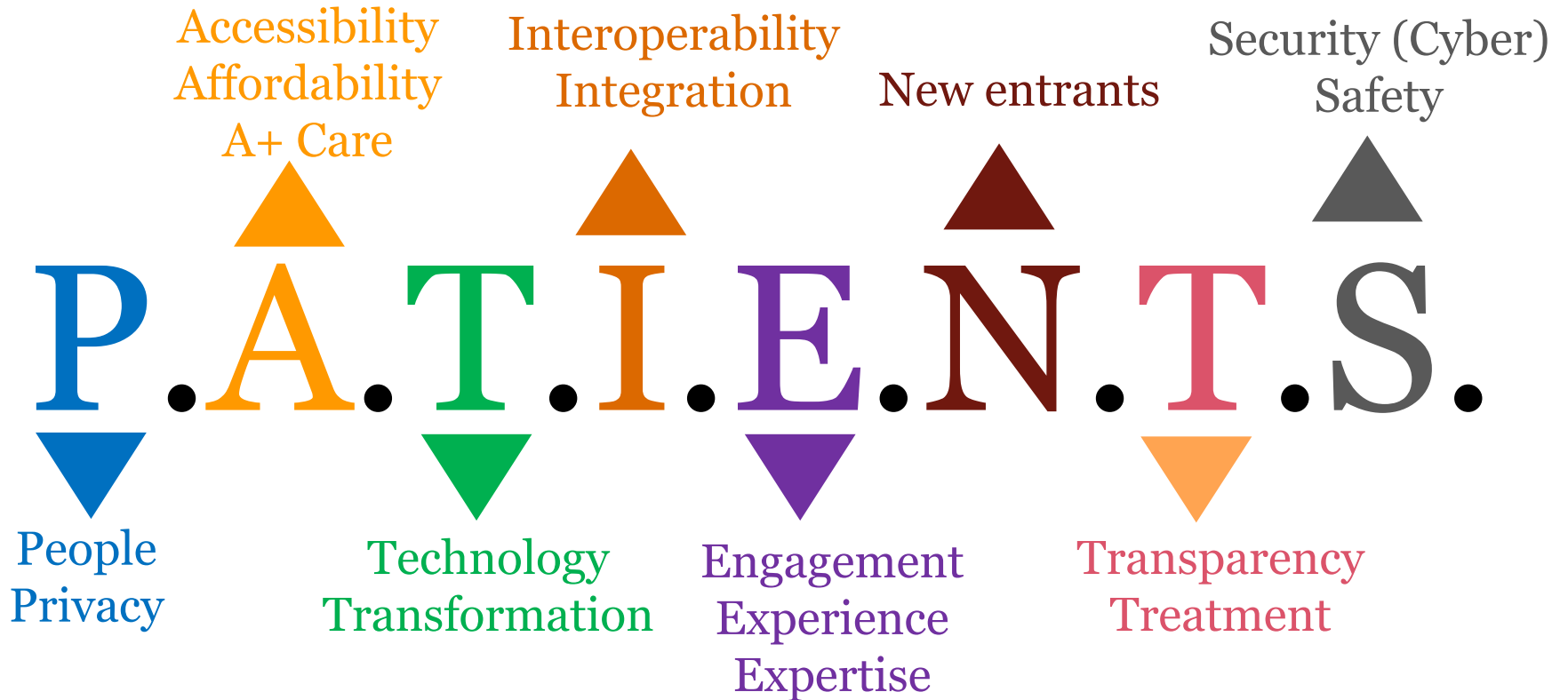


Image from: <https://livingfullywellness.files.wordpress.com/2015/10/slide1.jpg>

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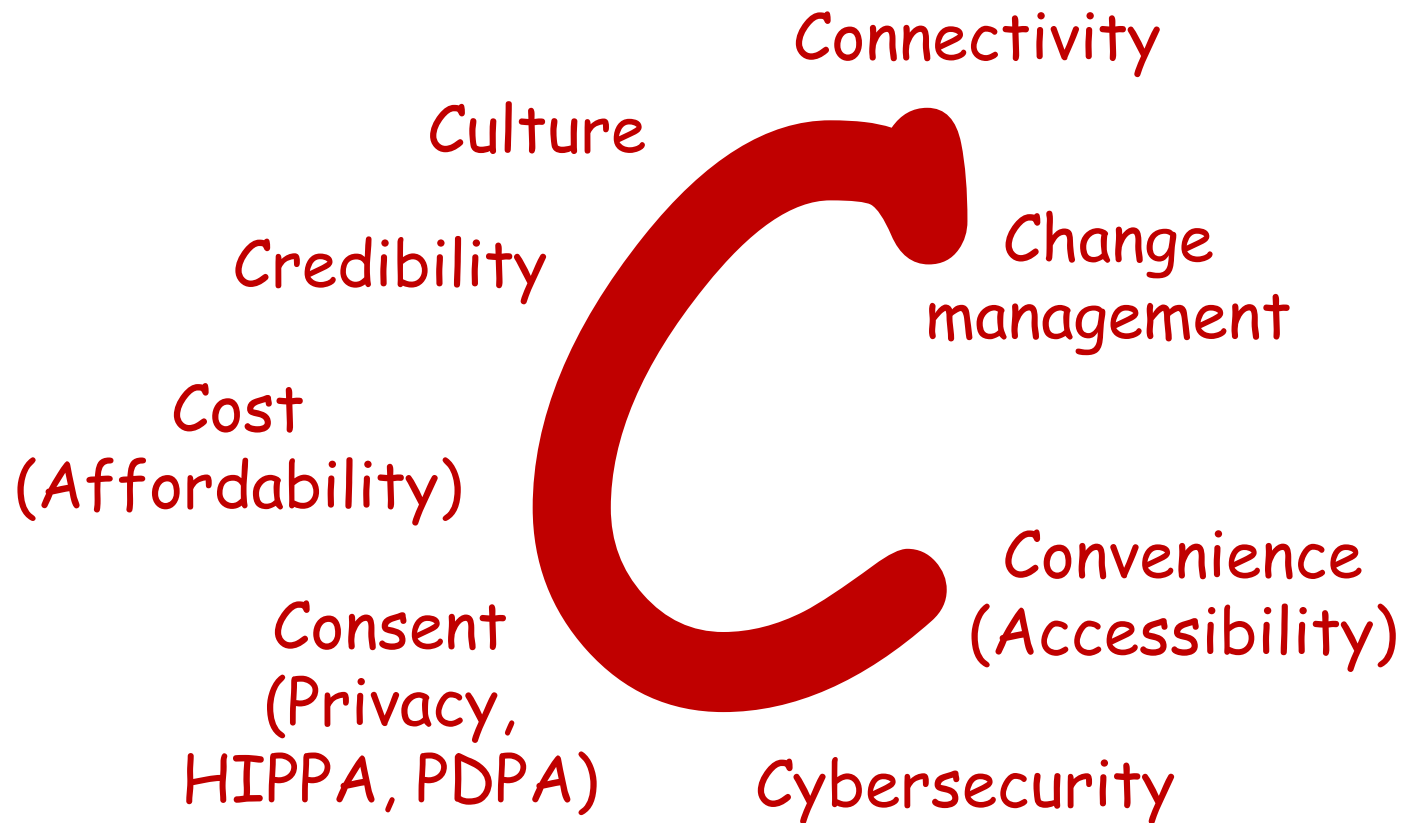
# PATIENTS





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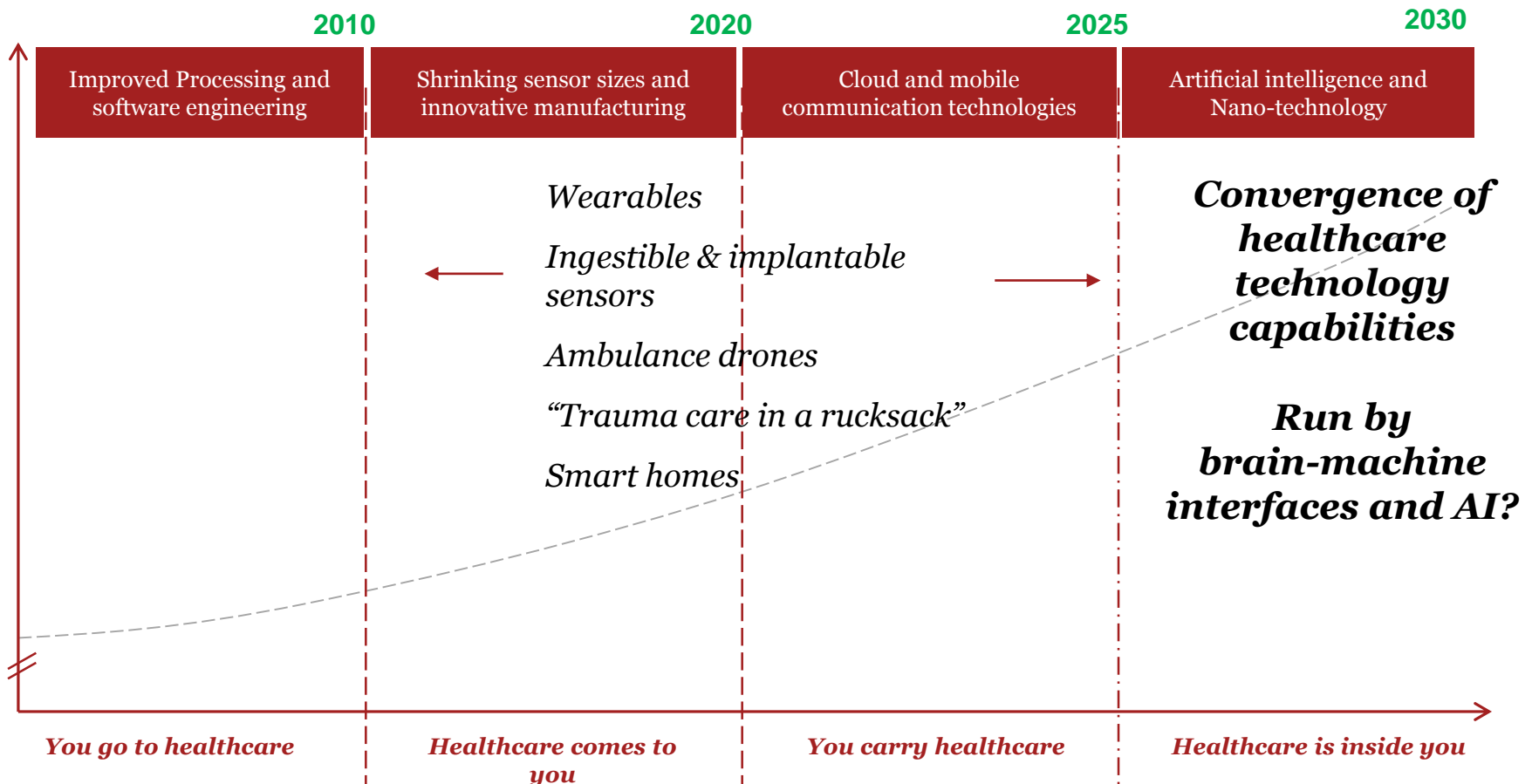
ollaboration

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# *An ode to the future*

Solving the challenge of accessibility, affordability and quality

# ***As technology gets more sophisticated, digital innovations and care delivery could evolve from a HCP professional coming to the patient to detection & treatment capabilities inside the body***



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*Remember, we really are only limited by our own imagination...*



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# *THANK YOU*

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