



# Taiwan's Role in Digital Health

## Opportunities and Challenges

**Michel Chu**

**Chief Innovation Officer**  
**Biomedical Development Board, Taiwan**  
**[michel.chu@bdb.org.tw](mailto:michel.chu@bdb.org.tw)**

# Who Am I

## Some personal backgrounds

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### ■ Current Positions

- Chief Innovation Officer, Biomedical Development Board 生醫創新方案執行中心 創新長
- General Partner, Acorn Campus Taiwan
- Chairman and acting CEO, VSense Limited
  - Semiconductor-based biosensor chip, first ever NTU spin-off

### □ Part-time Positions

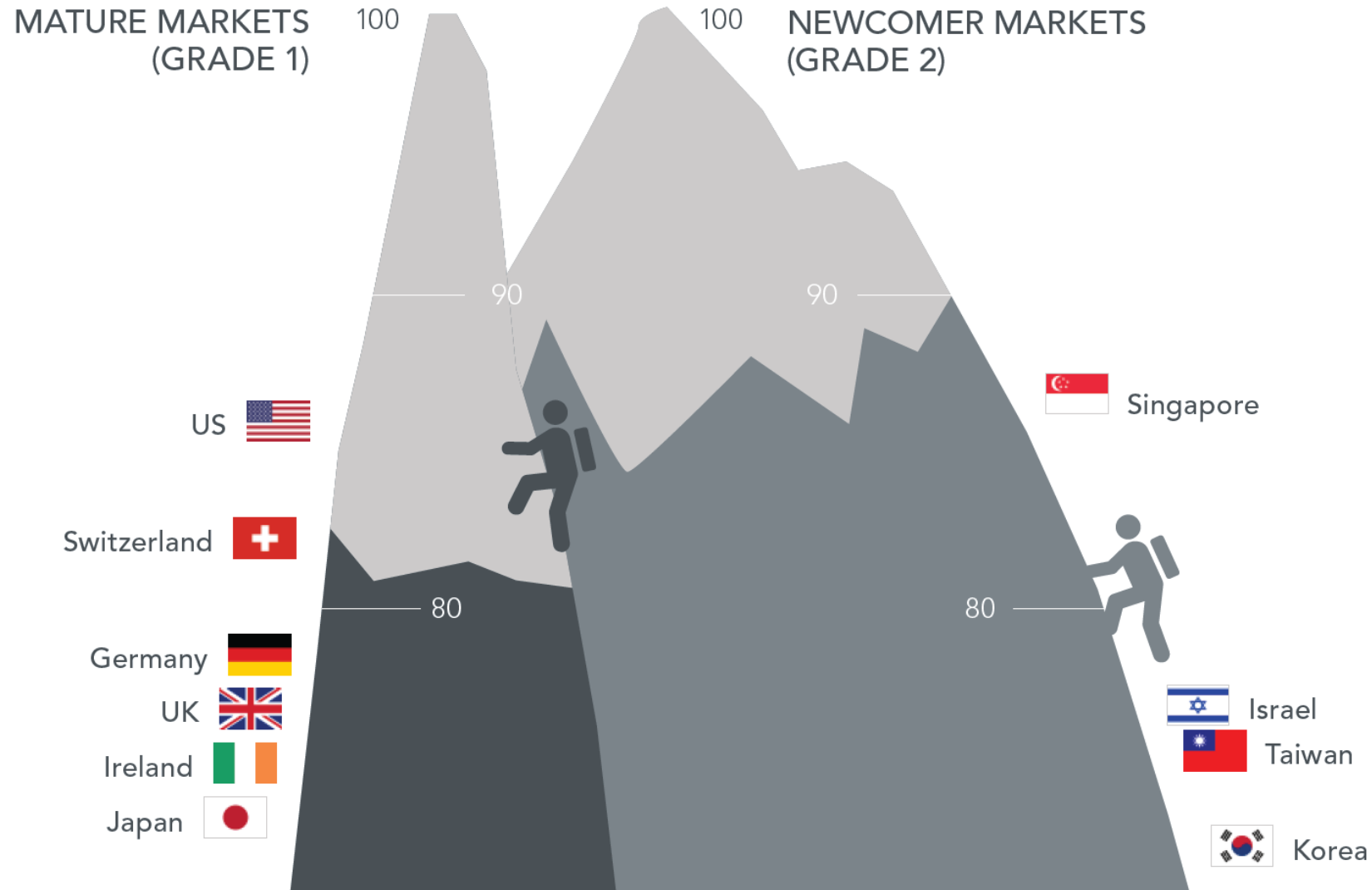
- Volunteer at NTU, YEF, Garage+, ... etc.
- Judge at FITI, YEF, TIC 100, Spark, 萌芽計畫, 育苗計畫, 價創計畫, 國發基金天使計畫 ... etc.
- Adjunct professor at NTU
  - Group Dynamics (組織運作導論)
  - Platform Strategy (平台策略)
  - BioDesign (生醫創新與商業化)

### ■ Previous Positions

- Co-founder, Executive VP and CTO of GigaMedia Limited (NASDAQ: GIGM)
- Deputy CEO of NTU EMBA Foundation
- Board director of Gamania (遊戲橘子), SoftStar (大宇), 重聚典, Cambridge Entertainment Software Limited... etc.

# Taiwan Ranked Number 3 in Biomedical Innovation

## For emerging newcomer markets



Source:  
Pugatch Consilium, BCI Survey, 4<sup>th</sup> Edition, 2017

# Most Biotech Savvy Administration in the World

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蔡英文

**President**

Experienced  
Biotech Investor



陳建仁

**Vice President**

World-Class  
Biotech Scholar



賴清德

**Prime Minister**

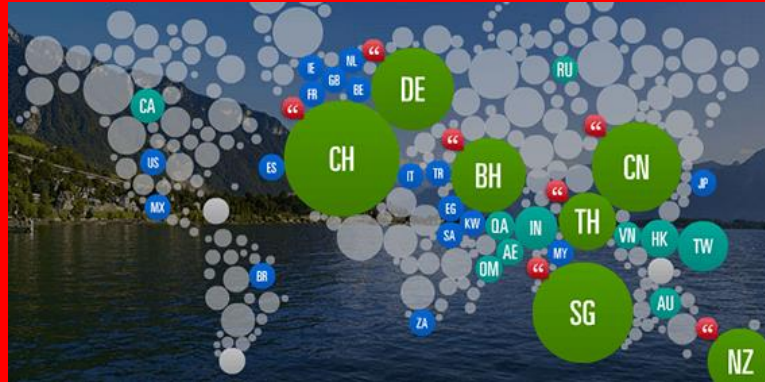
Accomplished Doctor



柯文哲

**Mayor of Capital**

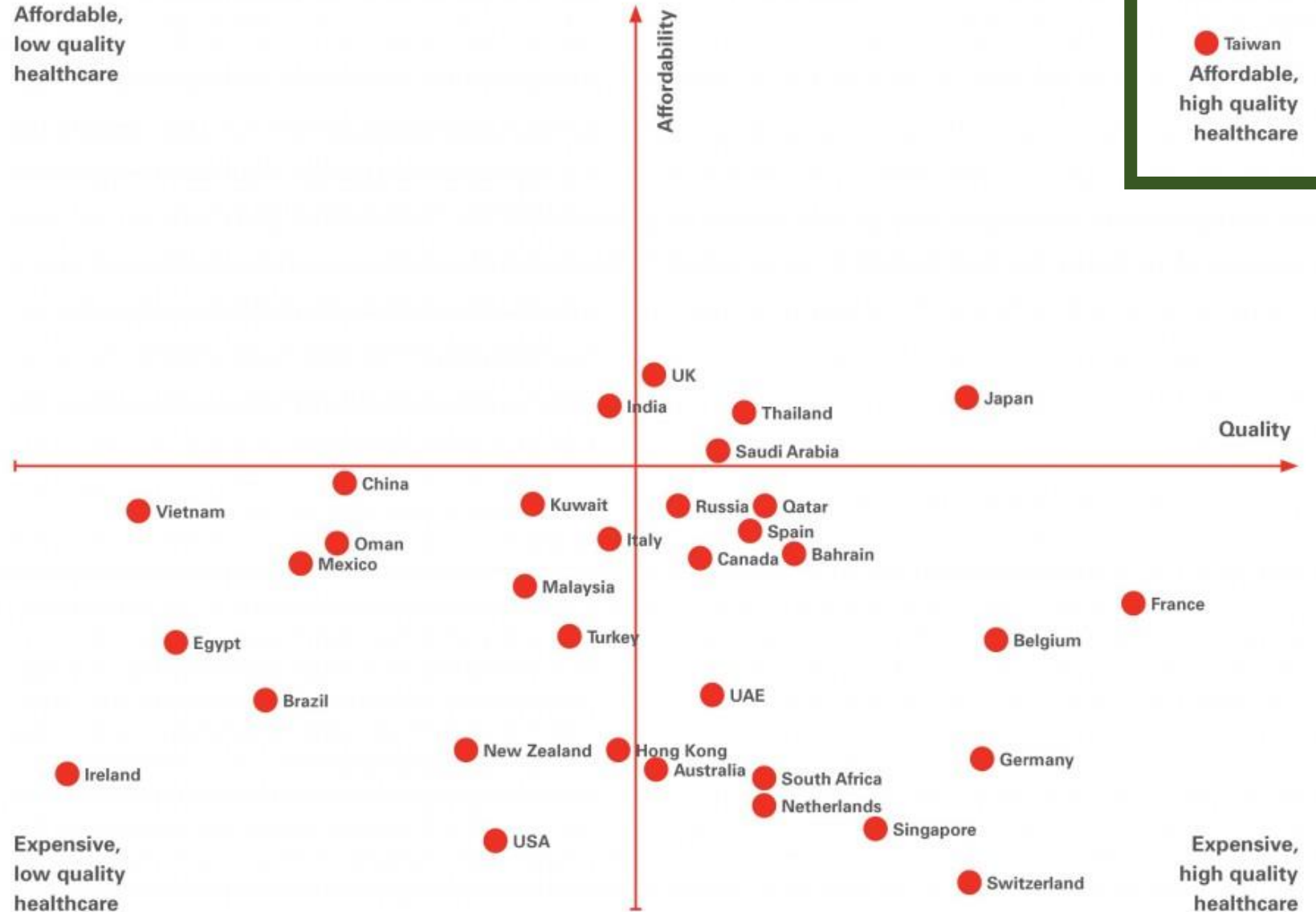
Highly Acclaimed  
Doctor



Expatriate Explorer Survey

### Affordability versus quality of healthcare

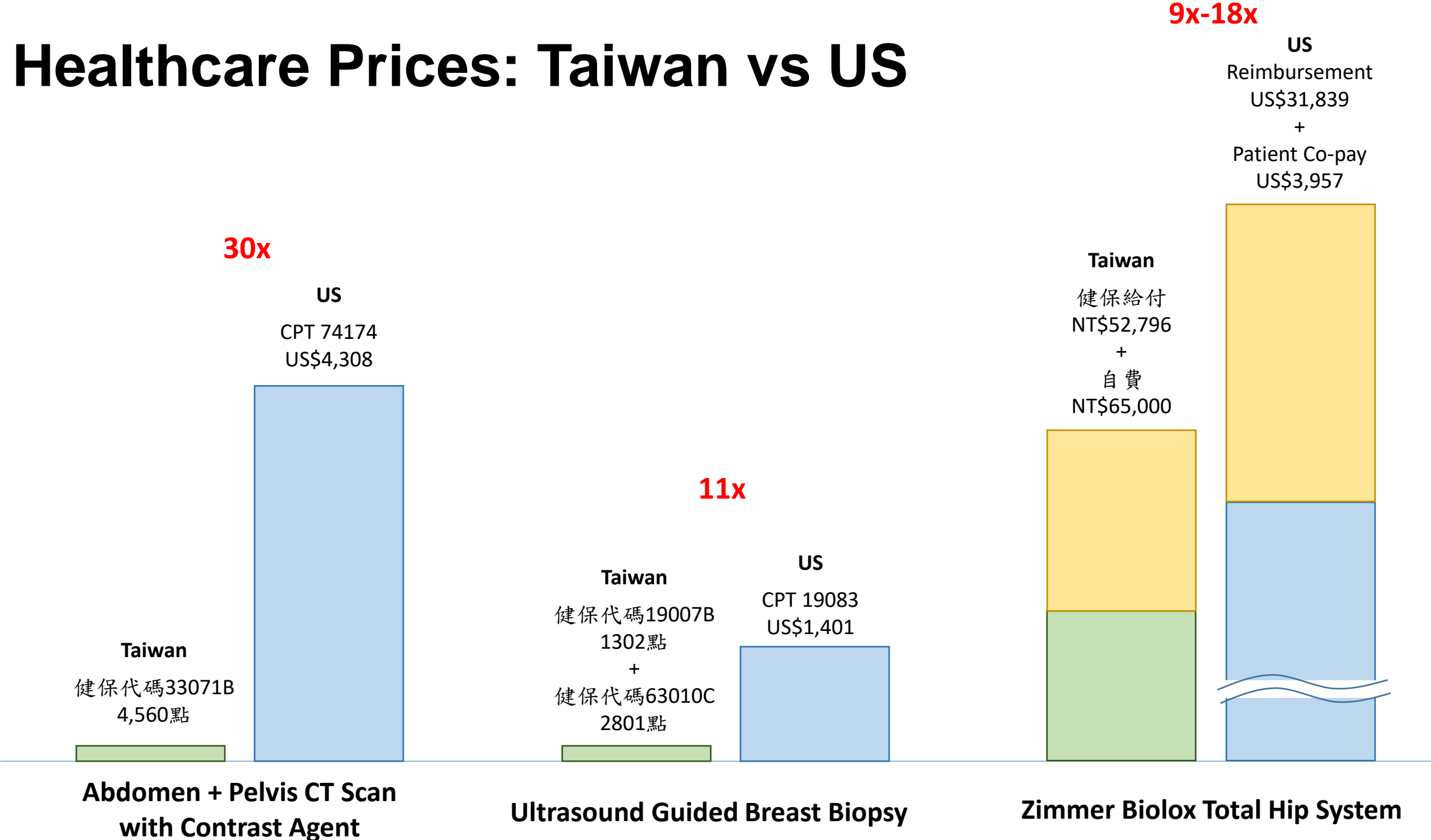
Affordable,  
low quality  
healthcare



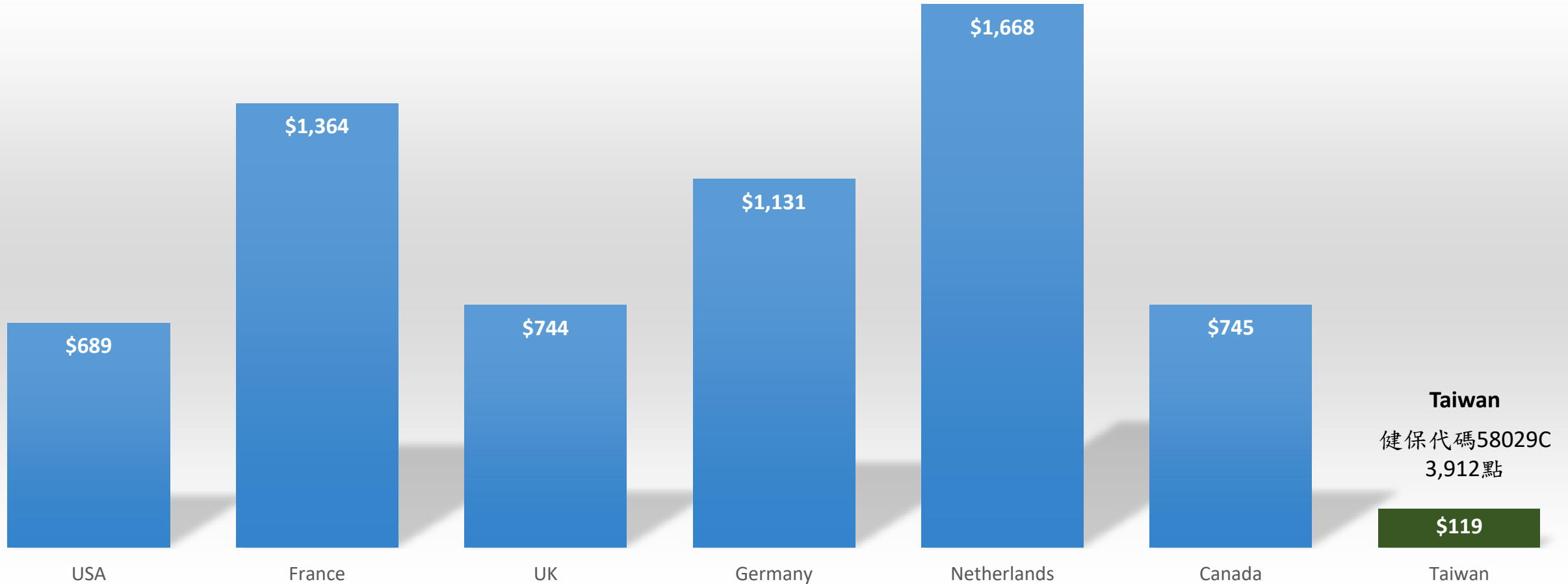
Expensive,  
low quality  
healthcare

Expensive,  
high quality  
healthcare

# Healthcare Prices: Taiwan vs US

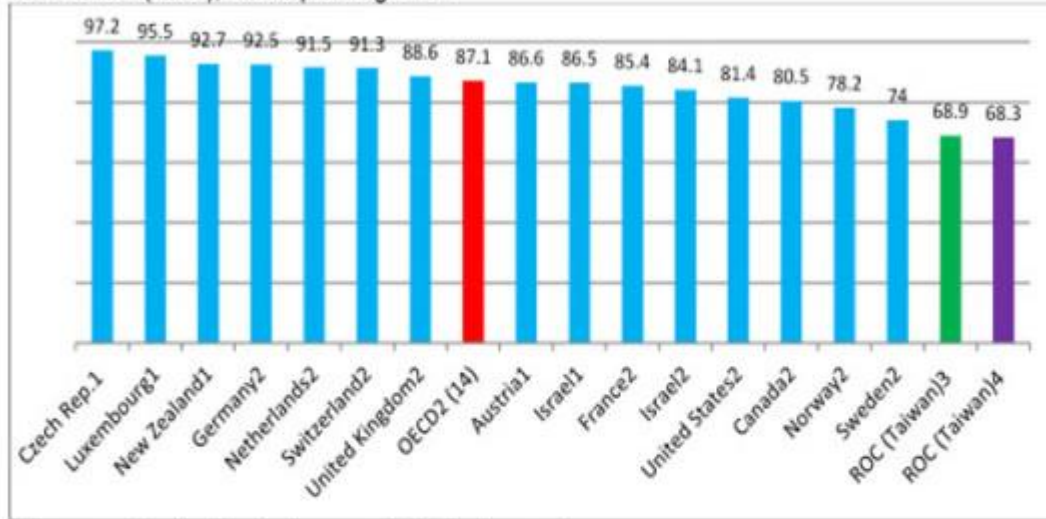


# Cost of Hemodialysis in Various Countries



# Taiwan's Value Comes at the Cost of Personal Touch

"Doctor spending enough time with patient during consultations" in select OECD countries (2011, 2012) and Taiwan (2013), % Responding "Yes"



(Age-sex standardized rates per 100 interviewees)

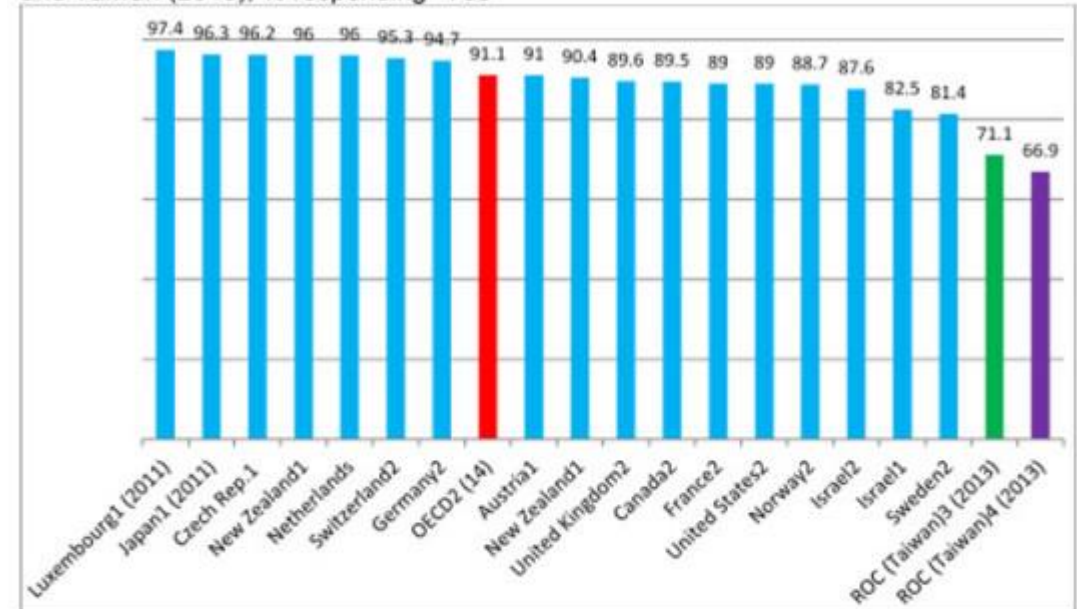
**Notes:**

1: Any doctor      2: Patient's regular doctor      3: Clinic doctors      4: Hospital-based doctors

**Green: Western medicine clinic doctors**      **Purple: Hospital-based doctors**

Source: Data for figure based on Taiwan Ministry of Health and Welfare, "2014 Population Healthcare Quality Indicators Report," Ministry of Health and Welfare, Taipei (March 2015): Tables 5.1.1.1 and 5.1.1.2

"Doctor provides easy to understand answers" in select OECD countries (2011, 2012) and Taiwan (2013), % responding "Yes"



(Age-sex standardized rates per 100 interviewees)

**Notes:**

1: Any doctor      2: Patient's regular doctor      3: Clinic doctors      4: Hospital-based doctors

**Green: Western medicine clinic doctors**      **Purple: Hospital-based doctors**

Source: Data for figure based on Taiwan Ministry of Health and Welfare, "2014 Population Healthcare Quality Indicators Report," Ministry of Health and Welfare, Taipei (March 2015): Tables 5.2.1.1 and 5.2.1.2



$$\text{Patient Value} = \frac{\text{Health Outcomes}}{\text{Cost}}$$

# Value that Matters

## Global shift from clinical toward economic buyers



**COST CONTROL**  
OF HEALTHCARE



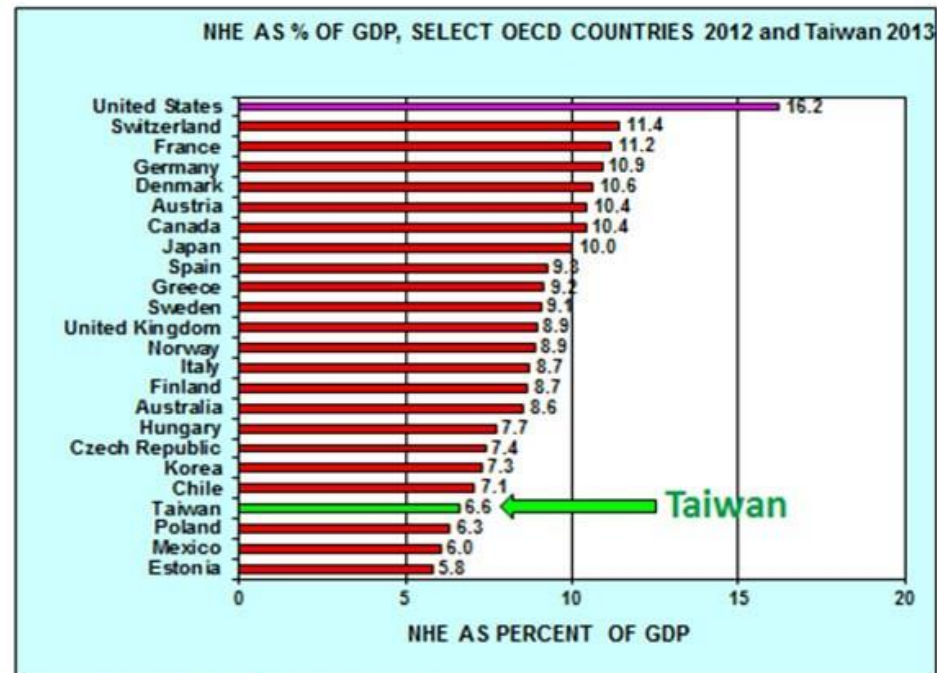
“How can we leverage the growing divide between physician and administrator?”

“Price pressure continues to increase as organizations professionalize their procurement”

“Healthcare budget cuts are becoming the new normal”

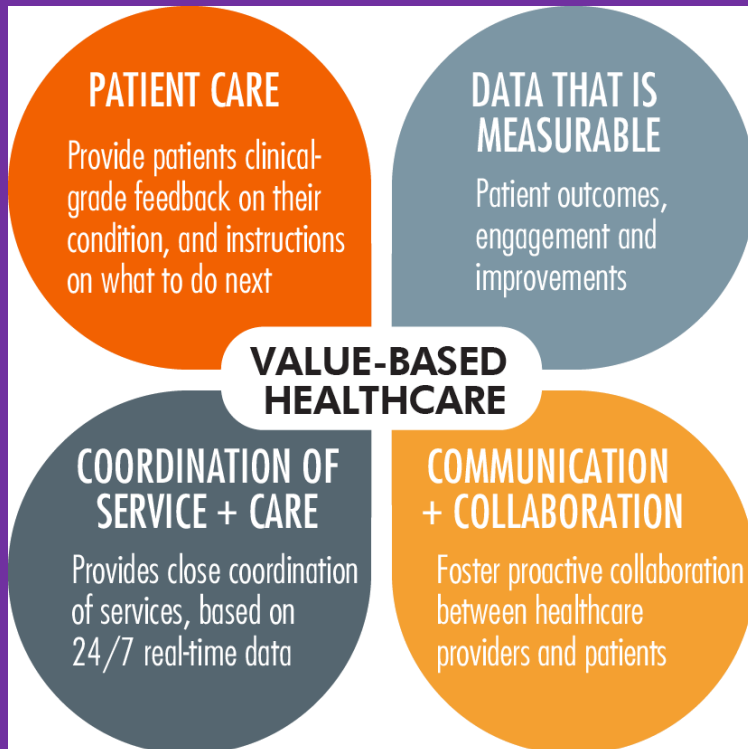


# Efficiency-Oriented Universal Healthcare



SOURCE: OECD DATA 2014; Taiwan - MOHW 2013

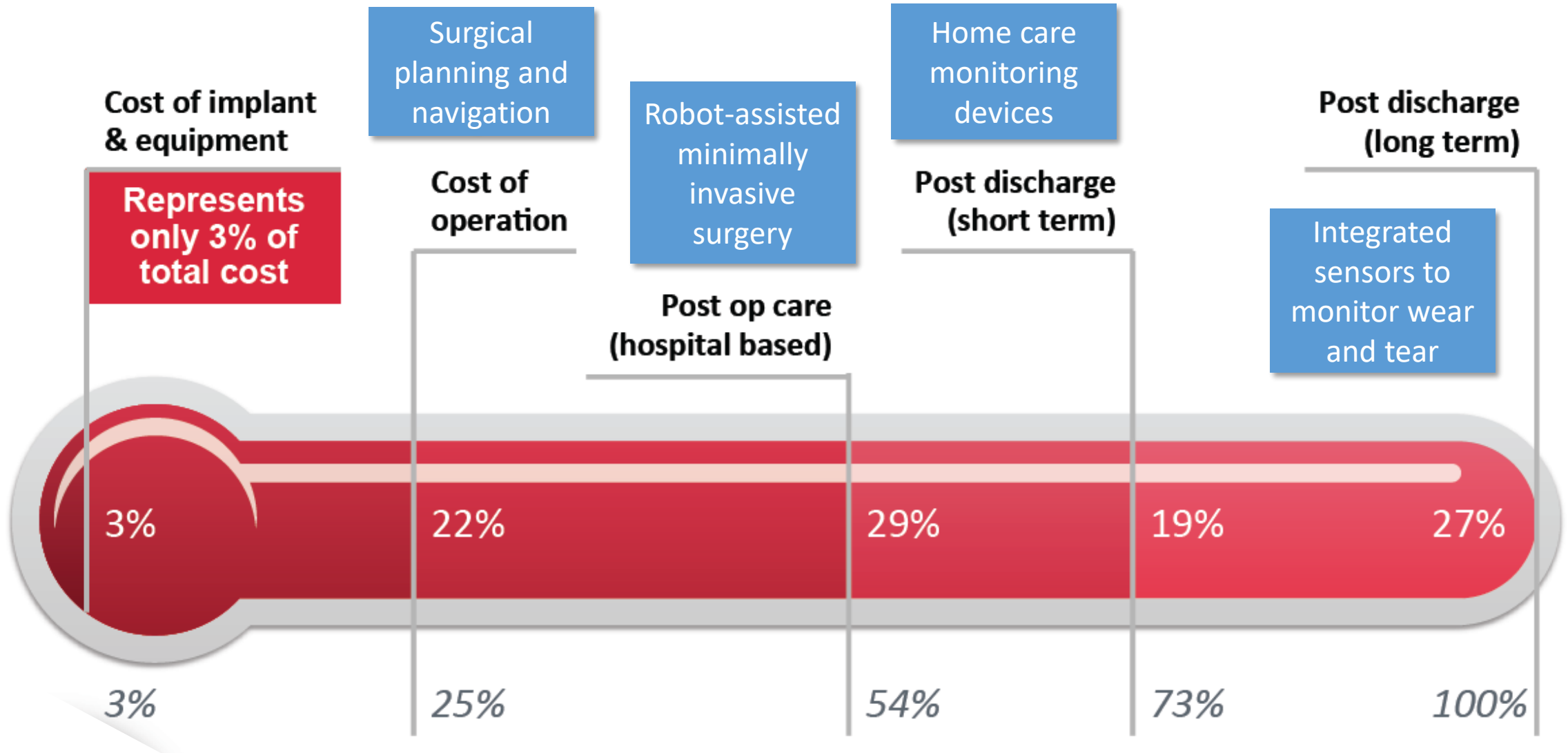
# Value Based Healthcare



## Creating Value in Healthcare

- **Generating better clinical outcome**
- **Increasing operation room efficiency**
- **Reducing length of hospital stays**
- **Avoiding unnecessary re-admissions**
- **Preventing hospital acquired infection**
- **Improving patient's adherence and satisfaction**

# Creating Value through Digital Health

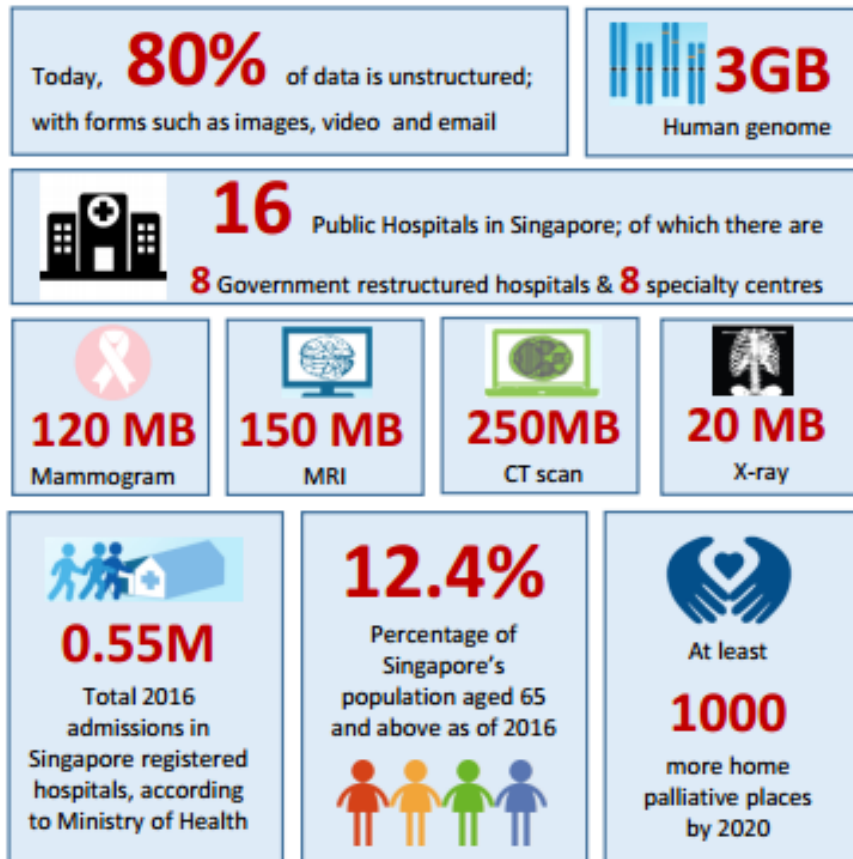


Cost Anatomy of Hip Replacement

# New Challenge Brought by Digital Health

Digitizing healthcare brought about huge amount of data

## KEY STATISTICS



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- Patients can generate different types of data from a **plethora of sources** in varied healthcare settings
- massive volume of information are generated with the **digitization and adoption** of EMR & Health IT technologies

## Health Factors

Exogeneous Sources

**60%**

Genomics Sources

**30%**

Clinical Sources

**10%**

## Data Generated

**1100 Terabytes**

Per life time

Volume, Velocity, Variety, Veracity

**6 Terabytes**

Per life time

**~ 1 Terabytes**

Per life time

SOURCE: ©2015 J.M. McGinnis et al., "The Case for More Active Policy Attention to Health Promotion," Health Affairs 21, no. 2 (2002):78-93 and IBM Watson Health

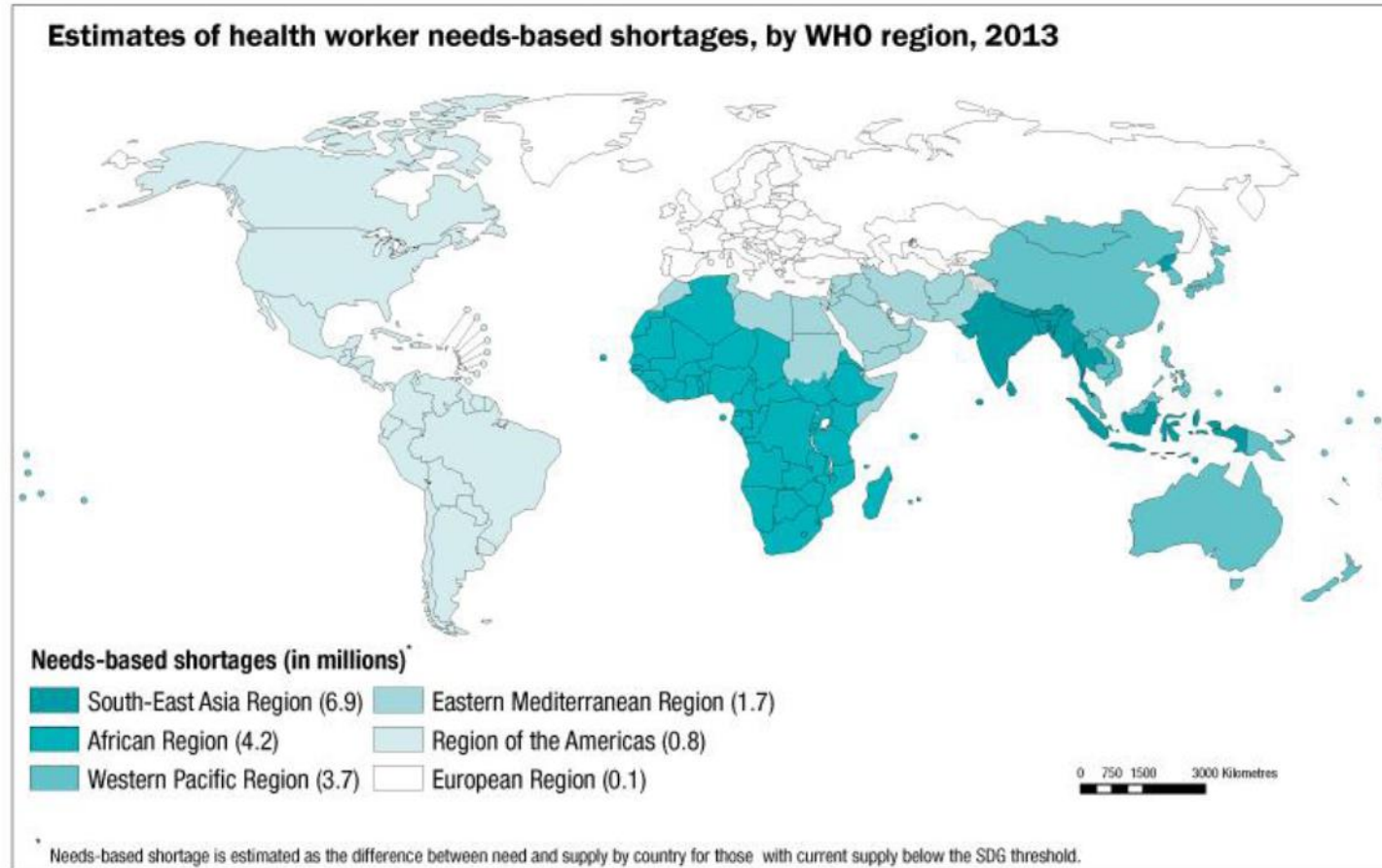
# AI in Healthcare

Multiple areas where artificial intelligence can come to help



# AI in Healthcare

## Addressing global shortage of healthcare workers



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Data Source: World Health Organization  
Map production: Information Evidence and Research (IER)  
World Health Organization



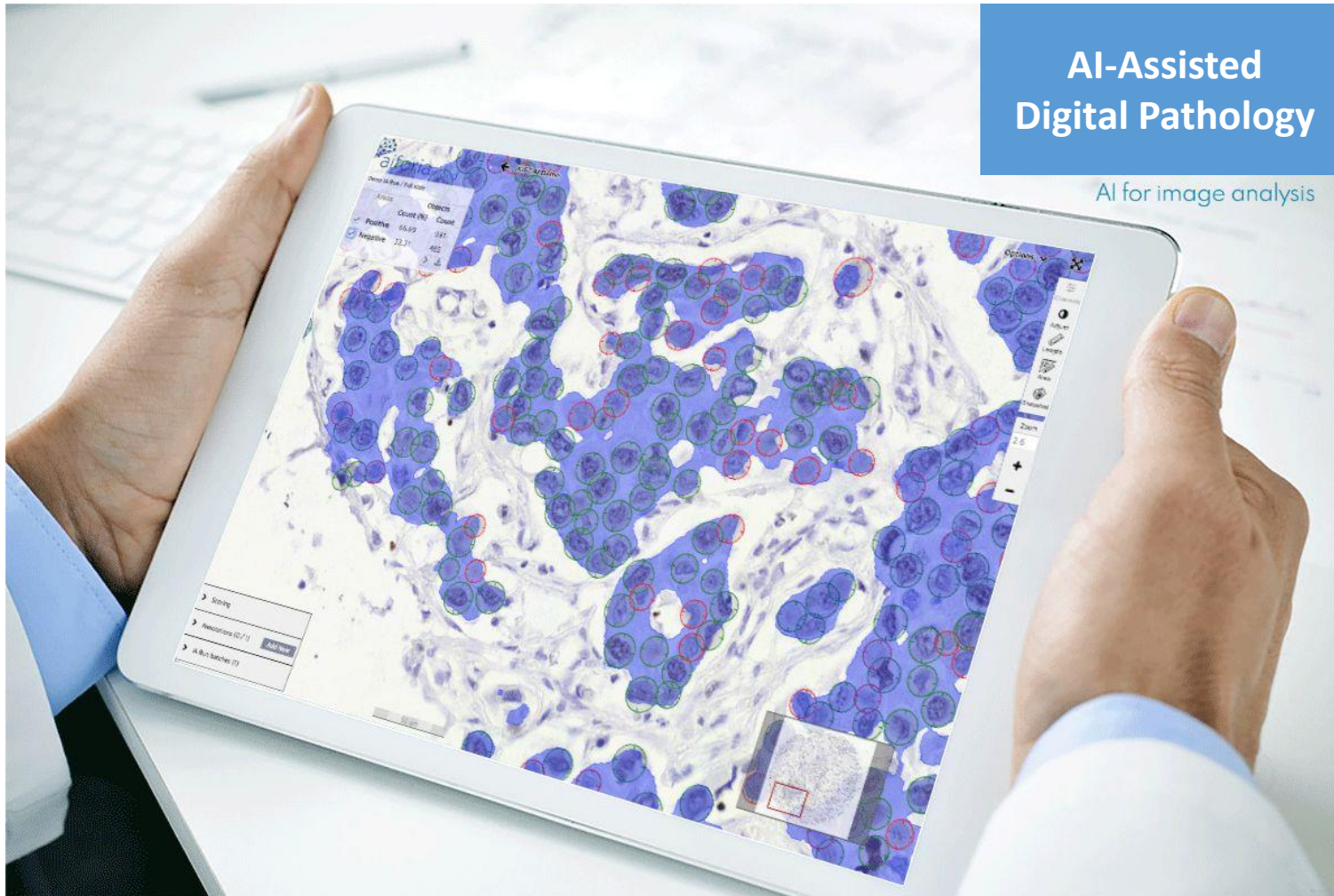


# Top 10 AI Applications in Healthcare



# AI in Pathology

Improving efficiency and accuracy of image recognition

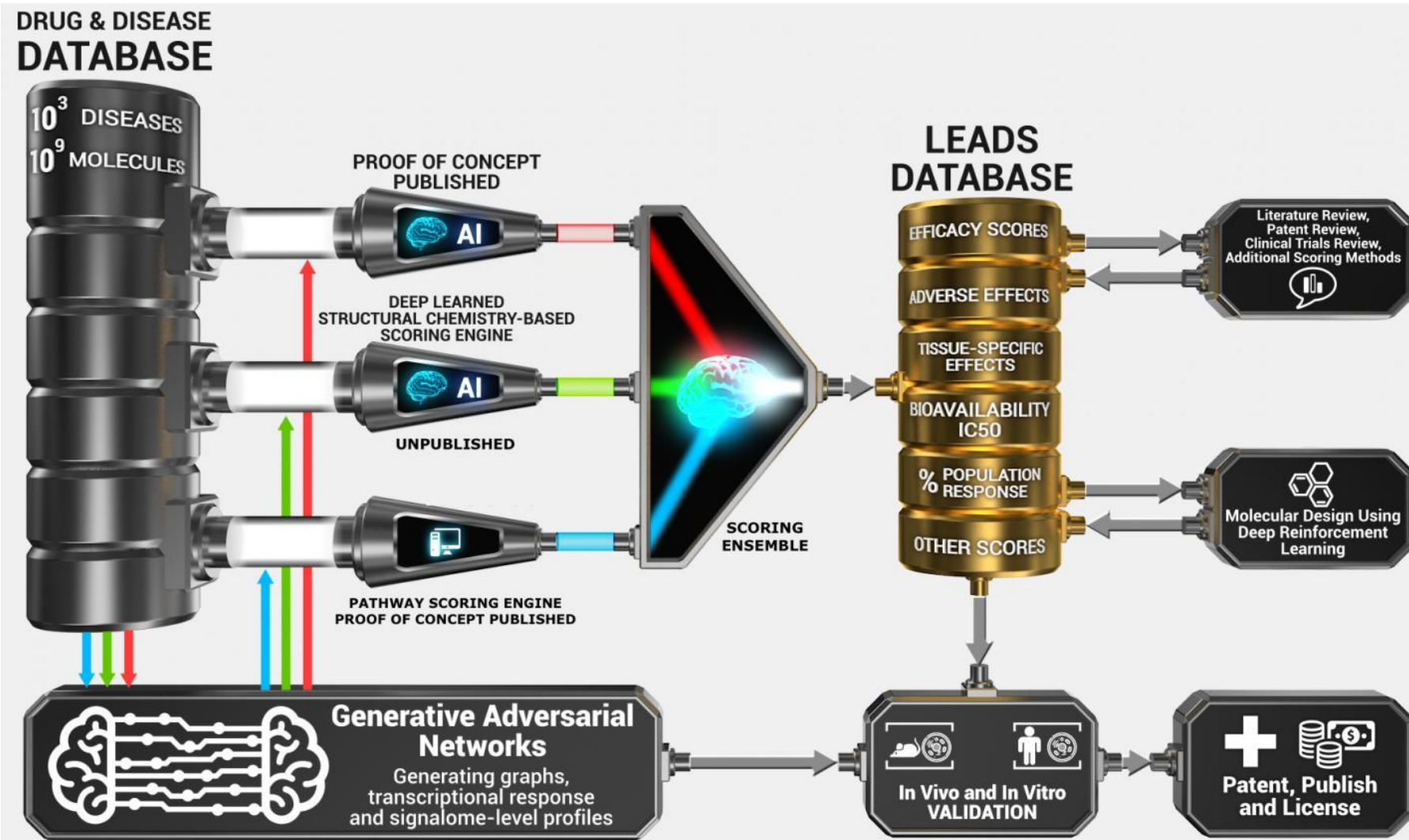


AI-Assisted  
Digital Pathology

AI for image analysis

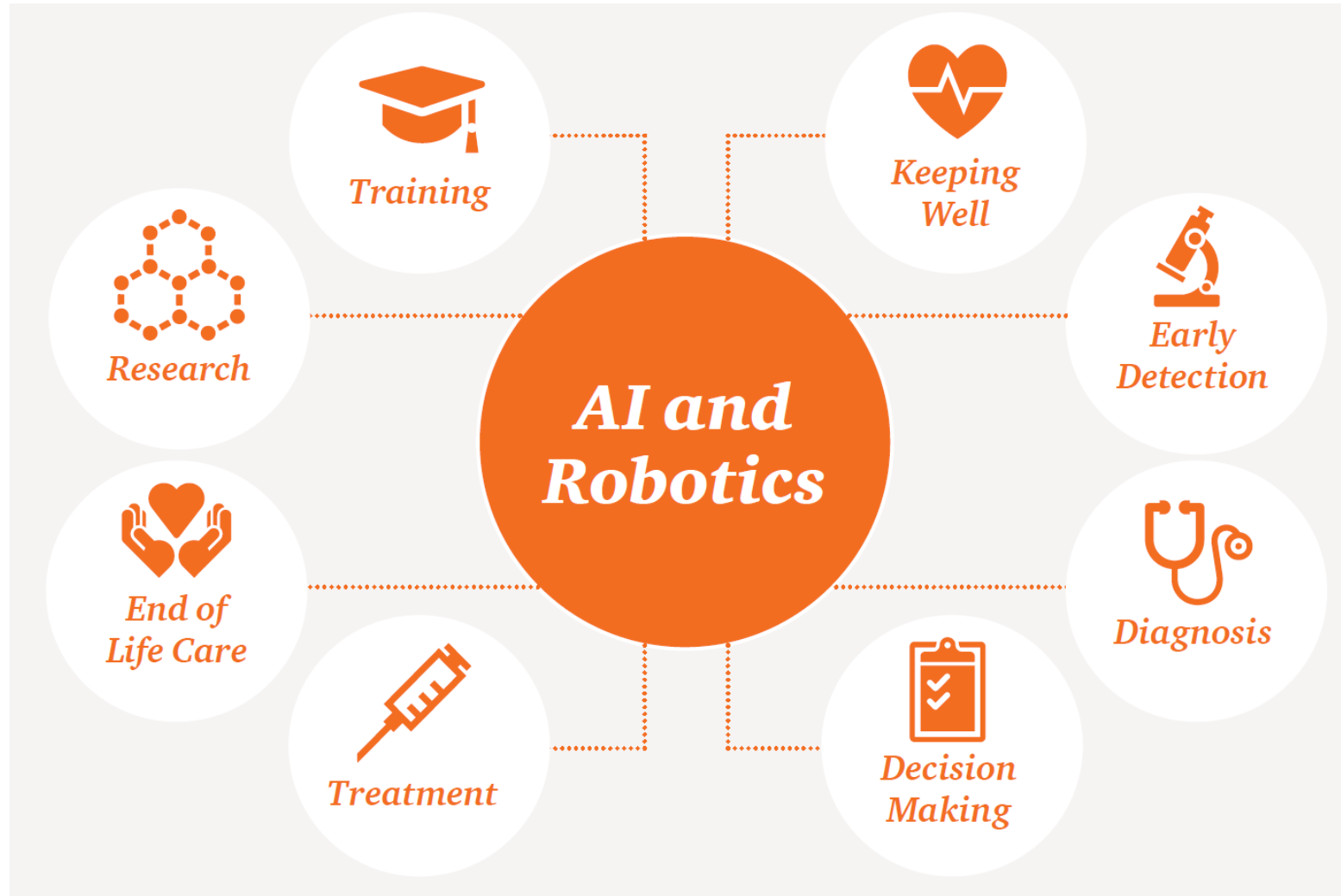
# AI-Driven Drug Discovery

## In Silico models for AI-assisted drug development pipeline



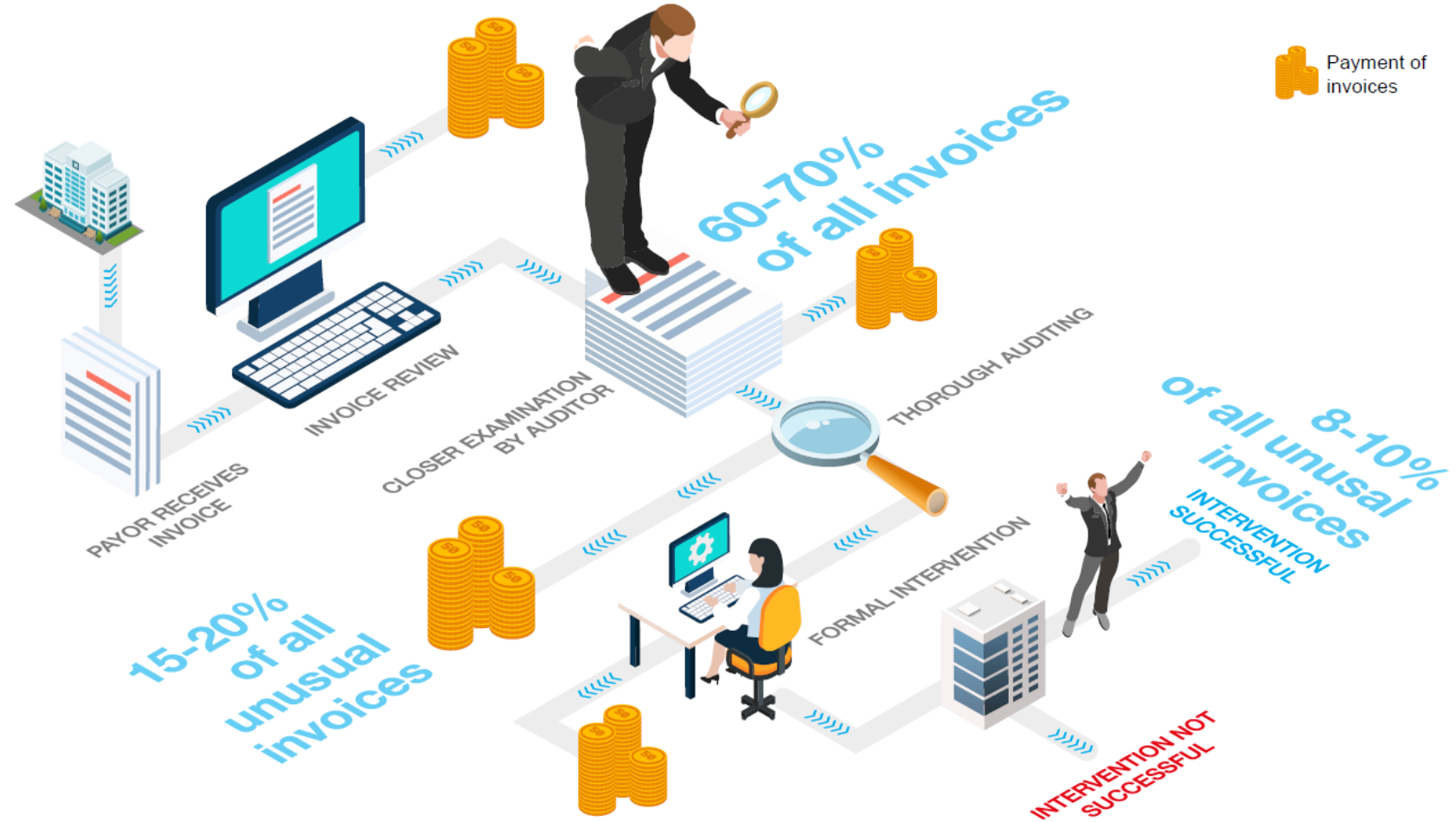
# AI + Robotics

Improved patient care at lower cost



# AI in Health Insurance

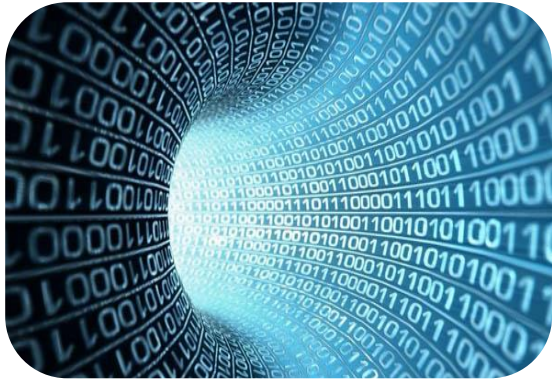
## Smart claims management with self-learning software



SOURCE: McKinsey

# Challenges of AI in Healthcare

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Data Quantity



Data Quality



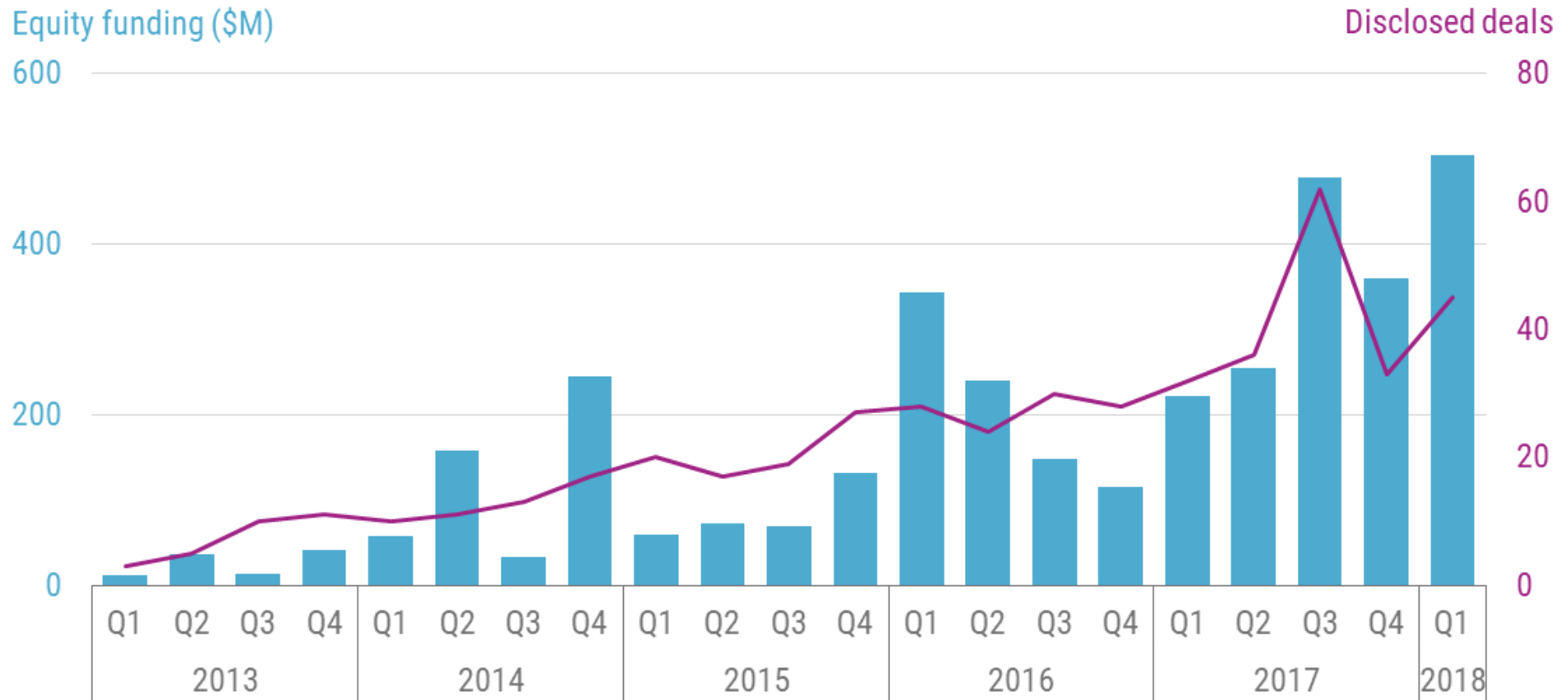
Security



Ethics and  
Liability

# Sentiments from the Investment Community

When it comes to AI in healthcare, investors aren't scrimping



Source: cbinsights.com

CBINSIGHTS

## Patient-Facing

### AI Chatbots



### Wearables & Devices



### Personalized Genetics



### Mental Health



### Women's Health



### Skin



## Telehealth

### Telemedicine



### Lifestyle Management



### Disease Management



## Doctor-Facing

### Medical Records



### Data Analytics



### Medical Imaging



### Hospital



# AI in Healthcare

## Research

### Drug Discovery



### Information & Clinical Trials



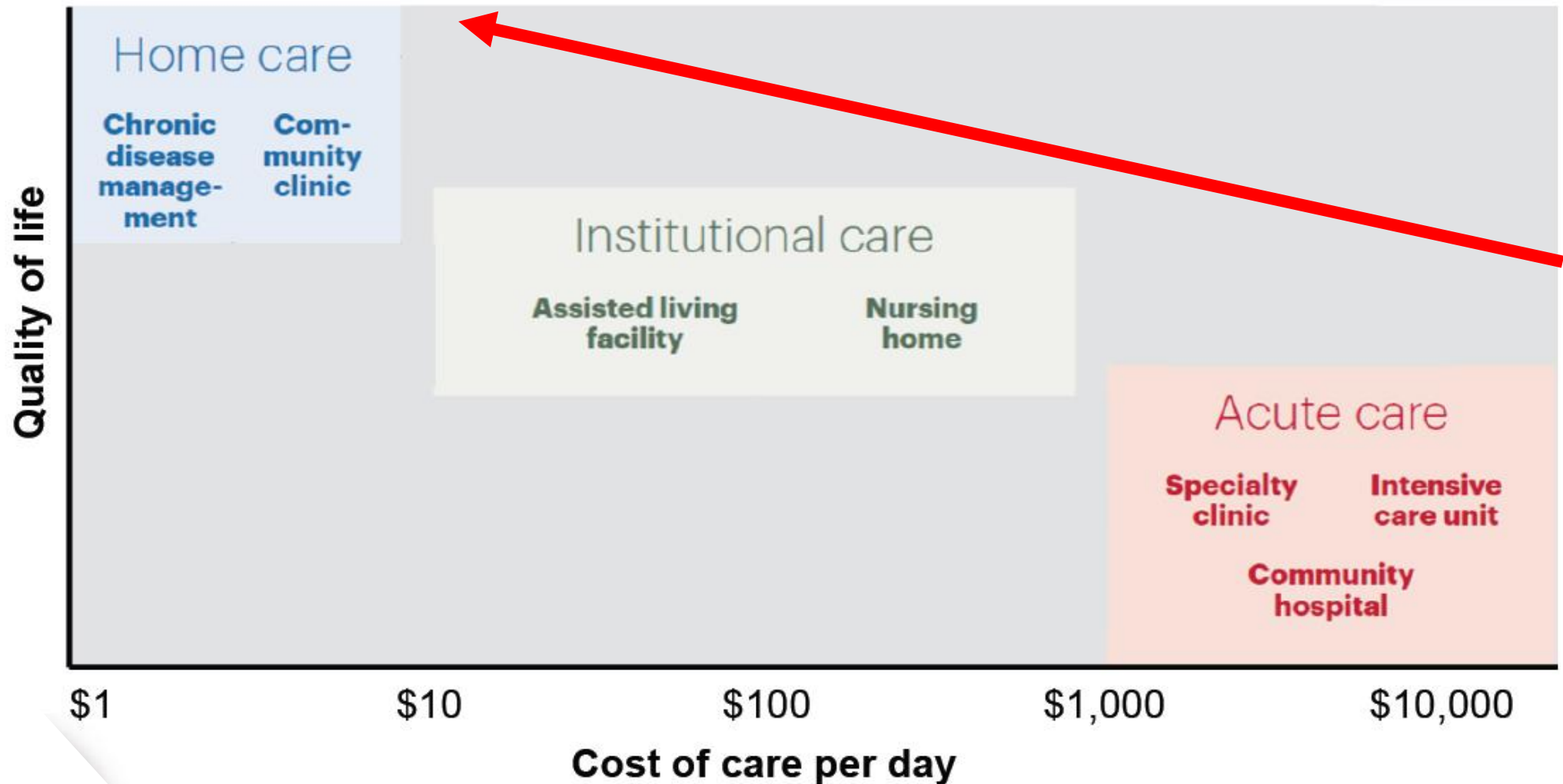
### Genetic Research





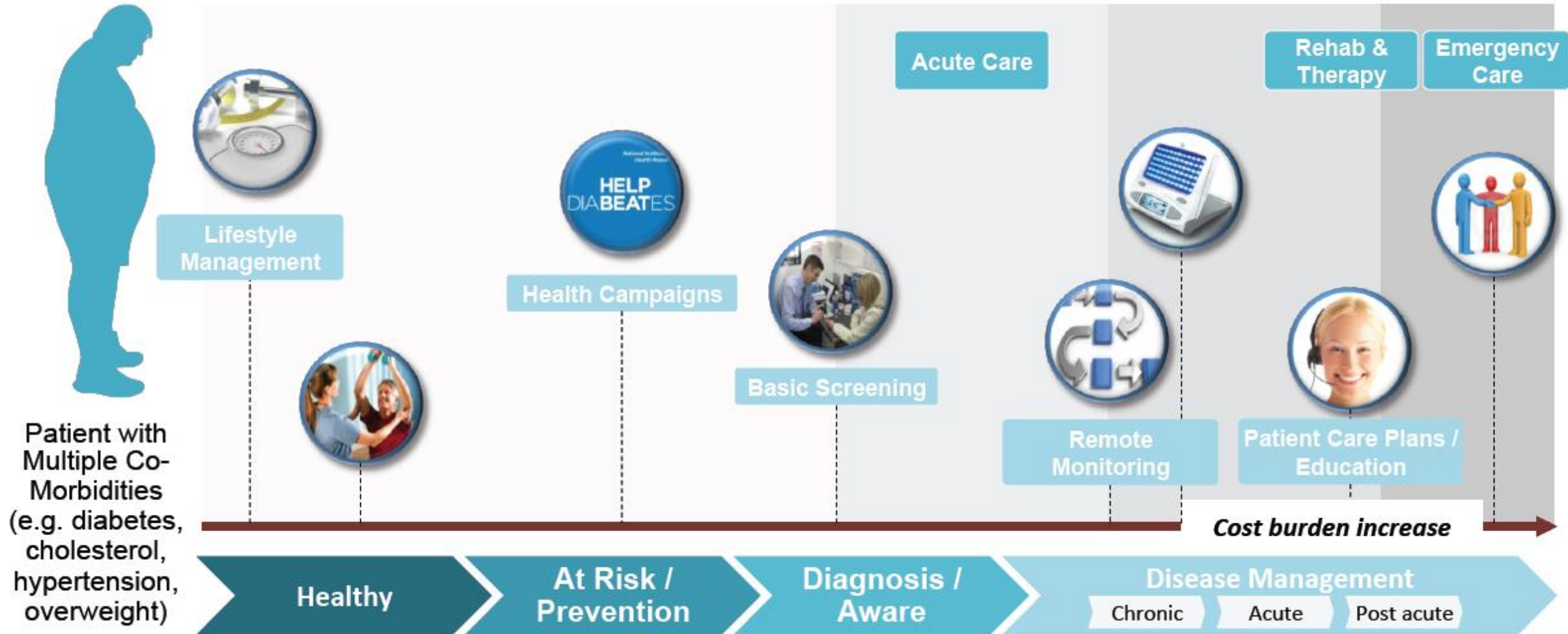
# Changing Trends in Model of Care

Pressures to move toward higher-quality lower-cost models



# Total Care through Digital Health

Managing across the patient pathway presents new opportunities



# Case Study: Livongo Health

## Livongo for Diabetes: smart BG meter, analytics platform, coach team



### Livongo for Diabetes™

Do away with paper log books, cables to upload, and the need to carry a smart phone to view your numbers.



Within seconds, our smart cloud analyzes incoming data like blood glucose (BG) readings and sends a message back to the user with relevant, actionable feedback to coach and encourage better self-management.



If a BG reading is significantly out of range, the cloud notifies our team of Certified Diabetes Educators (CDEs) who immediately reach out to the member to provide real-time support, education, and care.



Our care team is standing by 24/7/365 to support our members because diabetes never takes a vacation.

Livongo™ also aims to eliminate additional hassles of diabetes management by providing unlimited checking supplies (strips, lancets, and more) as part of our low monthly fee. This way our members don't need to worry about checking too often, when they'll be eligible for their next refill, or where to go to get more strips. The In Touch® meter tracks strip usage and prompts members with a simple yes/no question to re-order supplies. That's it! Supplies are then shipped right to our members' doors!