

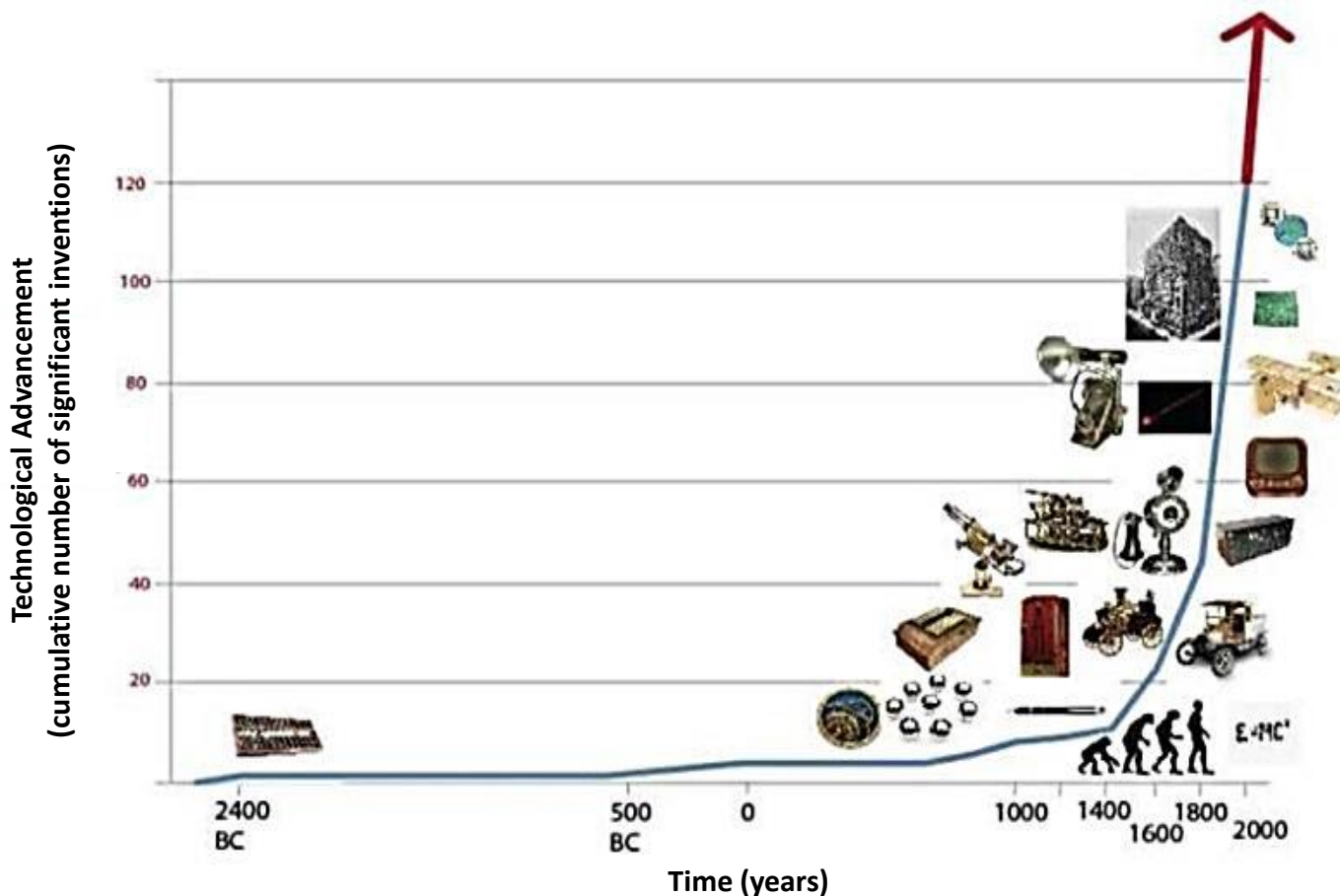
# Patient self-care and new technologies in health

**Θεόδωρος Διαβάτης**  
*Medical Affairs Manager*



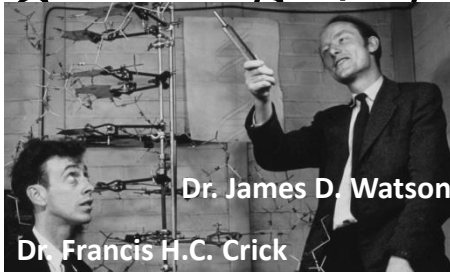
# Technological Growth

*The accelerating growth of technology has doubled every 200 years since 1400.*



# Technological Growth in Health

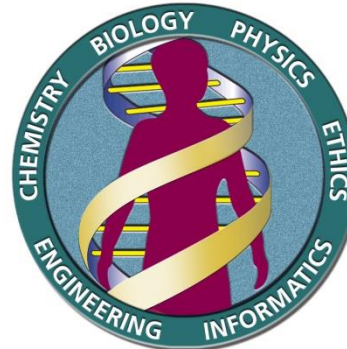
*50 years... from DNA discovery to Human*



Dr. James D. Watson

Dr. Francis H.C. Crick

Dr. James D. Watson and Dr. Francis H.C. Crick suggested the double helix structure of DNA<sup>1</sup>



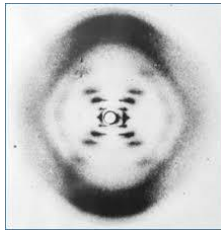
PCR System



1953



Rosalind Elsie Franklin.  
English chemist and X-ray crystallographer<sup>2</sup>



X-ray diffraction photograph of DNA<sup>3</sup>

2003

The Human Genome Project (HGP) is an international scientific research project with the goal of determining the sequence of chemical base pairs which make up human DNA and of identifying and mapping all of the genes of the human genome from both a physical and a functional standpoint<sup>4</sup>

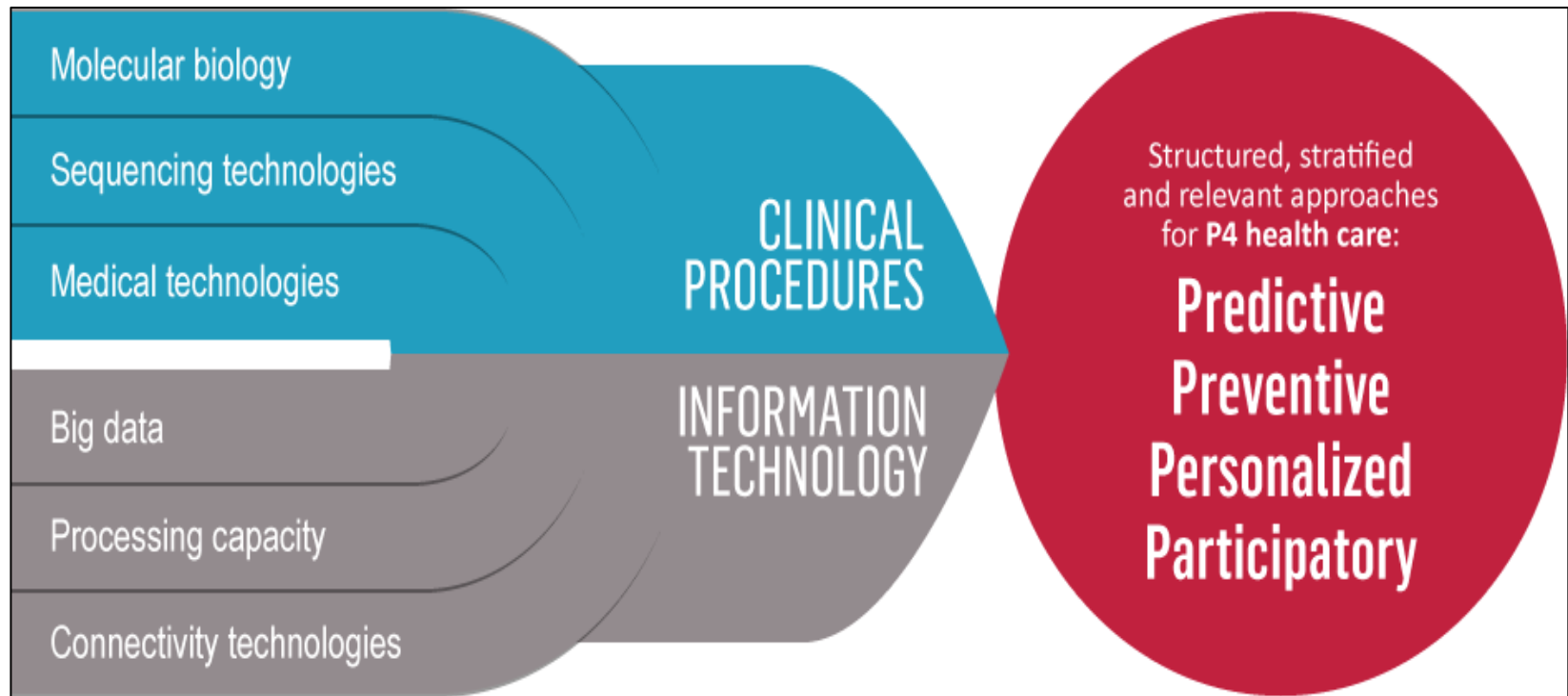
2016

PCR System<sup>5</sup>  
Height 19.0 cm  
Width 11.4 cm  
Length 24.1 cm  
Weight 3.76 kg

1. [www.thehistoryblog.com](http://www.thehistoryblog.com)
2. [en.wikipedia.org](http://en.wikipedia.org)
3. [en.wikipedia.org](http://en.wikipedia.org)
4. [en.wikipedia.org](http://en.wikipedia.org)
5. Roche Diagnostics

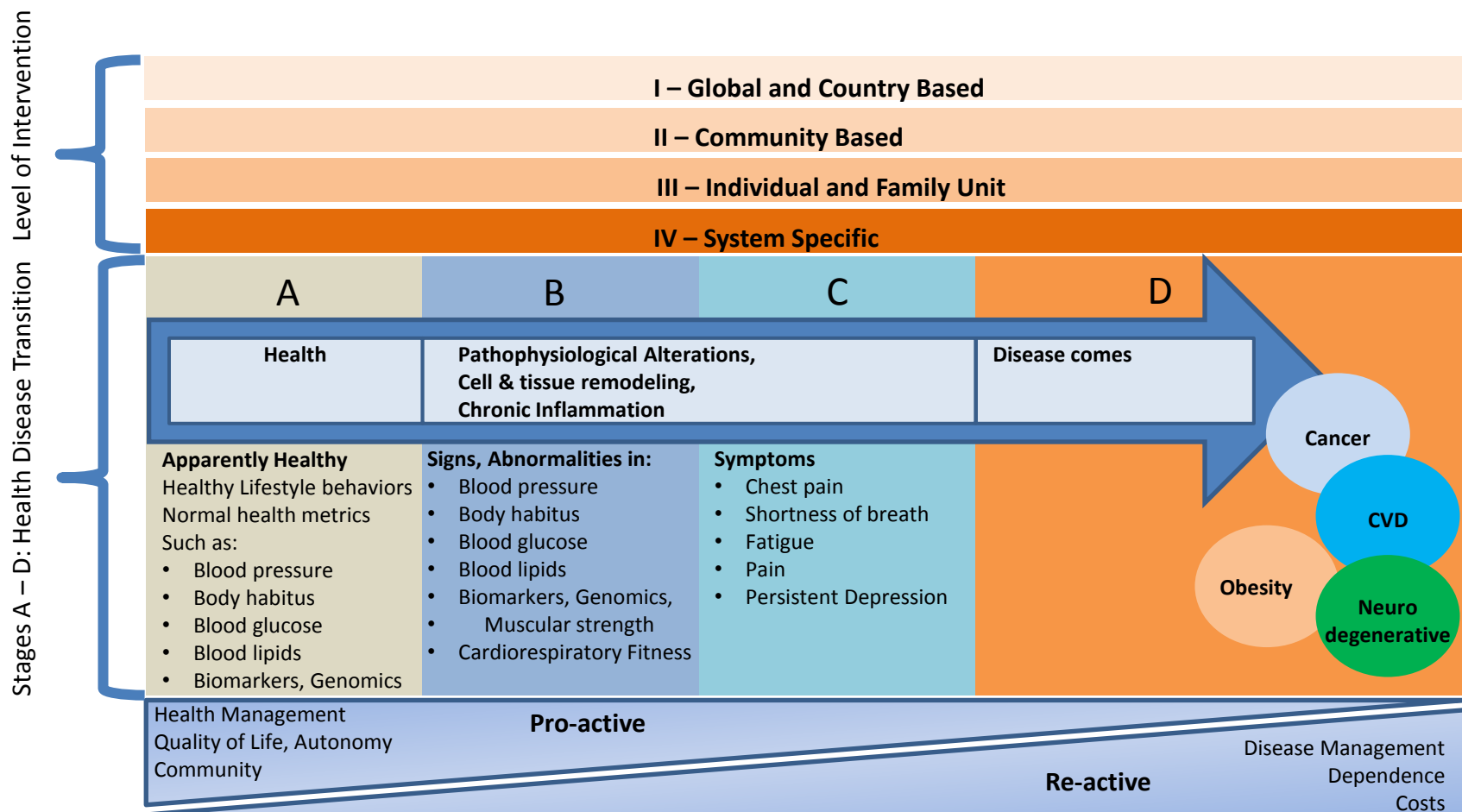
# Health Care Trends: P4 Health Care

*Leveraging advancements in research and technology drives personalization of HC*



# The P4 Health Spectrum

*A Predictive, Preventive, Personalized and Participatory Continuum for Promoting Healthspan*

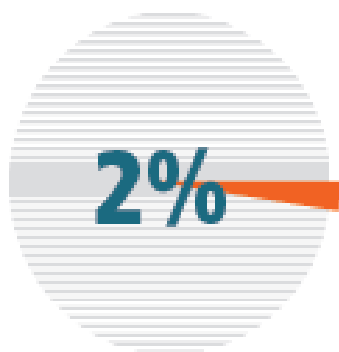


# The Value of Diagnostics

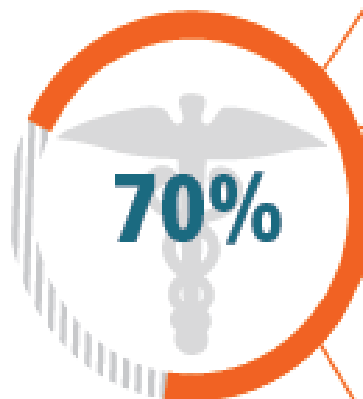
## *The health care system paradox*

**Diagnostic tests** are at the forefront of medical innovation, providing vital insights into patient health and care.

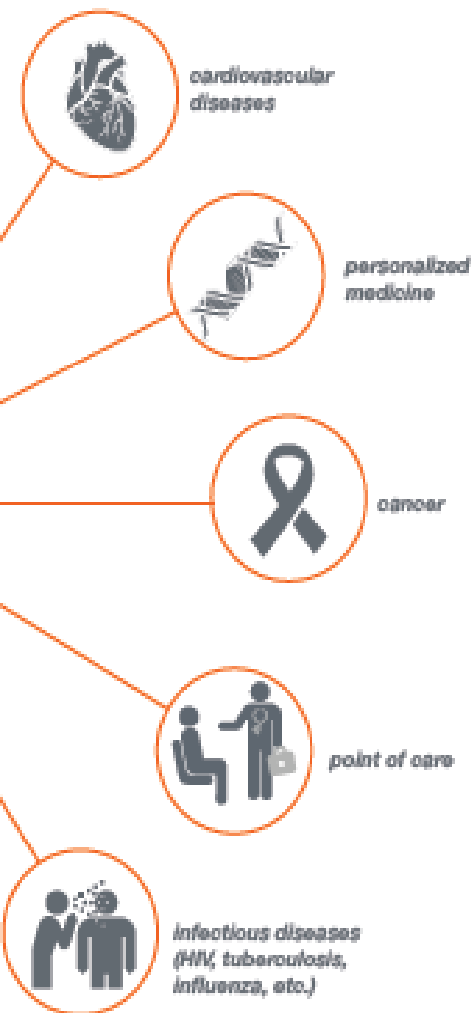
PERCENT OF WORLDWIDE HEALTH CARE  
SPENDING USED ON DIAGNOSTICS



PERCENT OF MEDICAL DECISION-MAKING  
INFLUENCED BY DIAGNOSTICS



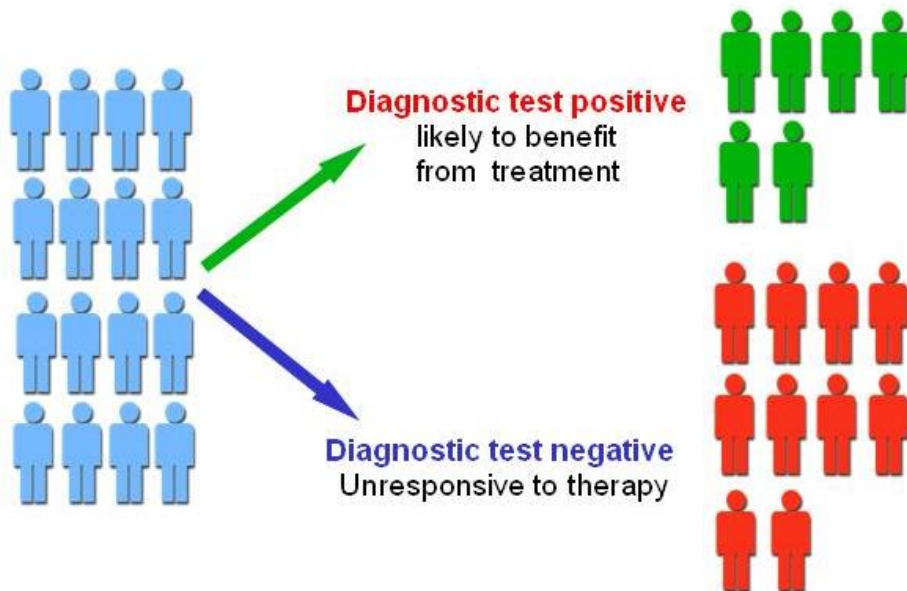
**Diagnostics** represent only 2% of overall health care spending, but are critical to medical decision-making, leading to better patient outcomes, lives saved and often reduced health care costs. There is huge potential for relatively low cost tests to greatly reduce the burden of diseases that cost billions of dollars every year.



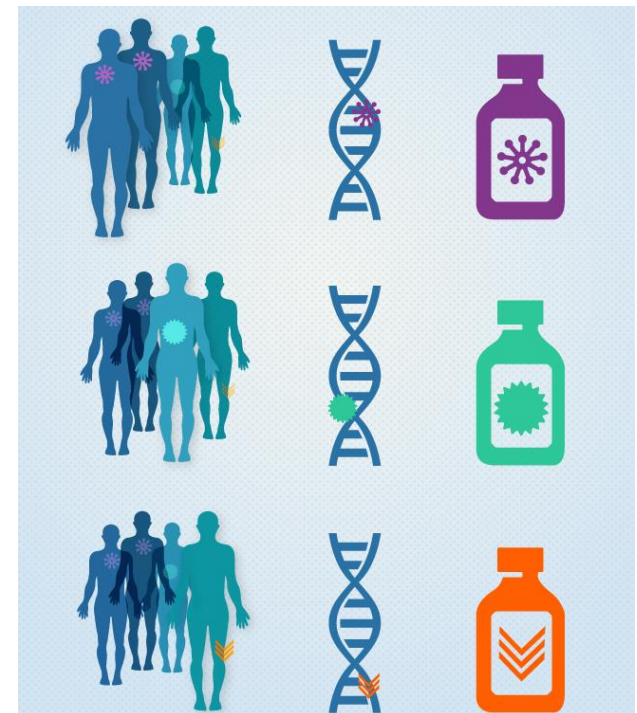
# Health Care Trends: Personalization of Medicine

*Leveraging advancements in research and technology drives personalization of HC*

## Personalized Medicine<sup>1</sup>



## Precision Medicine in Cancer Treatment<sup>2</sup>



1. [www.mediapharma.it/personalized-medicine.htm](http://www.mediapharma.it/personalized-medicine.htm)

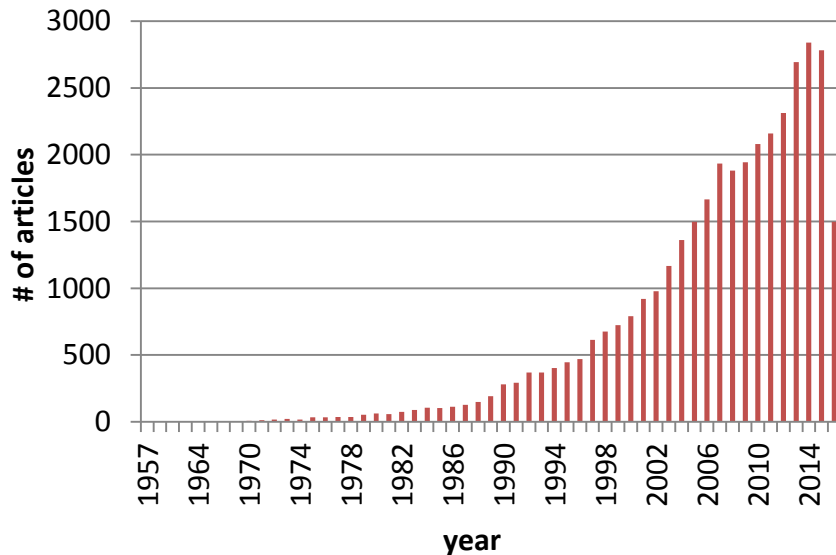
2. National Institute of Cancer

# Self care and patient management

## *Bibliography search*

Search terms: self care patient management, 10/9/2016<sup>1</sup>

### Patient Self-management of Chronic Disease in Primary Care<sup>2</sup>



Source: <http://www.ncbi.nlm.nih.gov/pubmed>

*“Once physicians recognize patients as experts on their own lives, they can add their medical expertise to what patients know about themselves to create a plan that will help patients achieve their goals”.<sup>3</sup>*

**Table 1.** Comparison of Traditional and Collaborative Care in Chronic Illness

| Issue   | Traditional Care  | Collaborative Care   |
|---|---|--|
| What is the relationship between patient and health professionals?                  | Professionals are the experts who tell patients what to do. Patients are passive. | Shared expertise with active patients. Professionals are experts about the disease and patients are experts about their lives.                                   |
| Who is the principal caregiver and problem solver? Who is responsible for outcomes? | The professional.   | The patient and professional are the principal caregivers; they share responsibility for solving problems and for outcomes.                                      |
| What is the goal?   | Compliance with instructions. Noncompliance is a personal deficit of the patient. | The patient sets goals and the professional helps the patient make informed choices. Lack of goal achievement is a problem to be solved by modifying strategies. |
| How is behavior changed?  | External motivation.  | Internal motivation. Patients gain understanding and confidence to accomplish new behaviors.   |
| How are problems identified?  | By the professional, eg, changing unhealthy behaviors.                            | By the patient, eg, pain or inability to function; and by the professional.  |
| How are problems solved?  | Professionals solve problems for patients.  | Professionals teach problem-solving skills and help patients in solving problems.  |

1. [www.ncbi.nlm.nih.gov/pubmed](http://www.ncbi.nlm.nih.gov/pubmed)

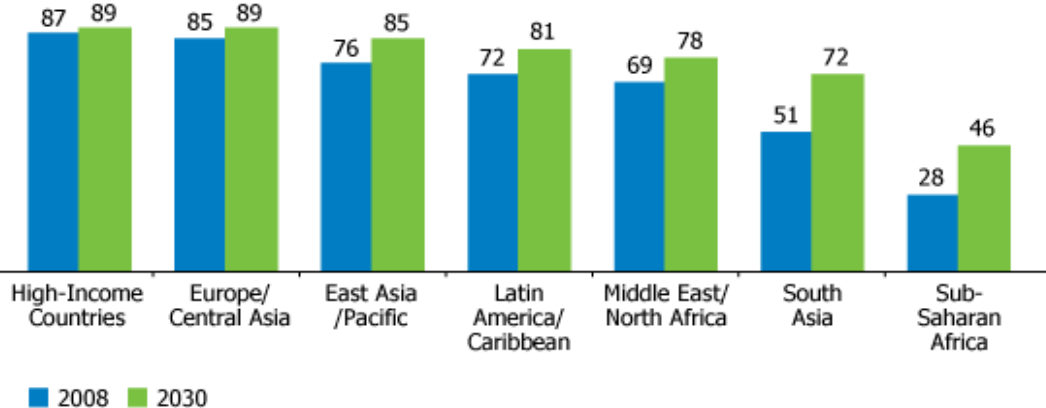
2. Bodenheimer T. et. al., JAMA 2002;288(19):2469-2475.

3. Funnell MM, An., et. al., JAMA 2000;284:1709.

# Health Care challenge: Change in Disease Demographics

*Lifestyle diseases and mental illnesses are spreading widely*

Percent of Total Deaths Attributed to NCDs\*, All Ages<sup>1</sup>



\*A **non-communicable disease (NCD)** is a medical condition or disease that is non-infectious or non-transmissible. NCDs can refer to chronic diseases which last for long periods of time and progress slowly

- NCDs are by far the leading cause of death in the world, representing 63% of all annual deaths.<sup>2</sup>
- 62% of baby boomers are overweight or obese, 1 in 5 is exercising less than once a week; 30% say they are often or always stressed (in the U.S.).<sup>3</sup>
- People living with chronic conditions account for 84% of Healthcare Costs, 2/3 of which are under the age of 65 (U.S.).<sup>3</sup>
- Spending on diabetes will increase by 10% in both developed and pharmerging regions through 2018 (driven by greater diagnosis rates, among other things).<sup>4</sup>

1. "Why NCDs Matter," *Health Nutrition and Population Discussion Paper*, Washington, DC: The World Bank, 2011

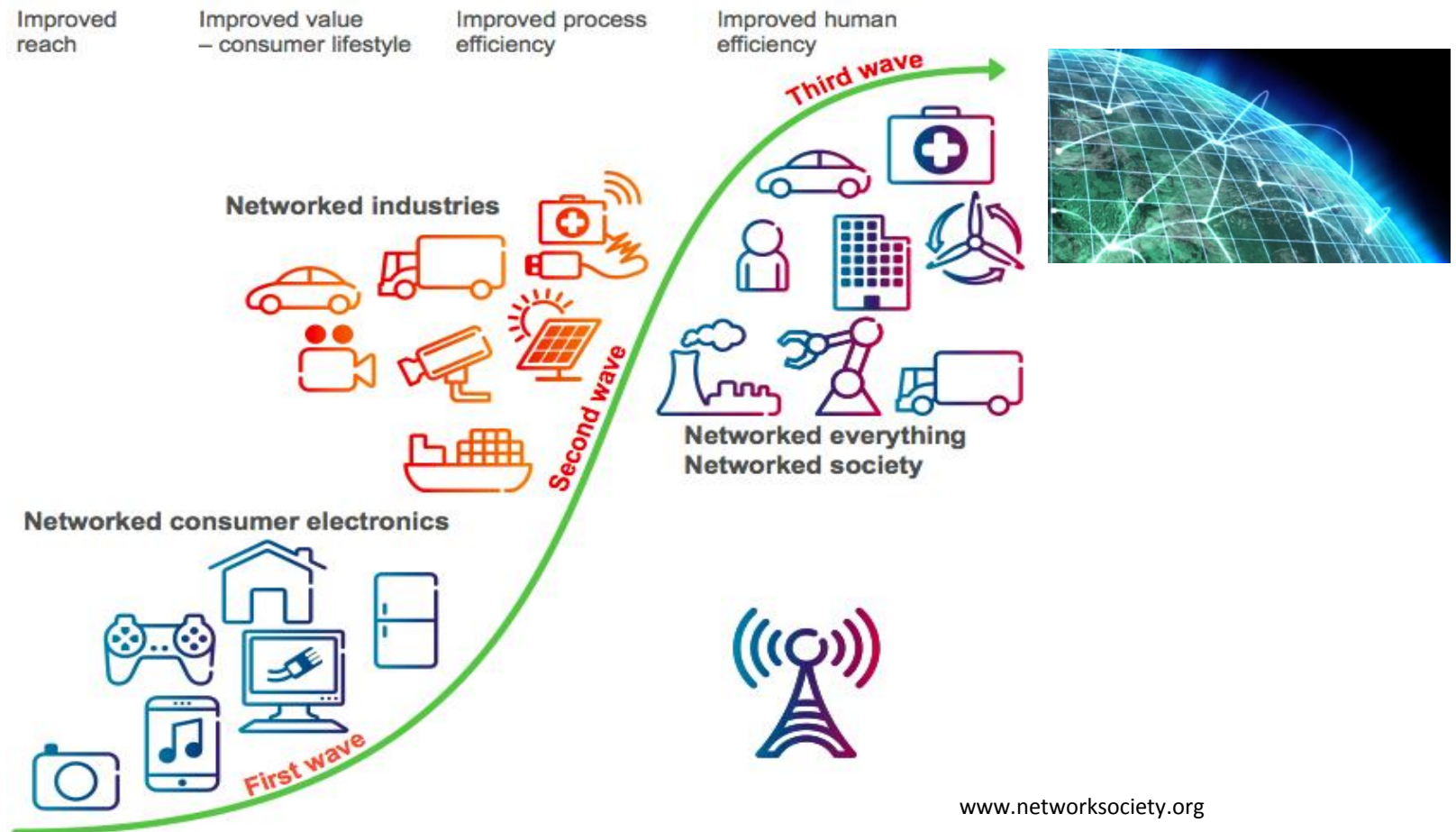
2. WHO

3. PEW Research Institute

4. IMS Health 2014

# Health Care Trend: Networked Society

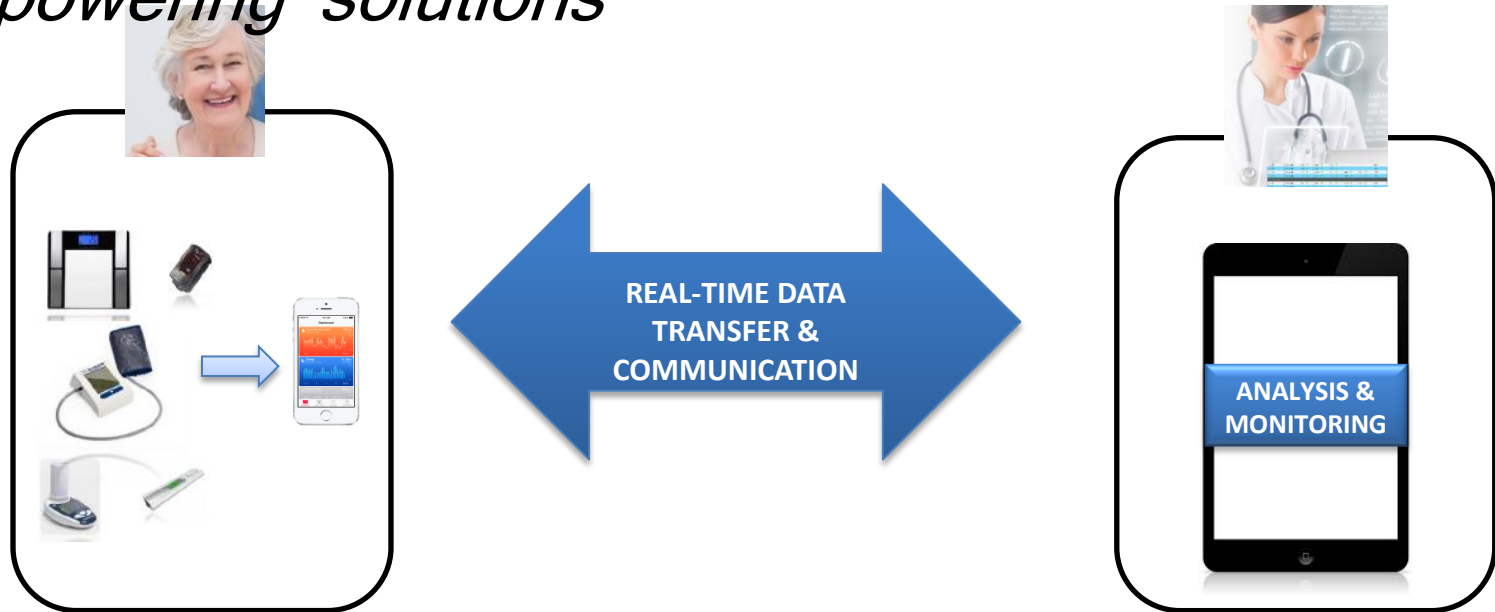
*HC providers and businesses can profit from the rise of non-physical interaction*



# Health Care Trend:

## Consumerization of Healthcare

*Future model of patient-HCP interaction: smart mobile devices and mobile internet allow for patient-empowering solutions*



- I get inspirational tips to staying healthy
- I own my health data
- I take care of myself at home
- I know that there is always a healthcare professional monitoring my health status
- I stay for longer in good health

- I am getting a high-quality real-time information and health of my patients
- I am using a large amount of data in decision-making
- I take care of the most needy patients
- I help my patients to stay for longer in good health

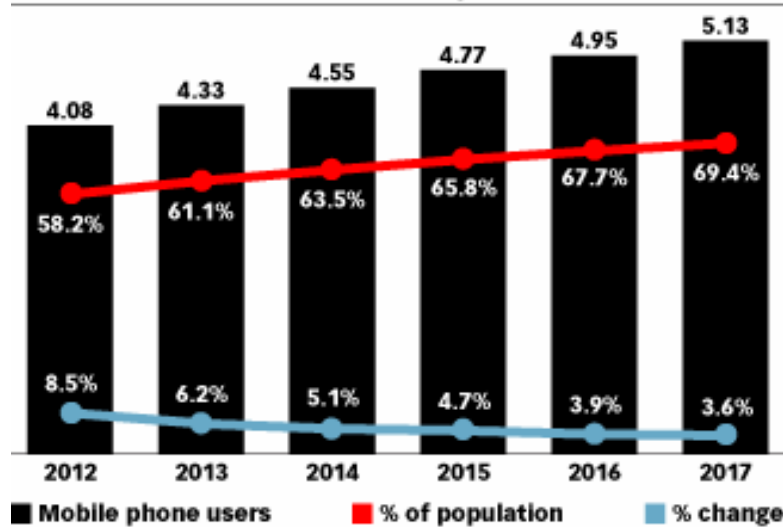
# Health Care Trend: Consumerization of Healthcare

*Future health companies*



# “SMART” Health Technologies

**Mobile Phone Users Worldwide, 2012-2017**  
billions, % of population and % change



**Mobile Phone Internet Users and Penetration Worldwide, 2012-2017**

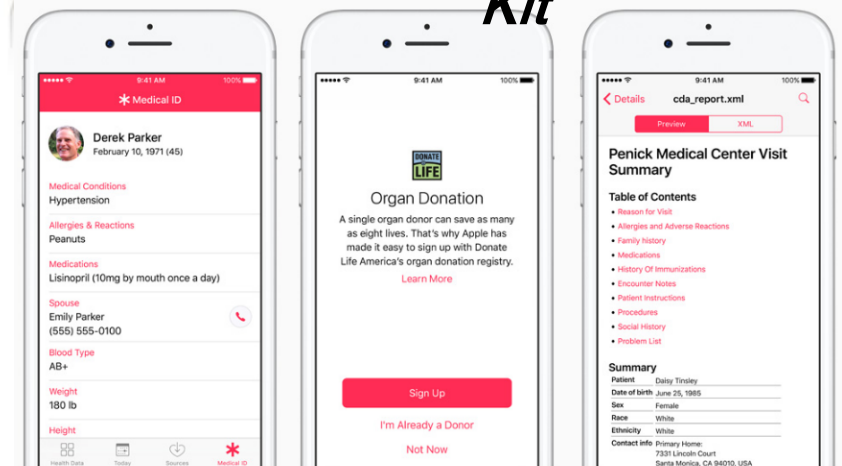
|   | 2012  | 2013  | 2014  | 2015  | 2016  | 2017  |
|---|-------|-------|-------|-------|-------|-------|
| <b>Mobile phone internet users (billions)</b> | 1.58  | 1.91  | 2.23  | 2.50  | 2.75  | 2.97  |
| —% change                                     | 37.4% | 20.7% | 16.5% | 12.2% | 10.0% | 8.0%  |
| —% of mobile users                            | 38.8% | 44.1% | 48.9% | 52.4% | 55.5% | 57.8% |
| —% of internet users                          | 66.8% | 73.4% | 79.1% | 83.6% | 87.3% | 90.1% |
| —% of population                              | 22.6% | 27.0% | 31.1% | 34.5% | 37.5% | 40.1% |

Apple sold 75 million iPhone's Last Quarter

... that is 15% of all phones sold.



## Apple's Health Kit



### Medical ID

Create an emergency card that allows first responders to access your critical medical information from the Lock screen, without needing your passcode.

### Organ donation sign-up

A single organ donor can save as many as eight lives. Make a big impact in just seconds by signing up for the Donate Life America registry directly from the Health app.

### Health records

Save records from your healthcare provider in Health, so it's easy to share things like immunizations and lab results with a new doctor or a family member at any time.

# Health Care System Apps

## Mayo Clinic App

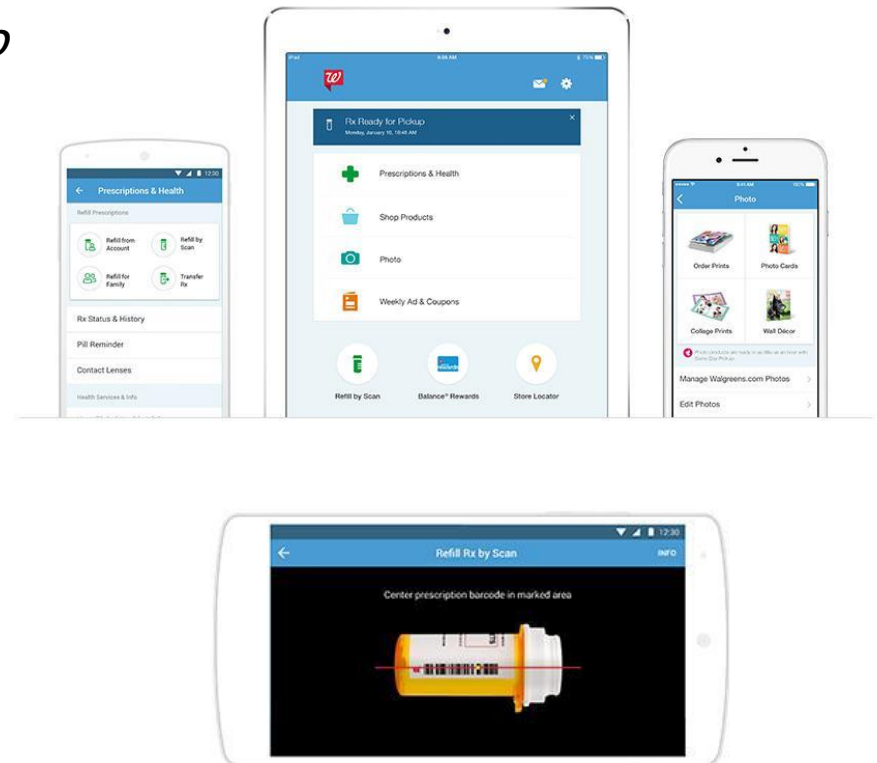
*"We are proud to be at the forefront of this innovative technology with the Mayo Clinic app."*

Mayo Clinic CEO, Dr. John Noseworthy



source: [www.mayoclinic.org/apps/mayo-clinic](http://www.mayoclinic.org/apps/mayo-clinic)

## Walgreens Pill Reminder App



source: [www.walgreens.com/topic/apps/l](http://www.walgreens.com/topic/apps/l)

# “SMART” Health Technologies



*cable connector to  
glucose meters*



*heart ECG smart phone  
case*



*Wireless Blood Pressure  
Monitor*



*oral fertility thermometer with  
app*



*baby monitor*



*health in a cube*

# Future Health Technologies

## *Health Wearables*

### Definition

**Wearable technology, wearables, fashionable technology, wearable devices, tech togs, or fashion electronics** are clothing and accessories incorporating computer and advanced electronic technologies. The designs often incorporate practical functions and features.

Wearable devices such as activity trackers are a good example of the Internet of things, since they are part of the network of physical objects or "things" embedded with electronics, software, sensors and connectivity to enable objects to exchange data with a manufacturer, operator and/or other connected devices, without requiring human intervention.

source: [en.wikipedia.org](http://en.wikipedia.org)



# Future Health Technologies

## WEARABLEs

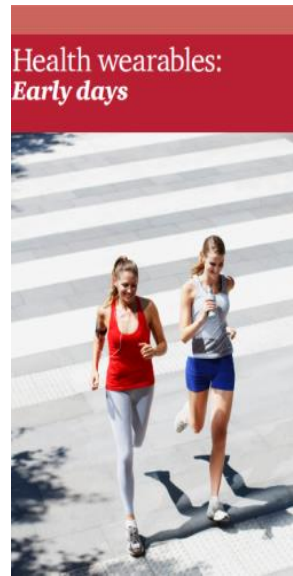
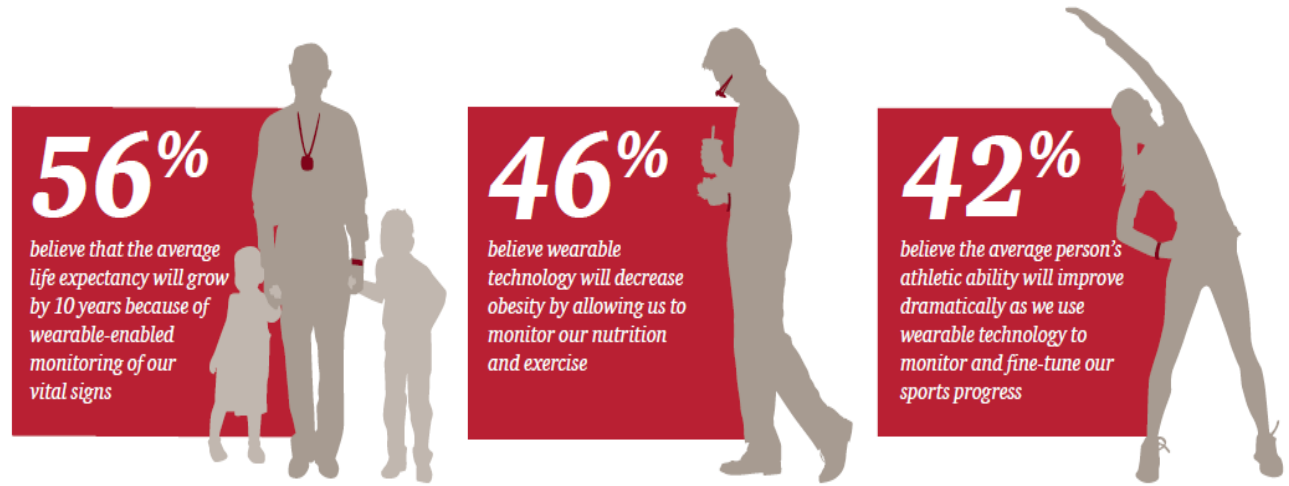


Figure 1: High hopes for wearables

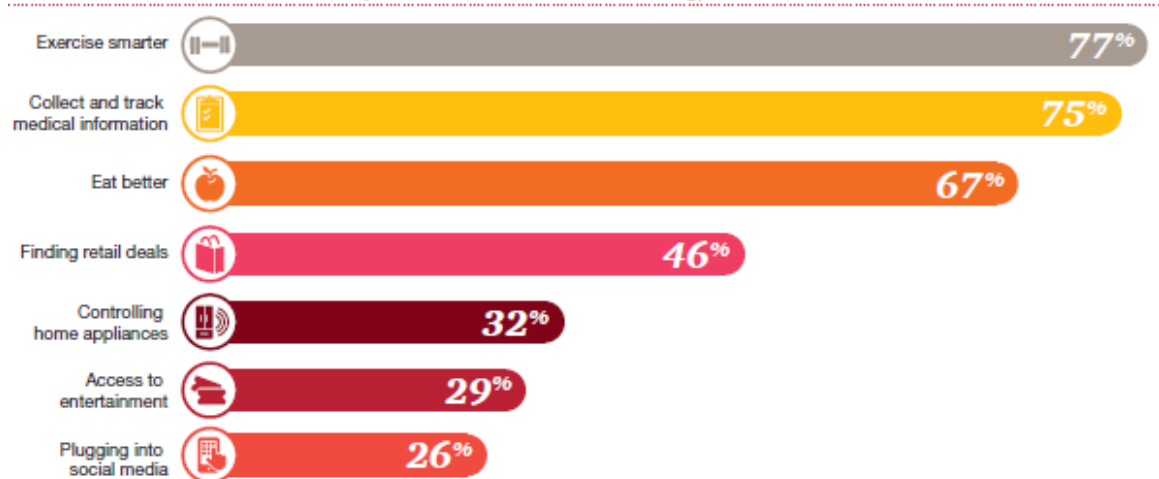
US consumers were asked how likely each of the following is to come about as a result of widespread use of wearable technology.



**21%** of US consumers currently own a wearable technology product

Figure 3: Health tops list of information US consumers want from wearables

Consumers were asked what information they want to receive from wearable technology.



# Future Health Technologies

WEARABLEs

*Corporate wellness programs*

## **Wellness programs grow more popular with employers**

Source: [www.themercurynews.com](http://www.themercurynews.com), article by Associated Press, April 2015

## **Here's why Fitbit is giving Target 335,000 fitness-tracking devices**

“It’s part of the company’s health initiative. Target will be offering Fitbits to its employees in an attempt to improve their health and cut down on health care costs”

Michal Addady, September 2016, Fortune ([www.fortune.com](http://www.fortune.com))

## **The 1 million step challenge**

BP employees who hit the mark over the course of a year are eligible for a more deductible health plan. In one year, 23,000 employees took over 23 billion steps.

Source: [www.mashable.com/2015/05/15/](http://www.mashable.com/2015/05/15/)

# Health at Hand: A Systematic Review of Smart Watch Uses for Health and Wellness

*Blaine R., Alexandria D.; Journal of Informatics, September 2016*

## Sensor-based methods

- Accelerometers: a) **Step counts**<sup>1, 2, 3, 4</sup>, b) **Overall activity levels**<sup>5</sup>, c) **Eating behavior**<sup>6</sup>, c) **Cardio Pulmonary Resuscitation (CPR) compression**<sup>7</sup>, d) **Seizures in epilepsy patients**<sup>8,9</sup>, e) **Tremors**<sup>10</sup>, f) **Scratching**<sup>11</sup>, g) **Sit, stand, and lie activities**<sup>12</sup>
- Gyroscopes: a) **Posture**<sup>12</sup>, b) **Palm rotation**<sup>25</sup>
- Microphones: a) **Speech therapy**<sup>17</sup>, b) **eating behavior**<sup>13</sup>
- Optical sensors: **Heart rate**<sup>12, 19, 20, 26</sup>
- Contact sensors: **Skin temperature**<sup>19,12</sup>
- Ambient light sensors: **Light intensity exposure**<sup>26</sup>
- Wireless signal strength: **Identify participant location in a residence**<sup>11</sup>

1. Ahanathapillai, V., et al., Healthc Technol Lett, 2015. **2**(1): p. 34-9.

2. Arsand, E., et al., Journal of Diabetes Science and Technology, 2015. **9**(3): p. 556-563

3. Jovanov, E., Conf Proc IEEE Eng Med Biol Soc, 2015. **2015**: p. 865-8.

4. Kamdar, M.R. and M.J. Wu, Pac Symp Biocomput, 2016. **21**: p. 333-44.

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7. Rawassizadeh, R., B.A. Price, and M. Petre, Communications of the ACM, 2015. **58**(1): p. 45-47.

8. Lockman, J., R.S. Fisher, and D.M. Olson, Epilepsy & Behavior, 2011. **20**(4): p. 638-641.

9. Patterson, A.L., et al., Pediatric Neurology, 2015. **53**(4): p. 309-311.

10. Wile, D.J., R. Ranawaya, and Z.H.T. Kiss. Journal of Neuroscience Methods, 2014. **230**: p. 1-4.

11. Lee, J., et al. ACM: Seoul, Republic of Korea. p. 1567-1572.

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13. Kalantarian, H., N. Alshurafa, and M. Sarrafzadeh, IEEE Sensors Journal, 2016. **16**(4): p. 1054-1061.

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15. Kalantarian, H. and M. Sarrafzadeh,. Computers in Biology and Medicine, 2015. **65**:p. 1-9.

16. Carlson, J.D., et al.,. Conf Proc IEEE Eng Med Biol Soc, 2014. **2014**: p. 2173-6.

17. Dubey, H., et al., ACM: Bethesda, Maryland. p. 1-8.

# Health wearables

## Bibliography search

Search date: 10/9/2016<sup>1</sup>  
Search terms: **health wearables**  
# of articles: **54**  
Years: **2004 – 2016 (September)**

## The Role of Technology in Chronic Disease Care

Richard V. Milani<sup>2</sup>, Robert M. Bober, Carl J. Lavie  
Department of Cardiovascular Diseases, John Ochsner Heart and Vascular Institute, New Orleans

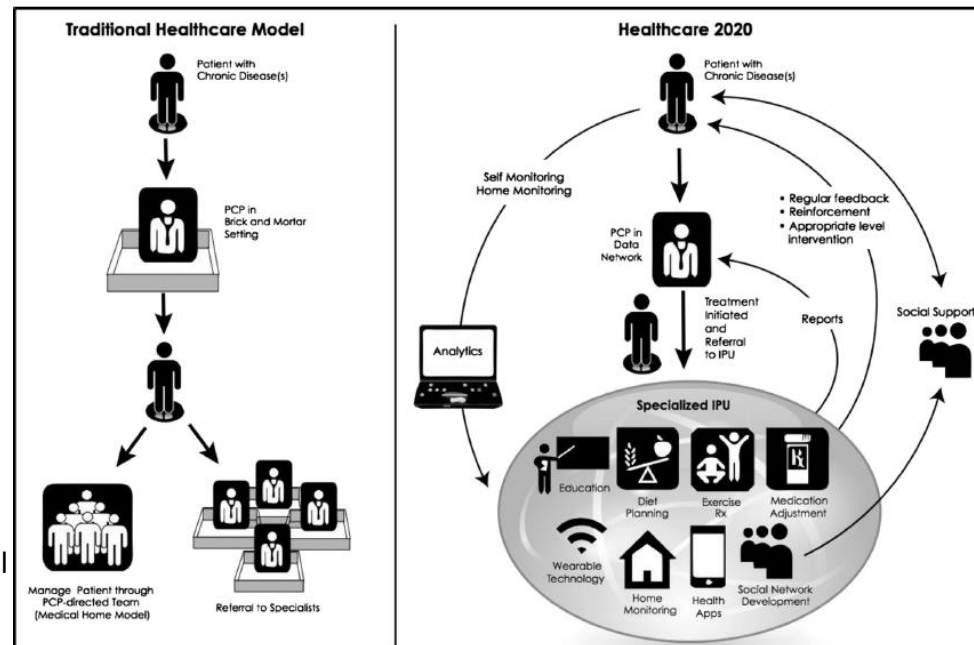
**FACT:** Chronic disease is present in half the adult population and responsible for 86% of United States (US) healthcare costs and 70% of deaths<sup>2</sup>

## EXAMPLES TECHNOLOGICAL INTERVENTION IN HEALTHCARE

- Reduction of hospital readmissions of HF patients by 44% by sending patients home with wireless scales. Daily weights are transmitted securely to a dashboard within the electronic medical record (EMR) that is monitored by a specialized clinical care team called an integrated practice unit (IPU)<sup>2</sup>
- Larger decrease of systolic blood pressure, more frequent blood pressure control and higher patient satisfaction about his care team<sup>3-5</sup>

## Health Care 2020: Reengineering Health Care Delivery to Combat Chronic Disease

Richard V. Milani, MD,<sup>a</sup> Carl J. Lavie, MD<sup>a</sup>, Department of Cardiovascular Diseases, John Ochsner Heart and Vascular, Louisiana State University System, Baton Rouge.



1. [www.ncbi.nlm.nih.gov/pubmed](http://www.ncbi.nlm.nih.gov/pubmed)
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# Some questions about future health technologies

Will there be a Health care Technology Assessment (HTA)?

How soon? How frequent?

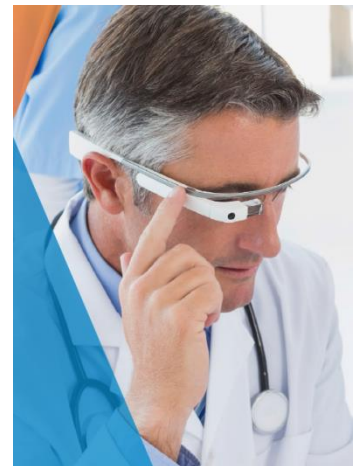
How will they contribute in cultivating the concept of self care?

How fast will they be adopted by the patients?

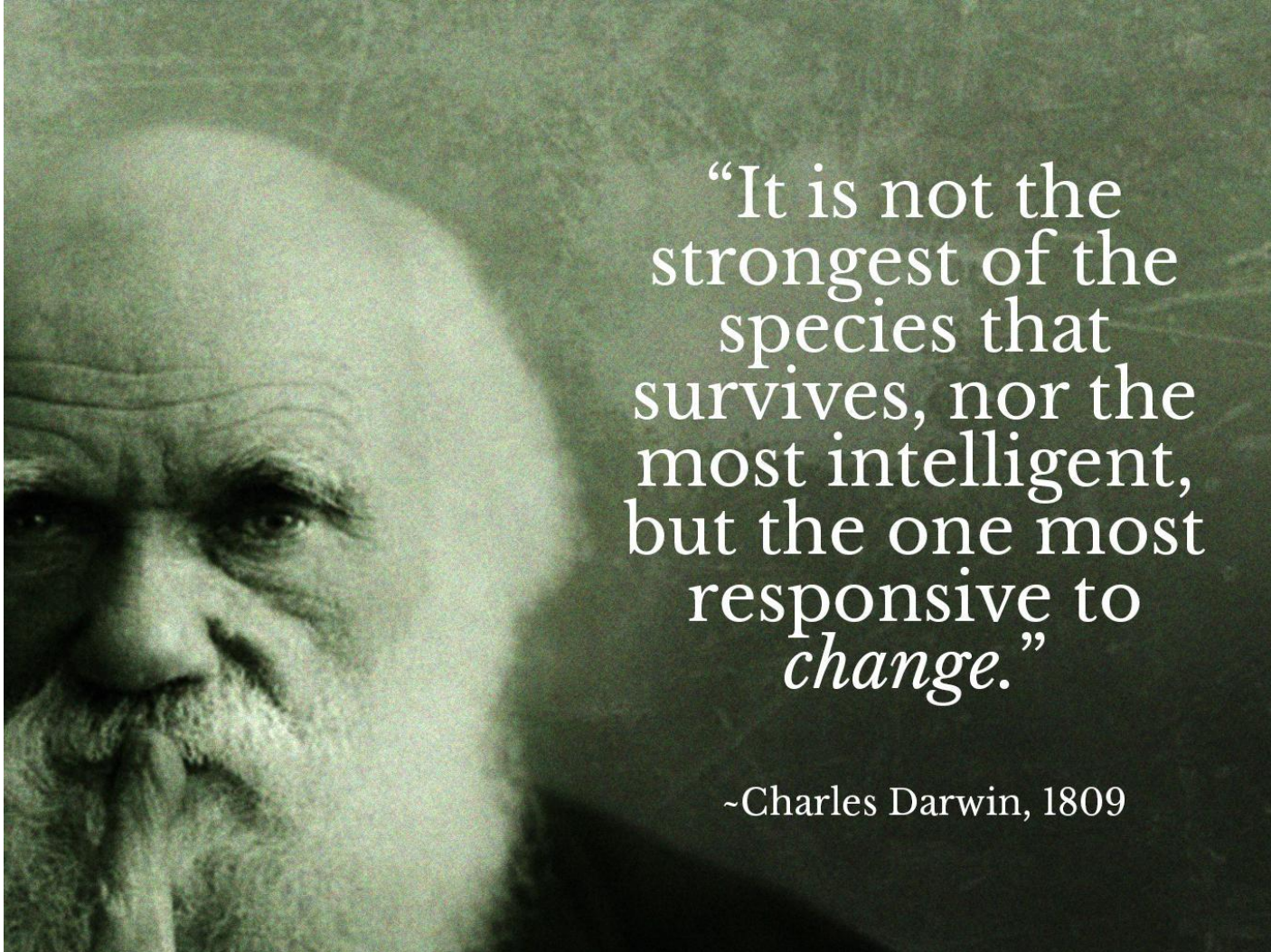
How much will HCPs embrace them?

Will they be reimbursed?

Level of personal medical data protection?



## Key Takeaway Points



“It is not the  
strongest of the  
species that  
survives, nor the  
most intelligent,  
but the one most  
responsive to  
*change.*”

~Charles Darwin, 1809

**Thank you for your attention**