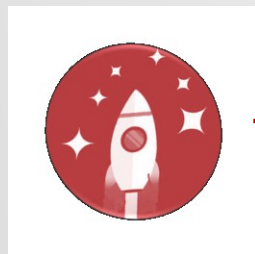
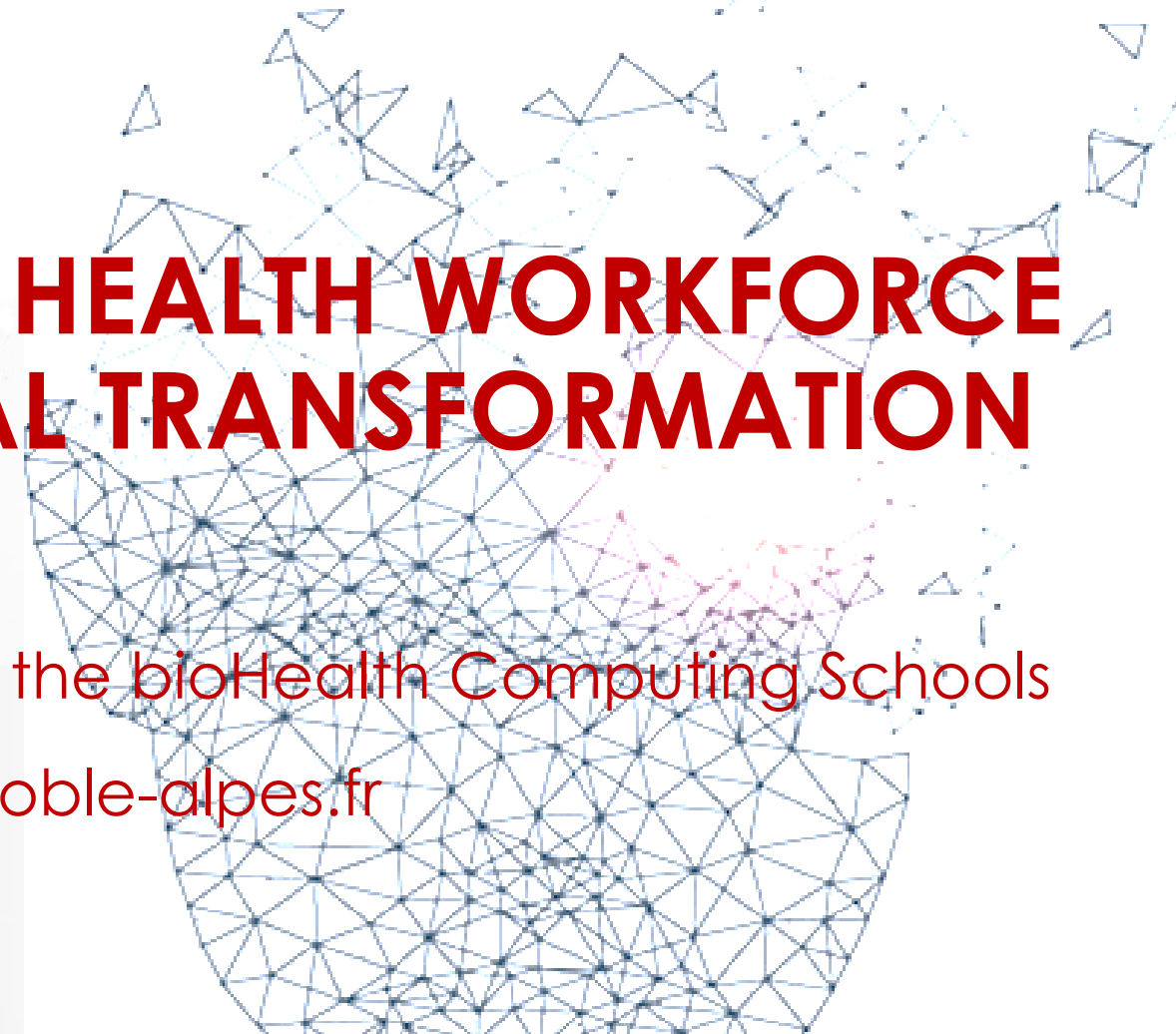




STRENGTHENING THE HEALTH WORKFORCE THROUGH THE DIGITAL TRANSFORMATION



The innovative challenge of the bioHealth Computing Schools
philippe.sabatier@univ-grenoble-alpes.fr



HEALTH WORKFORCE REQUIREMENTS FOR THE SDG

SUSTAINABLE DEVELOPMENT GOALS

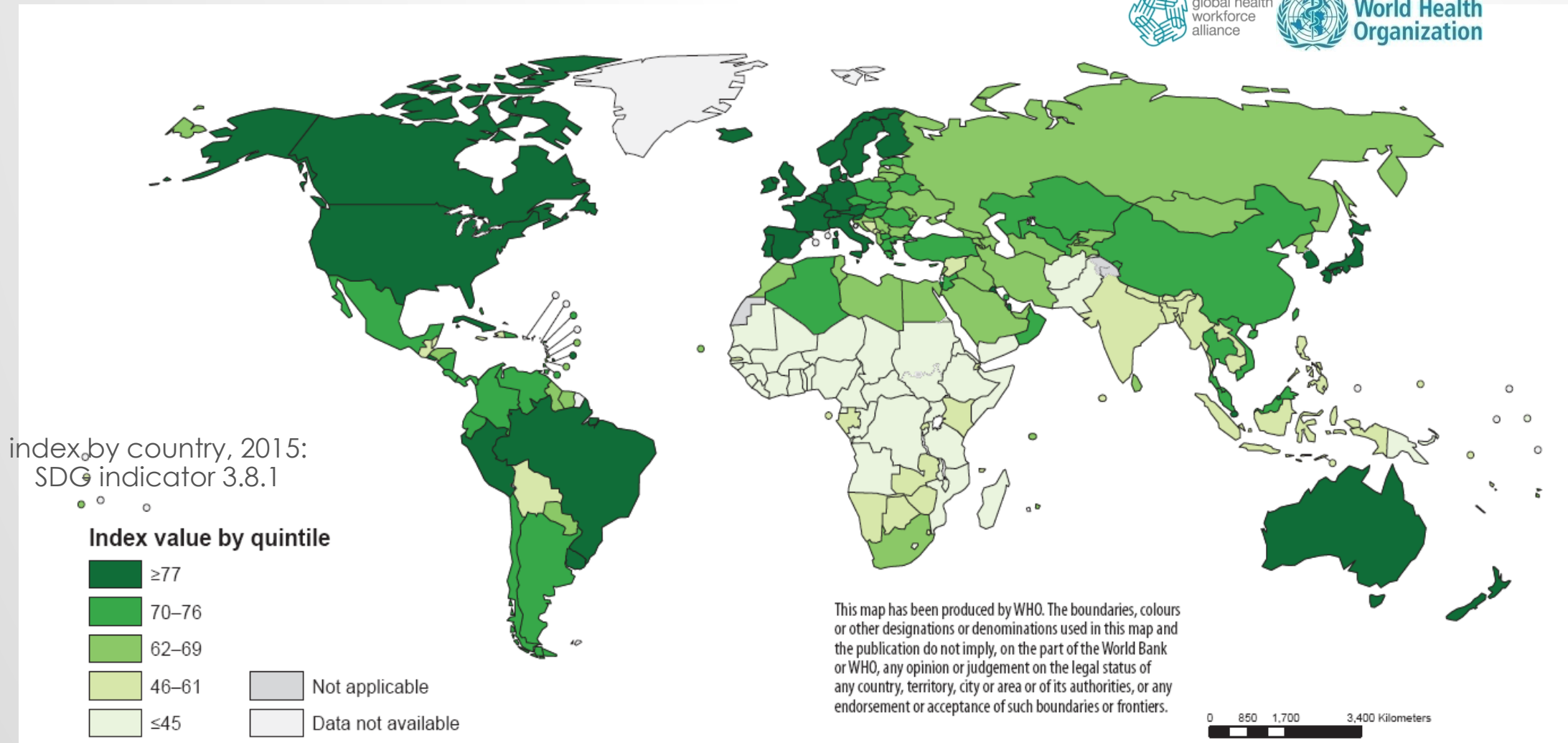
- “At current rates of progress, **fewer than 5% of countries were projected to reach 2030 targets** for 11 SDG indicators.”
 - Measuring progress and projecting attainment on the basis of past trends of the health-related Sustainable Development Goals in 188 countries: an analysis from the Global Burden of Disease Study 2016. Fullman, Nancy et al.. The Lancet , Volume 390 , Issue 10100 , 1423 –1459
[http://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(17\)32336-X/fulltext](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(17)32336-X/fulltext)
- “Meeting the Health SDG (UHC) means **investing 3.9 trillion USD over the next 15 years.**”
- **Health workforce represent almost 1.8 trillion USD (50%)** including education, training and employment costs (i.e. 70 million decent job creation opportunity in LMICs). Low & Middle Incomes Countries
 - Jim Campbell, UHC and a sustainable health workforce Commonwealth Civil Society Policy Forum, 19 May 2018



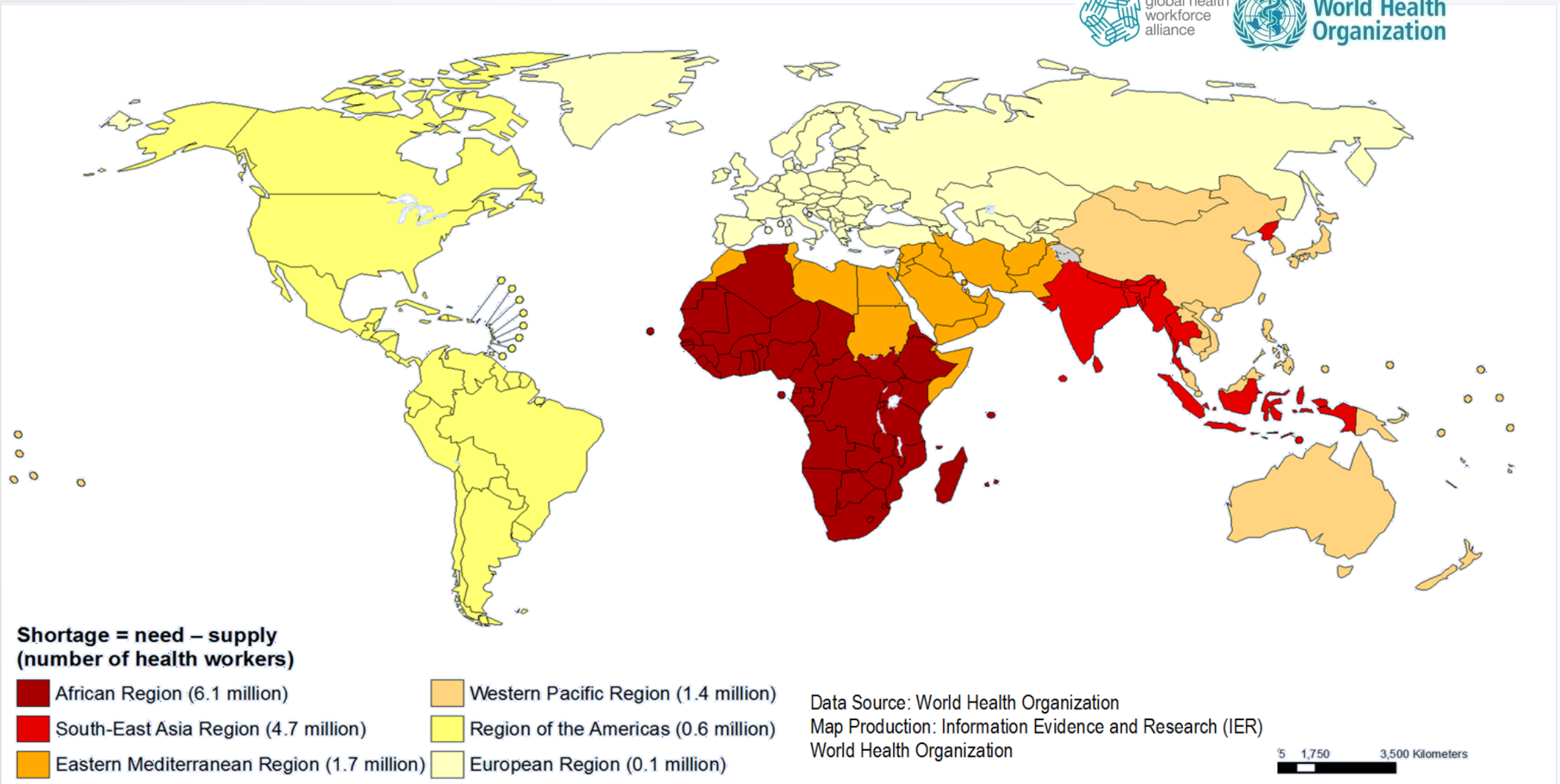
outline

- overcoming the health workforce crisis
- a.i. between promises and problems
- bioHC accelerating health innovation

THE UHC SERVICE COVERAGE



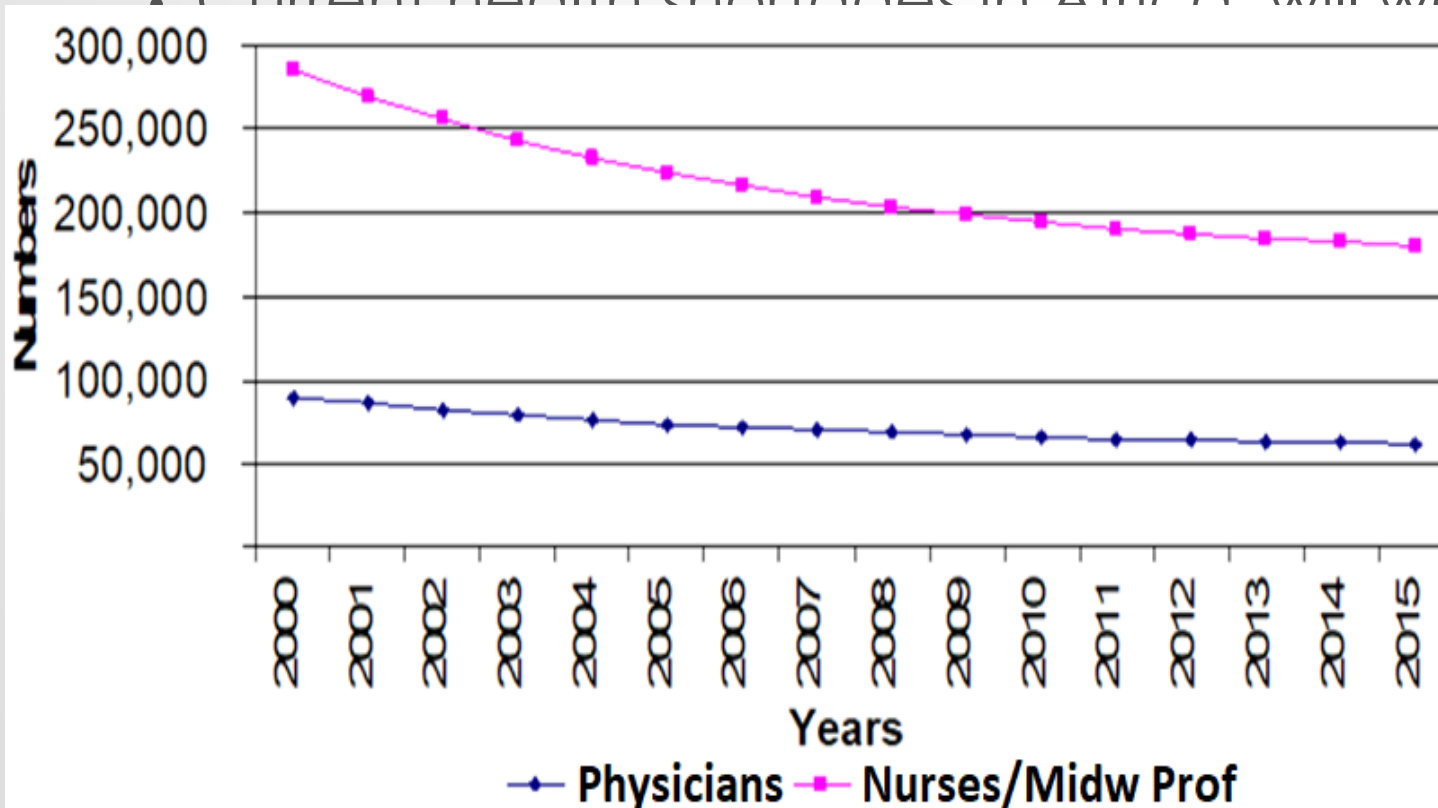
THE ASSOCIATED WORKERS SHORTAGE



THE AFRICA'S CRISIS

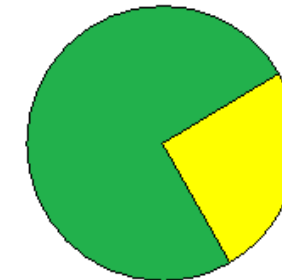


• Current health shortages in Africa will worsen in coming years.



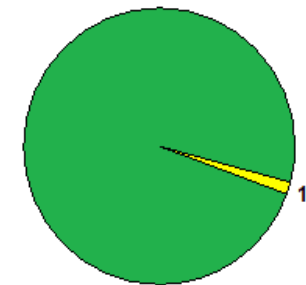
and the problems go beyond numbers!

Africa's Burden of the World's Diseases



25%

Africa's Share of the World's Health Workers



1.3%

Source: *Addressing Africa's Health Workforce Issues: An Avenue for Action.*, 2004.

• 36 countries in sub-Saharan Africa are without 2.3 doctors/nurses/ midwives per 1000 population are « very unlikely » to achieve MDGs (Millenium Development Goals, WHO)

THE WORDWIDE EPIDEMIC TRANSITION

- Worldwide Burden of Chronic Diseases: 35,6 millions of death
 - 57% of all deaths in 2005
 - 73% of all deaths by 2030.
- Worldwide Tectonics of Demography in aging societies:
 - 80% of age 60+ suffering from one or more CDs (as do many of the poor).

CD deaths increasing by 30% between 2005 and 2030.

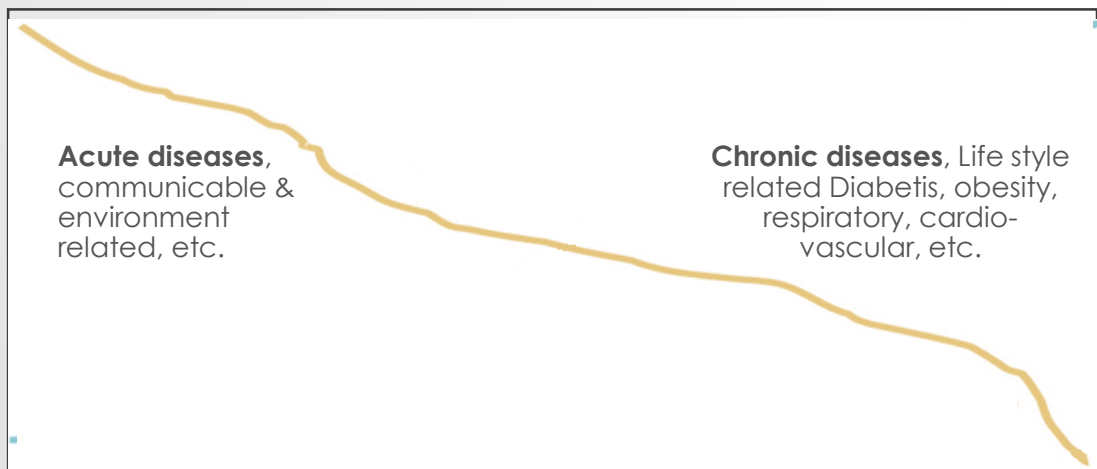
\$47 trillion 4% of the GDP by 2030



- Americans with five or more CDs spend 14 times more on health services than people with no CDs.



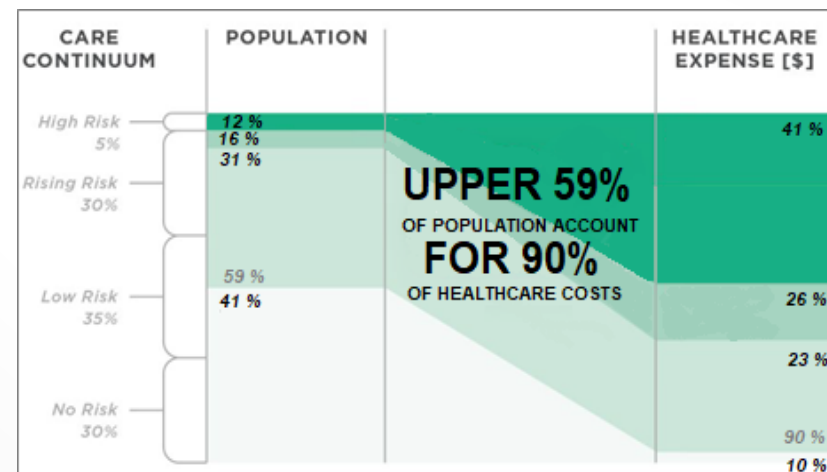
Mortality rate



Economic development

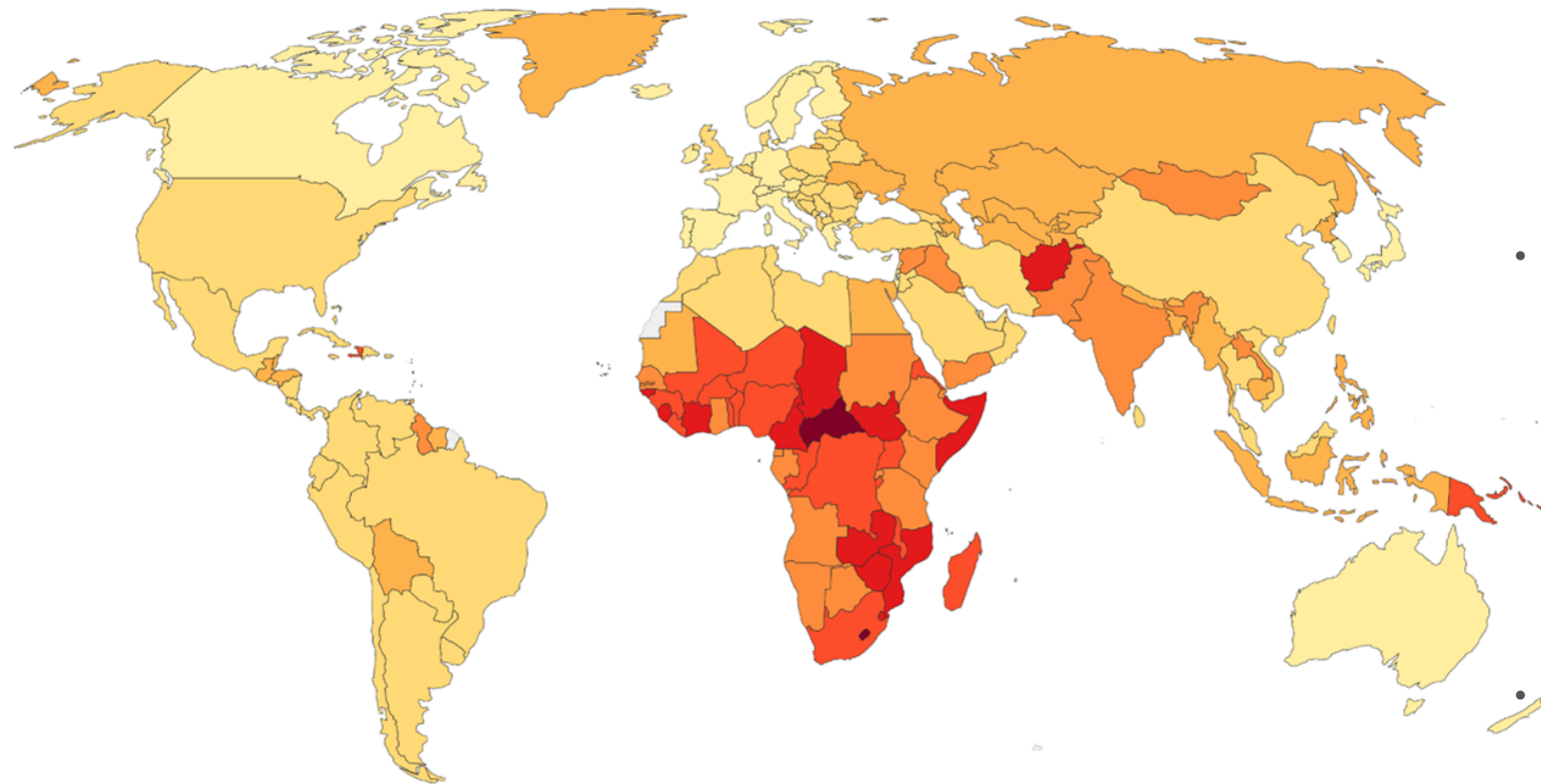
Least developed: low supply, limited life, emigration and "push" factors, etc

Most developed: aging population, environmental exposure, shrinking recruitment pool

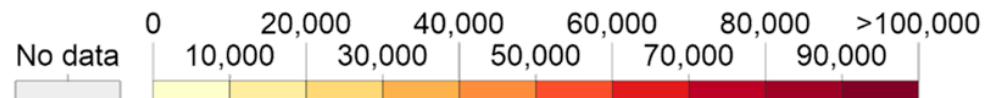


Source: C. Buttorff, T. Ruder, and M. Bauman. 2017. Multiple Chronic Conditions in the United States. RAND Corporation.

THE DALYS LOST YEARS OF HEALTHY LIFE



Our World
in Data



- **DALY (Disability-Adjusted Life Years) rates per 100.000 individuals for all causes.**
- DALYs are used to measure the "burden of diseases", which is a variable that combines mortality patterns with data on the prevalence of disability and illness.
- One DALY equal one lost year of healthy life (i.e. with illness or disability).

THE HEALTH WORKFORCE CHALLENGES

Driving Forces

Health needs

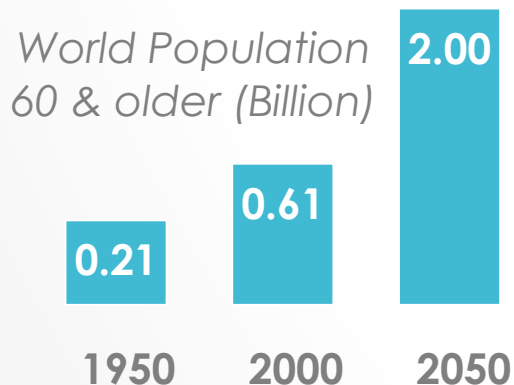
- Demographics & social inequalities
- Disease burden
- Wellbeing

Health Systems

- Digital transformation & Technology
- Citizen empowerment
- Financing

Context

- Education
- Public sector reforms
- Globalization



80% of age 60+ suffering from one or more Chronic Conditions (CC) – as do many of the poor.

Workforce Challenges

Education

- Outdated teaching
- Skill-mix imbalances

Management of HR

- Shortages, maldistribution, low supply & job satisfaction
- Poor working conditions, lack of professional development, respect & support
- Stress, overwork, burnout, absenteeism, illness & low productivity

Governance

- Continuing deficits, Insufficient investment & demand
- Failure of past public policy initiatives

outline

- overcoming the health workforce crisis
- a.i. between promises and problems
- bioHC accelerating health innovation

BURNING OBESITY AS A CASE STUDY

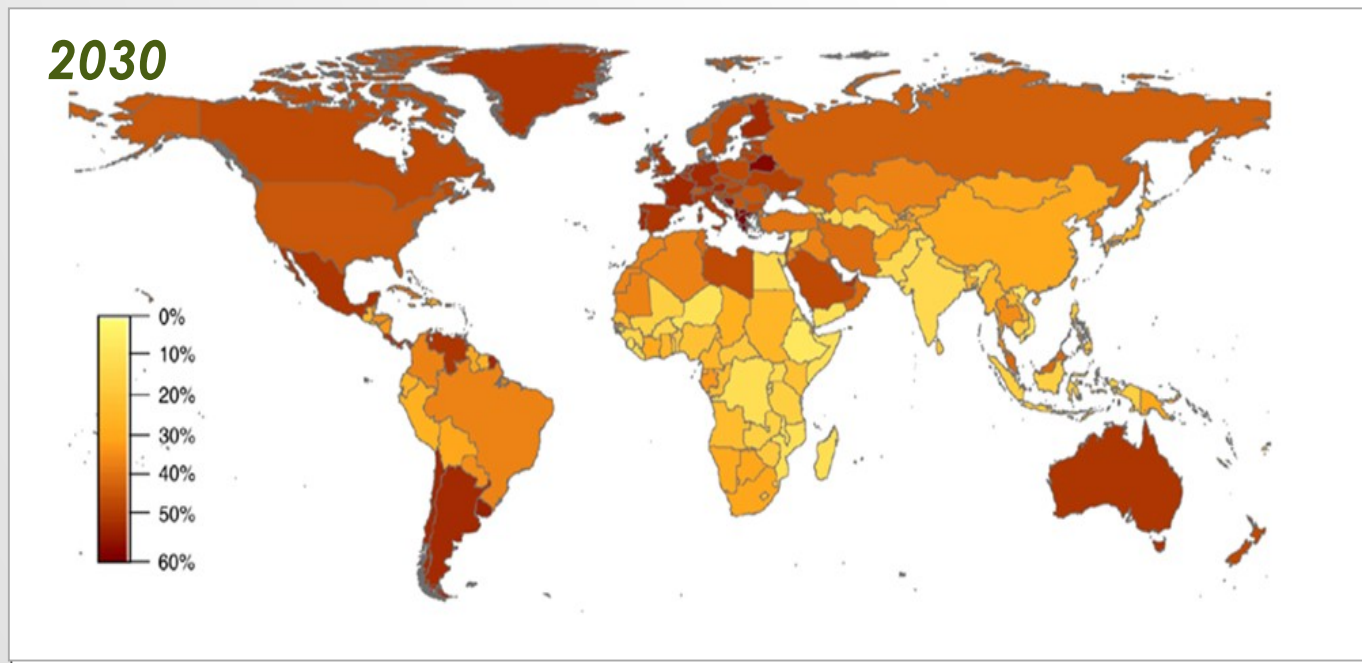
- 600 millions of obese, double in 30 years,
- More of 1,9 milliard of adults in overweight
- Double health spending (today obesity is responsible for 2–10 % of health costs.)



In the WHO/European Region



over 50%
of people are
overweight or obese



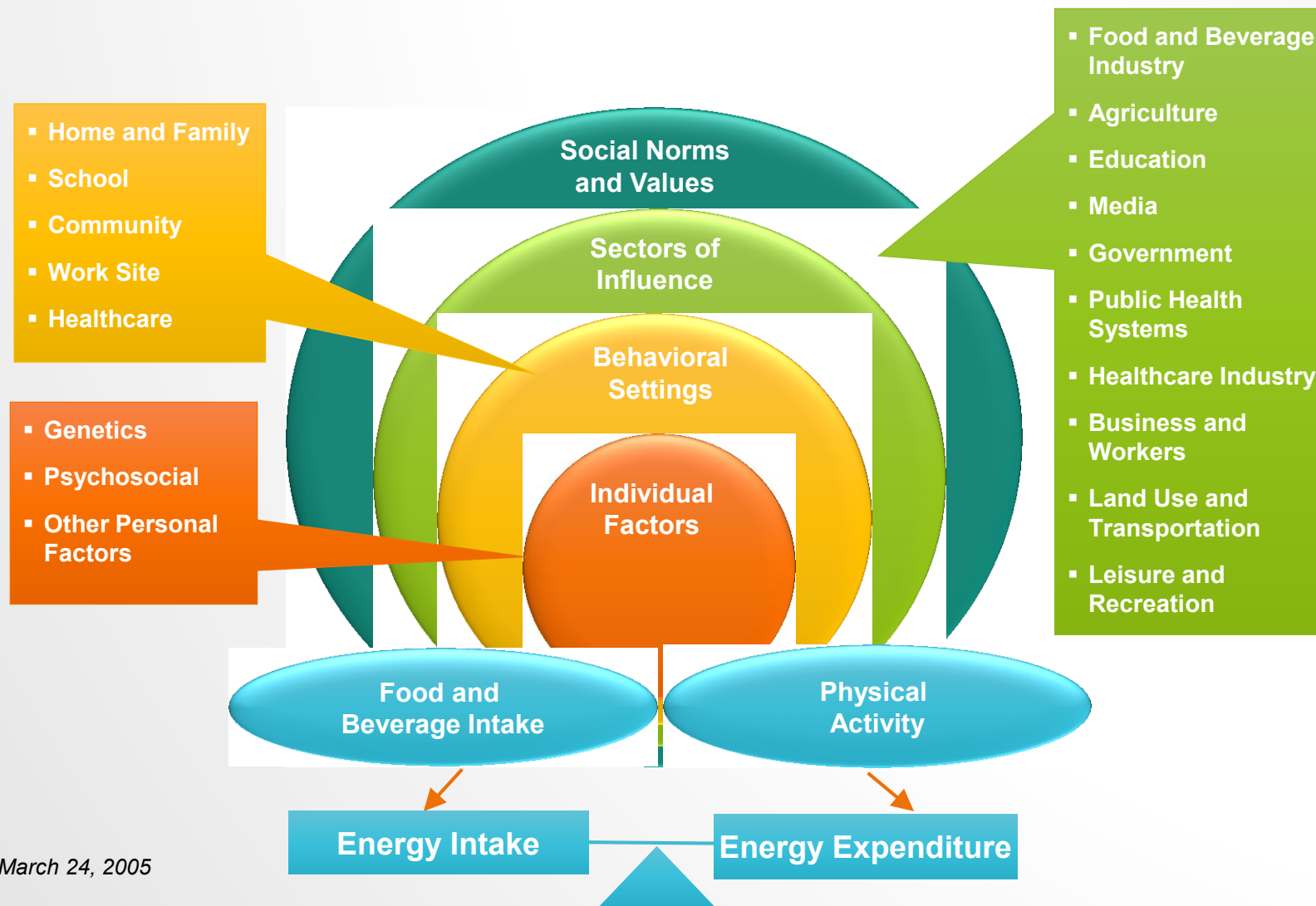
Prevalence of obesity among adults $BMI \geq 30 \text{ kg/m}^2$ [18+ age standardised estimates]

1 in 3 
11-year-olds is
overweight
or
obese

BMI
Body mass index is
a measure of
body fat based
on weight and
height (Kg/m^2)

<http://apps.who.int/bmi/index.jsp>

A COMPLEX FRAMEWORK FOR TREATING IT

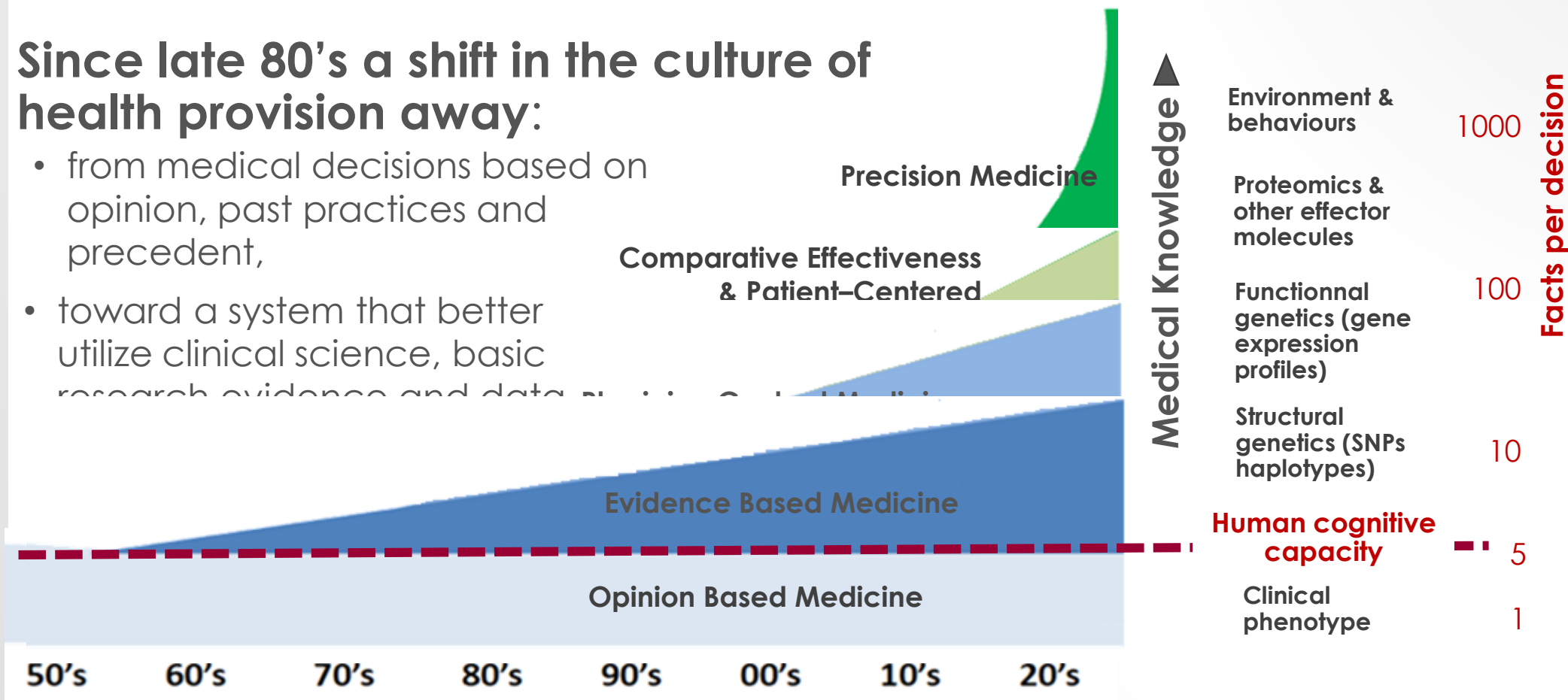


Draft – last revised, March 24, 2005
(adapted from IOM)

APPLICATION OF EVIDENCE TO CARE

Since late 80's a shift in the culture of health provision away:

- from medical decisions based on opinion, past practices and precedent,
- toward a system that better utilize clinical science, basic research evidence and data driven medicine.



THE DATA DELUGE

► Digital universe:

- 10 folds growth in 5 years (2005-11)
- 22 folds growth in 9 years (2011-20)

► Unstructured data:

- 100 folds growth every 10 years (2010-20)

Scales. On a computer, data is translated into 0s and 1s called bits. **Eight bits make up one byte**—enough information to represent one letter, number, or symbol.

Petabyte = 10^{15}

- **2.5 PB:** Memory capacity of the human brain
- **13 PB:** Amount that could be downloaded from the Internet in two minutes if every American got on a computer at the same time
- **98 PB:** Websites indexed by Google

Exabyte = 10^{18}

- **4.75 EB:** Total genome sequences of all people on Earth
- **422 EB:** Total digital data created in 2008

Zettabyte = 10^{21}

- **1 ZB:** World's current digital storage capacity
- **1.8 ZB:** Total digital data created in 2011

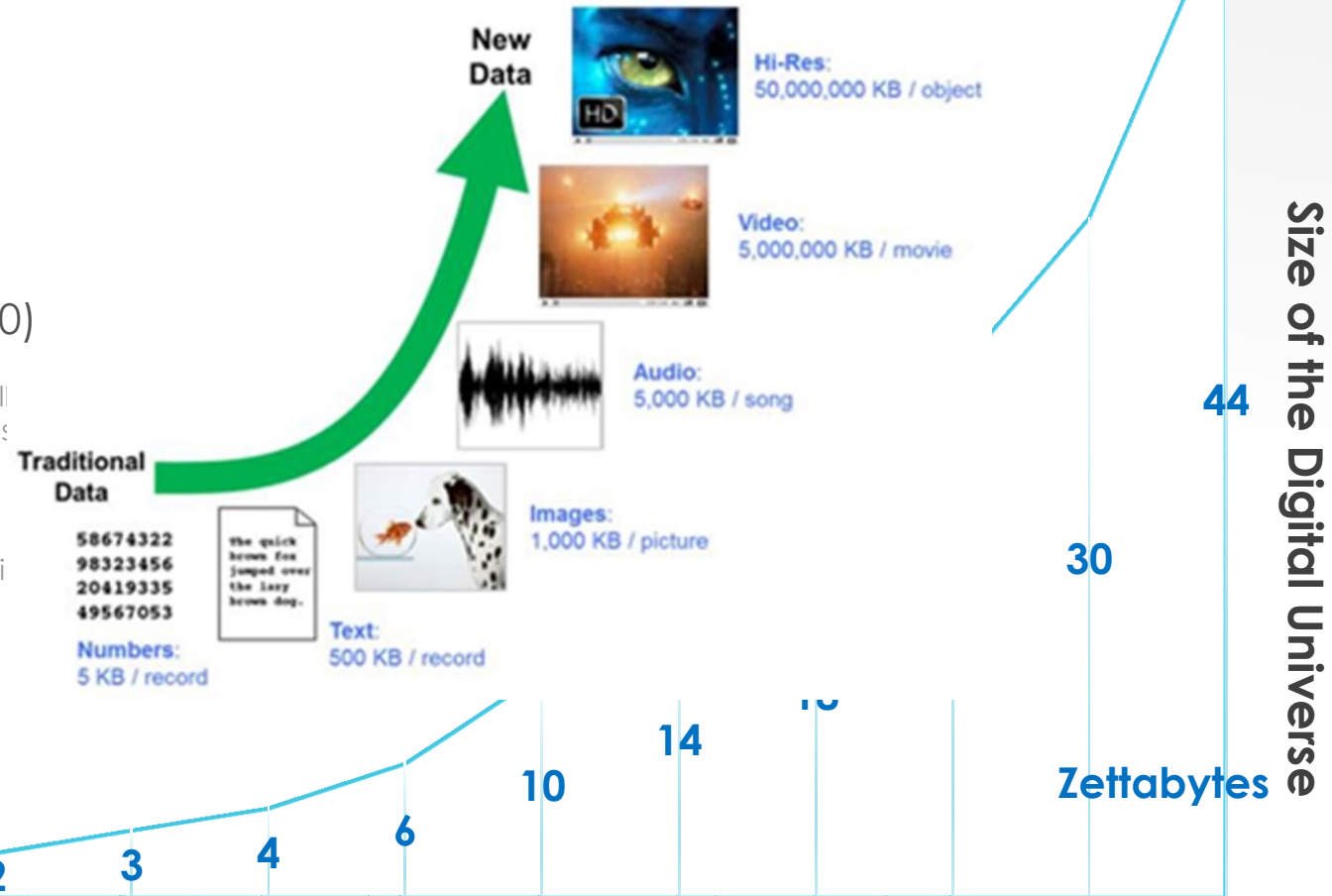


Source: Popular Science and Katie Peek

IDC iView "Big Data, Bigger Digital Shadows, and Biggest Growth in the Far East," Dec 2012



IoT: interconnected endpoints (devices and things) which can be addressed and identified with an IP (Internet Protocol) address.

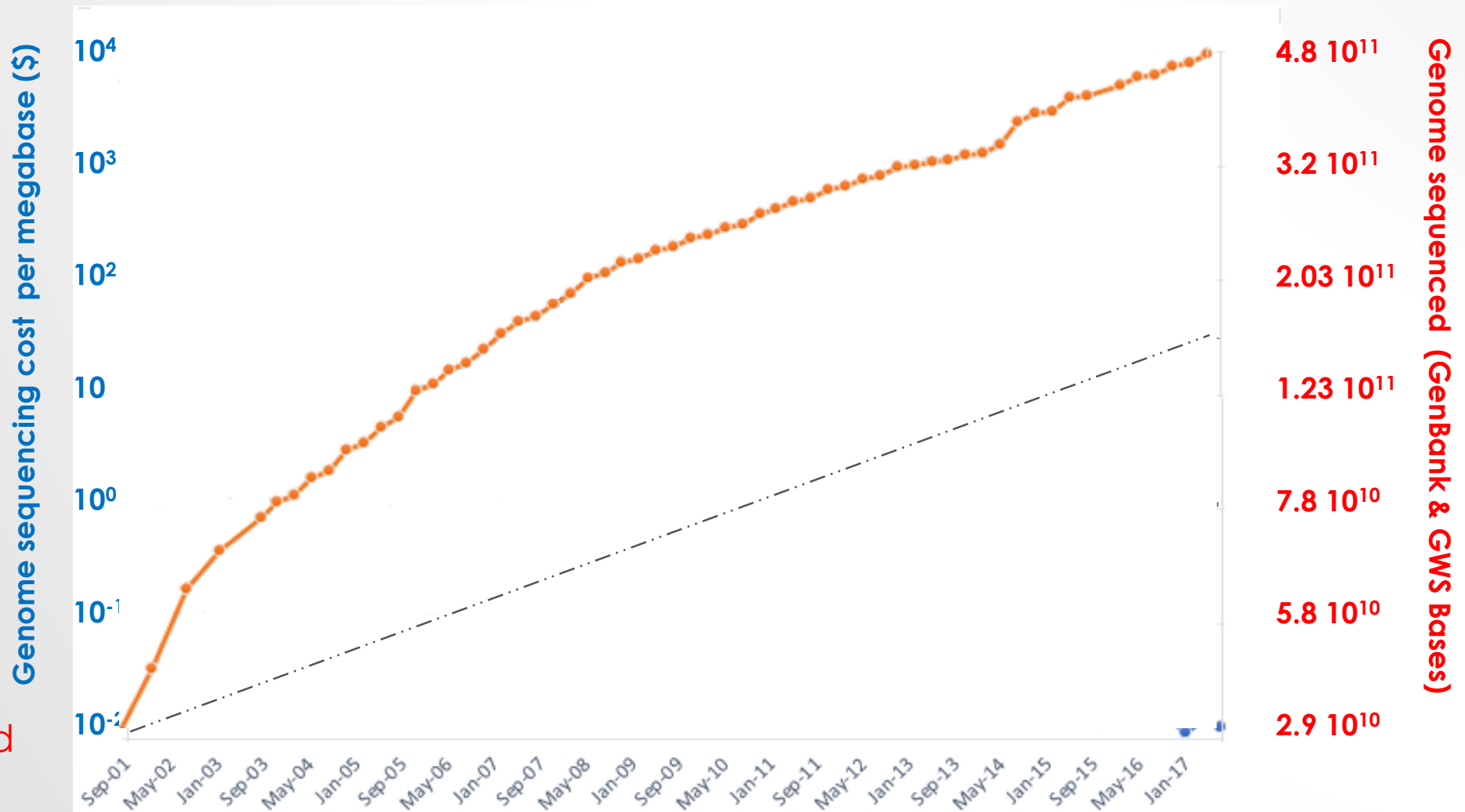


- Digital universe = volume of all the data created, replicated, and consumed in a single year.

DATA GENERATED BY DNA SEQUENCING

Costs have plummeted

Production have exploded

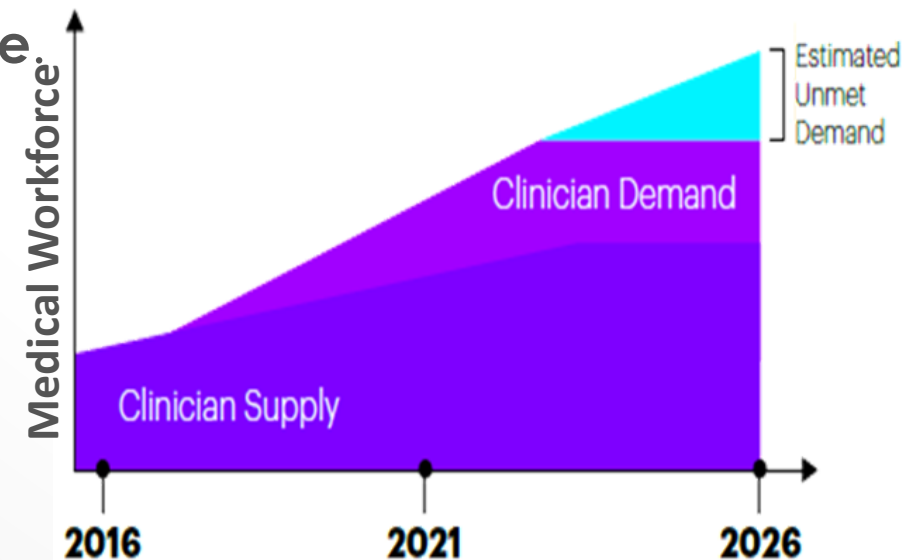


<https://www.genome.gov/27541954/dna-sequencing-costs-data/>

<https://www.ncbi.nlm.nih.gov/genbank/statistics/>

THE UNMET CLINICAL DEMAND

- **Pressing need for innovative models of care delivery:**
 - CD represents nowadays 75% of the healthcare spend.
 - Emergence of value-based reimbursement, payer-provider alliances, & patient self-management
 - Requirements for secure, networked technologies / workflow interoperability across the continuum-of-care/ flexible legal & policy framework / user experience.
- **Big Data & AI offer a way to reorganize healthcare**
 - AI has the power to alleviate burden on clinicians and give health workers tools to do their jobs better.
 - AI can address an estimated 20 percent of unmet clinical demand. For instance,
 - AI symptom checkers could triage patients to lower-cost retail or urgent care.

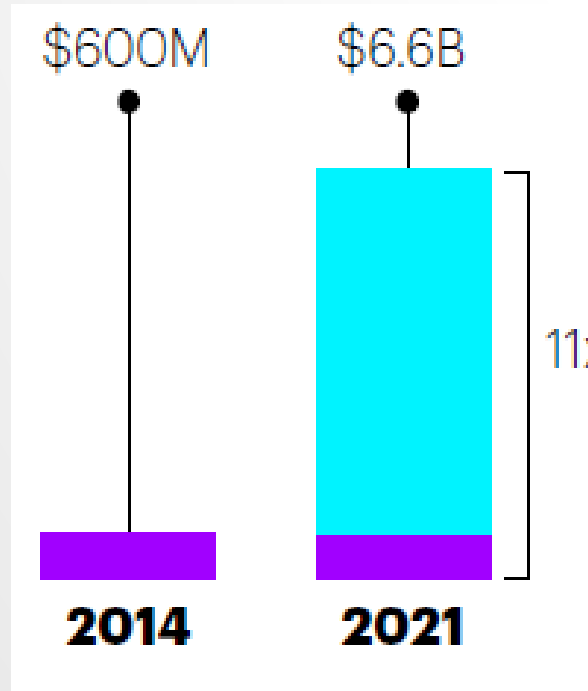


Source: Accenture. 2017. Artificial Intelligence: Healthcare's New Nervous System. Graph is not to scale and is illustrative.

THE EXPLOSIVE GROWTH OF THE AI FOR HEALTH

- Acquisitions of AI startups are rapidly increasing while the health AI market is set to register an explosive CAGR of 40% through 2021.

"We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next 10."
BILL GATES



APPLICATION	VALUE*
Robot-Assisted Surgery**	\$40B
Virtual Nursing Assistants	\$20B
Administrative Worklow Assistance	\$18B
Fraud Detection	\$17B
Dosage Error Reduction	\$16B
Connected Machines	\$14B
Clinical Trial Participant Identifier	\$13B
Preliminary Diagnosis	\$5B
Automated Image Diagnosis	\$3B
Cybersecurity	\$2B
TOTAL TOP 10	~\$150B



A.I. for Health: Hype Or Hope?

The short answer is “both”

- Since the birth of A.I. in 1956, the hype has far exceeded real achievements.
- But A.I. has continued to develop new and successful technologies and hopes are once again high, building on:
 - Advances in machine learning algorithms
 - Growth of computer power
 - Big Data collection
 - Rise of the Internet of Things
 - Social Networks
 - Digital life styles
 - Availability of Capital
- Despite their rapidly expanding experience, A.I. focused companies still face significant challenges particularly in a highly-regulated field such as health care.

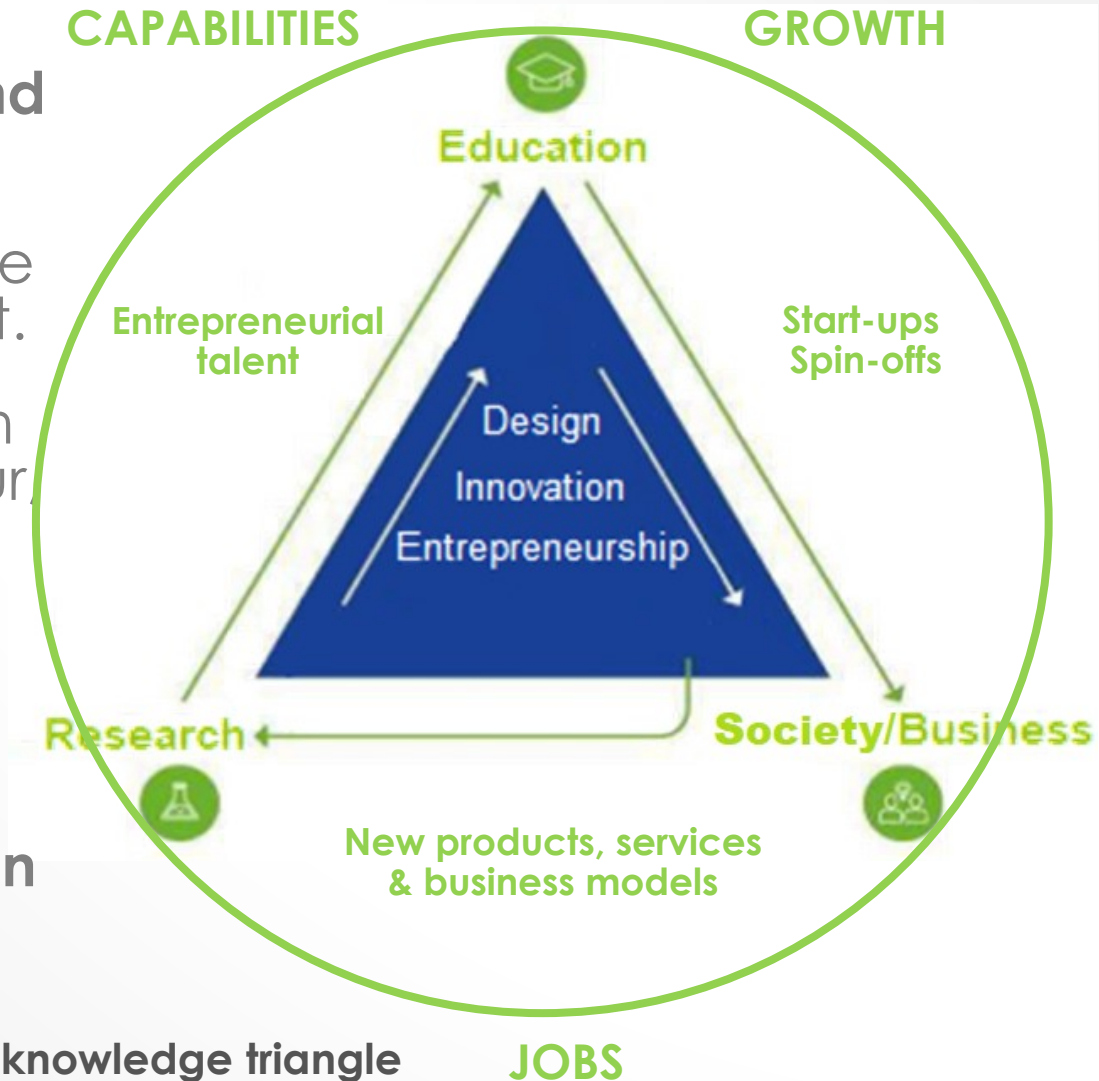


outline

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THE EU GOLD STANDART

- The **QALE model (Quality Assurance and Learning Enhancement)** transforms the **knowledge triangle paradigm into a working model** with all three sides of the knowledge triangle taken into account.
- From idea to product and service, from student and researcher to entrepreneur, from lab to the market – the **EIT is triggering a change towards a more innovative and has entrepreneurial mind-set in Europe.**
- In this new environment, **innovation thrives, and generated breakthroughs in the way in which business, higher education and research collaborate.**



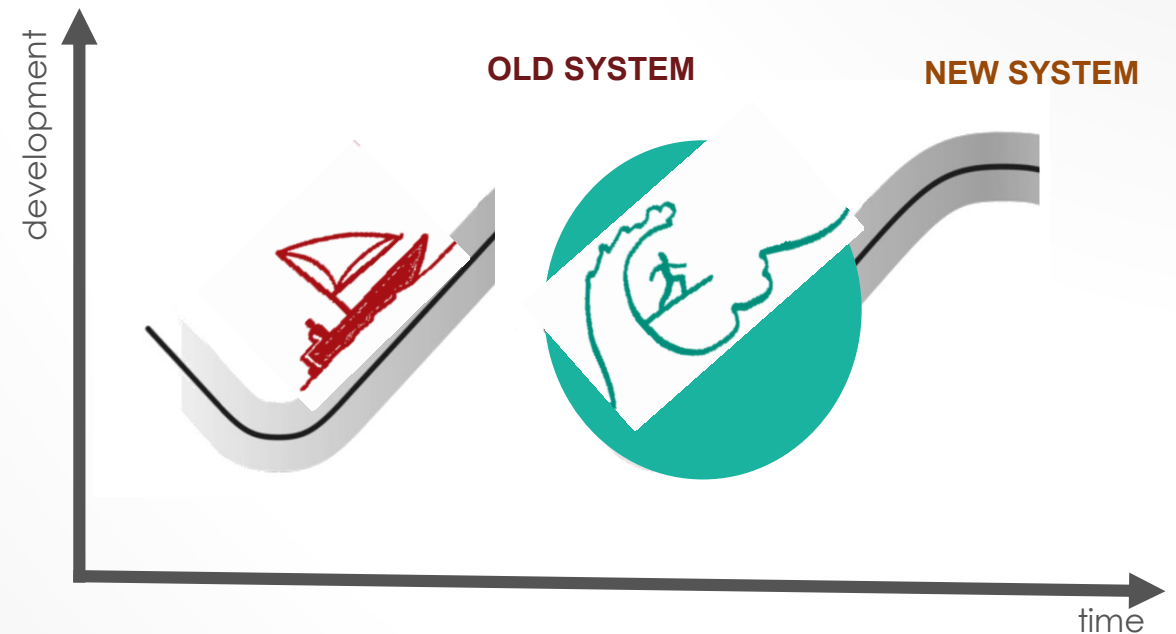
The Teaching quality in the knowledge triangle

JOBS

SUSTAINING VS DISRUPTIVE INNOVATION

- **Sustaining innovation**
 - Improving performances, lower cost, incremental changes
 - Existing & predictable market
 - Believable customer
 - Successful traditional business methods

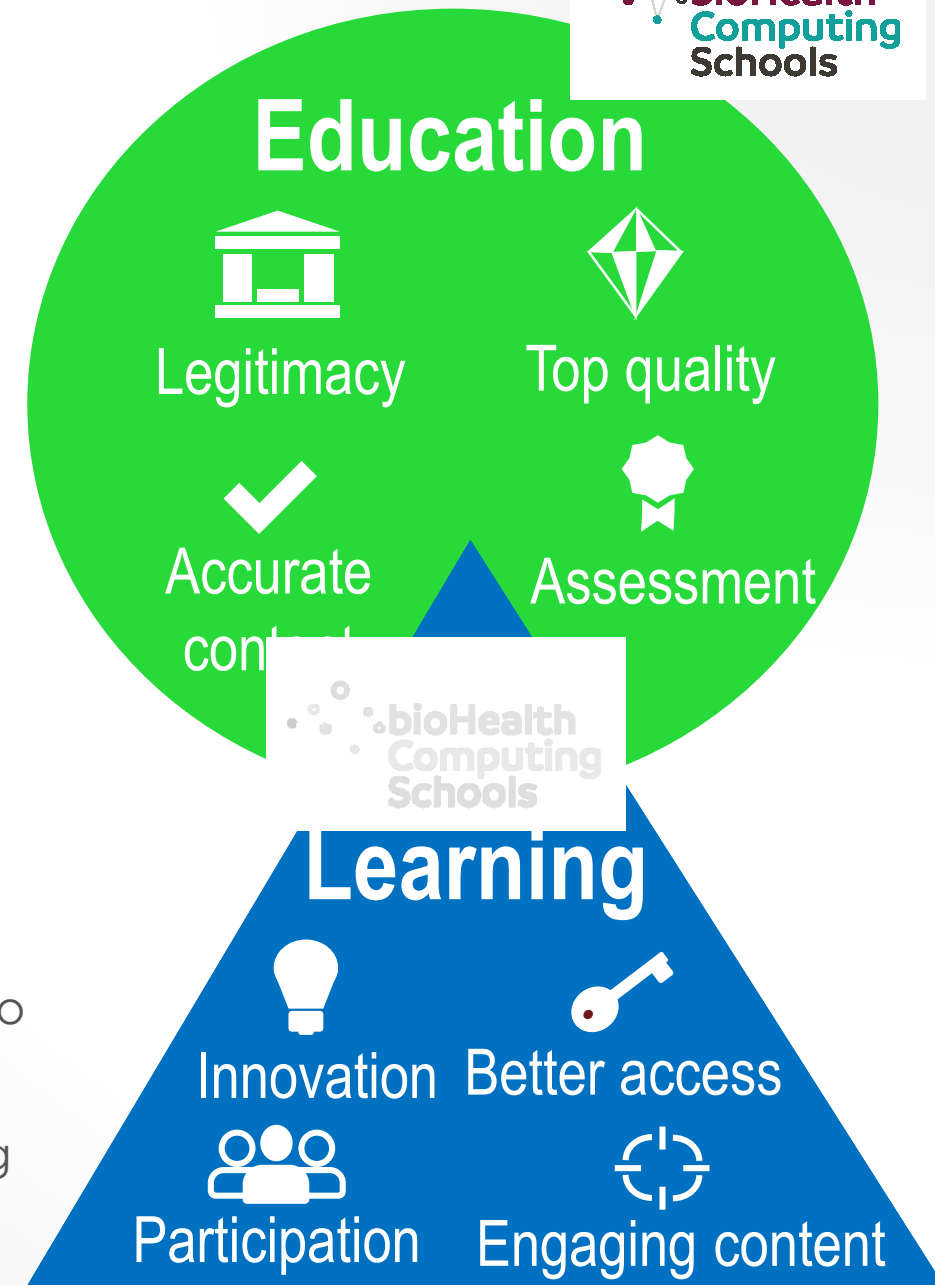
- **Disruptive innovation**
 - Problem not well understood
 - Emerging & unpredictable market
 - Unknown & unknowing customer
 - Game changing dramatically
 - Failing traditional business methods



Startups: are not smaller versions of Large Companies,
 BUT a temporary organization designed to search for
 a repeatable and scalable business model

THE LEARNING STRATEGY

- addressing the increasingly complex and disruptive societal challenges at the interface between Education and Learning
- implementing the four components of a creative learning experience:
 - **Projects**—Learning when we are actively working on **projects**—generating new ideas, designing prototypes, making improvements, and creating final products.
 - **Peers**—Learning flourishes as a social activity, with people sharing ideas, collaborating on projects, and building on one another's work. The hardest problems cannot be solved by one person alone.
 - **Passion**—Focus on things we care about, we are likely to work longer and harder, to persist in the face of challenges, and to learn more in the process.
 - **Play**—Learning involves playful experimentation—trying new things, tinkering with materials, testing boundaries, taking risks, iterating again and again.



THE BIOHC MAJOR CHALLENGES



- ***“To go fast, go alone.***
- ***To go far, go together.”***

--African Proverb

The programme...

The A.I. for Health summer school is an accelerated-learning programme proposed by EIT Health partner institutions and the European Scientific Institute.

Deep learning session

Breakout sessions on advanced applications

including decision support, robotics, text mining, image recognition, ethics, laws, regulation, etc.

Workshop, lab and computer practicals

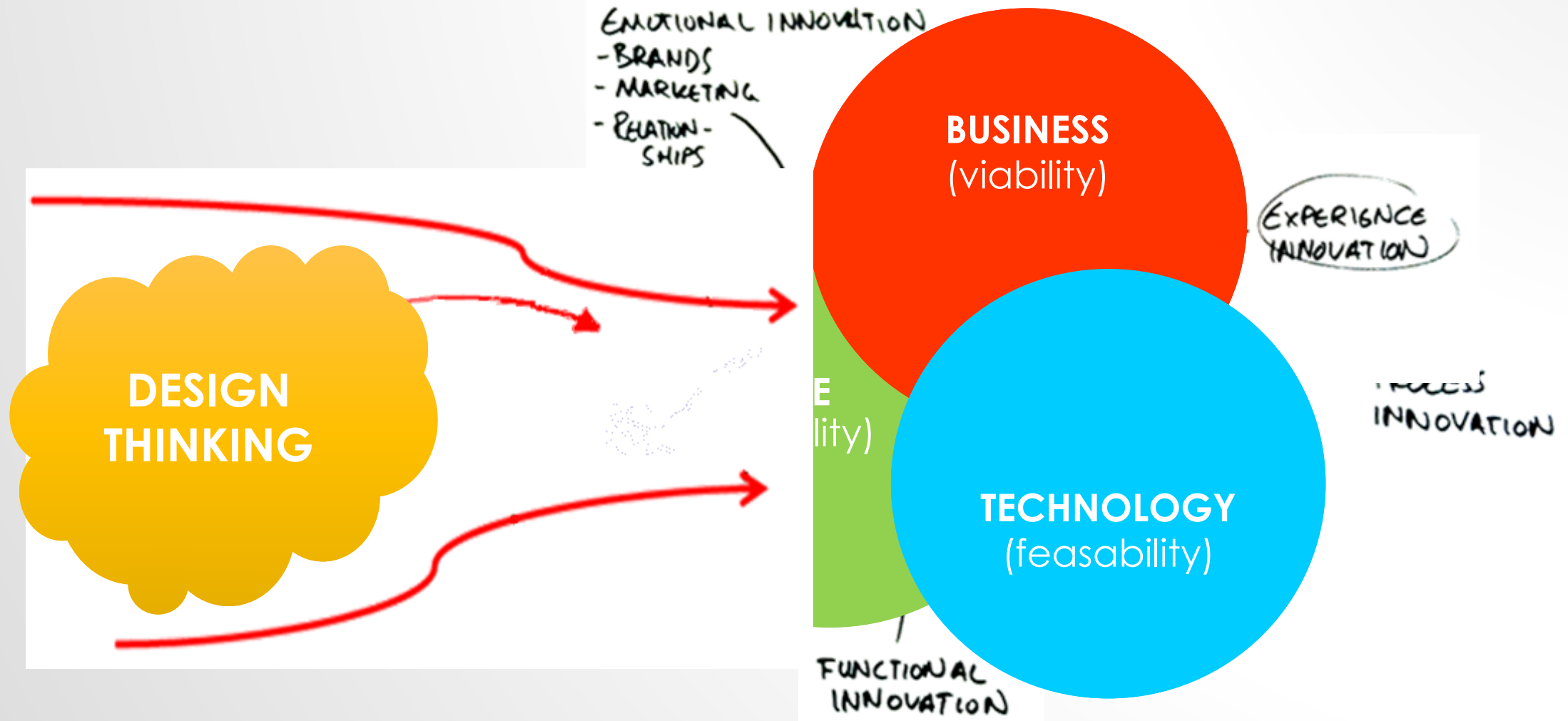
Multidisciplinary and design thinking group-work on innovation projects

Project pitches to a panel of experts from industry, academia, start-ups and business incubators.

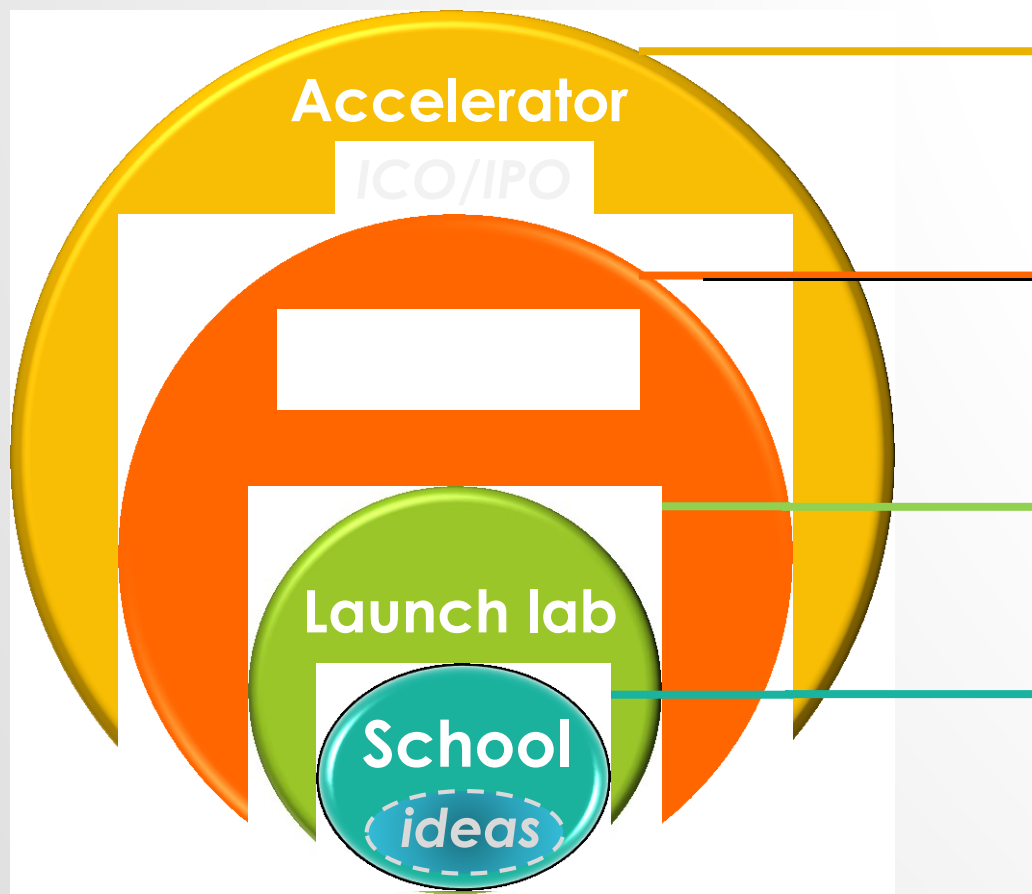
You will come out the other end armed with a comprehensive toolkit for implementing A.I. innovation in healthcare.



THE DESIGN FRAMEWORK



THE LEARNING PLATFORMS



In exchange for the expert mentoring, exposure to investors/future capital and cash investment that entrepreneurs get from the accelerator, the entrepreneur gives a portion of his or her company's equity to the partners of the program.

Business incubation catalyses the process of starting and growing companies, providing entrepreneurs with the expertise, networks and tools they need to make their ventures successful.

LaunchLab is a pressure cooker for not-yet entrepreneurs to explore the opportunities of their health tech idea. The programme supports them to develop and validate their idea, market potential, business model and launching customer.

The School survey state-of-the-art topics in Big Data, and introduce to Creative Thinking, Lean Start-up Design and Business Model. The participants have a unique opportunity to pitch their ideas for further development of promising ideas, and potential links to Business Incubators and Accelerators.

PROGRAMME



Computational medicine for chronic diseases

2011 2012 2013 2014 2015 2017 2018 2019 2020



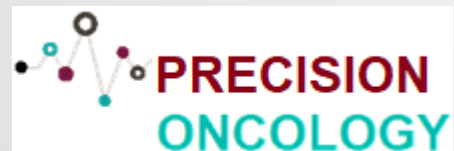
AI & big data for reinventing healthcare

2016 2017 2018 2019 2020



Accelerating nanotech innovations through a safer-by-design approach

2016 2017 2018 2019 2020



Innovation in precision oncology

2020



Innovation in Universal Health Coverage

2020



THE ADMISSIONS CRITERIA

The bioHC Summer School is open to Msc and PhD students in medical and life sciences, biotechnology and bioengineering, data sciences, business, human and social sciences. The successful applicants should have the following qualities before that contributed to their success at the Summer School and beyond:



- **capacity for calculated risk.** Success happens when preparation meets opportunity. But seizing new opportunities comes with an inescapable amount of risk. We look for applicants who are confident and calculated risk takers, and can weigh when it makes sense to embark on a new venture, pivot, or start anew.



- **focus on community.** We believe that the team is more important than the idea. Great teams make amazing companies and can turn average ideas into life-changing innovations. Ideal candidates will put the team above themselves, and have a strong track record of contributing to their community.



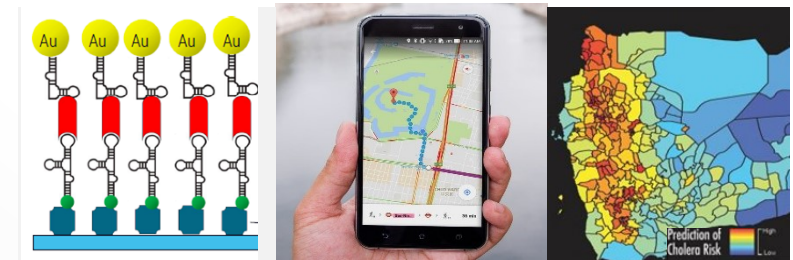
- **open and critical thinking.** Developing a venture will require collaboration and openness to new ideas. We look for individuals with an ability to combine critical thinking with an open mind.



- **initiative with follow-through.** Anyone can start a new venture, but what separates the thriving businesses from those that fail is follow-through. We look for applicants that start new ventures, but will follow-through even when the going gets tough.

WekalA: A 3-IN-1 SMARTPHONE SOLUTION

- Jusuf IMERI, Timothée AUBOURG & Soulaymane GUEDRIA (PhD students at Grenoble Alpes University) won:
- winners Of the 1st Jury EIT Health PhD Translational Fellowships 2019 Contest, Oxford University, England, United Kingdom from 12 to 16 August 2019
- **description: an embedded AI kit for the detection and prevention of cholera**
 - A field sensor for detecting the cholera from stool samples (aptamer technology)
 - A mobile decision support system for disease management using phone data and external sources (both medical and environmental)
 - R2D2: a distributed deep learning toolkit for environmental and medical imaging analysis





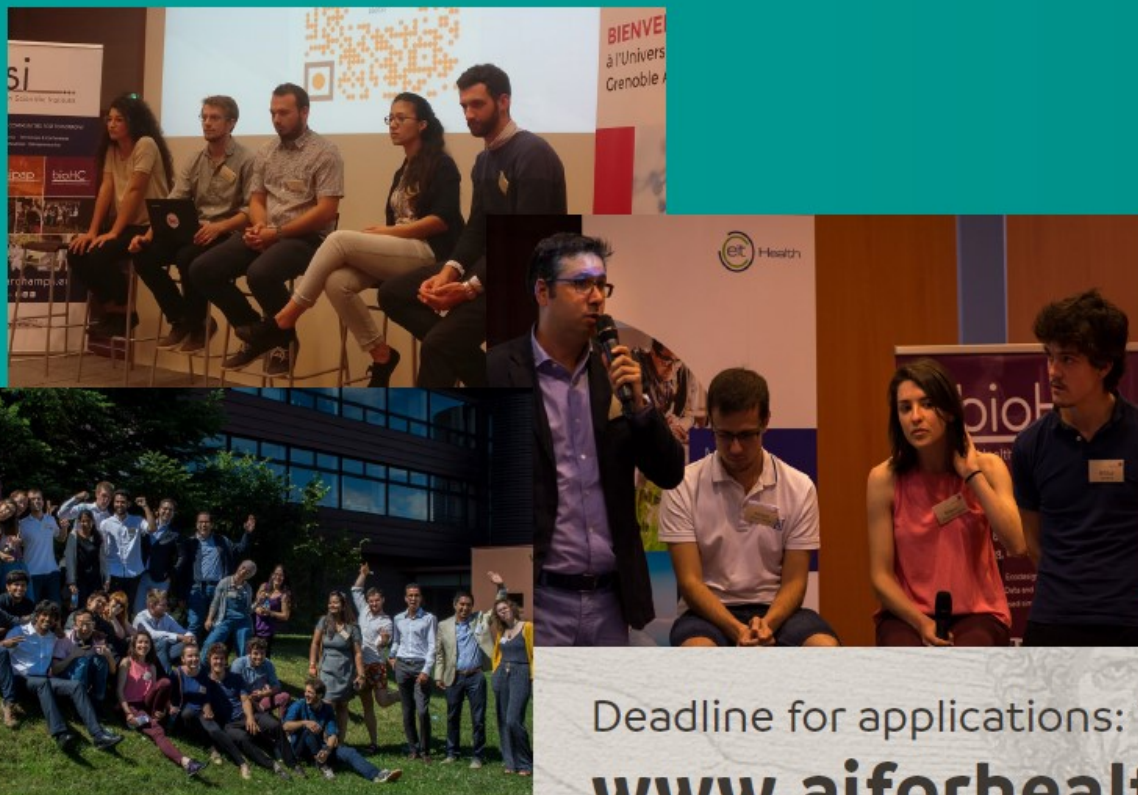
**A.I.
FOR HEALTH**

bioHealth Computing School

Join us to build a smarter
and healthier society

29 June - 10 July 2020

University Grenoble Alpes
European Scientific Institute
Archamps, France (Greater Geneva)



Deadline for applications: 15 May 2020

www.aiforhealth.eu



TAKEAWAYS FROM THIS PRESENTATION

- **overcoming the health workforce crisis:** an urgent goal if we want to move towards a UHC by 2030
- **developing alternative solutions (demonstrators)** for strengthening health systems in a context where everything have to be created
- **equipping project leaders** to develop their capacity to think about innovative projects (citizen centred, solution thinking, capacity building).
- **educating health educators** and **developing creative learning environments** (digital platform, data sharing, eLearning, etc.)
- **building an observatory of innovation** in the health sector (information sharing, monitoring, return of good practices, figures, ...)



1820 applicants since 2011; 70 pre-selected/year/school and 15-20 students/year/school
112 students since 2011 (59% nonEU + 41% EU)



JOIN OUR **LinkedIn** GROUP!