BioingTS

dipartimento di ingegneria e architettura

CEI
CENTRAL EUROPEAN INITIATIVE

BRIDGING EUROPE SINCE 1989

XI Spring School
on
“IoT, economic and management challenges for e-health integration in the enlarged Europe”
Trieste, Italy, 5th - 8th June 2023

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Who shall live?

The sustainability of health systems in the digital era

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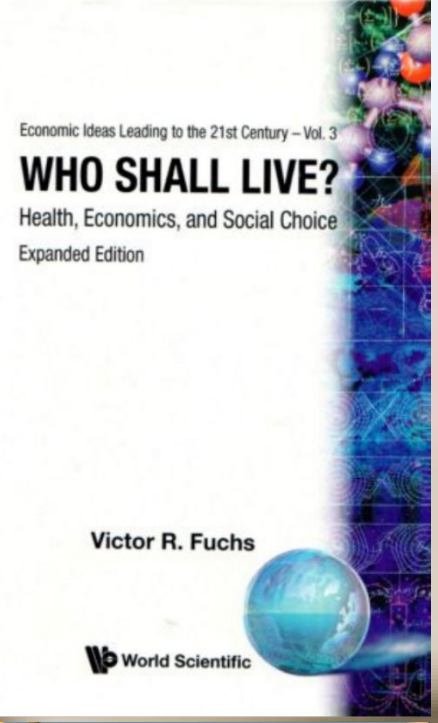
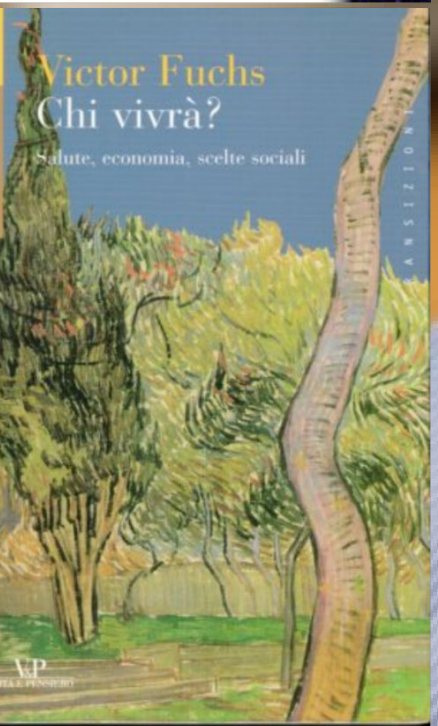




מִי יִחְיֶה

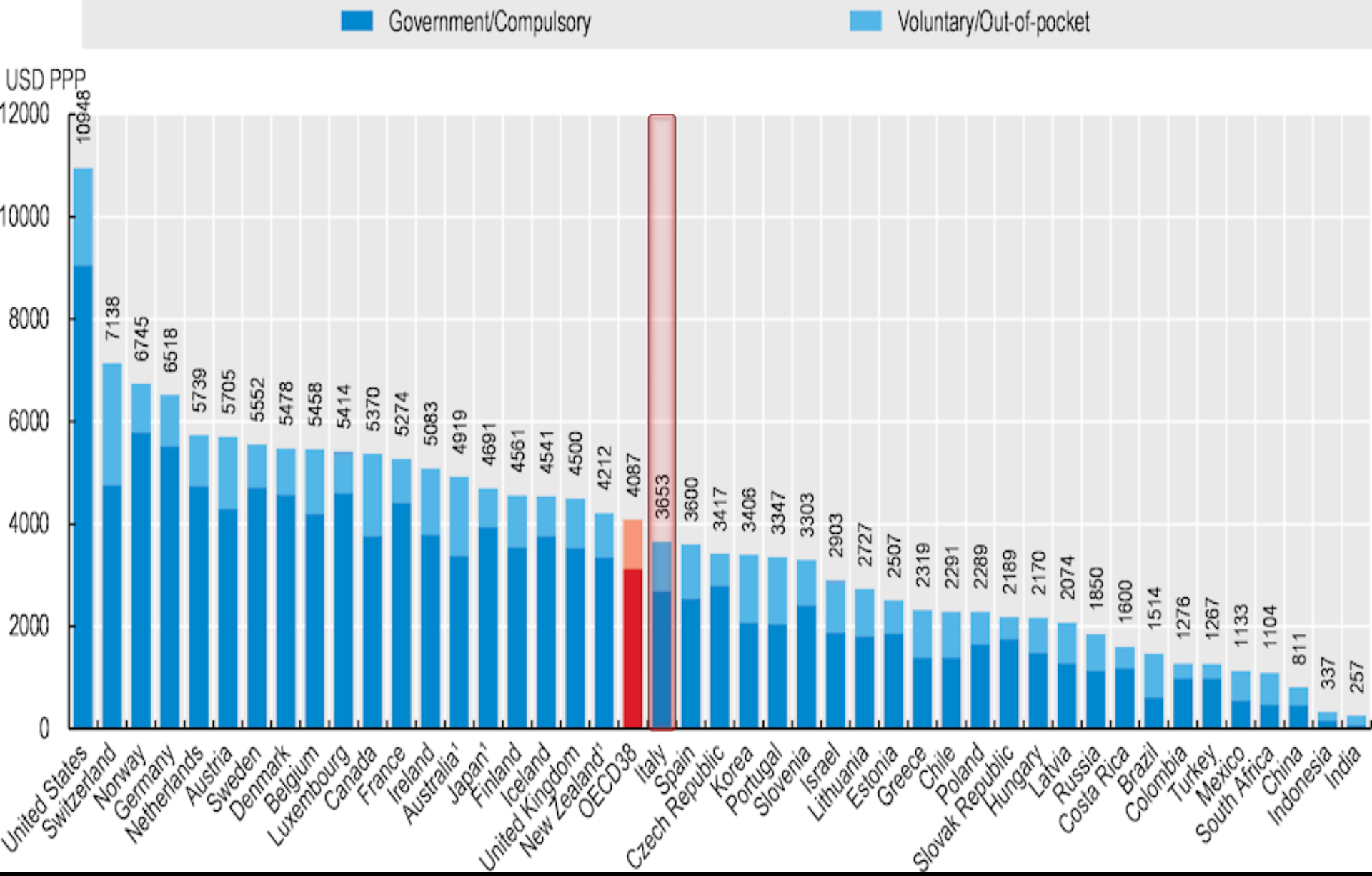
mi yich-yeh’

who shall live and who shall die; who shall live out his allotted time and who shall depart before his time*

***from «Unetaneh Tokef», liturgical poem describing the the Divine judgment of all existence, attributed to Amnon of Mainz, 11th century**

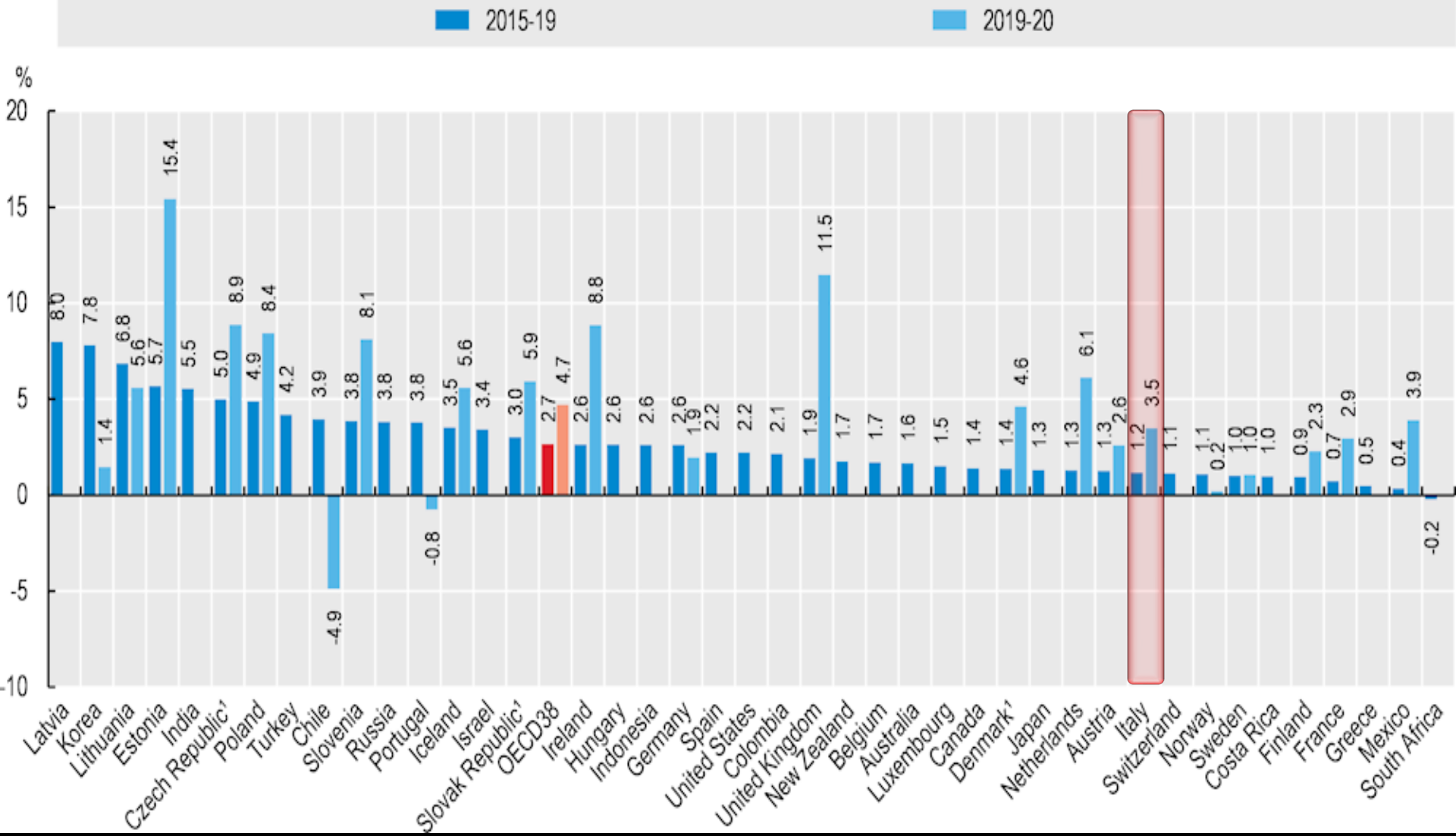
https://youtu.be/DyBToUaon2w

professor emeritus at Stanford University



>> Health expenditure per capita, 2019 (or nearest year)

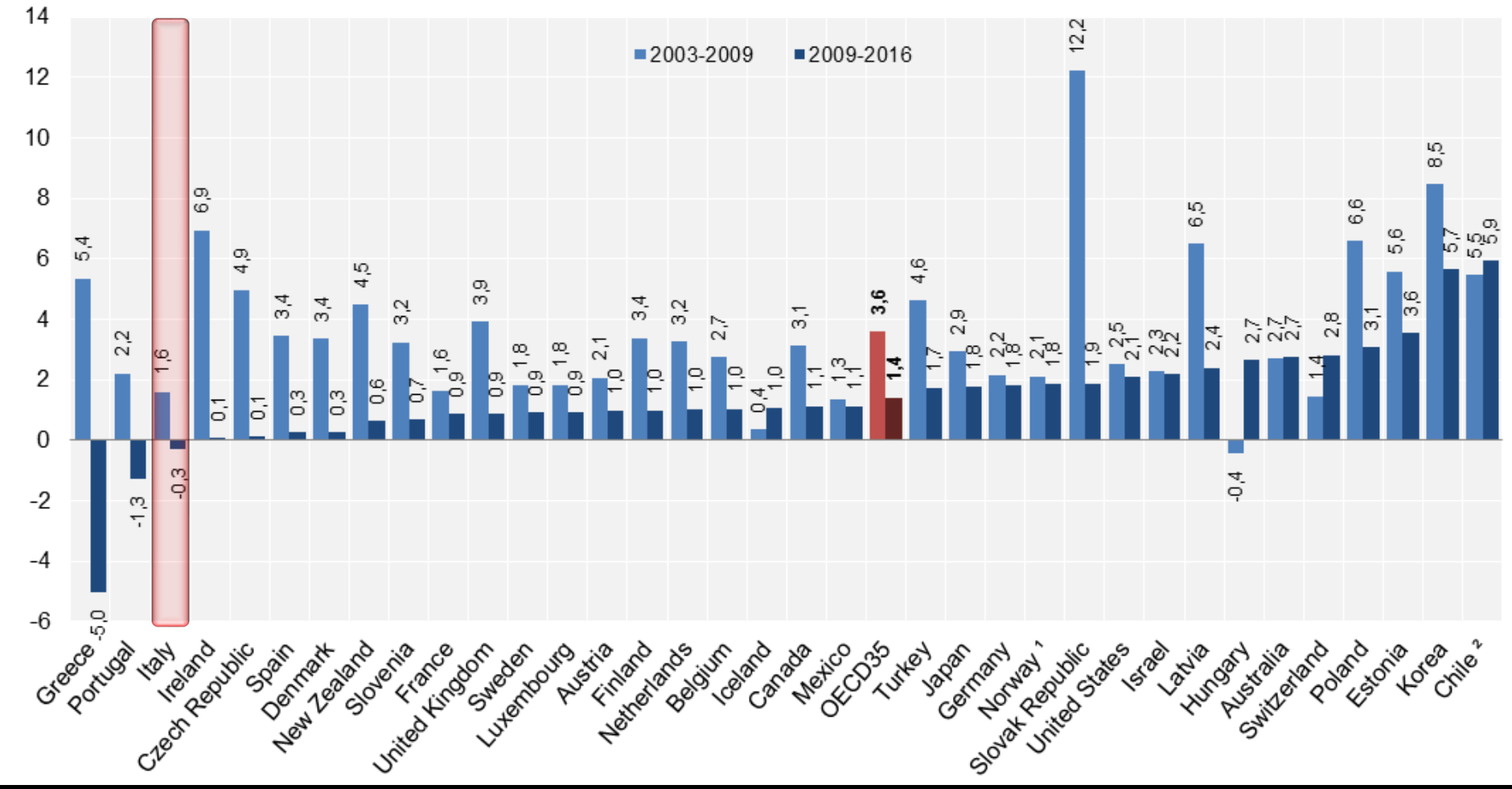
Source: OECD Health Statistics 2021, WHO Global Health Expenditure Database.



>> Annual growth in per capita health expenditure, real terms, 2015-19 (or nearest year) and 2019-20

Note: OECD average growth rate for 2019-20 is based on the preliminary estimates for 22 countries.
1. OECD estimates for 2020.

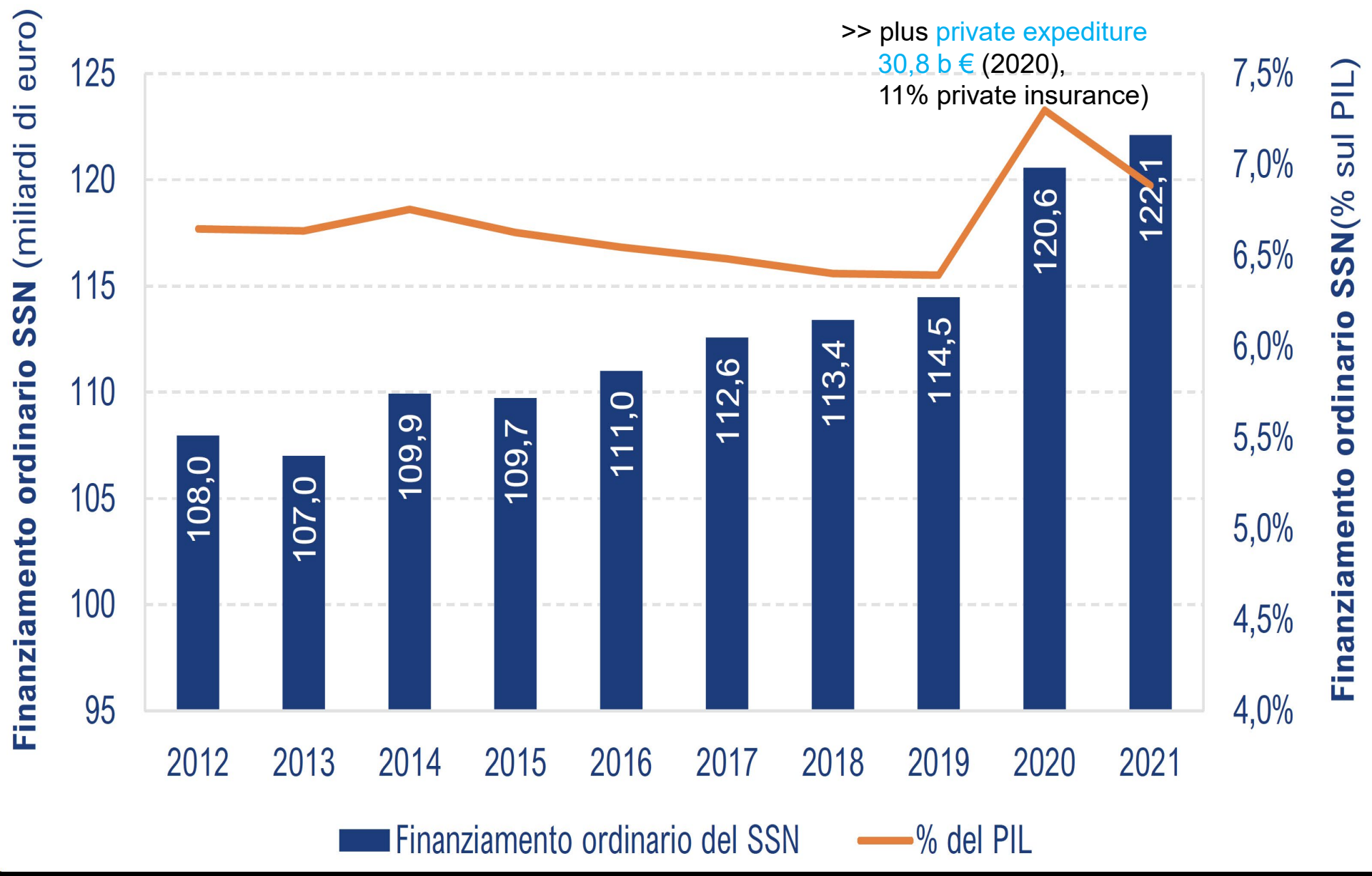
Source: OECD Health Statistics 2021.



>> Annual average growth rate in per capita health expenditure, real terms, 2003-2016 (or nearest year)

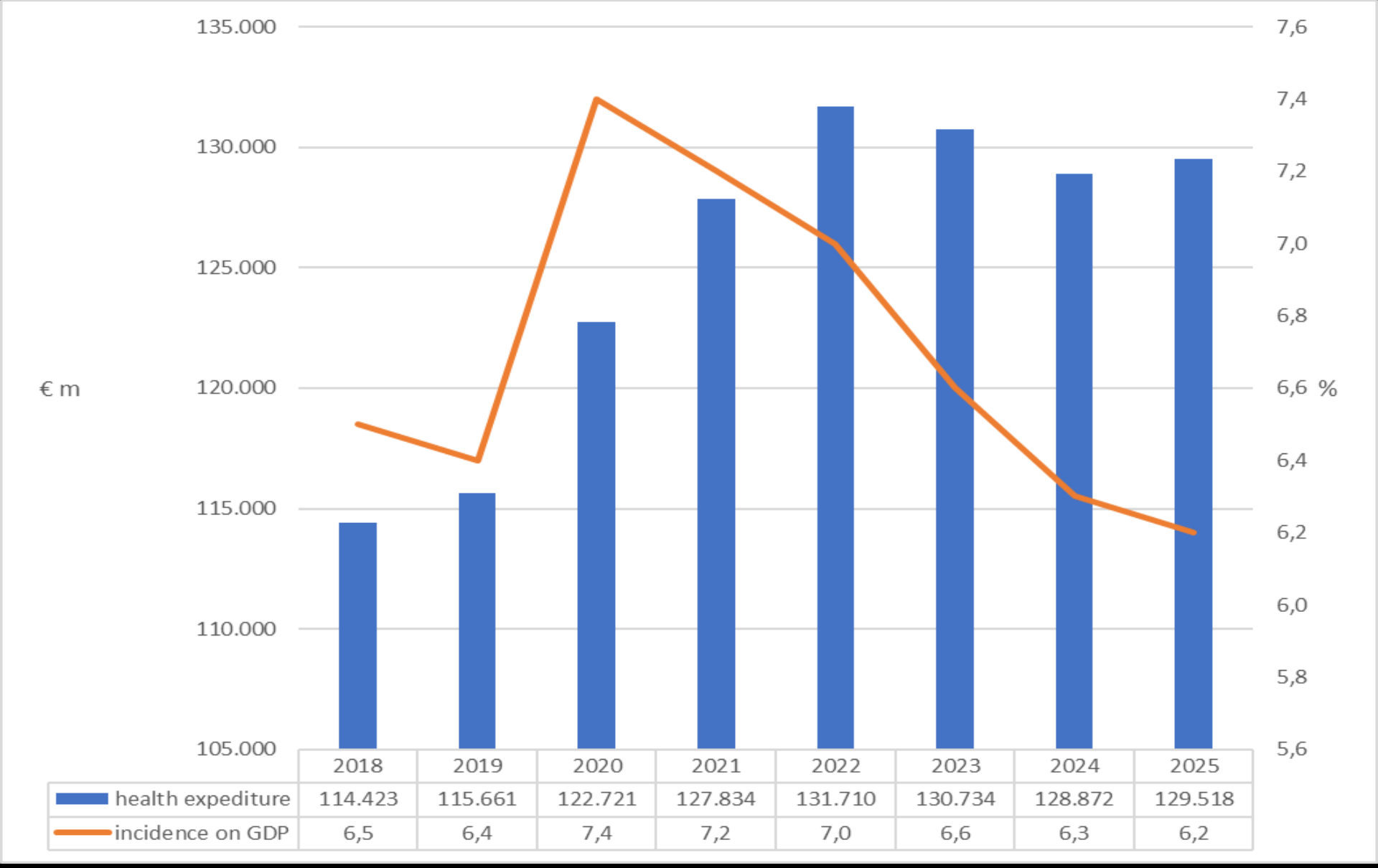
1. Mainland Norway GDP (gross domestic product) price index used as deflator.
2. CPI (consumer price index) used as deflator.

Source: OECD Health Statistics 2017.



>> Italy– funding of the national health service, 2012-2021 (b €) and incidence on GDP

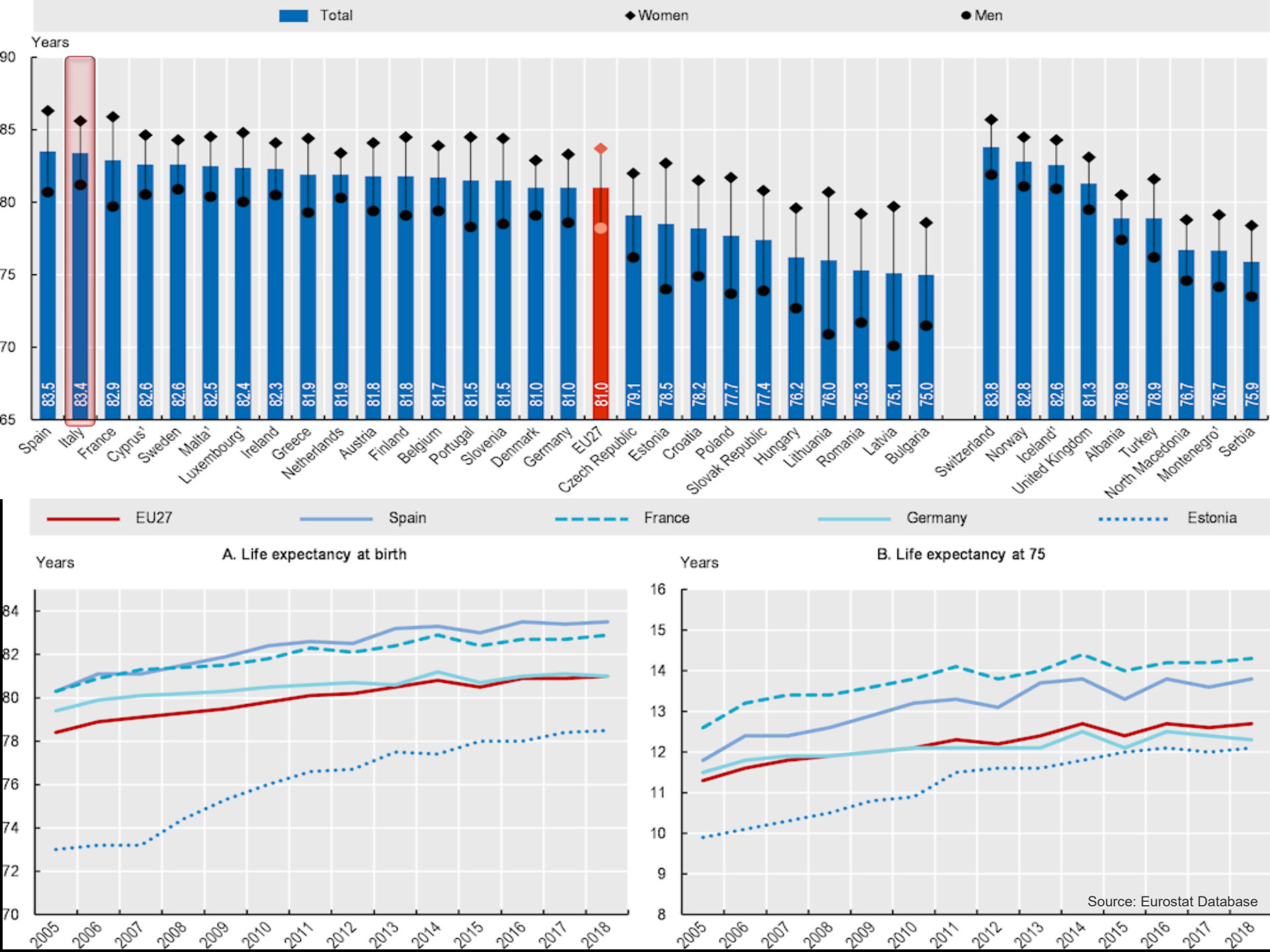
Source: Meridiano sanità – Le coordinate della salute – Rapporto 2021 - The European House - Ambrosetti on Italian General Accounting Office data, 2021.



	2018	2019	2020	2021	2022	2023	2024	2025
health expediture	114.423	115.661	122.721	127.834	131.710	130.734	128.872	129.518
incidence on GDP	6,5	6,4	7,4	7,2	7,0	6,6	6,3	6,2

>> Italy – trend of the ratio between health expenditure and GDP (in %), 2018-2025

Source: Documento di economia e finanza 2022 – Dossier April 2022 – Doc. LVII n.5 – Senato della Repubblica, Camera dei deputati


Total
Women
Men
Years
90
85
80
75
70
65
83.5
83.4
82.9
82.6
82.6
82.5
82.4
82.3
81.9
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81.8
81.8
81.7
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Spain
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France
Cyprus¹
Sweden
Malta¹
Luxembourg¹
Ireland
Greece
Netherlands
Austria
Finland
Belgium
Portugal
Slovenia
Denmark
Germany
EU27
Czech Republic
Estonia
Croatia
Poland
Slovak Republic
Hungary
Lithuania
Romania
Latvia
Bulgaria
Switzerland
Norway
Iceland¹
United Kingdom
Albania
Turkey
North Macedonia
Montenegro¹
Serbia
EU27
Spain
France
Germany
Estonia
A. Life expectancy at birth
Years
84
82
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2005
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B. Life expectancy at 75
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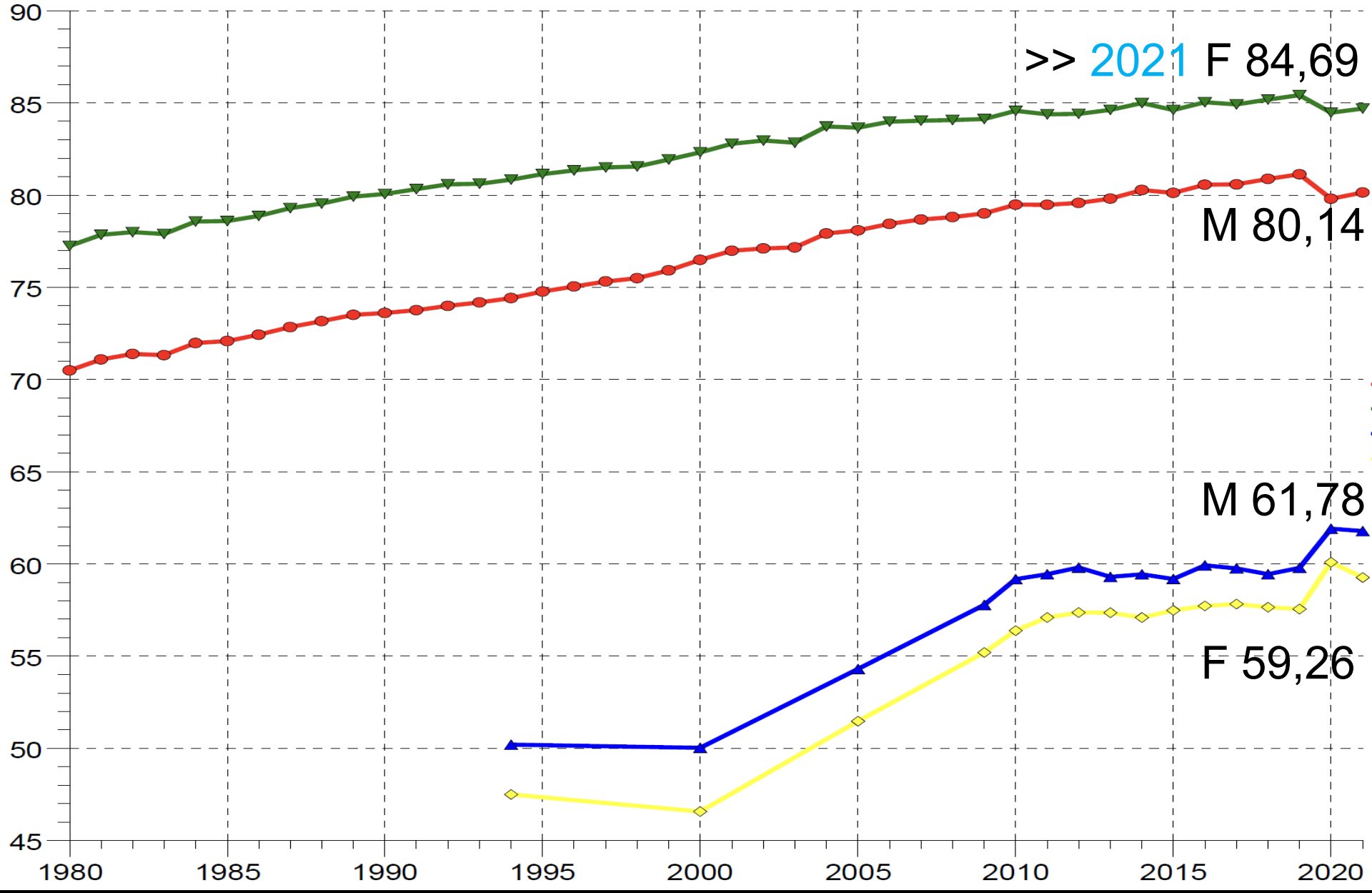
2018
Source: Eurostat Database



>> Italy – life and life in good health expentancy at birth, difference by gender (M / F, M / F)

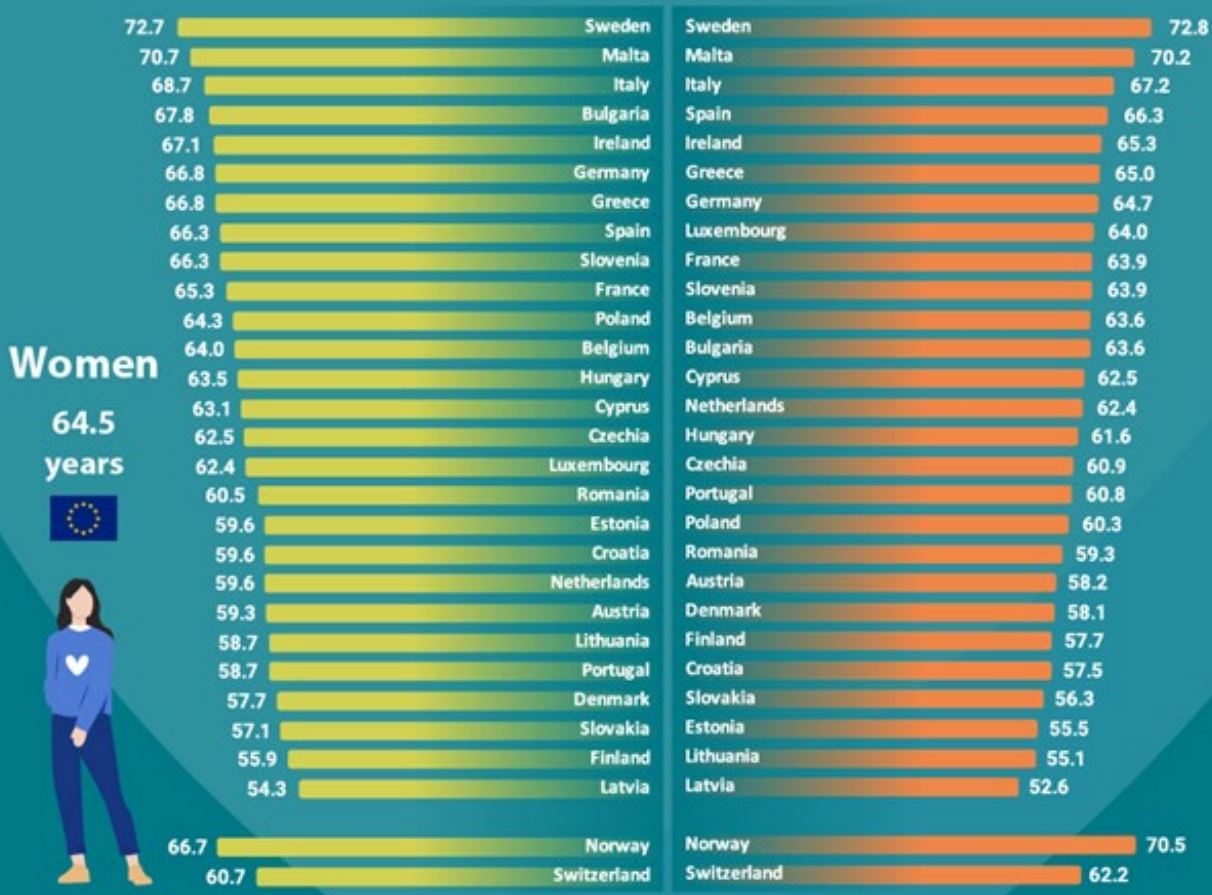
Source: ISTAT, Health for all – Italia, version June 2022.

>> Healthy life expectancy at birth

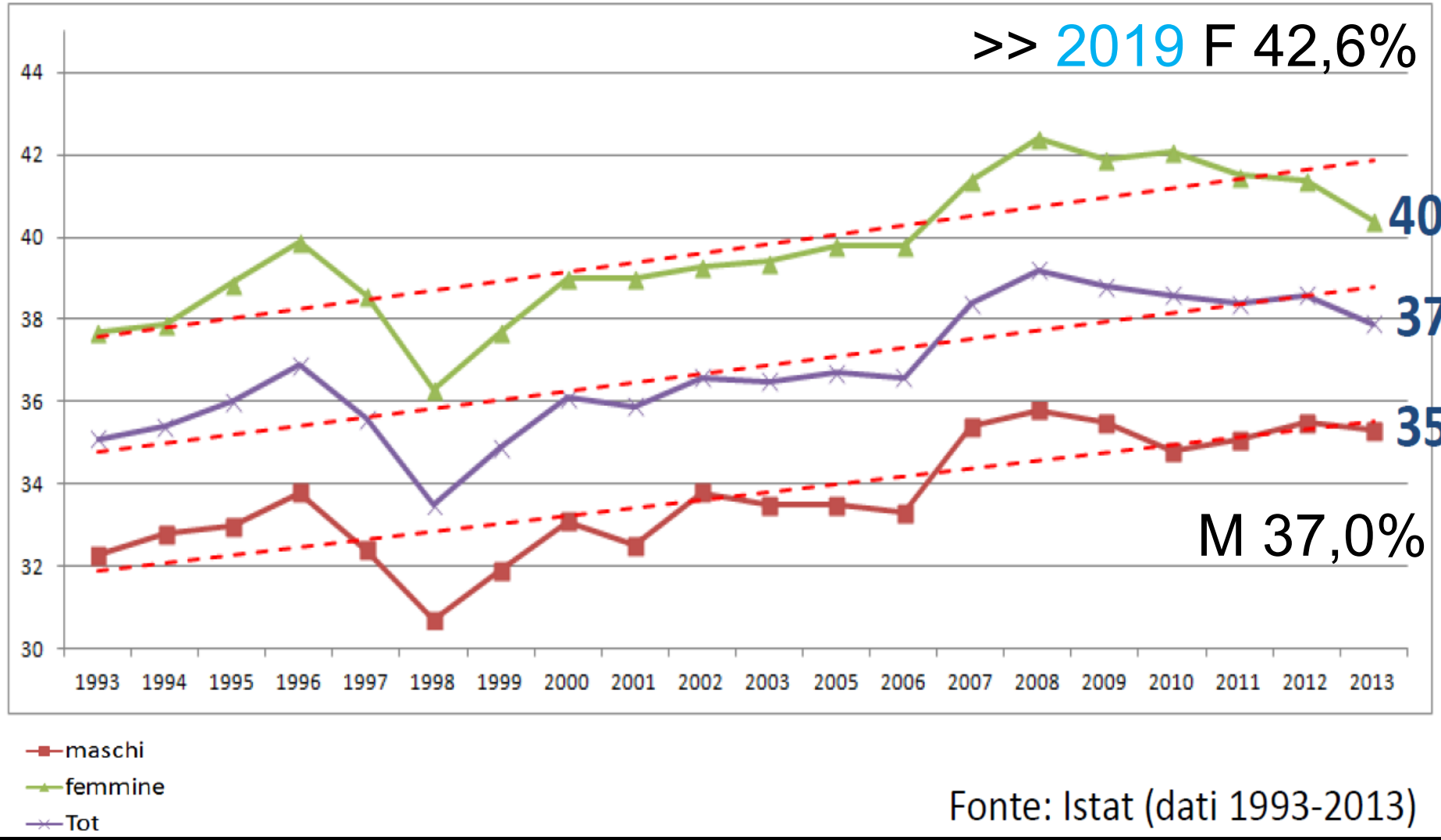
Healthy life years at birth

(2020 data)

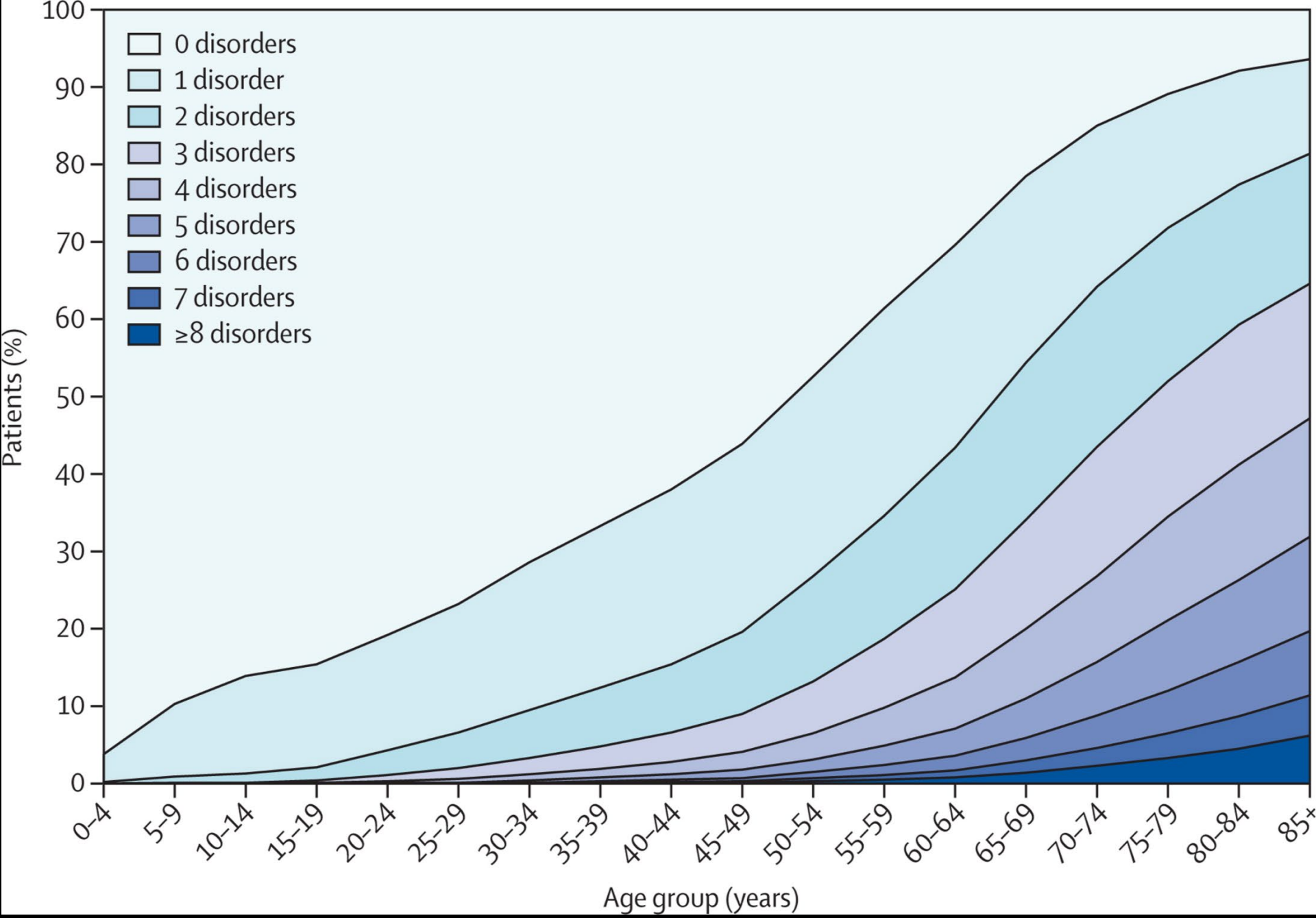
Healthy Life Years:
the number of years that a person is expected to live without an activity limitation (disability).



ec.europa.eu/**eurostat**



>> Italy – persons with at least one chronic condition



>> Number of chronic conditions by age segment

Source: Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study Karen Barnett, PhD et al., The Lancet

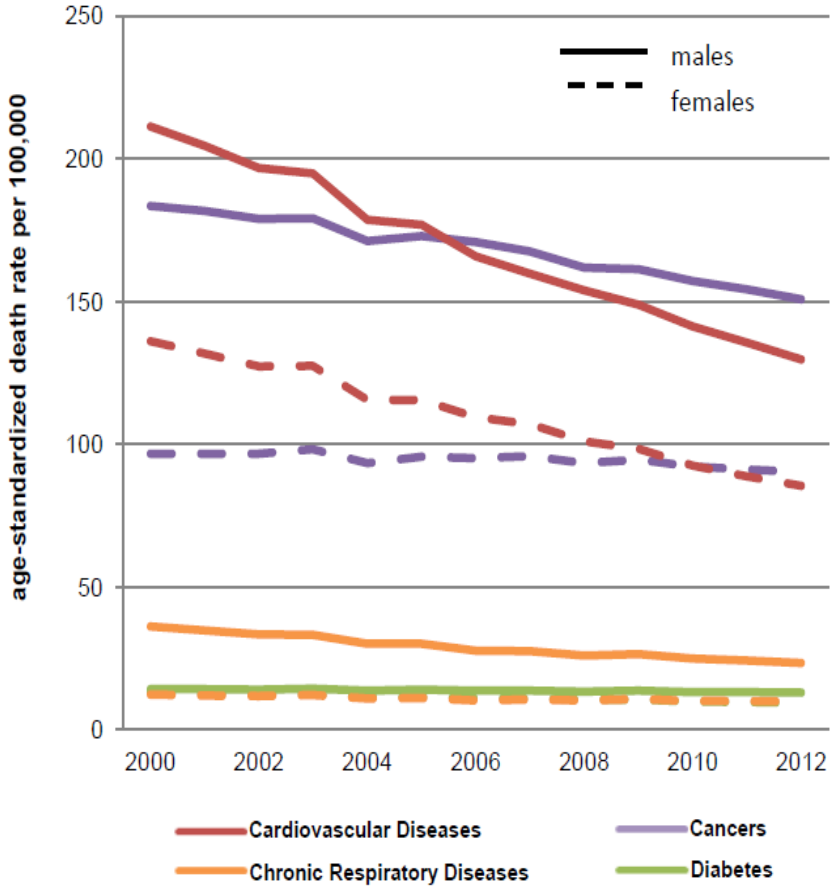
Source: WHO Global status report on noncommunicable diseases 2014

Italy

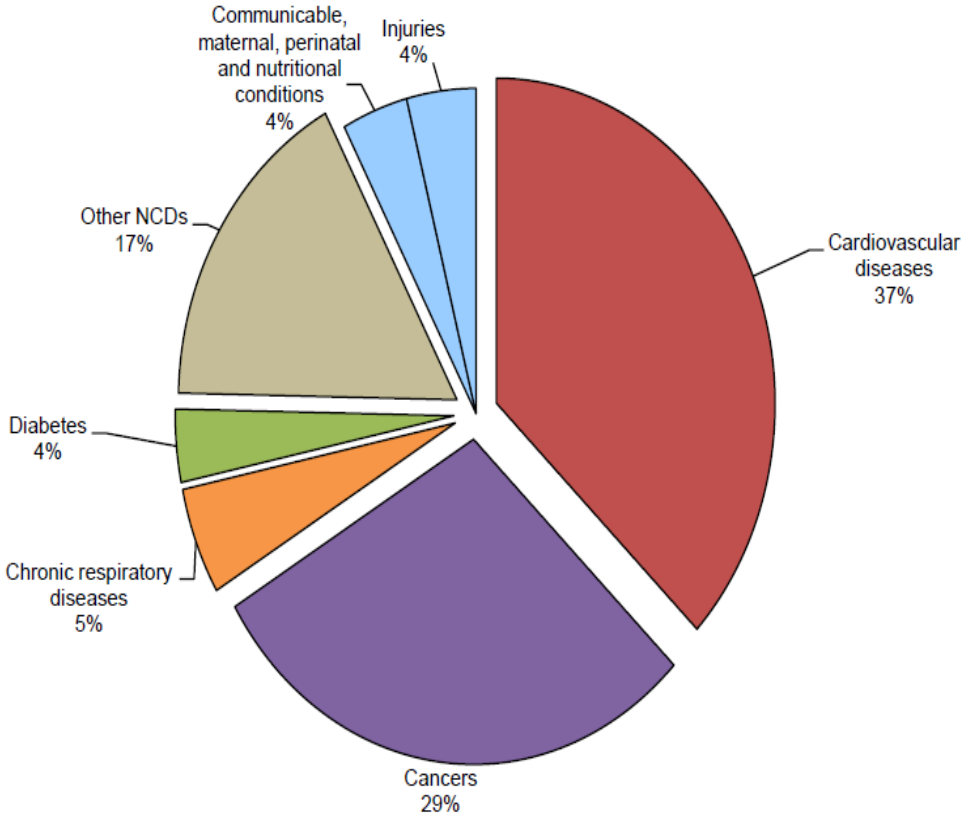
Total population: 60 885 000
Income Group: High

Percentage of population living in urban areas: 68.4%
Population proportion between ages 30 and 70 years: 55.0%

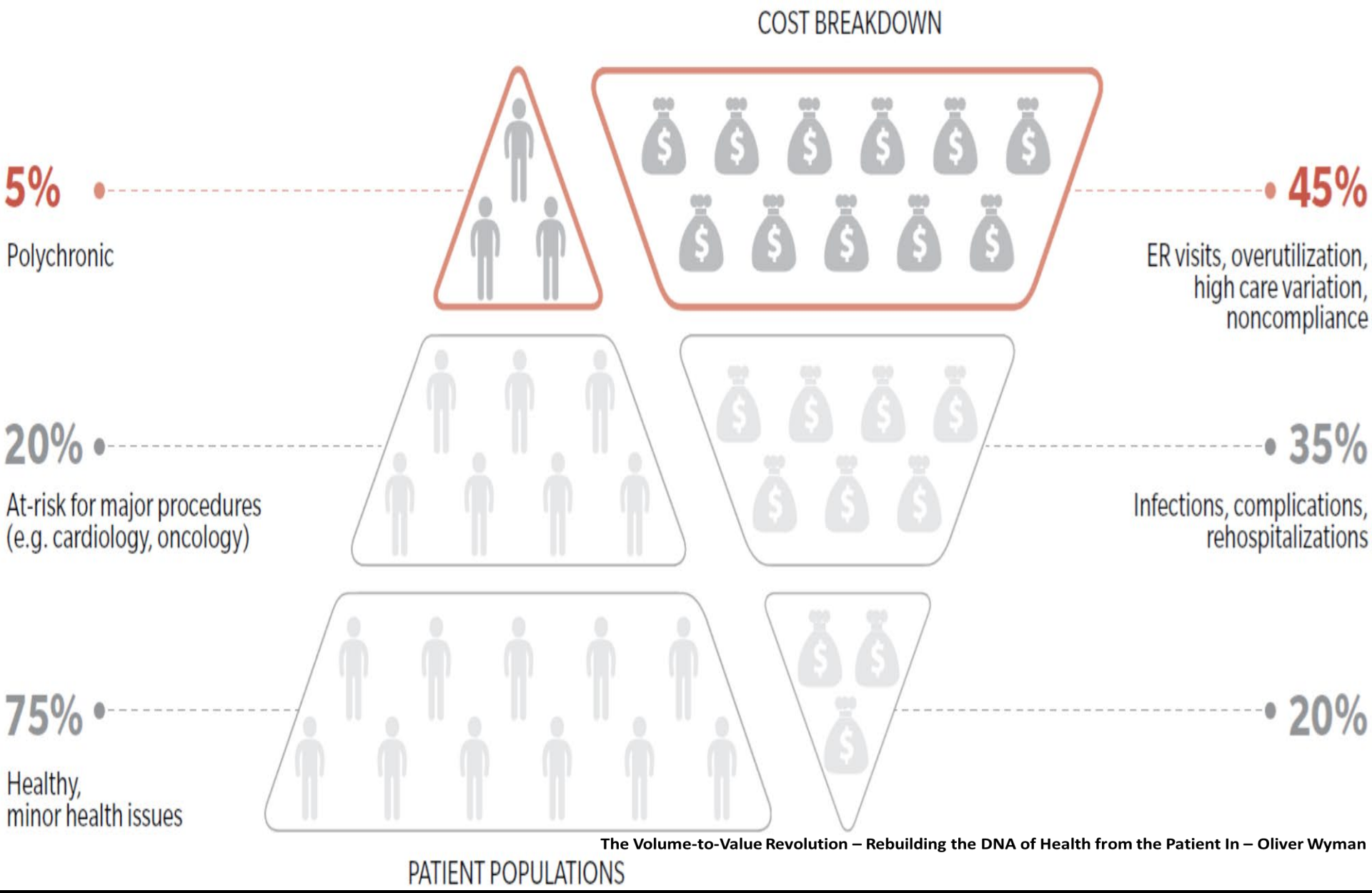
Age-standardized death rates



Proportional mortality (% of total deaths, all ages, both sexes)



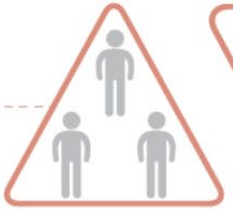
Total deaths: 573,000
NCDs are estimated to account for 92% of total deaths.



The Volume-to-Value Revolution – Rebuilding the DNA of Health from the Patient In – Oliver Wyman

>> The upside-down pyramid (today):
cost per clinical stratum

5%
Polychronic



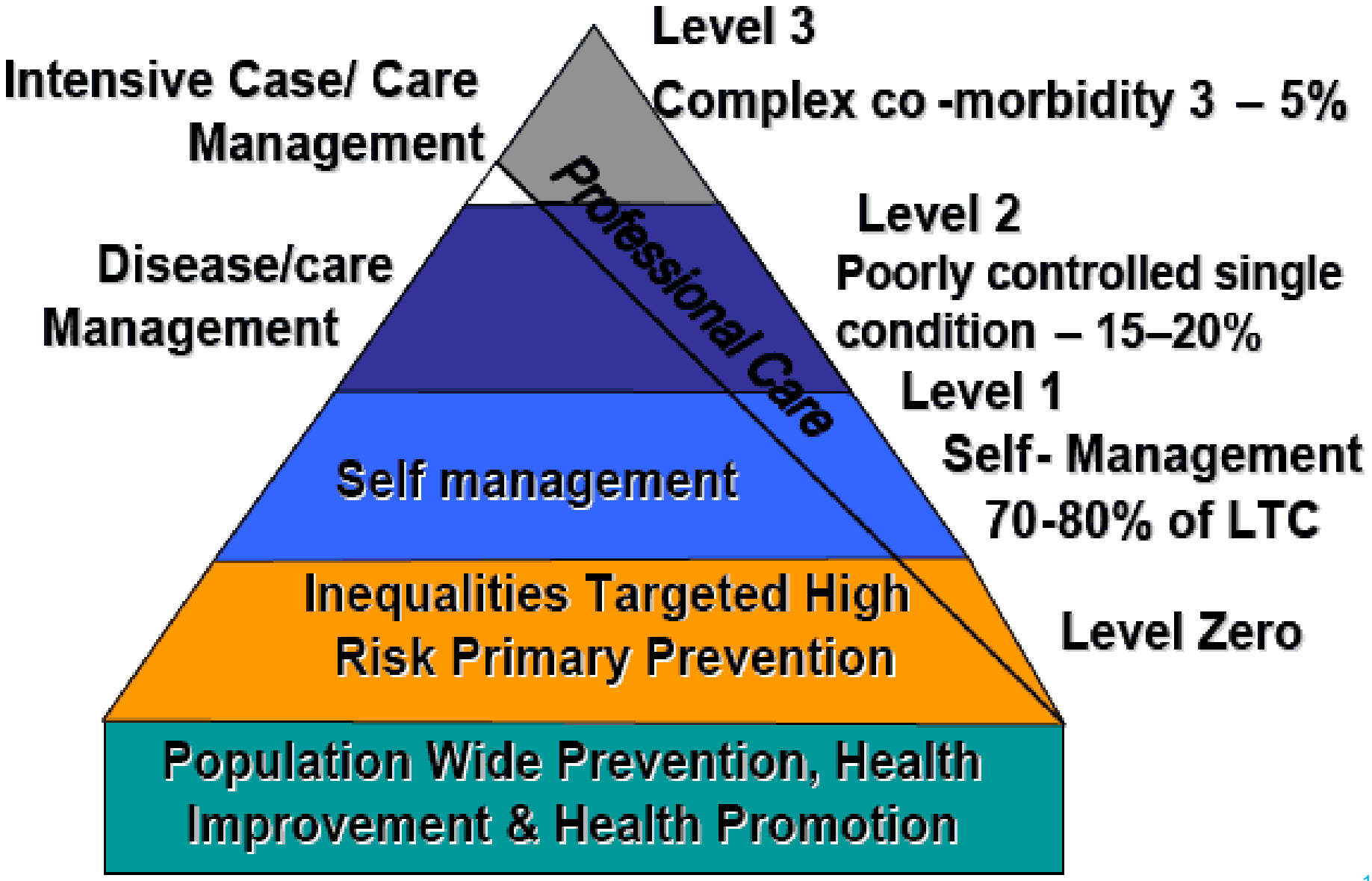
45%
ER visits, overutilization, high care variation, noncompliance

>> Expenditure growth:
«no action» scenario

Source:

>> Let's crush the pyramid!

>> Let's section the pyramid!



The Acute Hospital Setting Time Machine >> Yesterday

>> 135/2012 act: no more than
3,7 beds for 1,000 inhabitants,
including 0,7 rehab and
long-term stay post-acute beds

Renato Balduzzi
Italian Ministry of Health
from 11/2011 to 04/2013

The Acute Hospital Setting Time Machine >> Today

>> July 2014, the «Health Pact» is signed by the State-Regions Conference

>> THE PATIENT AT THE CENTRE
the humanization of care at the hearth of the pact

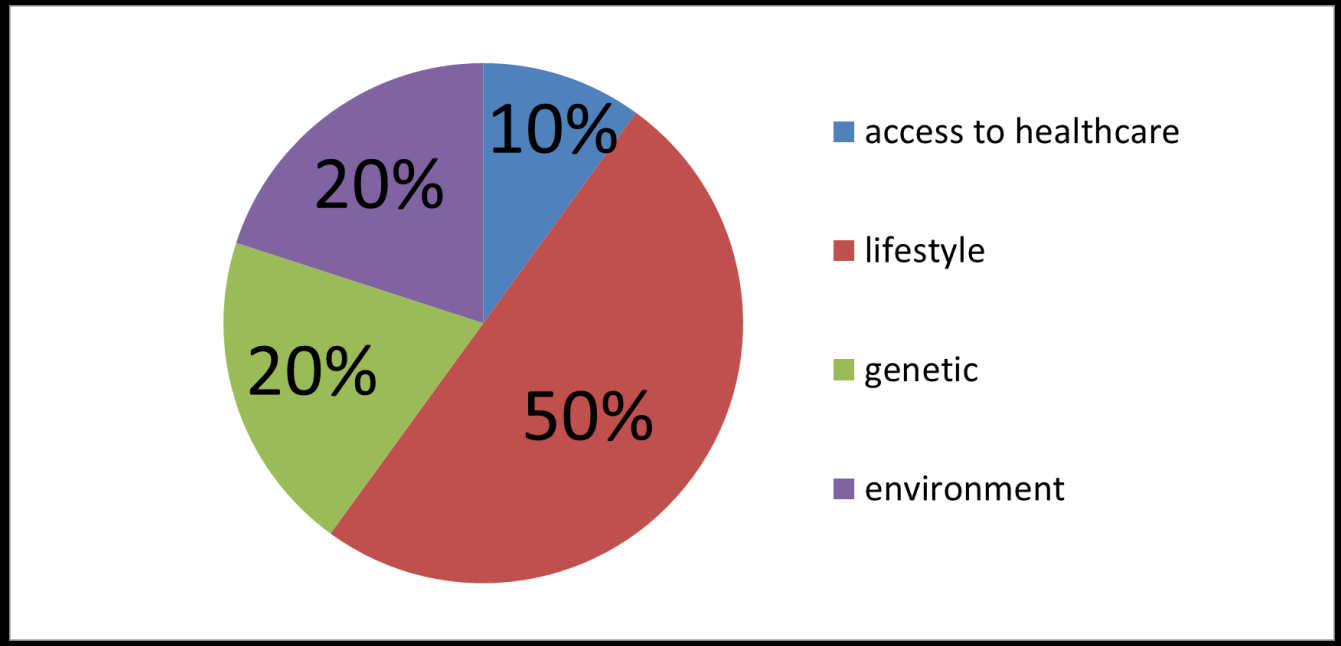
>> RESHAPING CARE
reorganize hospitals and boost community care through a more productive and pervasive healthcare network

Beatrice Lorenzin
Ministry of Health
from 04/2013 to 06/2018

The Hospital and the Community >> Tomorrow

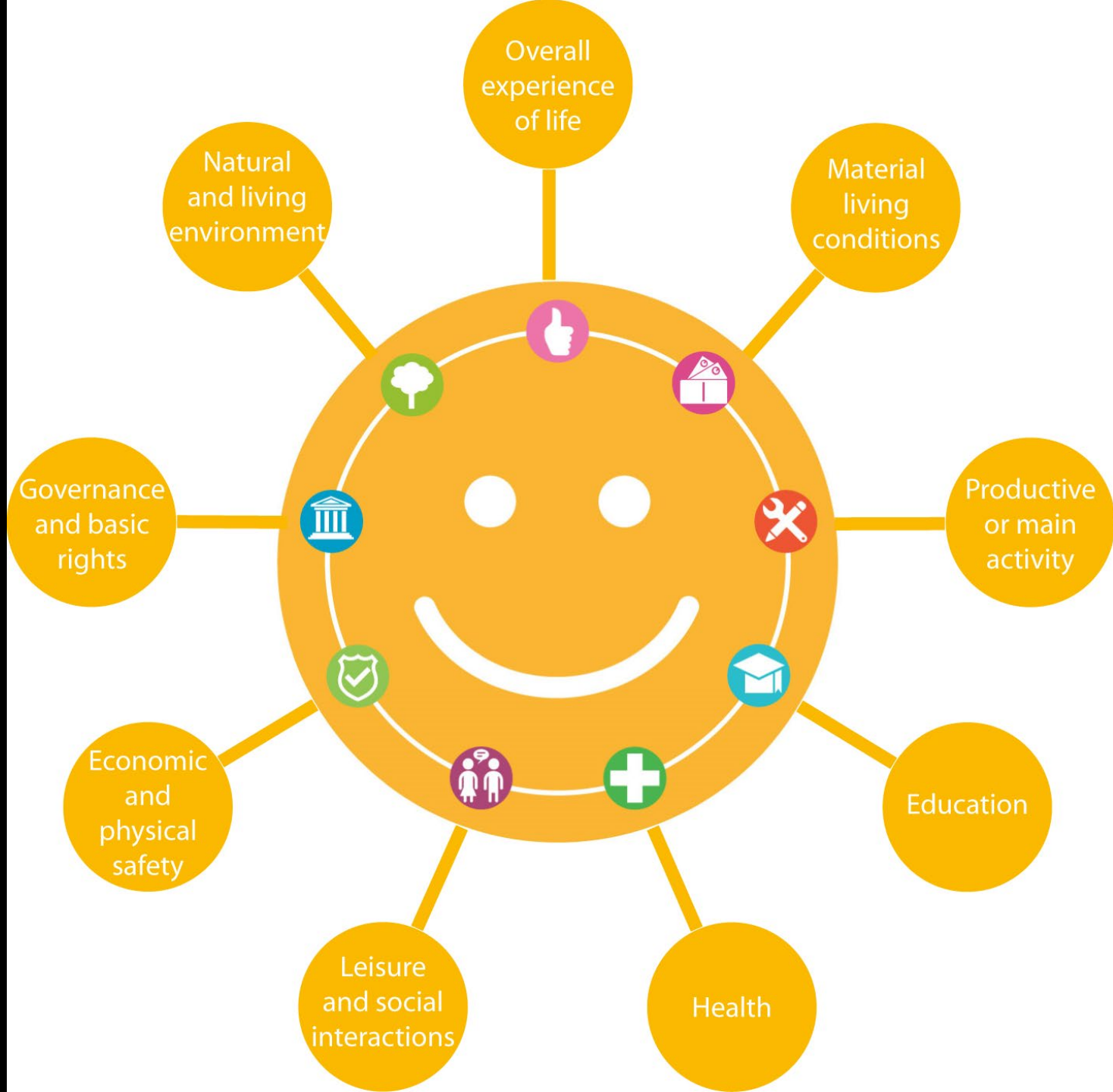
>> Social determinats of health

World Health Organization



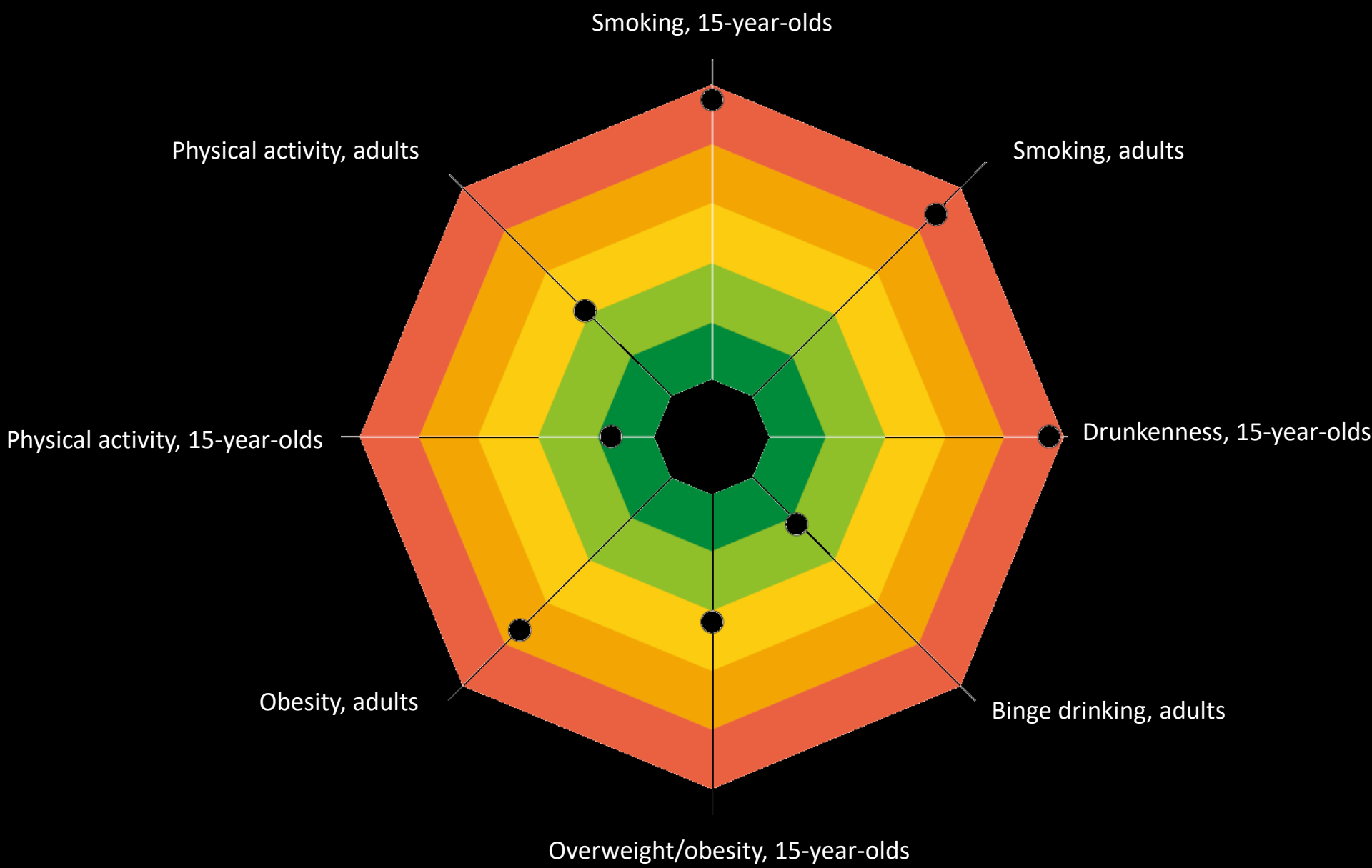
WHO SHALL LIVE?
Health, Economics, and Social Choice

>> the Quality of Life



Source: European Commissione - Eurostat

Smoking, alcohol drinking and obesity are major public health issues in Croatia



Source: European Commission, Observatory on Health Systems and Policies, State of Health in the EU – Croatia – Country Health Profile 2017.

>> Case study - *Kaiser Permanente*

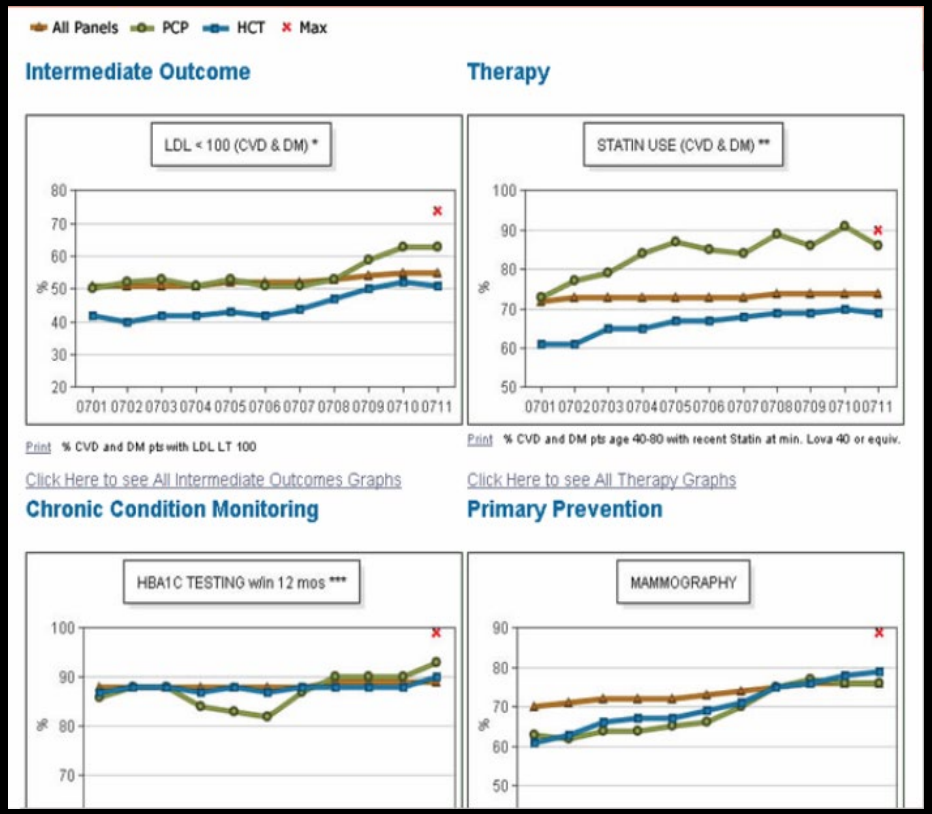
KAISER PERMANENTE®

The largest healthcare nonprofit organization in the US, founded in 1945 by Henry J. Kaiser e Sidney Garfield, based in Oakland (CA), manages, as an integrated managed care consortium, health plans for 10,2m members with 182k employees , over 17k phisicians and 48k nurses, 37 hospitals, with a budget of over US$ 60 billion.

>> How to crush and section the pyramid?

George Halvorson managed Kaiser Permanente from 2002 to 2013. He was the leading force behind a stunning clinical and care processes computerization plan: HealthConnect. The investments reached US$ 2.5b/y, about 5% of the turnover.

Main goal: know own members to better assist them. The overall investment for the HealthConnect project was US$ 4b, about US$ 400 per member.



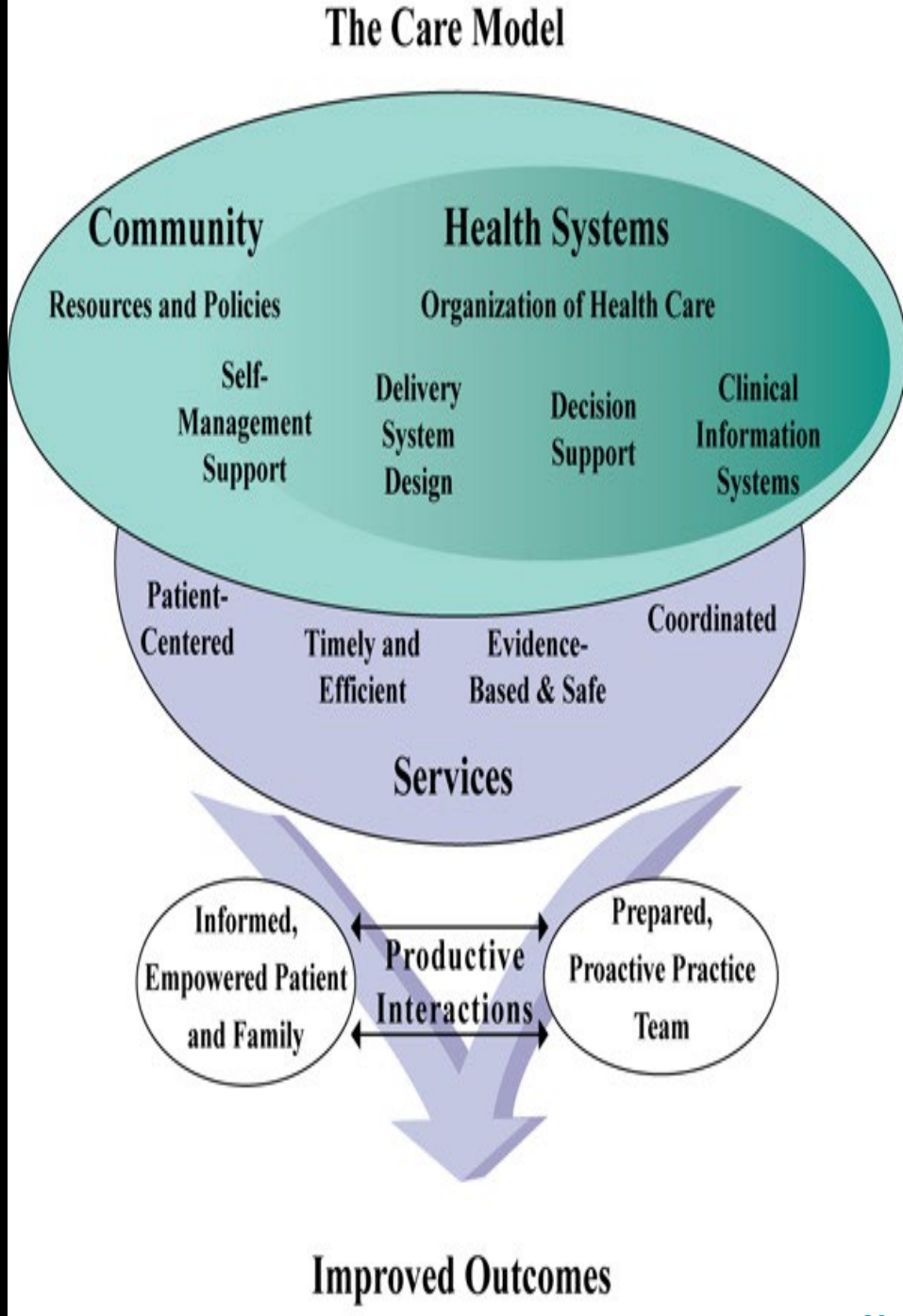
KAISER PERMANENTE HEALTHCONNECT™

>> Health-IT enabled outcome improvement

- **HIT-Enabled Diabetes Care** [1]
  - 44% lower failure rate of metformin treatment for type 2 diabetes
- **HIT-Enabled Cholesterol Management** [2]
  - 40% more very high risk patients achieve national cholesterol guidelines
- **HIT-Enabled Screening** [3]
  - Best breast cancer screening rates in US
  - Best HIV/AIDS screening rates in US
- **HIT-Enabled Cardiac Care** [4]
  - 24% lower probability of death from heart attack
  - 62% lower probability of serious heart attacks doing permanent damage
  - 90% lower mortality from second heart attacks
  - 89% lower all-cause cardiac mortality
- **HIT-Enabled Patient Satisfaction** [5]
  - Higher patient involvement in care
  - Over 800% more scheduled e-visits
  - Almost 600% more secure messaging with doctors
  - 24% fewer office visits

>> The role of digitalization in health management

The enabling factor to move from the «reactive medicine» model, structured to address the expressed needs of the patients, toward the «proactive medicine» model, aiming to answering to the not yet expressed needs of healthy people and to reach an optimal management of chronic coditions according to the chronic care model.



Developed by The MaColl Institute

>> How to impact well-being to manage population health

1 Collect data

Clinical, claims, Rx, lab, biometrics, well-being, device, social networks

2 Analyze & Forecast

Proprietary Analytics and Predictive Models

3 Stratify population

- Healthy
- At Risk
- High Risk

4 Establish Plan

☑ Individualized well-being plan and guidance

5 Engage and Support

Physician and individual directed well-being actions

- Self-directed Virtual coaching
- Individual and Group Live Coaching
- Ongoing Treatment Plan Support
- High Risk and Episodic Care Transition Management
- Community / Social Determinants

6 Report Impact

All progress and outcomes communicated to PCP / Patient / Sponsor

Source: Healthways

Peer-Reviewed Articles and Reports

Healthways Well-Being Literature

Well-Being, Health, and Productivity Improvement After an Empl
in Large Retail Distribution Centers

Regional Economic Activity and Absenteeism: A New Approach
Costs of Employee Productivity Loss

Comparing the Contributions of Well-Being and Disease Status t

The Well-Being 5: Development and Validation of a Diagnostic In
Population Well-being

Overall Well-being as a Predictor of Healthcare, Productivity, and
Large Employer

Well-Being and Employee Health—How Employees' Well-Being
Demographic Factors to Influence Risk of Hospitalization or an E

The Association between Modifiable Well-being Risks and Produ
in Pooled Employer Sample

Self-Rated Job Performance and Absenteeism According to Emp
Behaviors, and Physical Health

Classification of Individual Well-Being Scores for the Determinati
Productivity Outcomes in Employee Population

Assessing Correlation Between Macro and Regional Economic In
Healthways Well-Being Index

Presenteeism According to Healthy Behaviors, Physical Health, ar

Enhancing Multiple Domains of Well-Being by Decreasing Multip
A Randomized Clinical Trial

Evaluation of the Relationship Between Individual Well-Being an
Utilization and Cost

Development of an Individual Well-Being Scores Assessment

The Well-Being Assessment for Productivity: A Well-Being Appro

Evaluation of a Best-Practice Worksite Wellness Program in a Sma
Selected Well-Being Indices

The Impact of Worksite Wellness in a Small Business Setting

Facets of Well-Being Across the Age Spectrum in the American P

Estimating the Impact of Caregiving and Employment on Well-B

Effect of Comprehensive Lifestyle Changes on Telomerase Activity and Telomere Length in Men With Biopsy-Proven Low-Risk Prostate Cancer: 5-Year Follow-up of a Descriptive Pilot Study

Intensive Lifestyle Changes for Reversal of Coronary Heart Disease

Chronic Care Management Program Outcomes

Impact of a Chronic Disease Management Program on Hospital Admissions and Readmissions in an Australian Population with Heart Disease or Diabetes

Exploring Robust Methods for Evaluating Treatment and Comparison Groups in Chronic Care Management Programs

The Impact of Post-Discharge Telephonic Follow-Up on Hospital Readmissions

The Impact of a Proactive Chronic Care Management Program on Hospital Admission Rates in a German Health Insurance Society

Association between Frequency of Telephonic Contact and Clinical Testing for a Large, Geographically Diverse Diabetes Disease Management Population

Impact of Telephonic Interventions on Glycosylated Hemoglobin and Low-Density Lipoprotein Cholesterol Testing

Weight Loss Solutions

Initial Evaluation of a Scalable Lifestyle Program for Sustained Weight Loss

Comparative Effectiveness of Weight-Loss Interventions in Clinical Practice

Fitness Programs

Impact of a Senior Fitness Program on Measures of Physical and Emotional Health and Functioning

Healthways Predictive Models: Articles on Model Development and Effectiveness

Predictive Modeling: The Application of a Customer-Specific Avoidable Cost Model in a Commercial Population

Predicting Future Hospital Admissions: Can We Focus Intensive Readmission Avoidance Efforts More Effectively?

Maximizing Care Management Savings Through Advanced Total Population Targeting

Impact of Predictive Model-Directed End-of-Life Counseling for Medicare Beneficiaries

Research and Outcomes Methodology

Methods for Inferring Health-Related Social Networks among Coworkers from Online Communication Patterns

>> Challenges from an Insurer's Perspective

Conventional approach

- Claims management
- Network management
- Limitation of reimbursement and benefits

➢ **Dissatisfied members and providers**

Well-Being Improvement

- Population Health Management
- Sustainable behavior change
- Therapy and medication adherence
- Top of license practice

$$\text{Loss ratio} = \frac{\text{Claims Cost}}{\text{Premium}} = \frac{\text{Unit Costs x Utilization}}{\textbf{Premium}}$$

- Premium increase

➢ **Dissatisfied members**
➢ **Anti-selection**

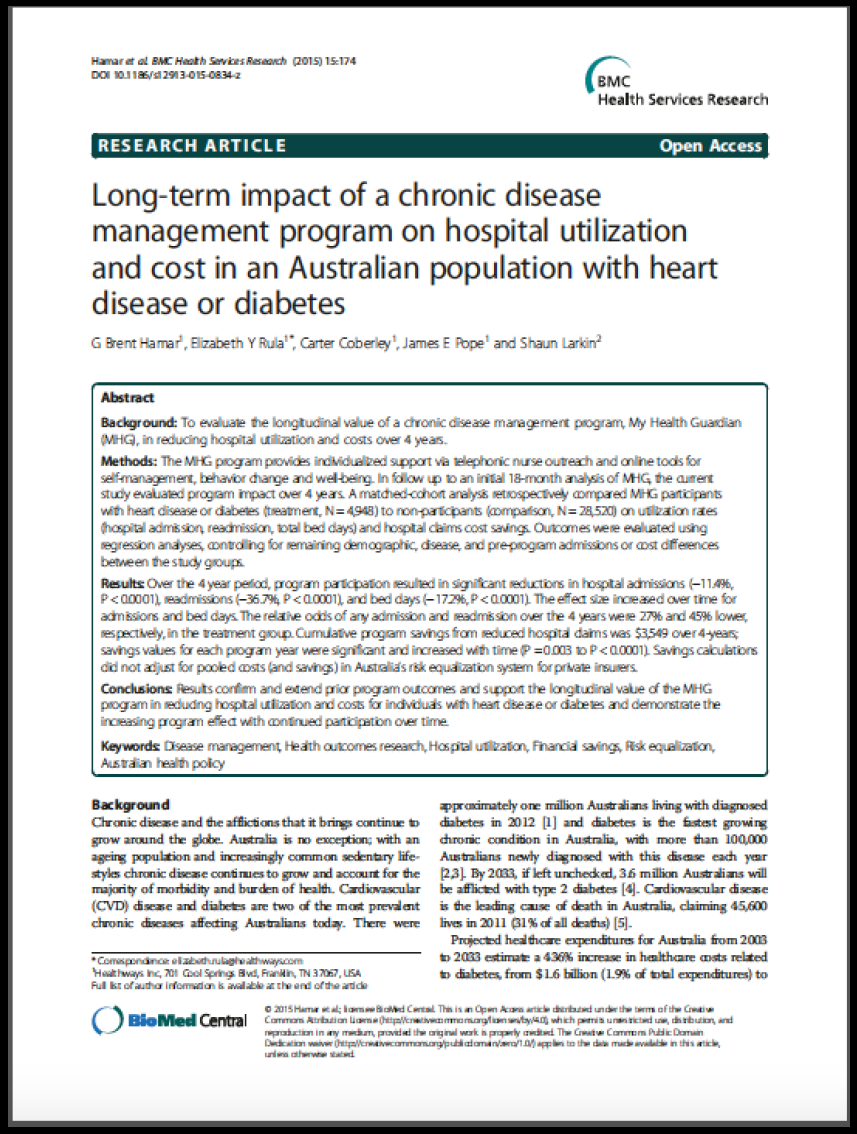
- **Improved population health, well-being**
- **Improved predictability of medical costs**
- **Lower short, long term medical cost** ***achieved by bending the demand curve***
- **Higher member satisfaction**

Plus, in addition

1. **Differentiated market position**
2. **Innovative products**
3. **Higher retention**
4. **Higher sales**
5. **Higher profitability**

Source: Healthways

>> Proven ability to reduce utilisation, costs



Hamar et al. BMC Health Services Research (2015) 15:174
DOI 10.1186/s12913-015-0834-z

BMC Health Services Research

RESEARCH ARTICLE Open Access

Long-term impact of a chronic disease management program on hospital utilization and cost in an Australian population with heart disease or diabetes

G Brent Hamar[2], Elizabeth Y Rula[1*], Carter Coberley[1], James E Pope[1] and Shaun Larkin[2]

Abstract

Background: To evaluate the longitudinal value of a chronic disease management program, My Health Guardian (MHG), in reducing hospital utilization and costs over 4 years.

Methods: The MHG program provides individualized support via telephonic nurse outreach and online tools for self-management, behavior change and well-being. In follow up to an initial 18-month analysis of MHG, the current study evaluated program impact over 4 years. A matched-cohort analysis retrospectively compared MHG participants with heart disease or diabetes (treatment, N = 4,948) to non-participants (comparison, N = 28,520) on utilization rates (hospital admission, readmission, total bed days) and hospital claims cost savings. Outcomes were evaluated using regression analyses, controlling for remaining demographic, disease, and pre-program admissions or cost differences between the study groups.

Results: Over the 4 year period, program participation resulted in significant reductions in hospital admissions (−11.4%, P < 0.0001), readmissions (−36.7%, P < 0.0001), and bed days (−17.2%, P < 0.0001). The effect size increased over time for admissions and bed days. The relative odds of any admission and readmission over the 4 years were 27% and 45% lower, respectively, in the treatment group. Cumulative program savings from reduced hospital claims was $3,549 over 4-years; savings values for each program year were significant and increased with time (P = 0.003 to P < 0.0001). Savings calculations did not adjust for pooled costs (and savings) in Australia's risk equalization system for private insurers.

Conclusions: Results confirm and extend prior program outcomes and support the longitudinal value of the MHG program in reducing hospital utilization and costs for individuals with heart disease or diabetes and demonstrate the increasing program effect with continued participation over time.

Keywords: Disease management, Health outcomes research, Hospital utilization, Financial savings, Risk equalization, Australian health policy

Background

Chronic disease and the afflictions that it brings continue to grow around the globe. Australia is no exception; with an ageing population and increasingly common sedentary lifestyles chronic disease continues to grow and account for the majority of morbidity and burden of health. Cardiovascular (CVD) disease and diabetes are two of the most prevalent chronic diseases affecting Australians today. There were approximately one million Australians living with diagnosed diabetes in 2012 [1] and diabetes is the fastest growing chronic condition in Australia, with more than 100,000 Australians newly diagnosed with this disease each year [2,3]. By 2033, if left unchecked, 3.6 million Australians will be afflicted with type 2 diabetes [4]. Cardiovascular disease is the leading cause of death in Australia, claiming 45,600 lives in 2011 (31% of all deaths) [5].

Projected healthcare expenditures for Australia from 2003 to 2033 estimate a 436% increase in healthcare costs related to diabetes, from $1.6 billion (1.9% of total expenditures) to

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Results

- Over the 4 year period, program participation resulted in significant reductions in:
  - Hospital admissions (−11.4%, P < 0.0001)
  - Readmissions (−36.7%, P < 0.0001), and
  - Bed days (−17.2%, P < 0.0001)
- Cumulative program savings from reduced hospital claims was $3,549 over 4-years
- Savings for each program year were significant and increased with time (P = 0.003 to P < 0.0001)
- Savings calculations did not adjust for pooled costs (and savings) in Australia' s risk equalization system for private insurers

Conclusions

- Results confirm the longitudinal value of the MHG program in reducing costs and hospital utilization for those with heart disease or diabetes
- Demonstrate the increasing program effect with continued participation over time

Source: Healthways

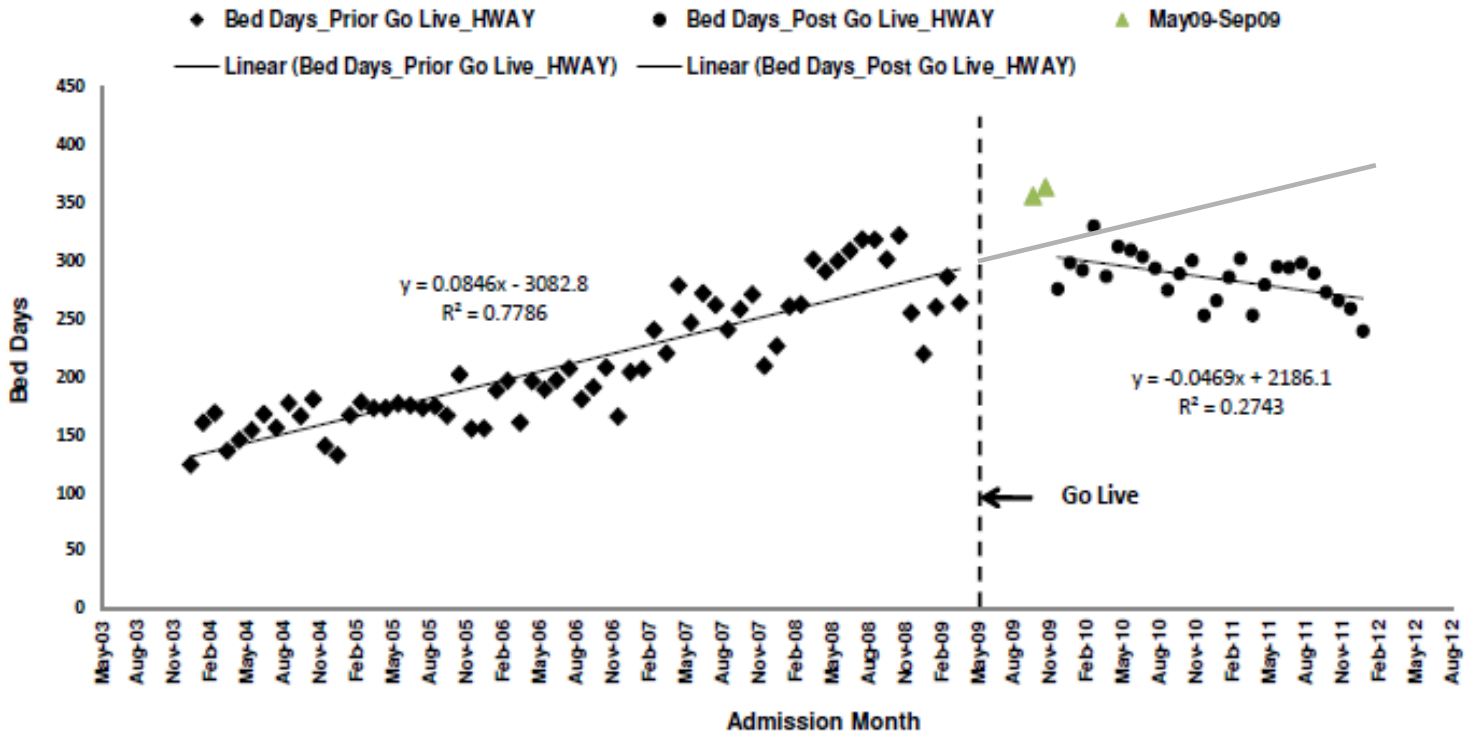
>> Near-term impact through reducing admissions

18-month outcomes

HCF My Health Guardian (MHG) Bed Days Per 1,000 Lives

In May 2012, there are 21,971 members enrolled in MHG disease management program.

These members had a 8.5% p.a. growth in bed days per 1,000 lives before program launch, and -4.7% p.a. decrease after program launch date.



MHG active members up to May 12 with active HCF hospital cover verified monthly until Feb 12.

Source: Healthways

Get more with HCF

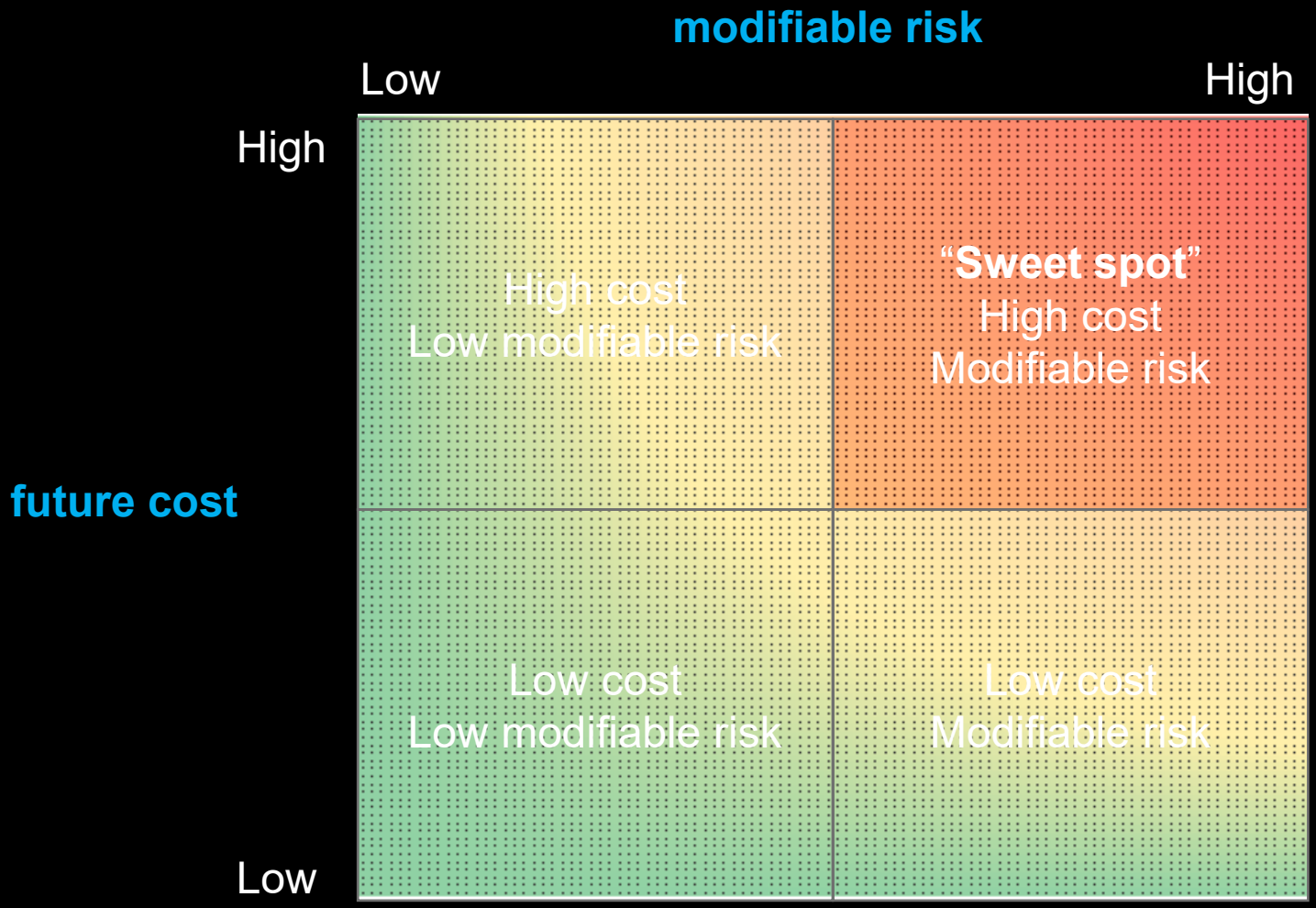
>> health improvement goes viral!

Boost engagement by employing social networks

Source: Healthways

>> prioritising interventions based on two dimensions

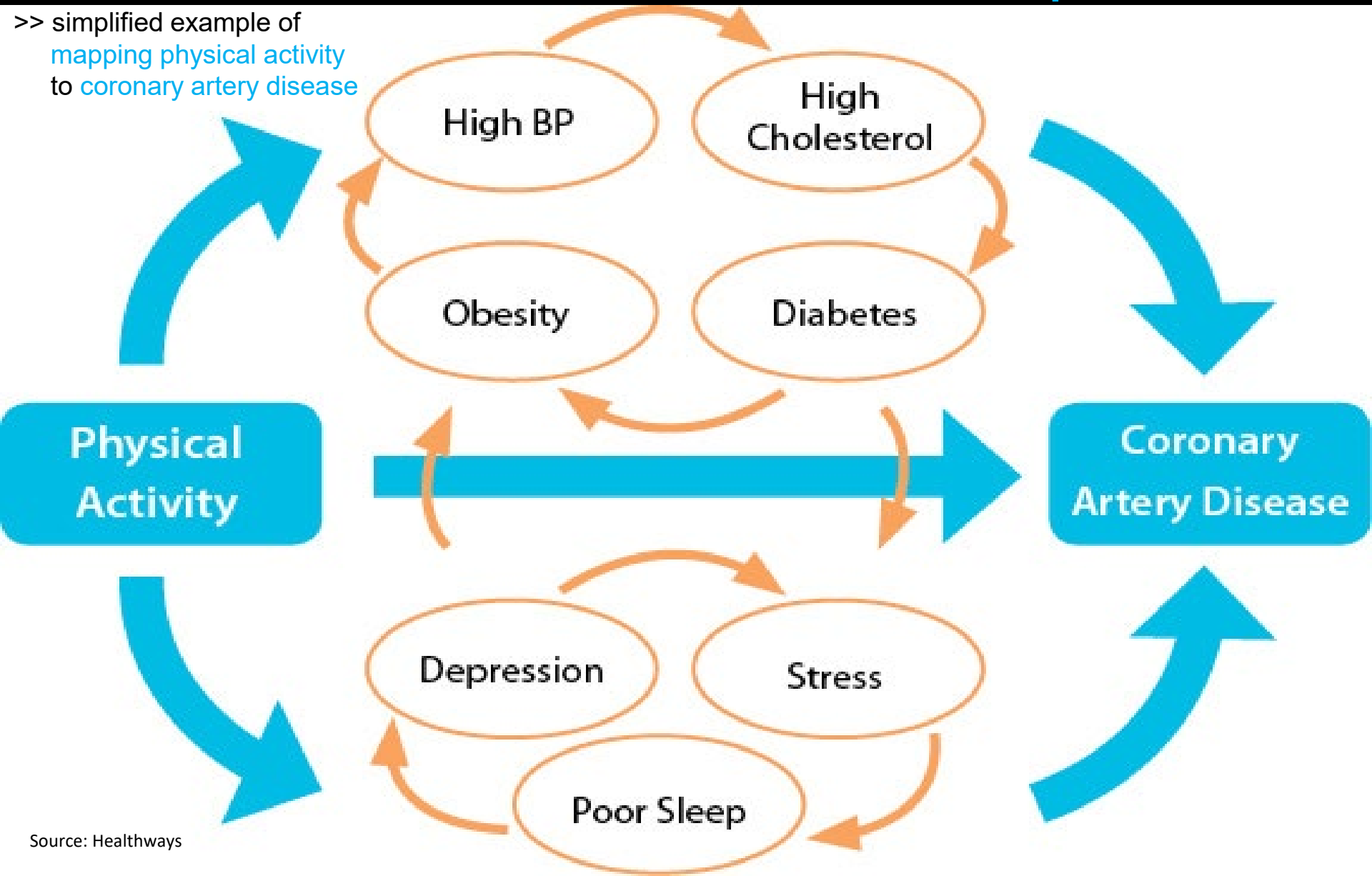
cost risk + evidence based impact



Source: Healthways

> > founded on the science of behavior-condition relationships

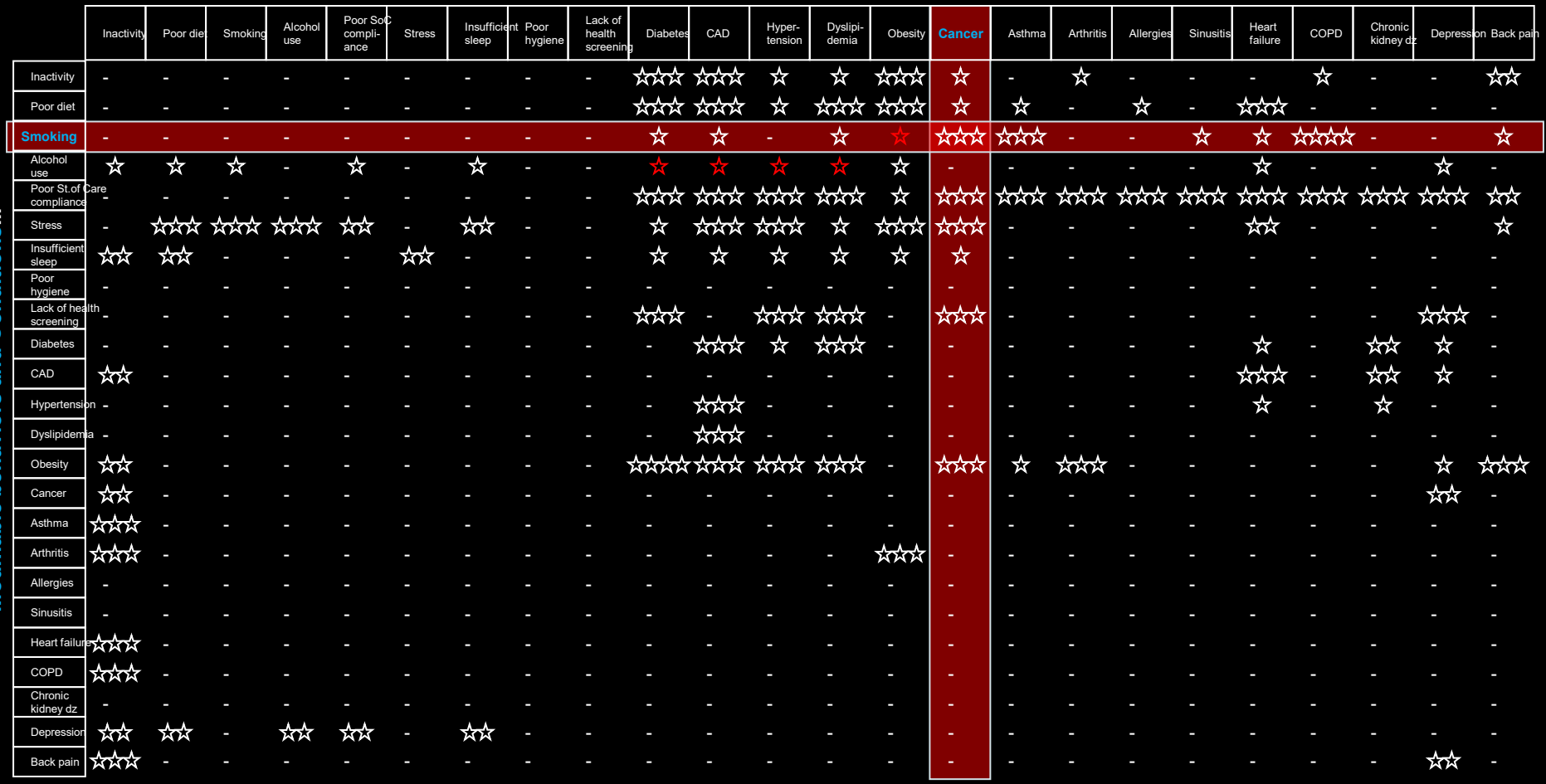
>> simplified example of mapping physical activity to coronary artery disease



Source: Healthways

>> first order impacts between behaviors & conditions

>> are converted into model inputs



Source: Healthways

>> building the epidemiology engine

>> external experts had significant input on model development

Epidemiologist, Harvard School of Public Health
Health Policy expert, Harvard Medical School
Health management expert, Johns Hopkins Bloomberg School of Public Health

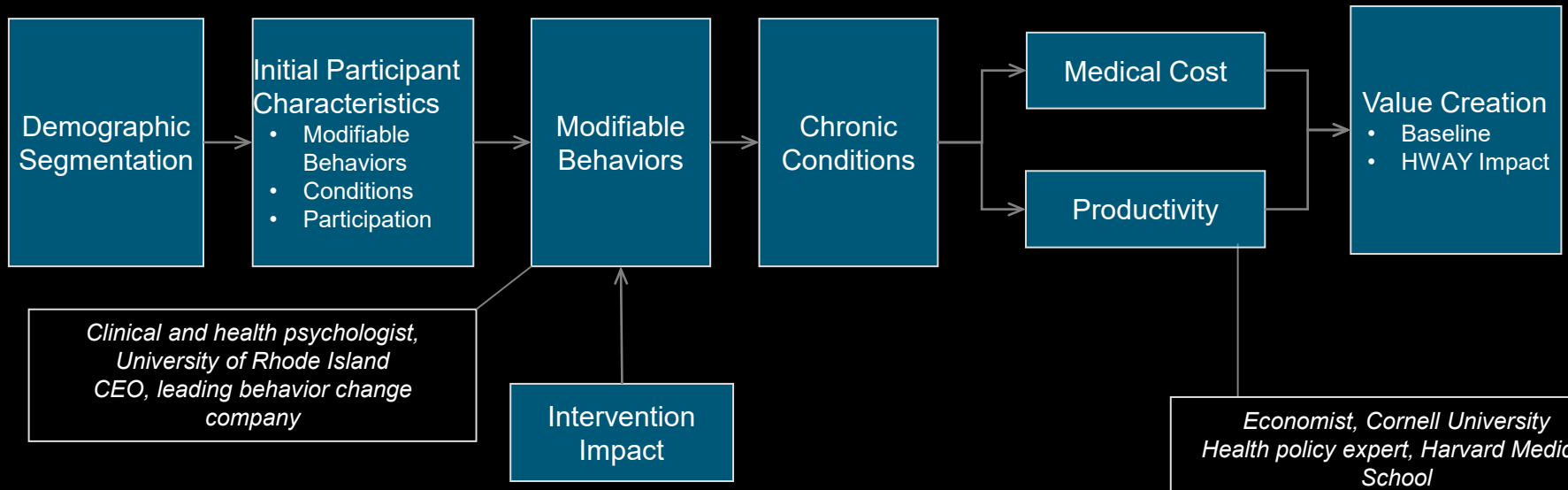
Customizable Inputs

Assign Initial Member Level Characteristics

Assumptions Based Epidemiological Engine

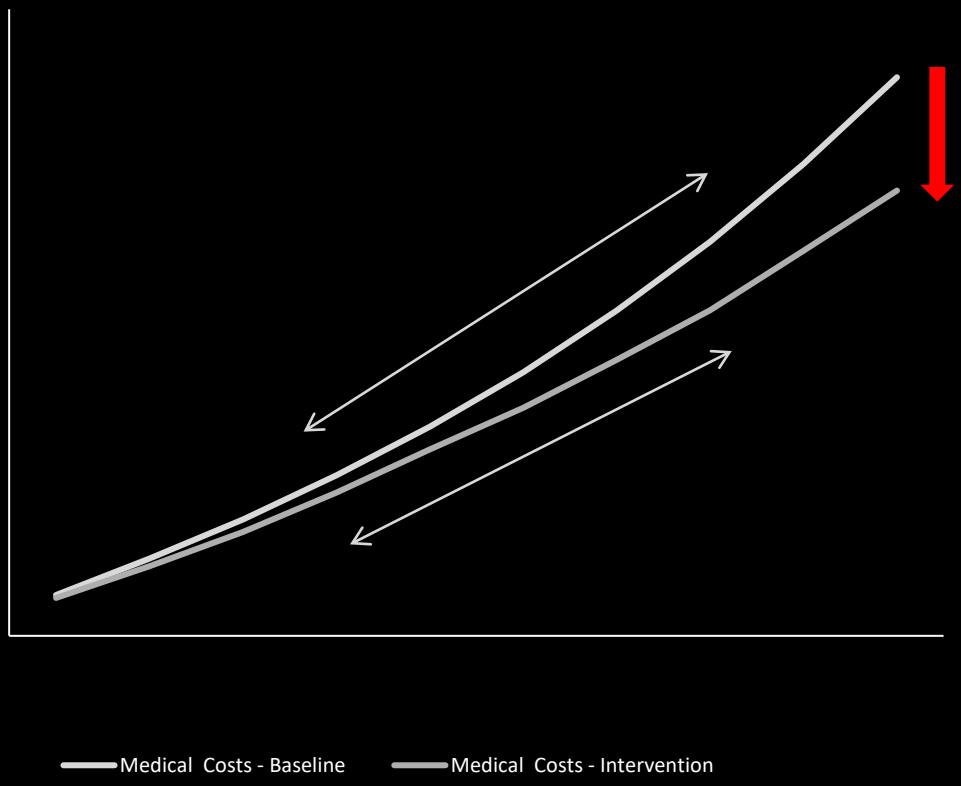
Assign Cost to Severity of Existing Conditions

Managing principal, leading actuarial and healthcare research company,
Healthcare economic expert, Harvard University



Source: Healthways

>> interventions impact the medical cost trend

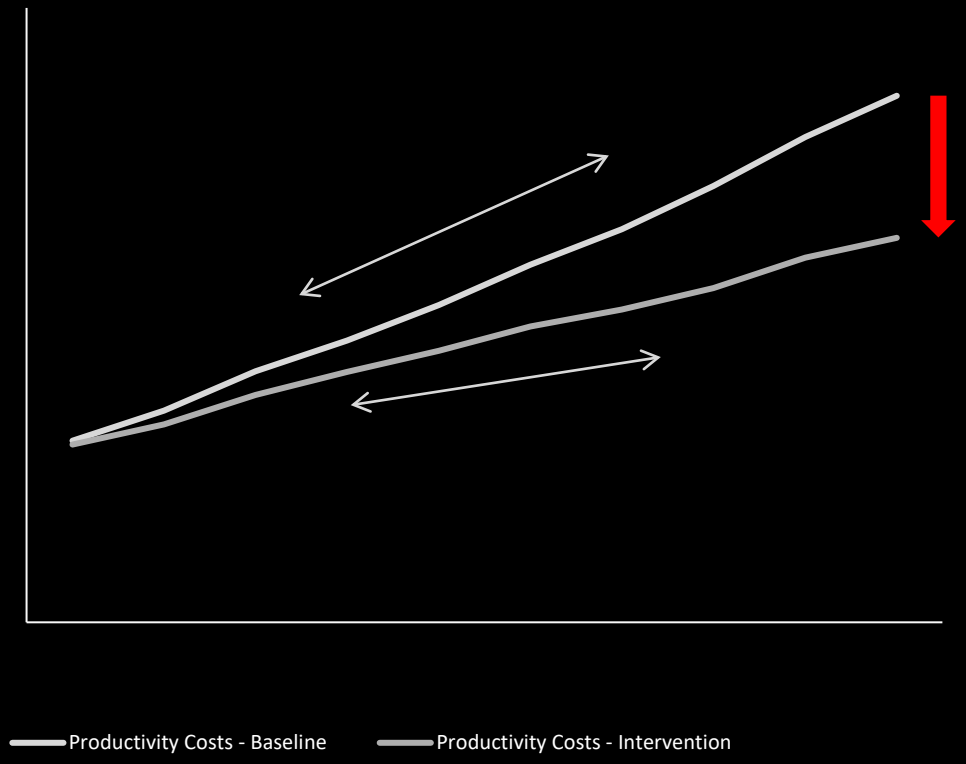


>> interventions decrease the prevalence of risky behaviors and diseases that lead to higher medical costs

>> without intervention, chronic conditions can be expected to progress more aggressively than with intervention

Source: Healthways

>> interventions impact the productivity cost trend

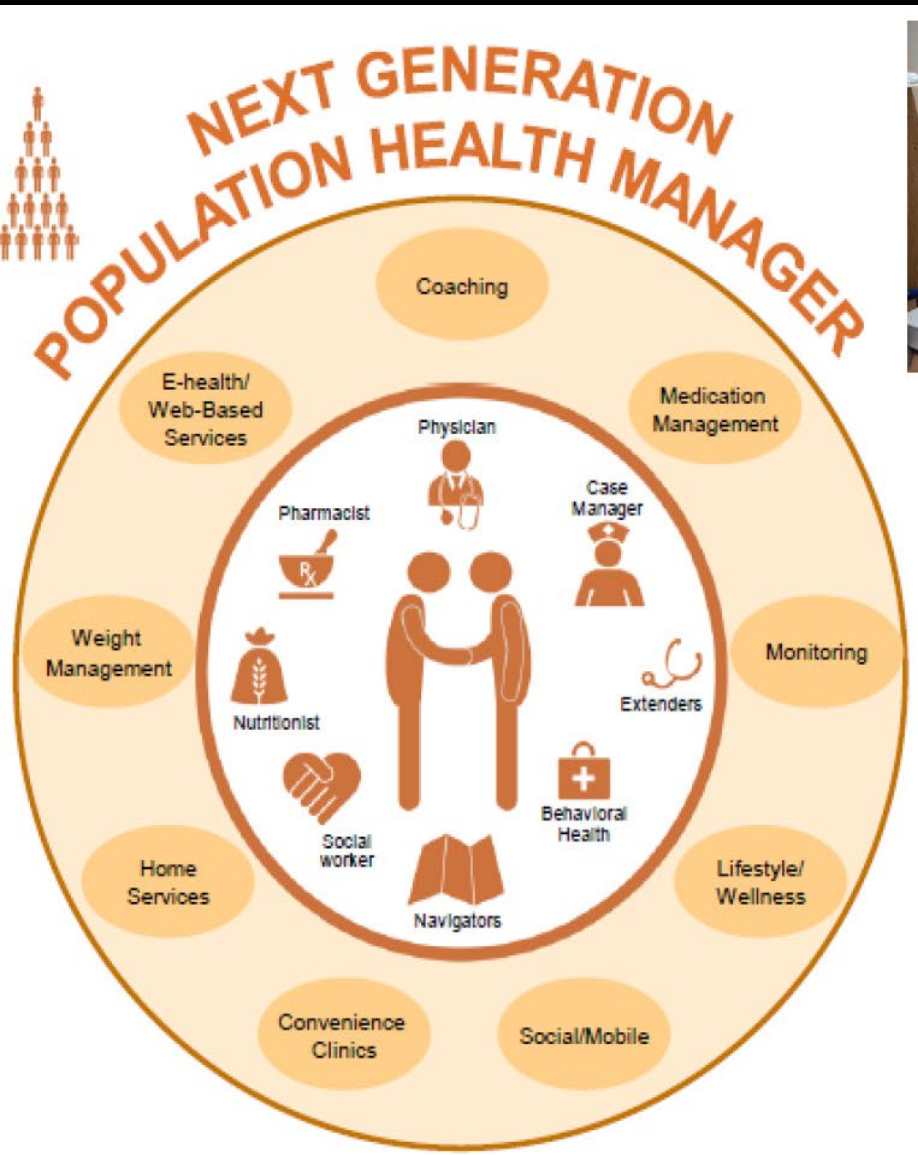


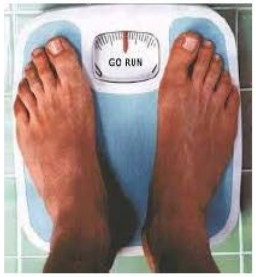
>> interventions decrease the prevalence of risky behaviors and diseases that lead to higher productivity costs

>> the same conditions that require medical expenditures also contribute to lower productivity while an individual is at work

Source: Healthways

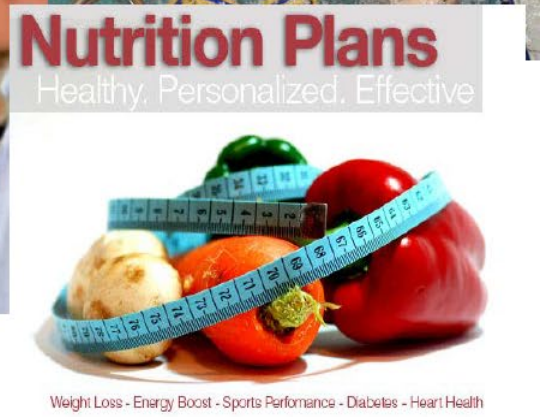
>> new professions





Source: Oliver Wyman

>> new makets



Source: Oliver Wyman

>> new channels

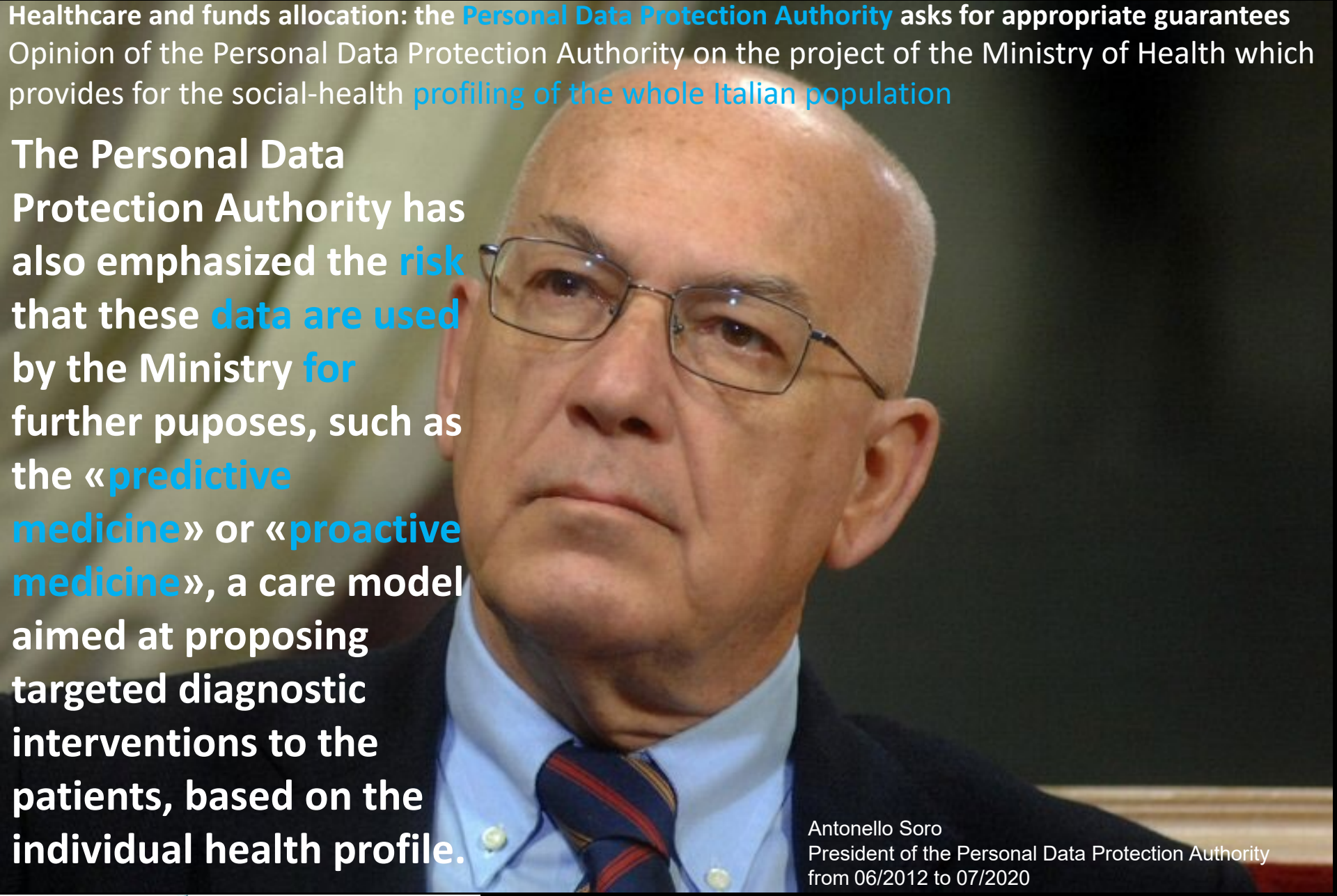
FSEr
FASCICOLO SANITARIO ELETTRONICO REGIONALE

Source: Oliver Wyman

Healthcare and funds allocation: the Personal Data Protection Authority asks for appropriate guarantees

Opinion of the Personal Data Protection Authority on the project of the Ministry of Health which provides for the social-health profiling of the whole Italian population

The Personal Data Protection Authority has also emphasized the risk that these data are used by the Ministry for further puposes, such as the «predictive medicine» or «proactive medicine», a care model aimed at proposing targeted diagnostic interventions to the patients, based on the individual health profile.



Antonello Soro
President of the Personal Data Protection Authority
from 06/2012 to 07/2020

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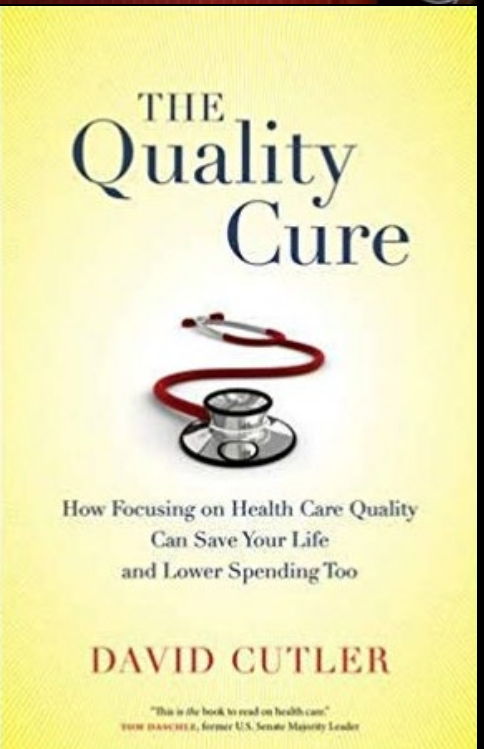
n. 464 – April the 6th 2020



"HEALTH CARE IS AMONG THE MOST INFORMATION-INTENSIVE PROCESSES IN THE ECONOMY. AND YET, THE INFORMATION BASIS ON WHICH HEALTH CARE MAKES THESE DECISIONS IS AMONG THE LEAST SOPHISTICATED OF ANY INDUSTRY IN THE ECONOMY" — DAVID CUTLER

HARVARD UNIVERSITY

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