



**POLITECNICO**  
MILANO 1863  
SCHOOL OF MANAGEMENT

Con il contributo scientifico di

**CERM**  
competitività regole mercati



# **INVECCHIAMENTO E FRAGILITÀ: IL RUOLO DELLA SANITÀ INTEGRATIVA**

## **VINCENZO ATELLA**

L'invecchiamento in Europa:  
come e quanto si invecchia

**ROMA 5 MARZO 2019  
LUISS BUSINESS SCHOOL**

# Background and motivation

- The impact of ageing population represents a main concern around the world and, in particular, in Europe which will be turning “increasingly grey” in the upcoming decades.
- As a result, the demographic old-age dependency ratios are projected to almost double from now until 2060, moving from 4 to 2 working-age people for every person aged 65 and above (EC, 2015).
- From a macroeconomic perspective, this implies that the projected potential GDP growth will remain much lower than in previous decades.
- Aging of the population, combined with the weak economic growth, result in increasingly stringent public finances with serious threats to the financial sustainability of the social security and healthcare systems

# Background and motivation

- Life expectancy (LE) and fertility rates are the **key features of the current aging process** in Europe and around the world (Cutler and Meara, 2013).
- **Medical technologies** are among the **main determinants** for the increase in LE: they have turned many, once deadly diseases into chronic conditions. This phenomenon has been more sustained in Europe with respect to other parts of the world, placing the EU-28 among the worldwide leaders for LE.

# Background and motivation

- A longer LE can be seen as a potentially “good” or “bad” news, depending on the quality of the “extra” life years lived. In particular, at aggregate level, an older and unhealthy population implies an extra burden in terms of both pensions and health care expenditure.
- According to GBD (2016), despite global health improvement and life expectancy increases, people spend more time with reduced functional health status.

# Background and motivation

- These results are particularly true for high income countries during the 1990-2015 period, when trends in years of functional health loss have increased more than expected and similar trends are forecasted for the near future.
- Since 2000 many countries have witnessed a significant decline in healthy life expectancy at birth, inverting what had been a continuous growth process.
- This decline has been particularly marked in Europe, with significant differences across geographical areas, and more importantly, across gender: women, tend to live longer, but spend more years in bad health with respect to men.

# The WHO health system ranking - 2000

OVERALL PERFORMANCE									
Rank	Uncertainty interval	Member State	Index	Uncertainty interval					
1	1 – 5	France	0.994	0.982 – 1.000	21	18 – 24	Belgium	0.915	0.903 – 0.926
2	1 – 5	Italy	0.991	0.978 – 1.000	22	14 – 29	Colombia	0.910	0.881 – 0.939
3	1 – 6	San Marino	0.988	0.973 – 1.000	23	20 – 26	Sweden	0.908	0.893 – 0.921
4	2 – 7	Andorra	0.982	0.966 – 0.997	24	16 – 30	Cyprus	0.906	0.879 – 0.932
5	3 – 7	Malta	0.978	0.965 – 0.993	25	22 – 27	Germany	0.902	0.890 – 0.914
6	2 – 11	Singapore	0.973	0.947 – 0.998	26	22 – 32	Saudi Arabia	0.894	0.872 – 0.916
7	4 – 8	Spain	0.972	0.959 – 0.985	27	23 – 33	United Arab Emirates	0.886	0.861 – 0.911
8	4 – 14	Oman	0.961	0.938 – 0.985	28	26 – 32	Israel	0.884	0.870 – 0.897
9	7 – 12	Austria	0.959	0.946 – 0.972	29	18 – 39	Morocco	0.882	0.834 – 0.925
10	8 – 11	Japan	0.957	0.948 – 0.965	30	27 – 32	Canada	0.881	0.868 – 0.894
11	8 – 12	Norway	0.955	0.947 – 0.964	31	27 – 33	Finland	0.881	0.866 – 0.895
12	10 – 15	Portugal	0.945	0.931 – 0.958	32	28 – 34	Australia	0.876	0.861 – 0.891
13	10 – 16	Monaco	0.943	0.929 – 0.957	33	22 – 43	Chile	0.870	0.816 – 0.918
14	13 – 19	Greece	0.933	0.921 – 0.945	34	32 – 36	Denmark	0.862	0.848 – 0.874
15	12 – 20	Iceland	0.932	0.917 – 0.948	35	31 – 41	Dominica	0.854	0.824 – 0.883
16	14 – 21	Luxembourg	0.928	0.914 – 0.942	36	33 – 40	Costa Rica	0.849	0.825 – 0.871
17	14 – 21	Netherlands	0.928	0.914 – 0.942	37	35 – 44	United States of America	0.838	0.817 – 0.859
18	16 – 21	United Kingdom	0.925	0.913 – 0.937	38	34 – 46	Slovenia	0.838	0.813 – 0.859
19	14 – 22	Ireland	0.924	0.909 – 0.939	39	36 – 44	Cuba	0.834	0.816 – 0.852
20	17 – 24	Switzerland	0.916	0.903 – 0.930	40	36 – 48	Brunei Darussalam	0.829	0.808 – 0.849



## Bloomberg 2017 Healthiest Country Index

Rank	Country	Health grade	Health score	Health risk penalties	Rank	Country	Health grade	Health score	Health risk penalties
1	Italy	93.11	97.44	-4.33	26	Belgium	80.96	86.03	-5.07
2	Iceland	91.21	96.20	-4.99	27	Slovenia	80.81	86.65	-5.83
3	Switzerland	90.75	94.96	-4.21	28	Denmark	80.36	85.02	-4.66
4	Singapore	90.23	94.11	-3.88	29	Chile	77.18	82.53	-5.35
5	Australia	89.24	93.88	-4.64	30	Czech Rep.	75.76	81.82	-6.06
6	Spain	89.19	94.14	-4.95	31	Cuba	74.23	79.13	-4.90
7	Japan	89.15	93.69	-4.54	32	Lebanon	74.03	79.55	-5.51
8	Sweden	88.92	93.78	-4.85	33	Costa Rica	73.14	77.16	-4.01
9	Israel	88.14	92.47	-4.33	34	U.S.	73.05	78.25	-5.21
10	Luxembourg	87.87	92.90	-5.03	35	Croatia	72.88	78.16	-5.28
11	Norway	86.81	91.61	-4.81	36	Qatar	71.78	77.33	-5.55
12	Austria	86.34	90.78	-4.44	37	Brunei	70.21	75.14	-4.92
13	Netherlands	85.83	89.94	-4.11	38	Estonia	69.24	75.67	-6.43
14	France	85.59	90.93	-5.34	39	Poland	68.92	75.34	-6.42
15	Finland	84.80	89.58	-4.78	40	Bahrain	68.73	74.20	-5.46
16	Germany	84.78	89.40	-4.62	41	Maldives	67.90	71.82	-3.92
17	Canada	84.57	89.53	-4.96	42	Bosnia & H.	67.83	72.91	-5.08
18	Cyprus	84.52	89.17	-4.65	43	U.A.E.	67.30	73.56	-6.26
19	New Zealand	84.48	89.95	-5.47	44	Macedonia	65.64	69.96	-4.32
20	Greece	84.28	88.17	-3.89	45	Uruguay	65.40	70.86	-5.45
21	Portugal	82.97	88.24	-5.27	46	Slovakia	65.10	70.54	-5.44
22	Ireland	82.52	88.53	-6.01	47	Barbados	64.14	68.55	-4.41
23	U.K.	82.28	87.21	-4.94	48	Oman	62.89	67.79	-4.90
24	S. Korea	82.06	87.67	-5.61	49	Panama	62.39	67.13	-4.73
25	Malta	81.27	86.42	-5.15	50	Albania	62.01	66.72	-4.71

by Wei Lu and Vinc

March 20, 2017, 5:01

From Benchmark

When it comes

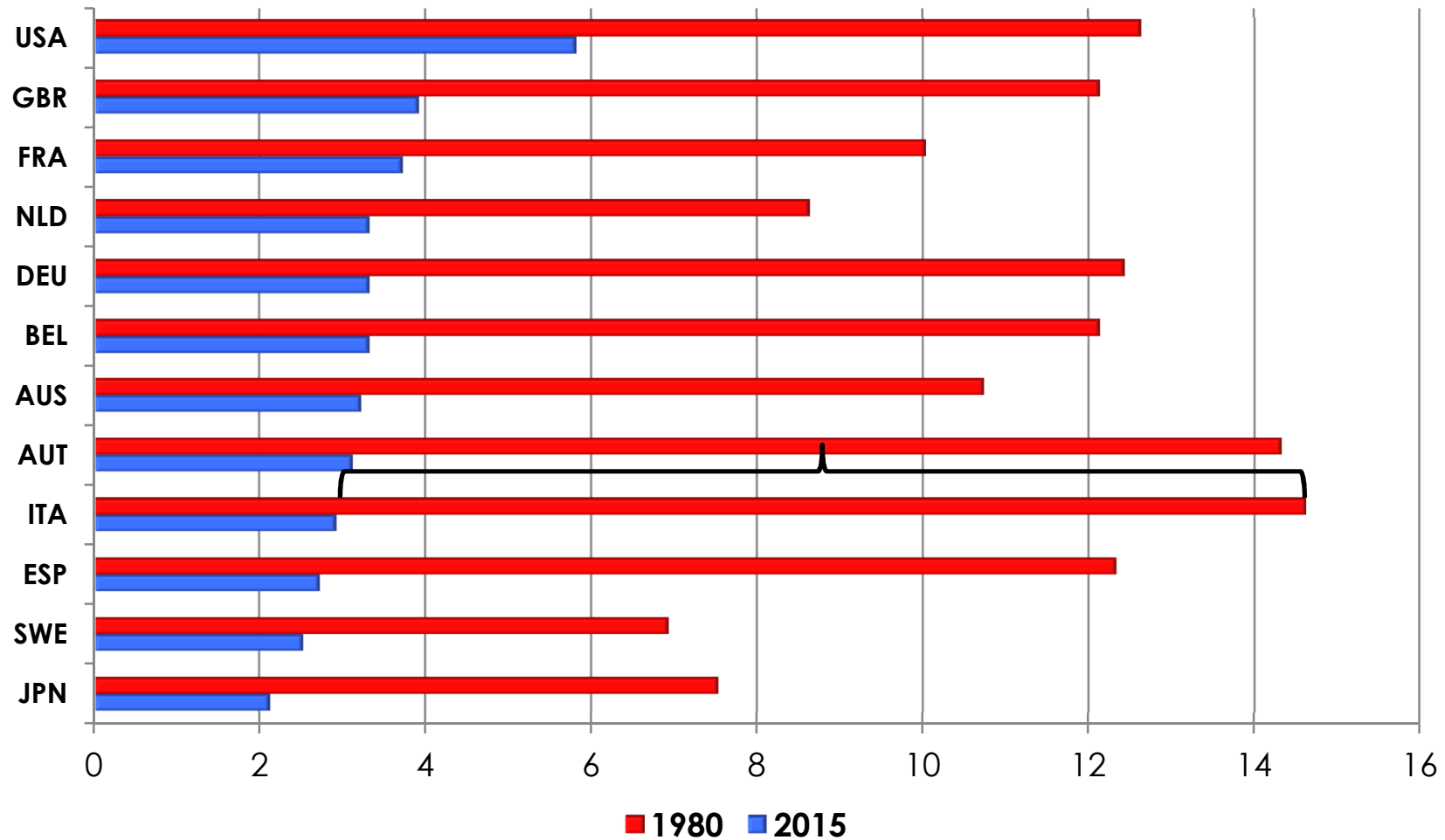
Sources: World Health Organization, United Nations Population Division, World Bank

Note: Health grade (X) = Health score (A) - Health risk penalties (B)

A: Health score metrics: 1. mortality by communicable, non-communicable diseases and injuries; 2. life expectancy at the defining age of birth, childhood, youth and retirement; 3. probability to survive neonatal, into young adulthood and retirement stages; B: Health risk penalties: 1. behavioral/endogenous factors such as high incidences of population with elevated level of blood pressure, blood glucose and cholesterol, prevalence of overweight, tobacco use, alcohol consumption, physical inactivity and childhood malnutrition, as well as mental health and basic vaccination coverage; 2. environmental/exogenous factors such as greenhouse gas emissions per capita and percentage of population with access to improved drinking water.

Most recent data used. Of the more than 200 countries and regions evaluated, 163 had enough data to be included in the final outcome; The top 50 are displayed.

# Child mortality (deaths x 1000)

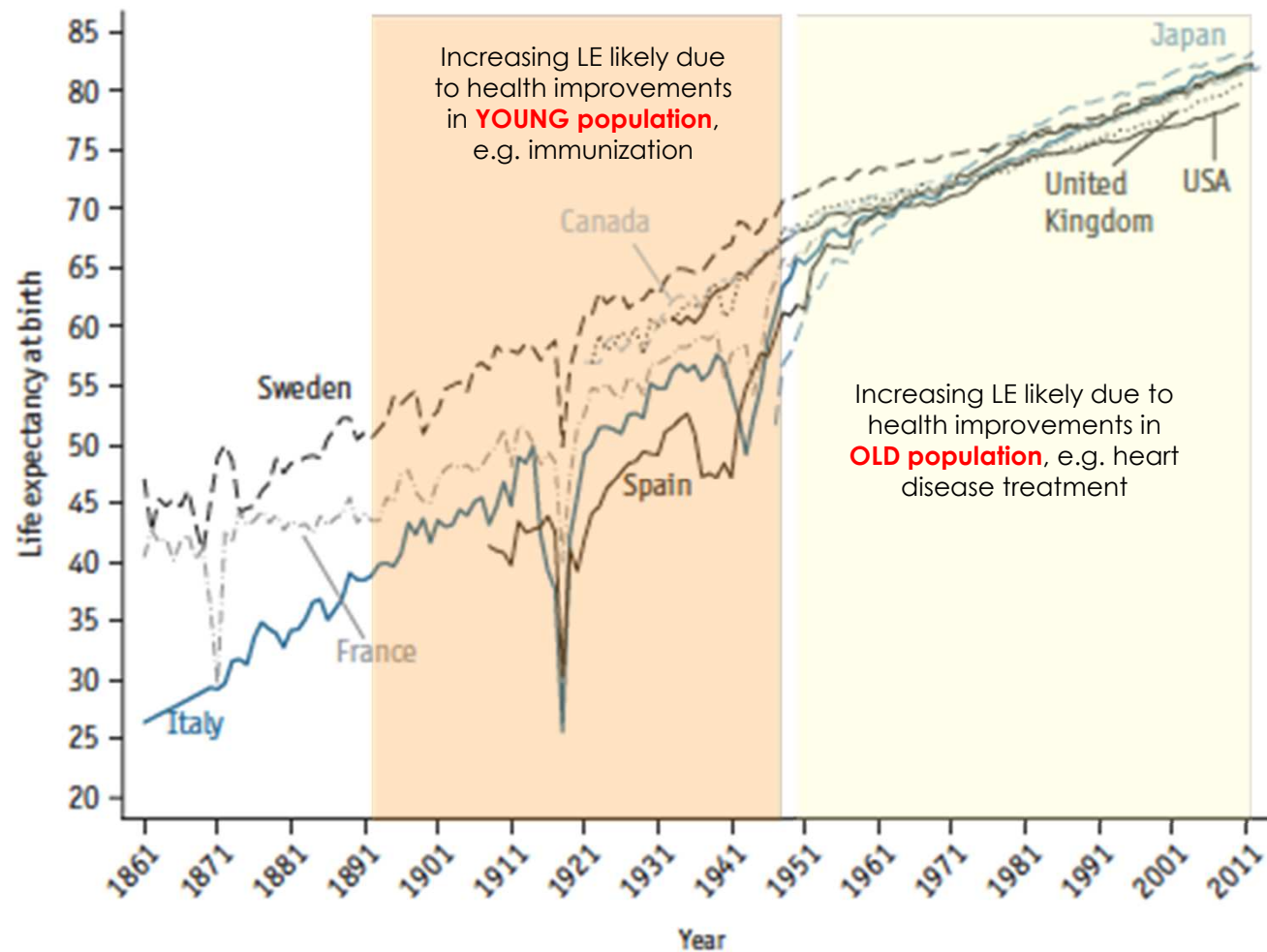




## Where we do come from: the awful initial conditions

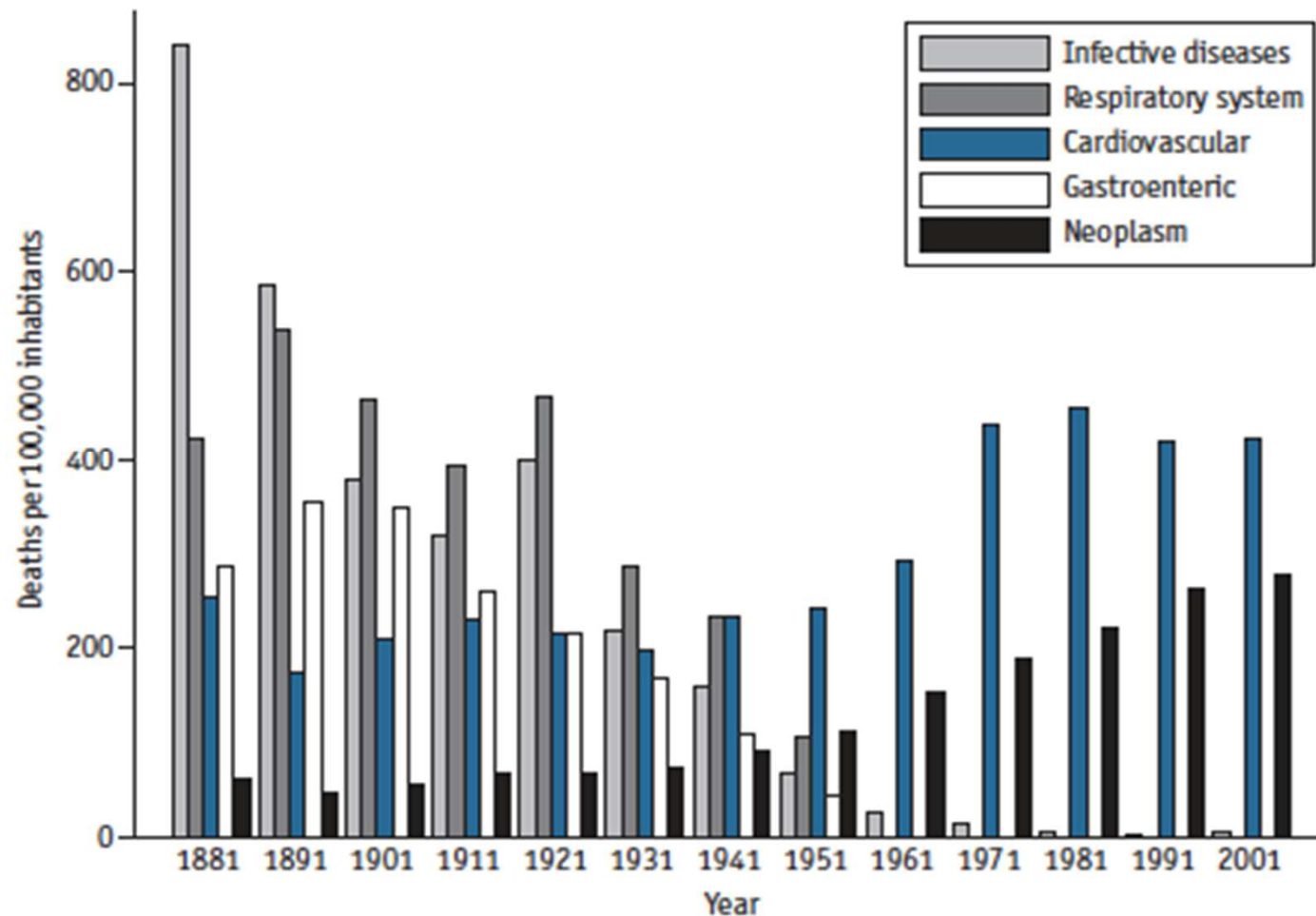
- In 1873, **Carlo Maggiorani**, a Bolognese physician, reported the health conditions of the population to the senate of the Italian kingdom: “**pale looks, morbid flesh, frail machines and weak constitutions**”, the result of the “**heap of ills**” (caterva di mali) that afflicted the Kingdom’s population (Della Peruta 1980, p.200).
- **Charles Dickens** came back dazed from his trip to mid-nineteenth-century Italy, charmed by the magnificence of its artistic heritage, but **deeply disturbed and disgusted** by the living conditions of the mass of the population (Dickens 1846).
- Italy was, in short, **hardly an enviable place to live in**, as noted by witnesses of the times.

# Life expectancy at birth in Italy: a comparison with the rest of the world



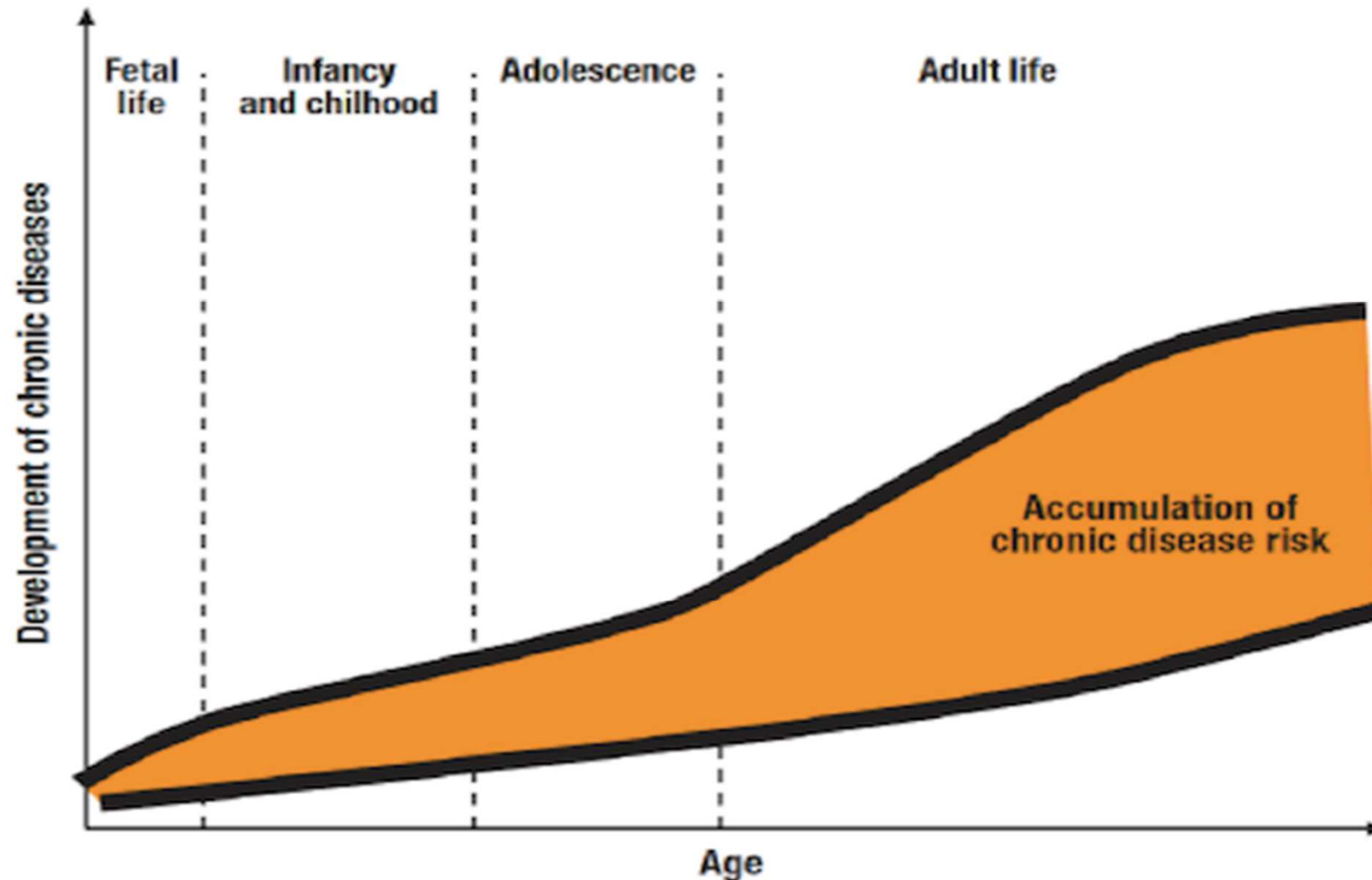
Source: Atella, Francisci e Vecchi (2017) "Health", in G. Vecchi, "Measuring Wellbeing. A History of Italian Living Standards", ch. 2, pp. 43-87. New York: Oxford University Press.

# The epidemiologic transition in Italy



Source: Atella, Francisci e Vecchi (2017) "Health", in G. Vecchi, "Measuring Wellbeing. A History of Italian Living Standards", ch. 2, pp. 43-87. New York: Oxford University Press.

Ageing and accumulation of molecular damage begins in utero and not when we turn 65



# The economist approach

*American Economic Review* 2009, 99:3, 1006–1026

THE  
ECONOMIC  
JOURNAL



*The Economic Journal*, 125 (November), F372–F393. Doi: 10.1111/eoj.12281 © 2015 Royal Economic Society. Published by John Wiley & Sons, 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA.

## INDIVIDUAL BEHAVIOUR AS A PATHWAY BETWEEN EARLY-LIFE SHOCKS AND ADULT HEALTH: EVIDENCE FROM HUNGER EPISODES IN POST-WAR GERMANY\*

*Iris Kesternich, Bettina Siflinger, James P. Smith and Joachim K. Winter*

We investigate long-run effects of hunger episodes experienced during childhood on health status and behavioural outcomes in later life. We combine self-reported data on hunger experiences from SHARELIFE with administrative data on food supply (caloric rations) in post-war Germany. The data suggest that individual behaviour is a pathway between early life-shocks and adult health. We find that lower-income adults who experienced hunger spend a larger fraction of income on food. Taken together, our results confirm that in addition to the well-documented biological channel from early life circumstances to adult health, there are also behavioural pathways.

# Available causal evidence

- ▣ Education and social context (mother education)
- ▣ Socio-economic status (SES)
- ▣ Genetics (mother QI)
- ▣ Adverse events, in particular if long lasting and severe
- ▣ Nutrition (breast-feeding, quality of food, calorie intake, etc.)
- ▣ Environmental exposures to dangerous elements (i.e., lead, alcohol, smoke, particulate matter (pm10, pm2.5), etc.)
- ▣ Use and quality of services, in particular health care and social services

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# Causes of chronic conditions

## UNDERLYING FACTORS

SEEs    Urbanization    Pollution    Ageing



## MODIFIABLE RISK FACTORS – LIFE STYLES

Diet    Physical activity    Obesity    Tobacco    Alcohol    Drugs



## CHRONIC DISEASES

CVDs    Cancer    Diabetes    Respiratory

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# A LOOK TO THE FUTURE

Are we going in the right  
direction?

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# Causes of chronic conditions

## UNDERLYING FACTORS

**SEs**

Urbanization

Pollution

Ageing



## MODIFIABLE RISK FACTORS – LIFE STYLES

Diet

Physical  
activity

Obesity

Tobacco

Alcohol

Drugs



## CHRONIC DISEASES

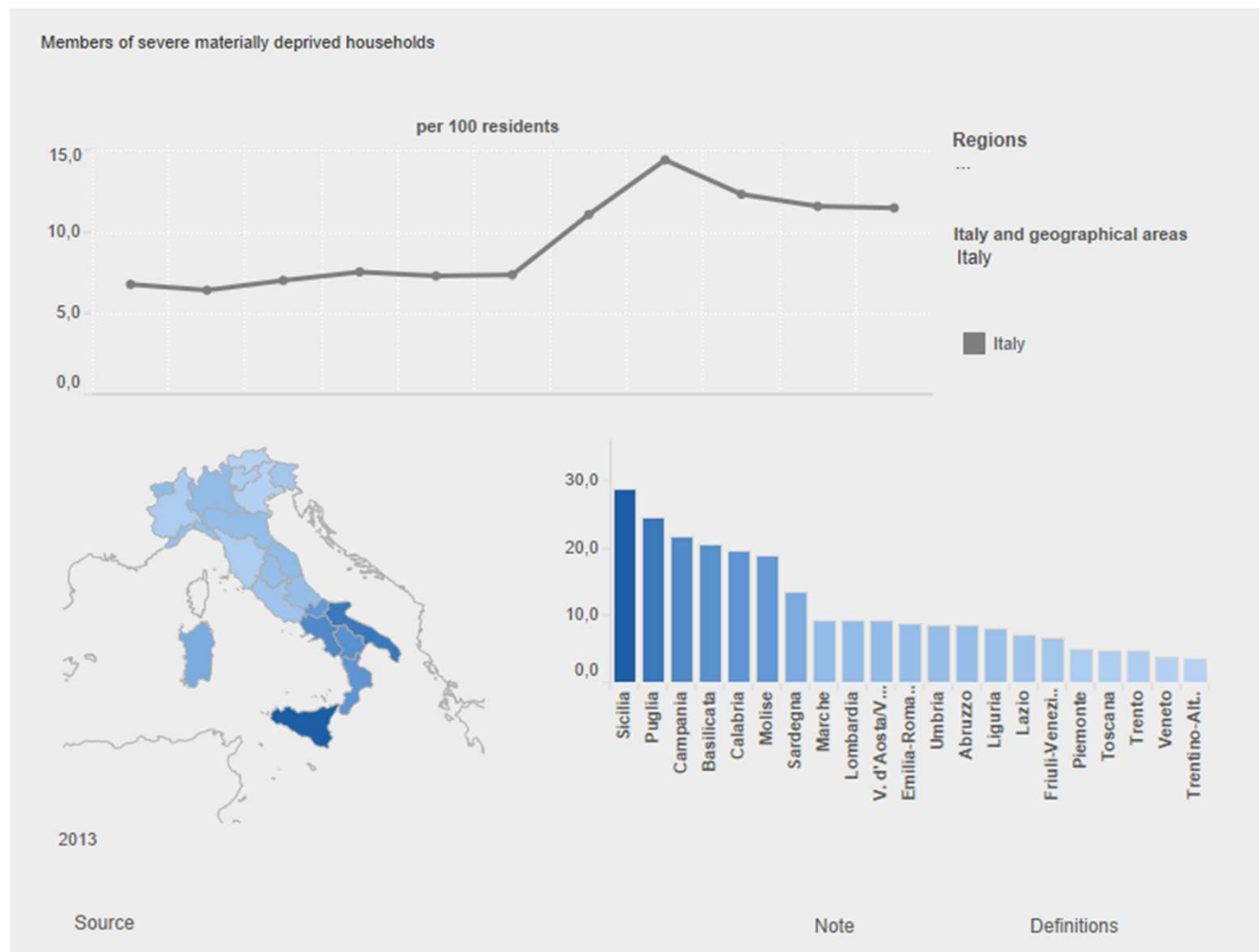
CVDs

Cancer

Diabetes

Respiratory

# Socio-Economic Status



# Causes of chronic conditions

## UNDERLYING FACTORS

SEEs    Urbanization    **Pollution**    Ageing



## MODIFIABLE RISK FACTORS – LIFE STYLES

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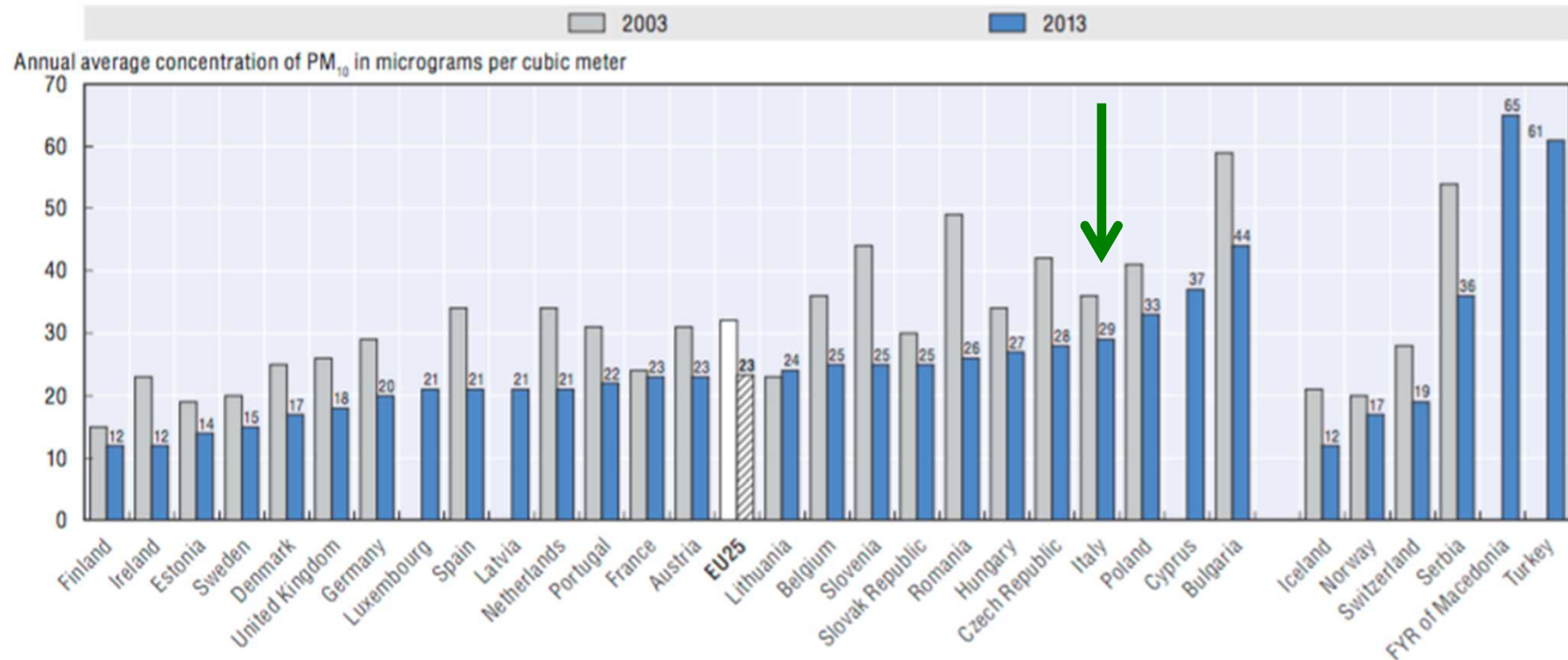


## CHRONIC DISEASES

CVDs    Cancer    Diabetes    Respiratory

# Pollution

## 4.30. Urban population exposure to air pollution by particulate matter (PM<sub>10</sub>), 2003 and 2013 (or nearest years)

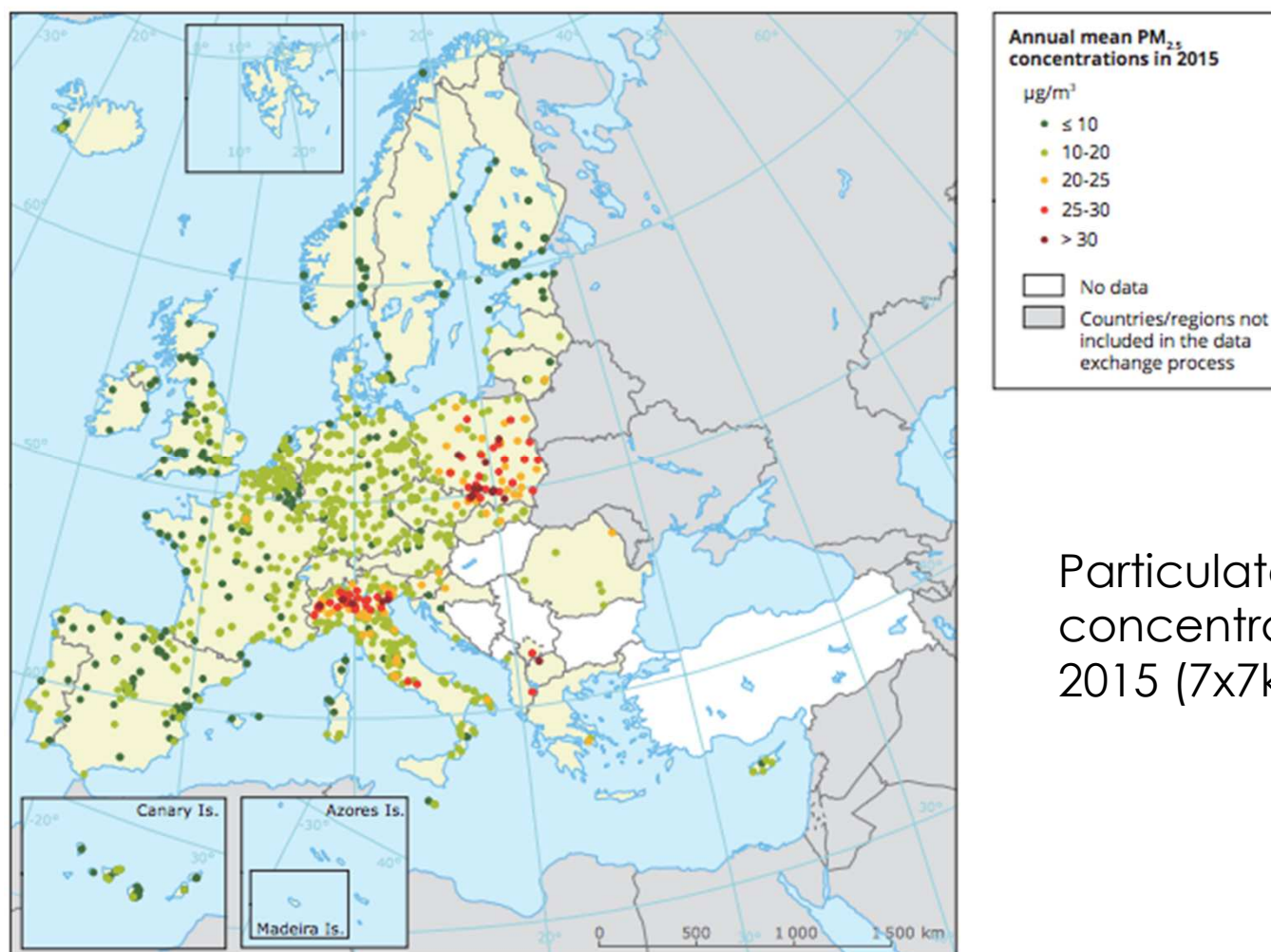


Source: European Environment Agency (2015), Air Quality in Europe – 2015 Report.

StatLink  <http://dx.doi.org/10.1787/888933429213>

# POLLUTION CONCENTRATION LEVELS IN EUROPE

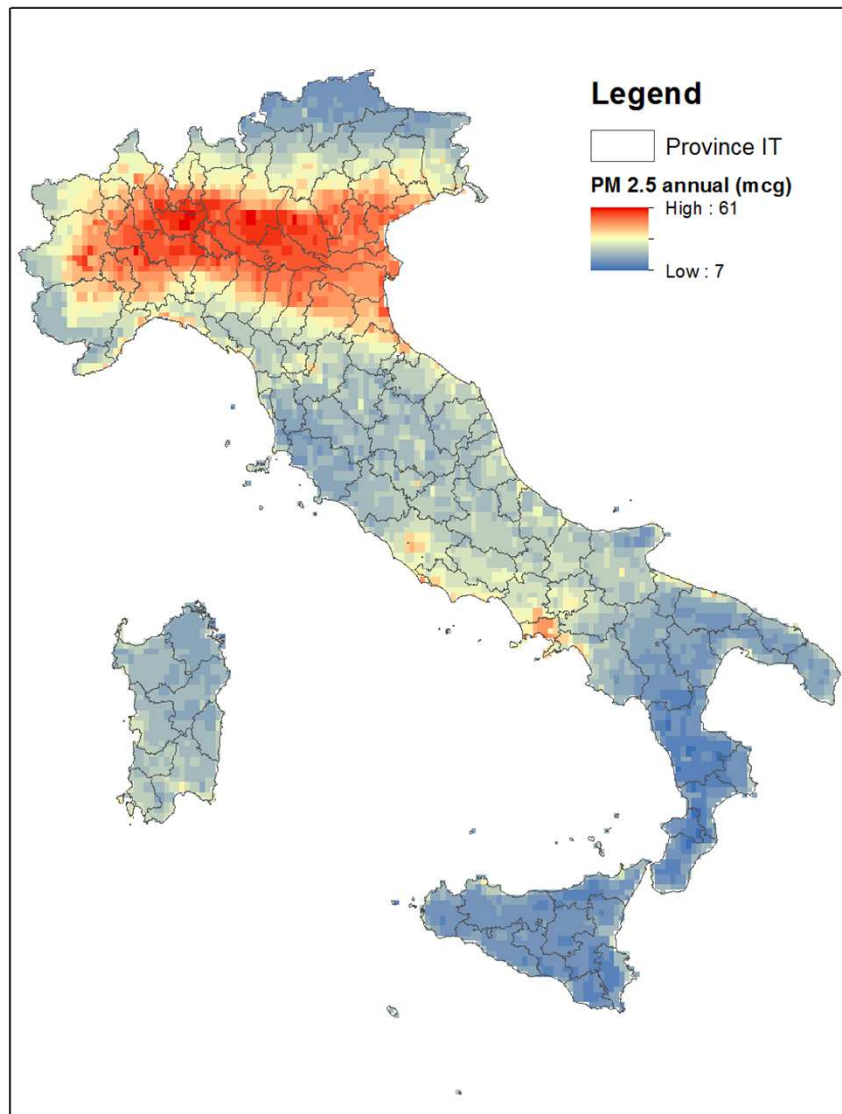
Map 4.3 Concentrations of PM<sub>2.5</sub>, 2015



Particulate matter (PM) 2.5 concentration in Europe in 2015 (7x7km grid).



# POLLUTION CONCENTRATION LEVELS IN ITALY



Particulate matter (PM) 2.5 concentration in Italy in 2015 (7x7km grid).

# Causes of chronic conditions

## UNDERLYING FACTORS

SESs    Urbanization    Pollution    **Ageing**



## MODIFIABLE RISK FACTORS – LIFE STYLES

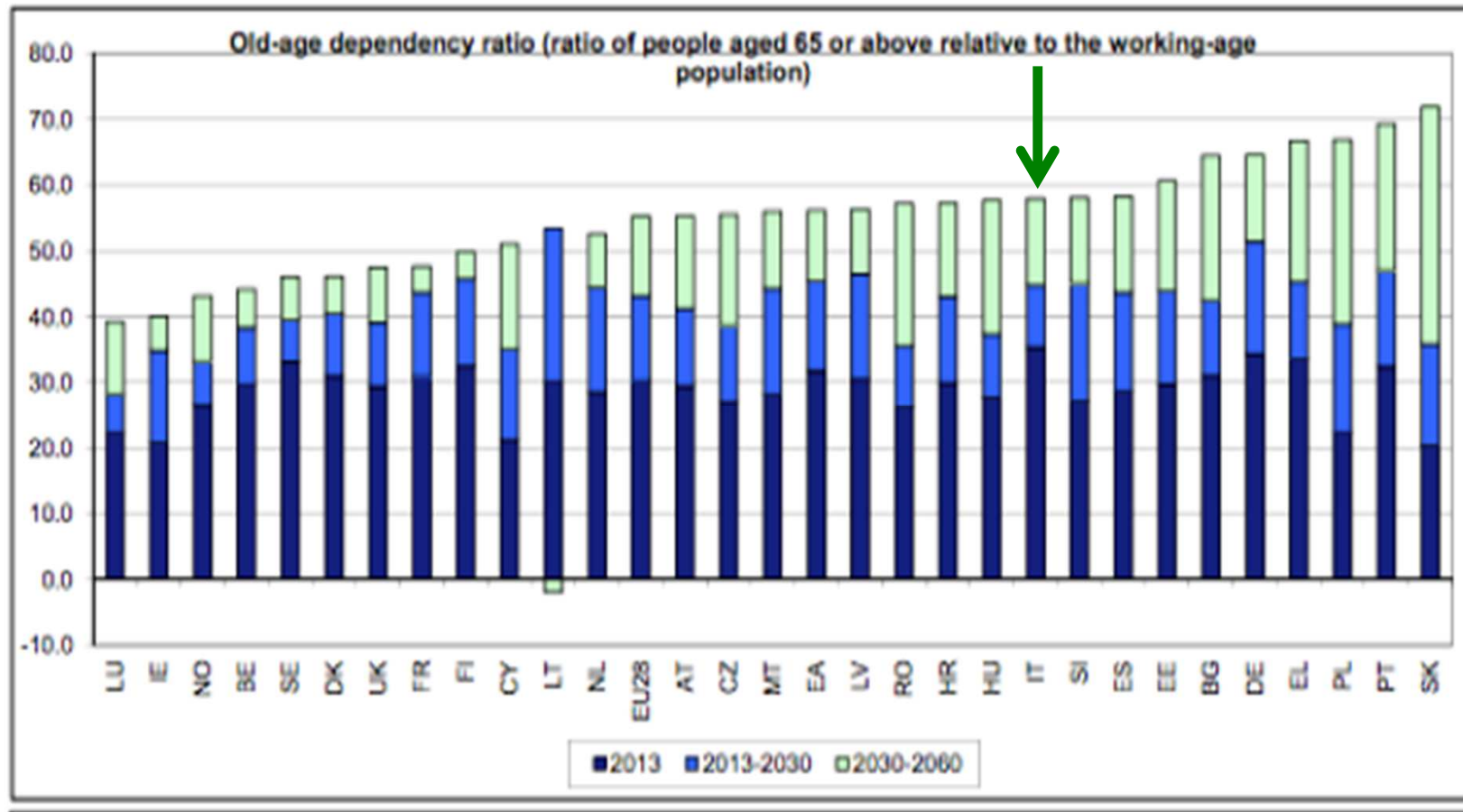
Diet    Physical activity    Obesity    Tobacco    Alcohol    Drugs



## CHRONIC DISEASES

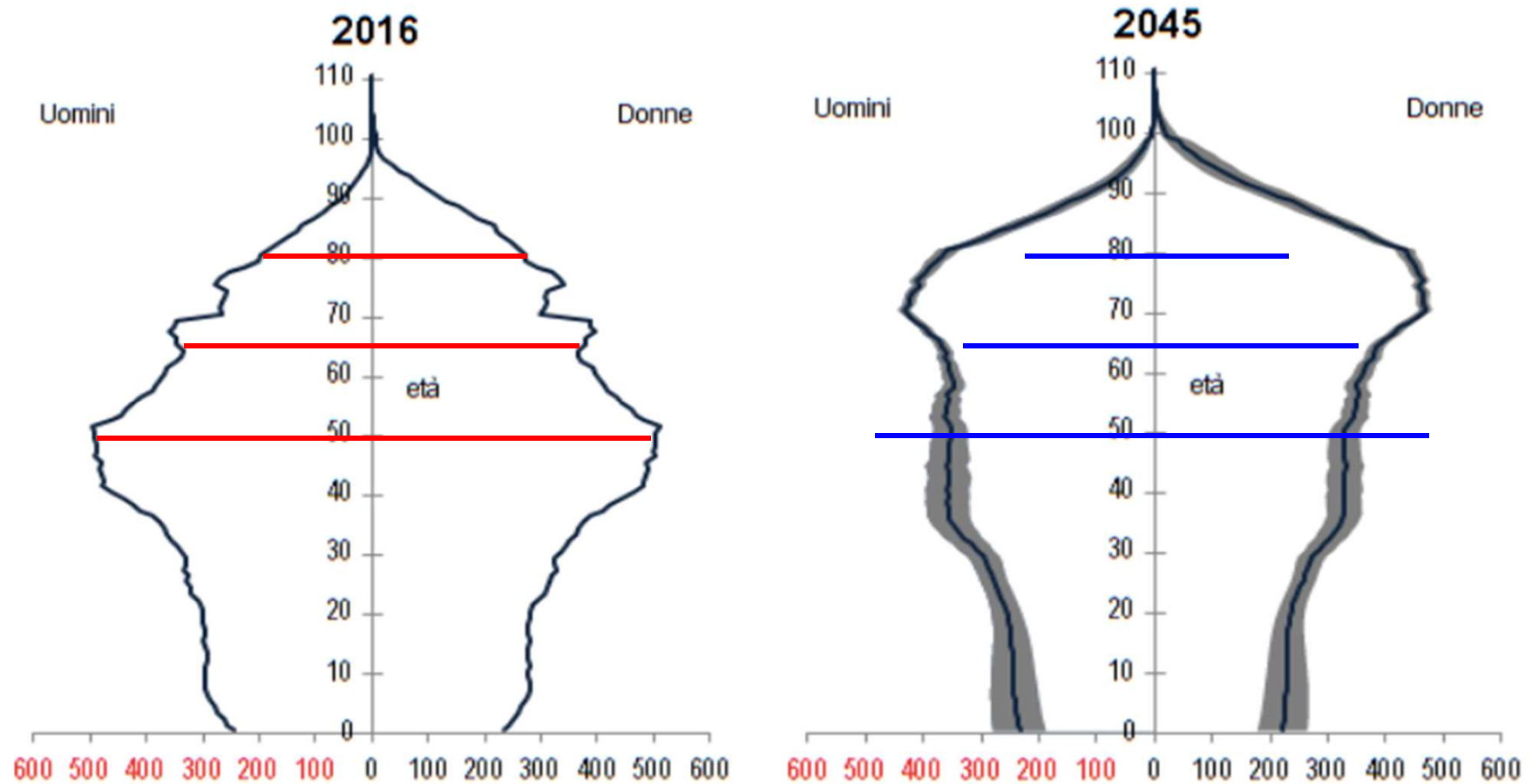
CVDs    Cancer    Diabetes    Respiratory

# The ageing process



Source: EC (2016). "The 2015 Ageing Report. Economic and budgetary projections for the 28 EU Member States (2013-2060)", Directorate-General for Economic and Financial Affairs.

# The ageing process



Source: ISTAT (2017). "IL FUTURO DEMOGRAFICO DEL PAESE. Previsioni regionali della popolazione residente al 2065." Statistiche Report. 26 Aprile 2017. <https://www.istat.it/it/files/2017/04/previsioni-demografiche.pdf>.

# Causes of chronic conditions

## UNDERLYING FACTORS

SEs Urbanization Pollution Ageing



## MODIFIABLE RISK FACTORS – LIFE STYLES

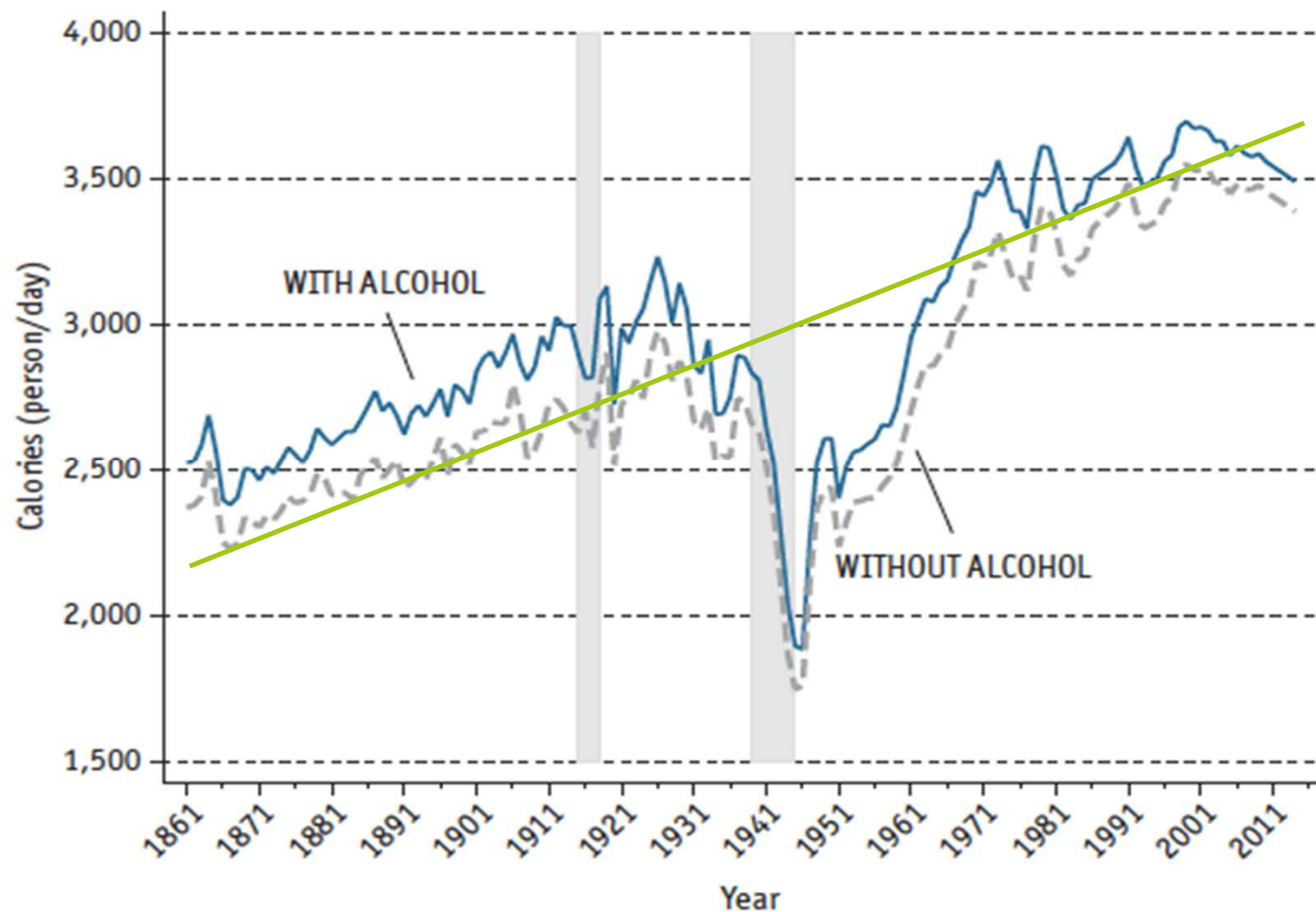
**Diet** Physical activity Obesity Tobacco Alcohol Drugs



## CHRONIC DISEASES

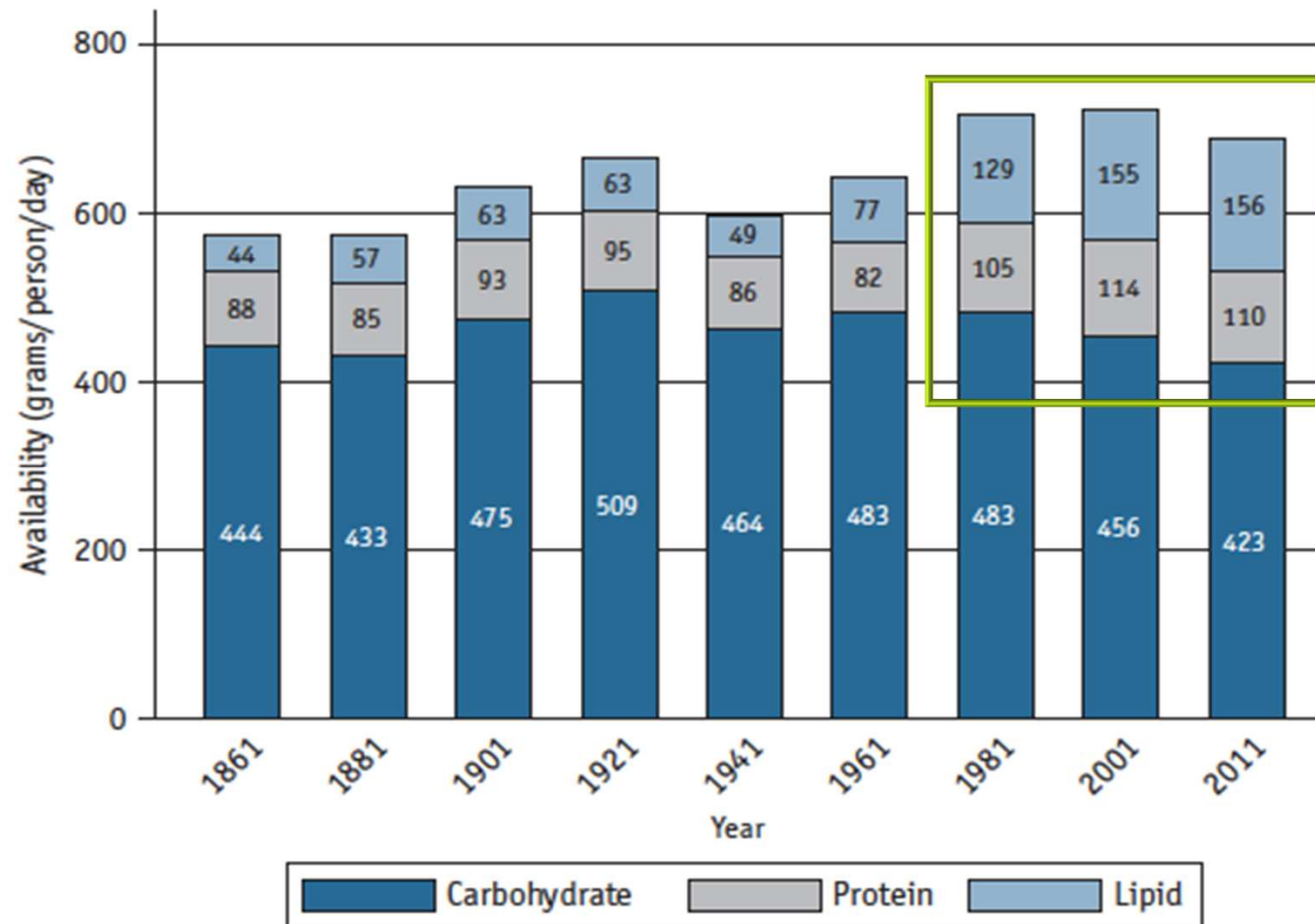
CVDs Cancer Diabetes Respiratory

# Trend in per capita daily calorie availability



Source: Sorrentino e Vecchi (2017), "Height", in G. Vecchi, "Measuring Wellbeing. A History of Italian Living Standards", ch. 2, pp. 43-87. New York: Oxford University Press.

# Nutrient composition over time

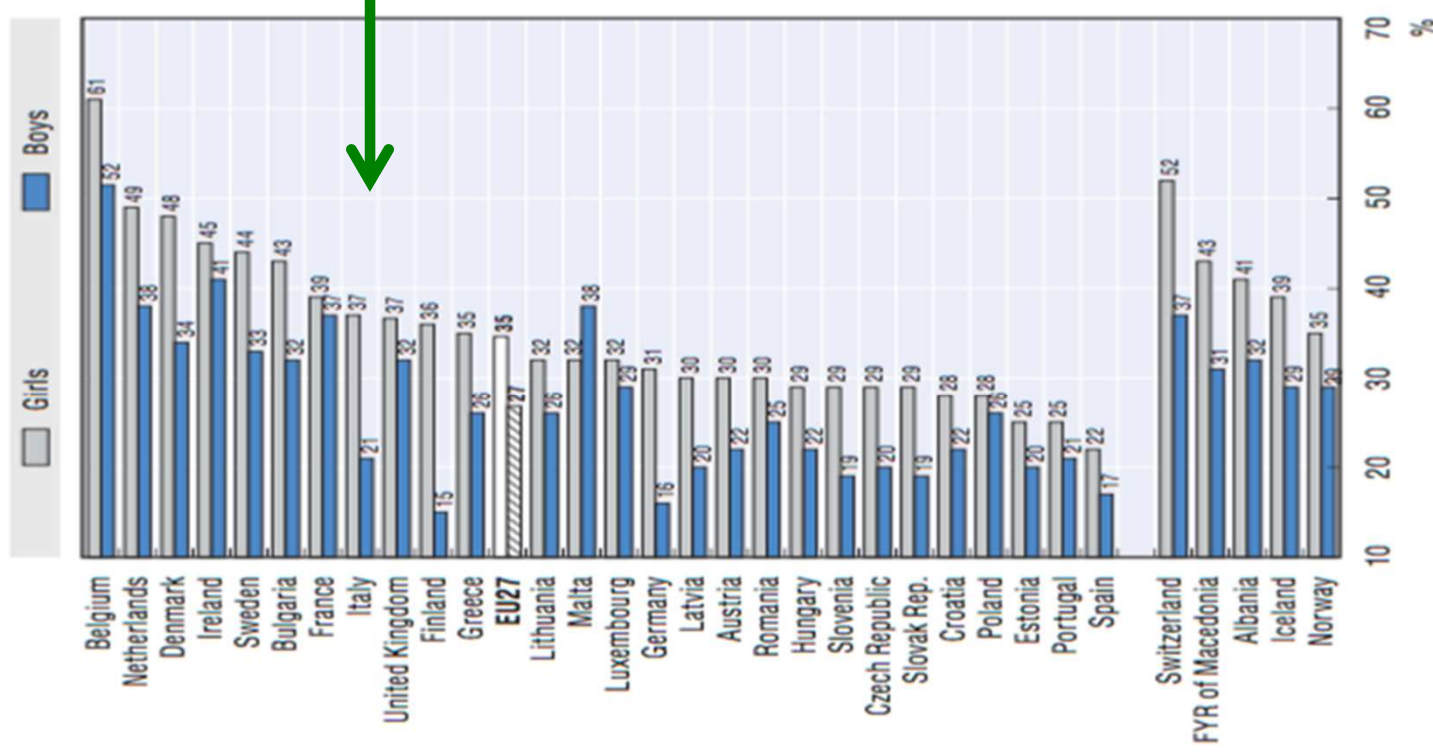


Source: Sorrentino e Vecchi (2017), "Height", in G. Vecchi, "Measuring Wellbeing. A History of Italian Living Standards", ch. 2, pp. 43-87. New York: Oxford University Press.



# Vegetable eating

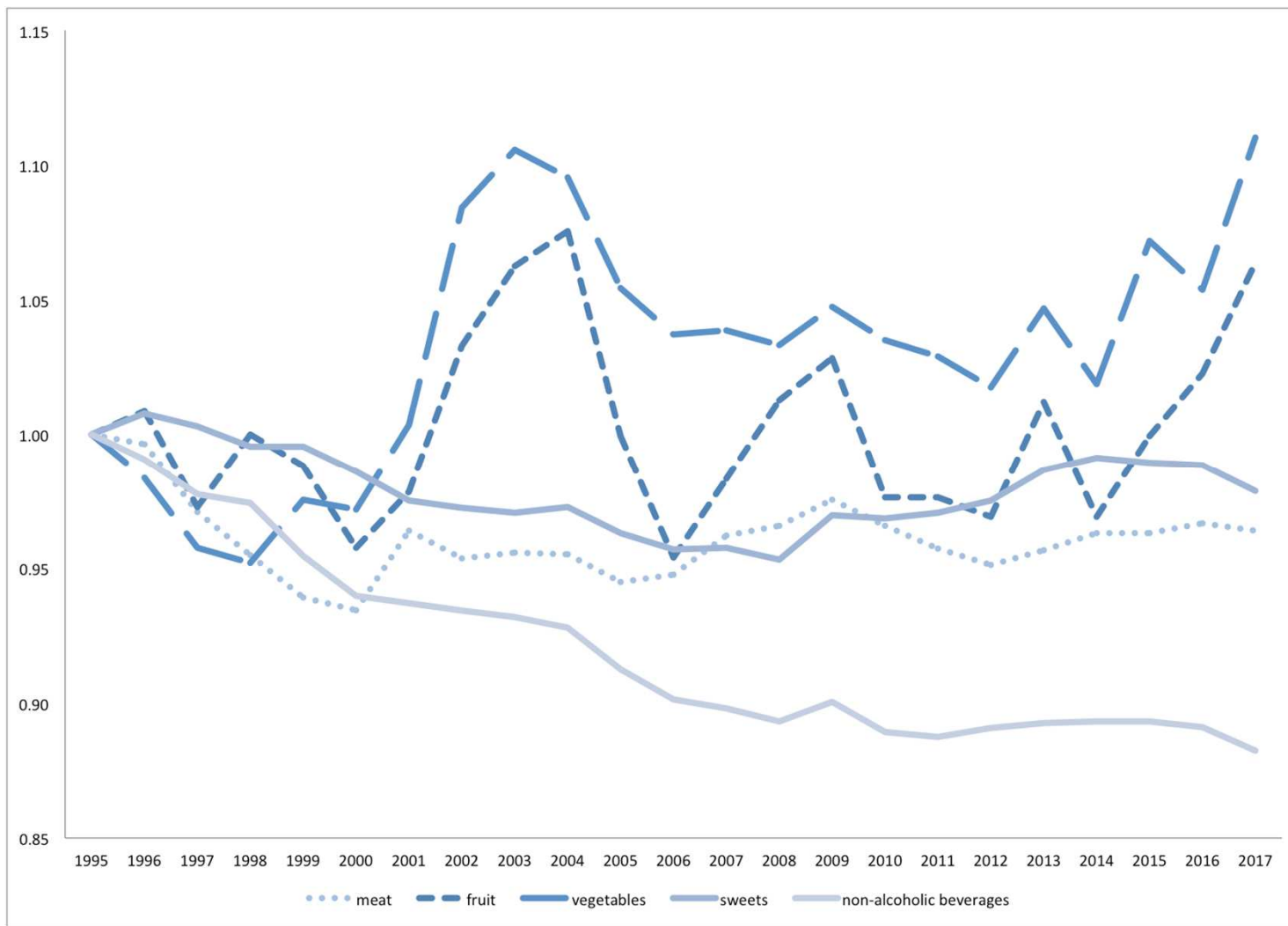
4.17. Daily vegetable eating among 15-year-olds, 2013-14



Source: Inchley et al. (2016).

StatLink  <http://dx.doi.org/10.1787/888933429087>

# Trends in food price



# Causes of chronic conditions

## UNDERLYING FACTORS

SEEs    Urbanization    Pollution    Ageing



## MODIFIABLE RISK FACTORS – LIFE STYLES

Diet    **Physical activity**    Obesity    Tobacco    Alcohol    Drugs

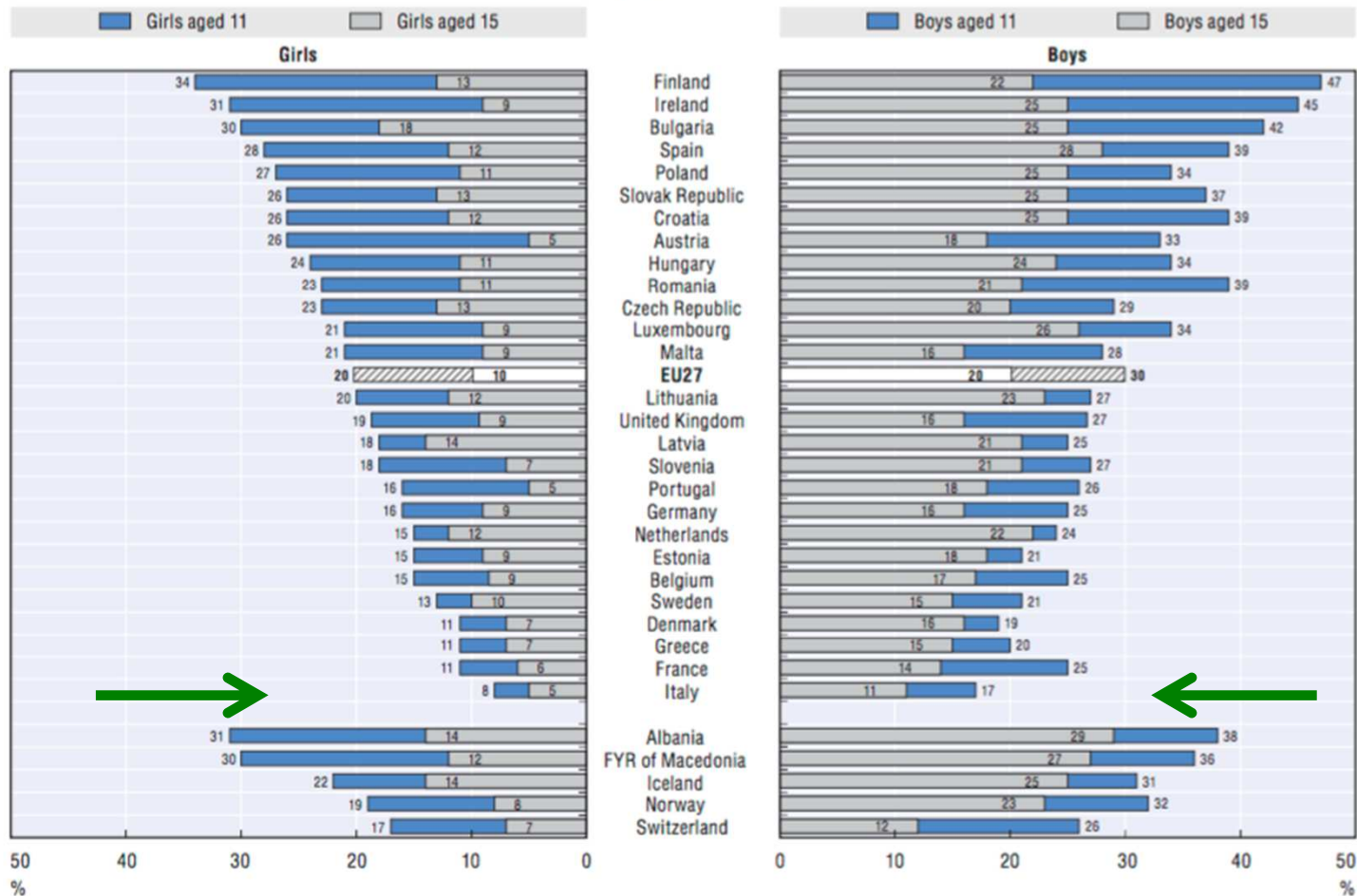


## CHRONIC DISEASES

CVDs    Cancer    Diabetes    Respiratory

# Physical activity

4.22. Daily moderate-to-vigorous physical activity, 11- and 15-year-olds, 2013-14



Source: Inchley et al. (2016).

StatLink <http://dx.doi.org/10.1787/888933429132>

# Causes of chronic conditions

## UNDERLYING FACTORS

SEEs    Urbanization    Pollution    Ageing



## MODIFIABLE RISK FACTORS – LIFE STYLES

Diet    Physical activity    **Obesity**    Tobacco    Alcohol    Drugs

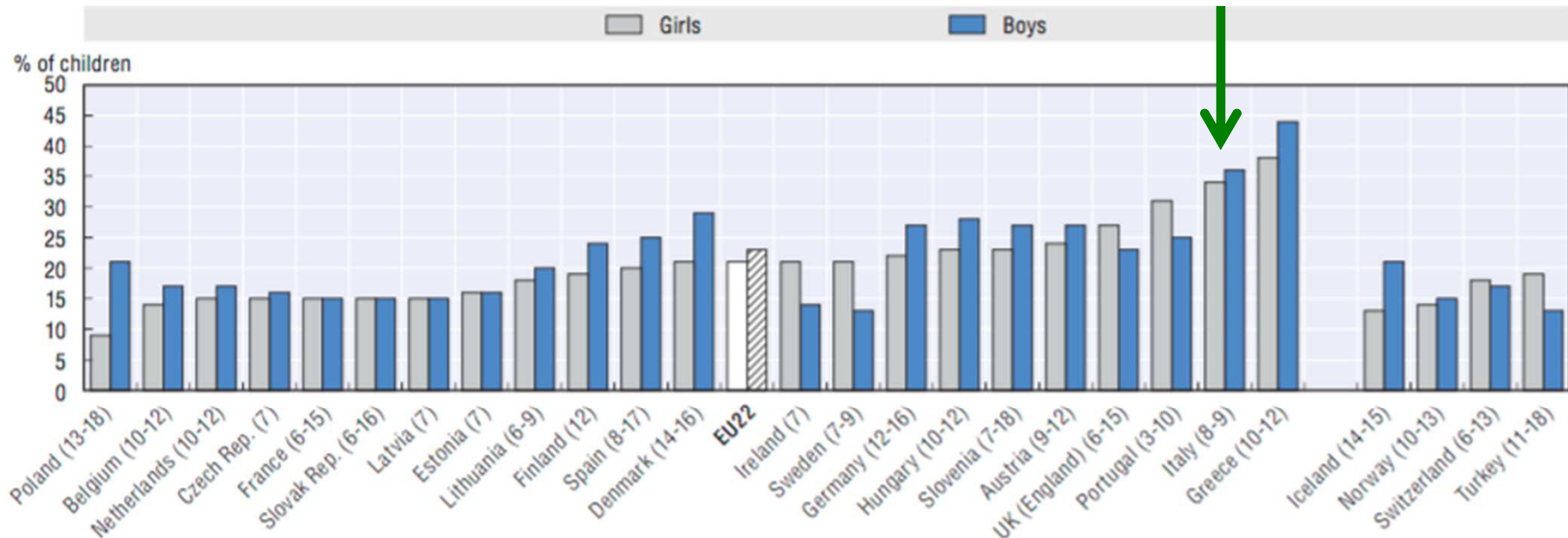


## CHRONIC DISEASES

CVDs    Cancer    Diabetes    Respiratory

# Overweight and obesity

4.10. Measured overweight (including obesity) among children at various ages, 2010 (or latest year)



Note: The numbers in parentheses refer to the age of the children surveyed in each country.

Source: International Association for the Study of Obesity, 2013; World Obesity Forum, 2016.

**For GIRLS:**

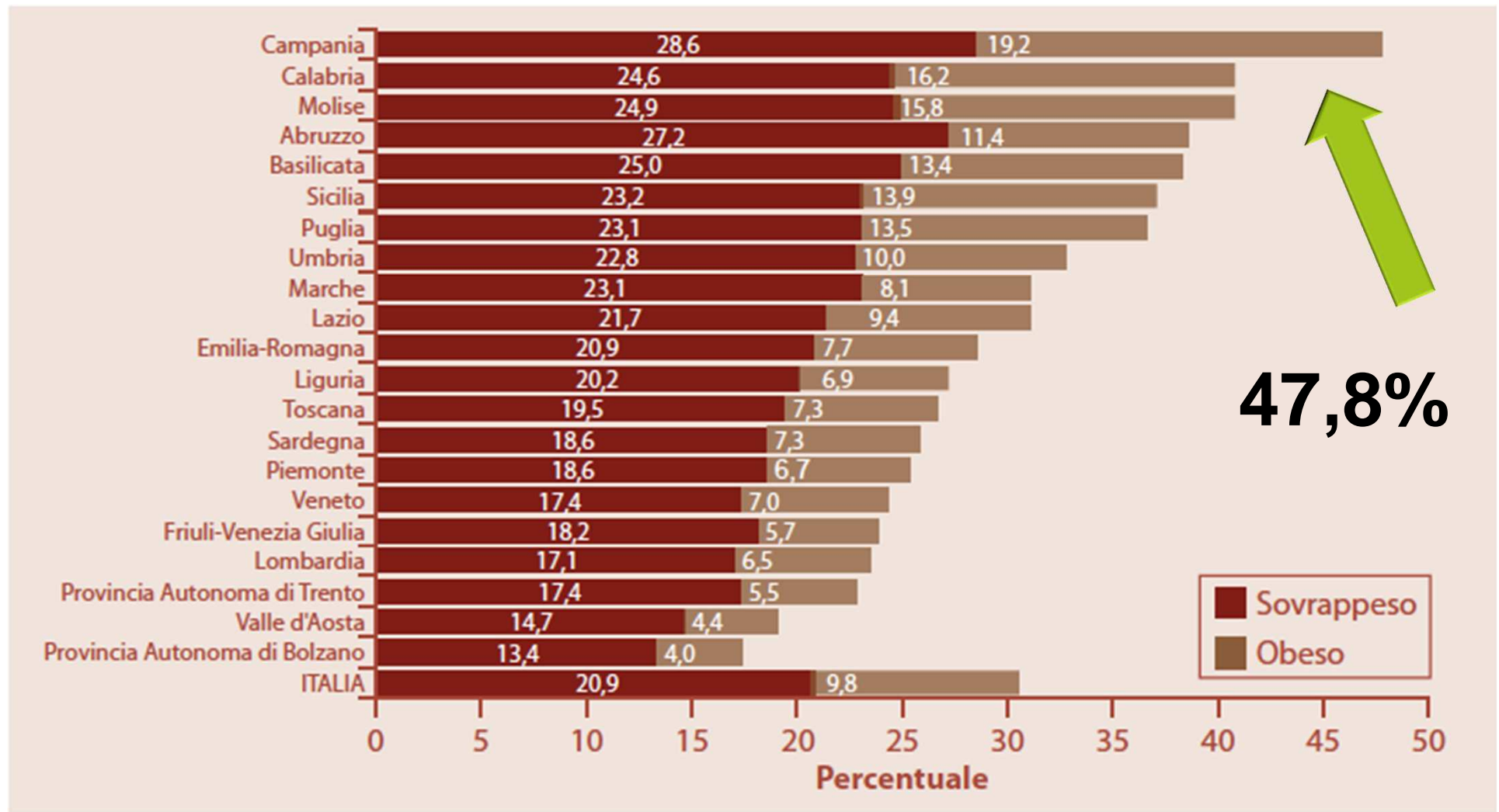
**Italy** = 34%  
**England** = 26%  
**Germany** = 22%  
**France** = 15%

**For BOYS:**

**Italy** = 36%  
**England** = 22%  
**Germany** = 26%  
**France** = 15%

StatLink <http://dx.doi.org/10.1787/888933429010>

## Overweight and obesity (%) in children 8-9 years by region. Italy, 2014



Source: OKkio alla SALUTE: Risultati 2014



# Why worry about child and adolescent obesity?

- The **comorbidities of obesity** in childhood and adolescence include abnormalities in the endocrine, cardiovascular, gastrointestinal, pulmonary, orthopedic, neurologic, dermatologic, and psychosocial systems, as well as functional limitations.
- Certain comorbidities, such as type 2 diabetes mellitus and steato-hepatitis, **that used to be considered "adult diseases" are now regularly seen in obese children.**
- Moreover, obesity during adolescence **increases the risk for disease and premature death during adulthood, independent of obesity during adulthood.**
- As an example, in a longitudinal study,
  - **Females** who had been overweight during childhood had an increased risk of **death from breast cancer** and from all causes in adulthood.
  - **Males** who had been overweight during childhood had an increased risk of **death from ischemic heart disease.**

# Causes of chronic conditions

## UNDERLYING FACTORS

SEs Urbanization Pollution Ageing



## MODIFIABLE RISK FACTORS – LIFE STYLES

Diet Physical activity Obesity **Tobacco** Alcohol Drugs



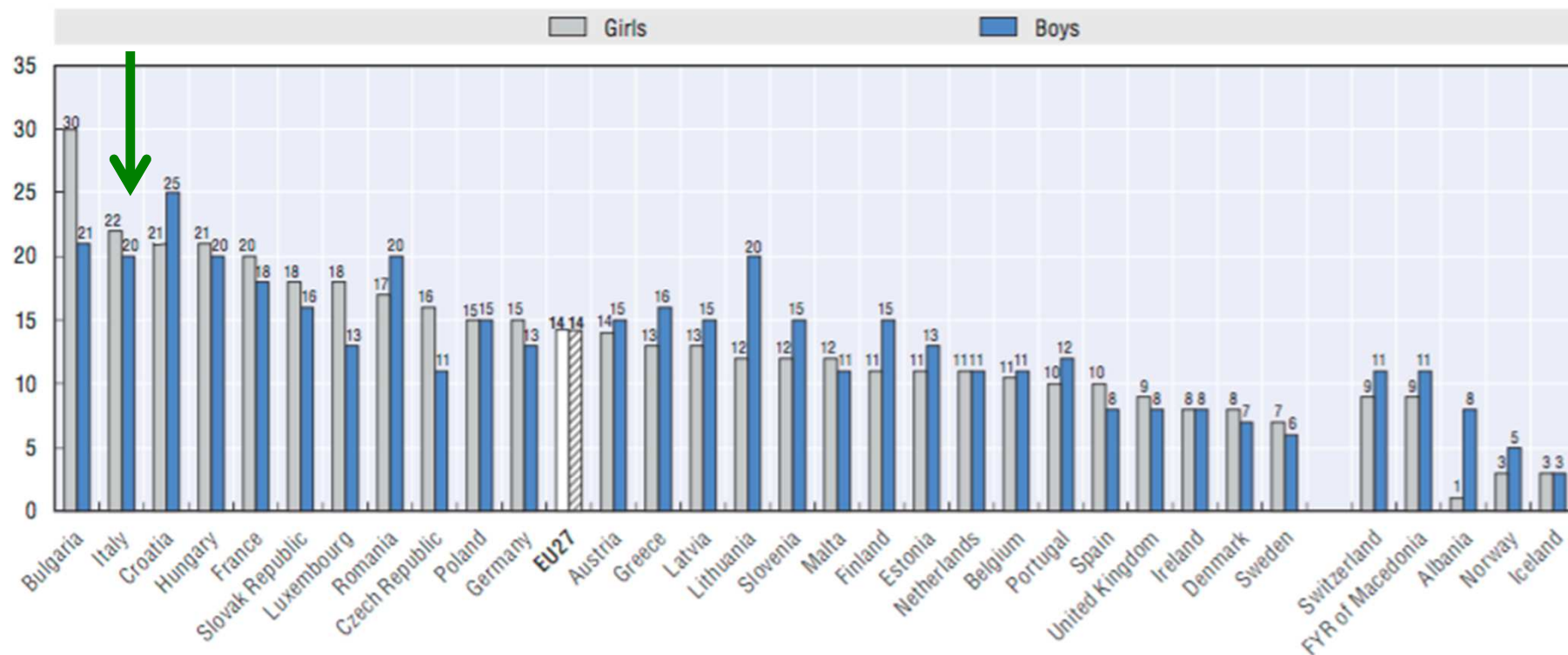
## CHRONIC DISEASES

CVDs Cancer Diabetes Respiratory


# Smoking

## 4.1. Smoking among 15-year-olds, 2013-14

Smoking at least once a week



Source: Inchley et al. (2016).

StatLink  <http://dx.doi.org/10.1787/888933428929>

# Causes of chronic conditions

## UNDERLYING FACTORS

SEEs    Urbanization    Pollution    Ageing



## MODIFIABLE RISK FACTORS – LIFE STYLES

Diet    Physical activity    Obesity    Tobacco    **Alcohol**    Drugs



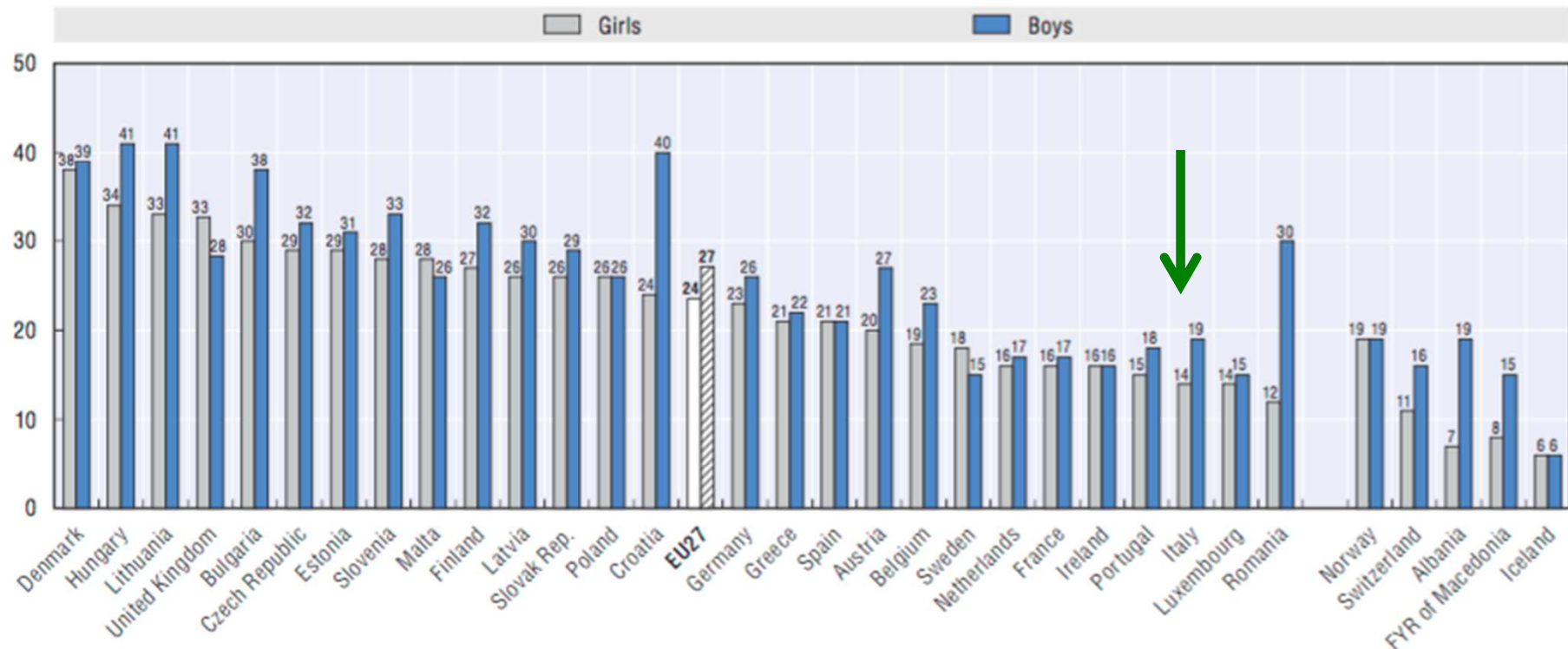
## CHRONIC DISEASES

CVDs    Cancer    Diabetes    Respiratory


# Drunkenness

## 4.6. Drunkenness among 15-year-olds, 2013-14

Drunk at least twice in life



Source: Inchley et al. (2016).

StatLink  <http://dx.doi.org/10.1787/888933428978>

# Causes of chronic conditions

## UNDERLYING FACTORS

SESS    Urbanization    Pollution    Ageing



## MODIFIABLE RISK FACTORS – LIFE STYLES

Diet    Physical activity    Obesity    Tobacco    Alcohol    **Drugs**

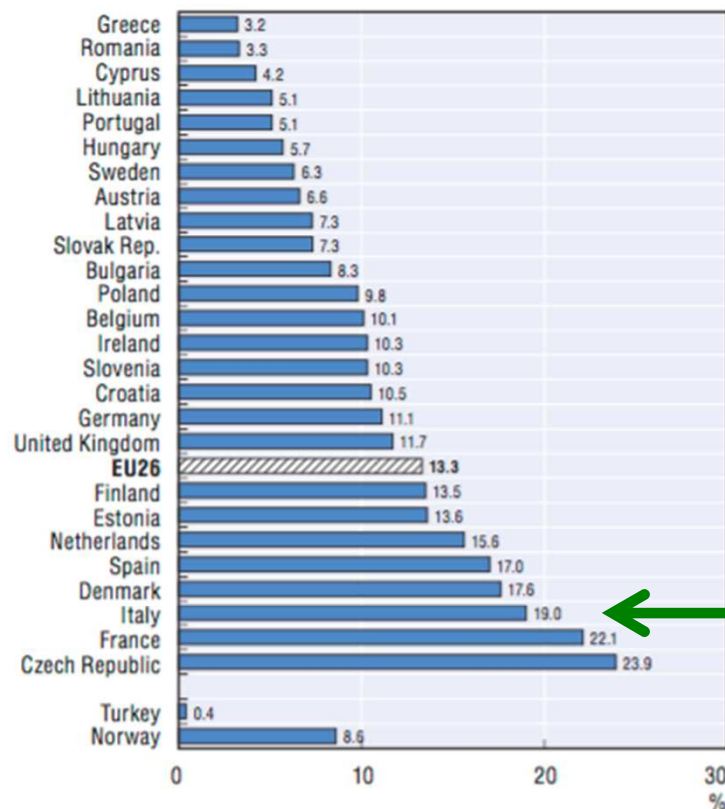


## CHRONIC DISEASES

Heart Disease    Stroke    Cancer    Diabetes    Respiratory

# Cannabis and cocaine

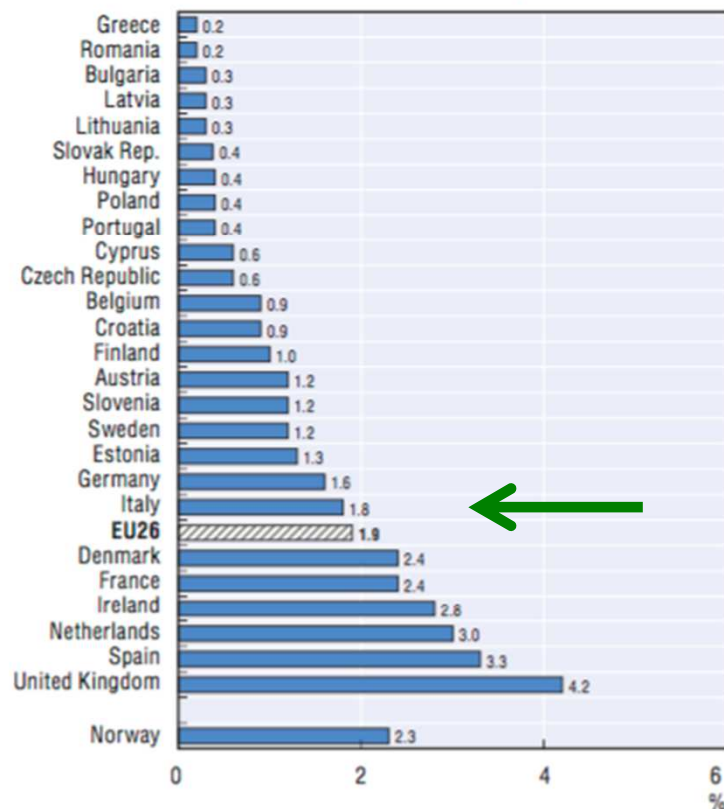
**4.26. Cannabis use over the last 12 months among people aged 15 to 34, 2014 (or nearest year)**



Source: EMCDDA (2016), European Drug Report 2016: Trends and Developments.

StatLink <http://dx.doi.org/10.1787/888933429174>

**4.27. Cocaine use over the last 12 months among people aged 15 to 34, 2014 (or nearest year)**



Source: EMCDDA (2016), European Drug Report 2016: Trends and Developments.

StatLink <http://dx.doi.org/10.1787/888933429180>

# Causes of chronic conditions

## UNDERLYING FACTORS

SESS    Urbanization    Pollution    Ageing



## MODIFIABLE RISK FACTORS – LIFE STYLES

Diet    Physical activity    Obesity    Tobacco    Alcohol    Drugs

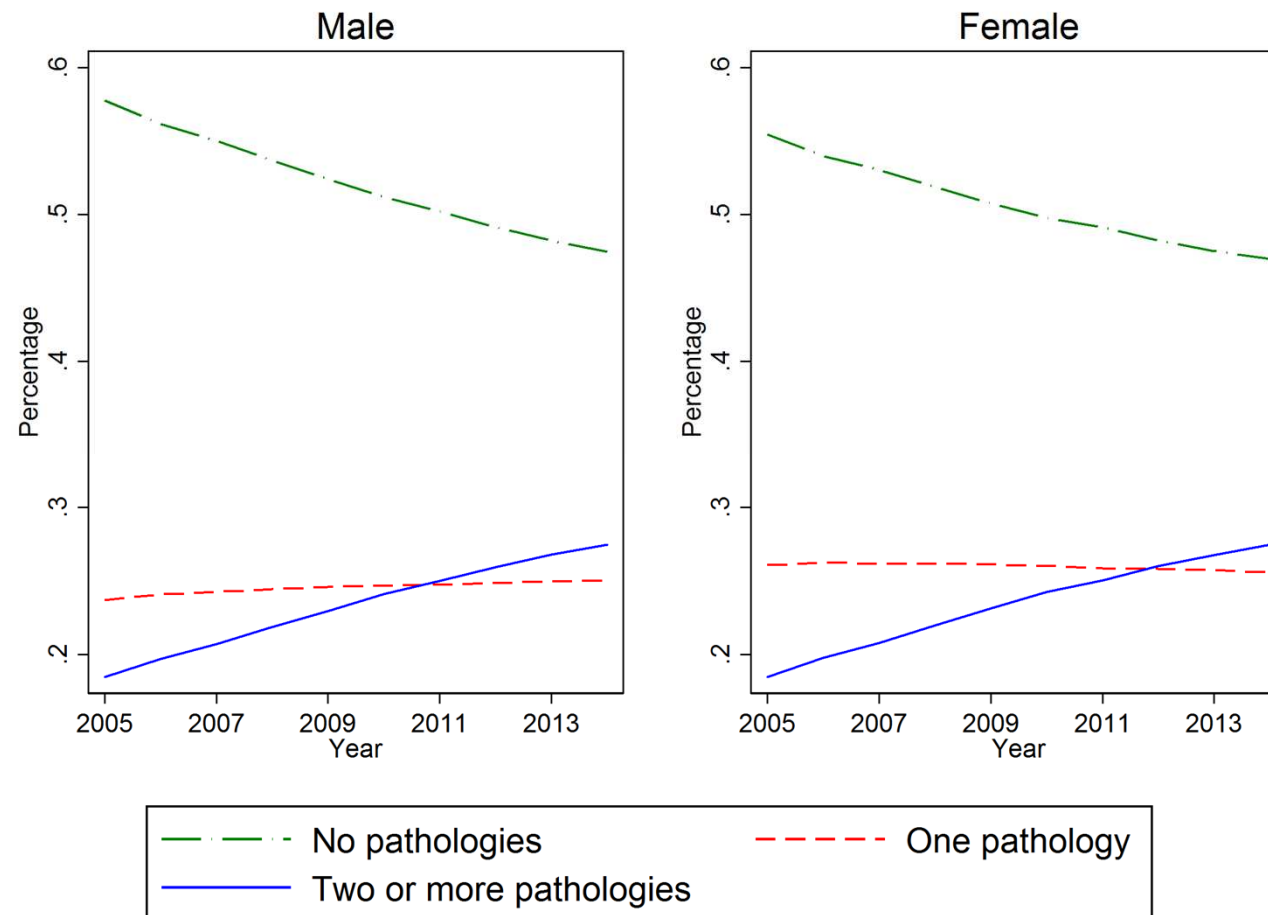


## CHRONIC DISEASES

Heart Disease    Stroke    Cancer    Diabetes    Respiratory

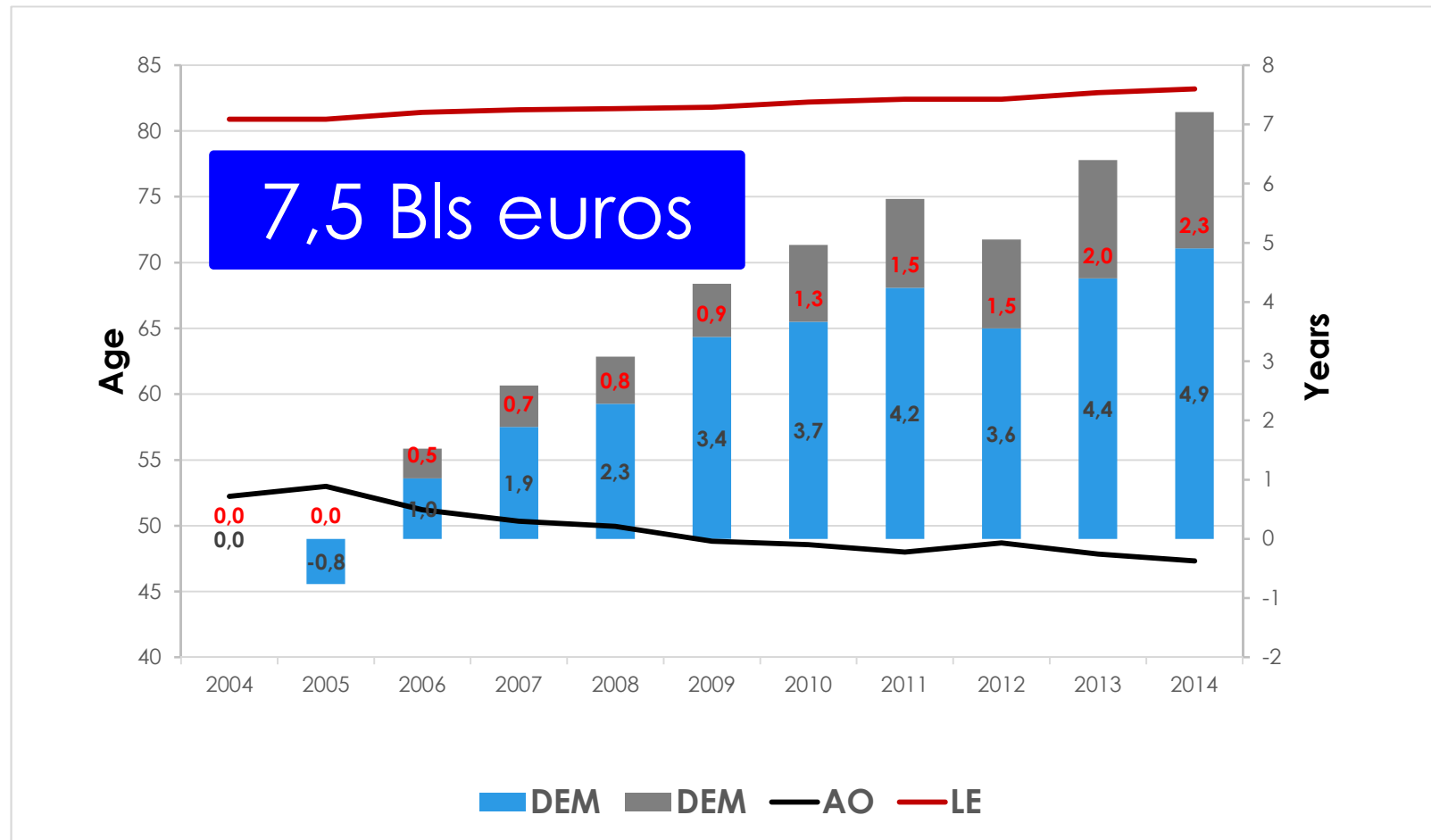


# Percentage of patients by sex, year and number of chronic diseases



Source: Atella et al., The burden of age-associated chronic diseases in Italy. CEIS WP, 2017

# Trend in LE and Age Onset of chronic diseases (2004-2014)



Source: Atella et al. 2017, The "Double Expansion of Morbidity" Hypothesis: Evidence from Italy. CEIS Research Paper, 396, February 2017.

# The reversion hypothesis

PNAS PNAS PNAS



## Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st century

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This paper documents a marked increase in the all-cause mortality of middle-aged white non-Hispanic men and women in the United States between 1999 and 2013. This change reversed decades of progress in mortality and was unique to the United States; no other rich country saw a similar turnaround. The midlife mortality reversal was confined to white non-Hispanics; black non-Hispanics and Hispanics at midlife, and those aged 65 and above in every racial and ethnic group, continued to see mortality rates fall. This increase for whites was largely accounted for by increasing death rates from drug and alcohol poisonings, suicide, and chronic liver diseases and cirrhosis. Although all education groups saw increases in mortality from suicide and poisonings, and an overall increase in external cause mortality, those with less education saw the most marked increases. Rising midlife mortality rates of white non-Hispanics were paralleled by increases in midlife morbidity. Self-reported declines in health, mental health, and ability to conduct activities of daily living, and increases in chronic pain and inability to work, as well as clinically measured deteriorations in liver function, all point to growing distress in this population. We comment on potential economic causes and consequences of this deterioration.

midlife mortality | morbidity | US white non-Hispanics

the United Kingdom (UK), Canada (CAN), Australia (AUS), and Sweden (SWE). The comparison is similar for other Organisation for Economic Co-operation and Development countries.

Fig. 1 shows a cessation and reversal of the decline in midlife mortality for US white non-Hispanics after 1998. From 1978 to 1998, the mortality rate for US whites aged 45–54 fell by 2% per year on average, which matched the average rate of decline in the six countries shown, and the average over all other industrialized countries. After 1998, other rich countries' mortality rates continued to decline by 2% a year. In contrast, US white non-Hispanic mortality rose by half a percent a year. No other rich country saw a similar turnaround. The mortality reversal was confined to white non-Hispanics; Hispanic Americans had mortality declines indistinguishable from the British (1.8% per year), and black non-Hispanic mortality for ages 45–54 declined by 2.6% per year over the period.

For deaths before 1989, information on Hispanic origin is not available, but we can calculate lives lost among all whites. For those aged 45–54, if the white mortality rate had held at its 1998 value, 96,000 deaths would have been avoided from 1999 to 2013, 7,000 in 2013 alone. If it had continued to fall at its previous (1979–1998) rate of decline of 1.8% per year, 488,500 deaths would have been

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# Final remarks

- The epidemiology is changing along the life cycle, and the young adults seems to be the most at risk.
  - From an economic standpoint it is important to understand why this is happening and what are the channels and mechanisms involved.
  - Learning more about the medical and biological process behind health status can help economists and policy makers to design efficient policies.
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Thank for your attention