Mediterranean Diet&Health
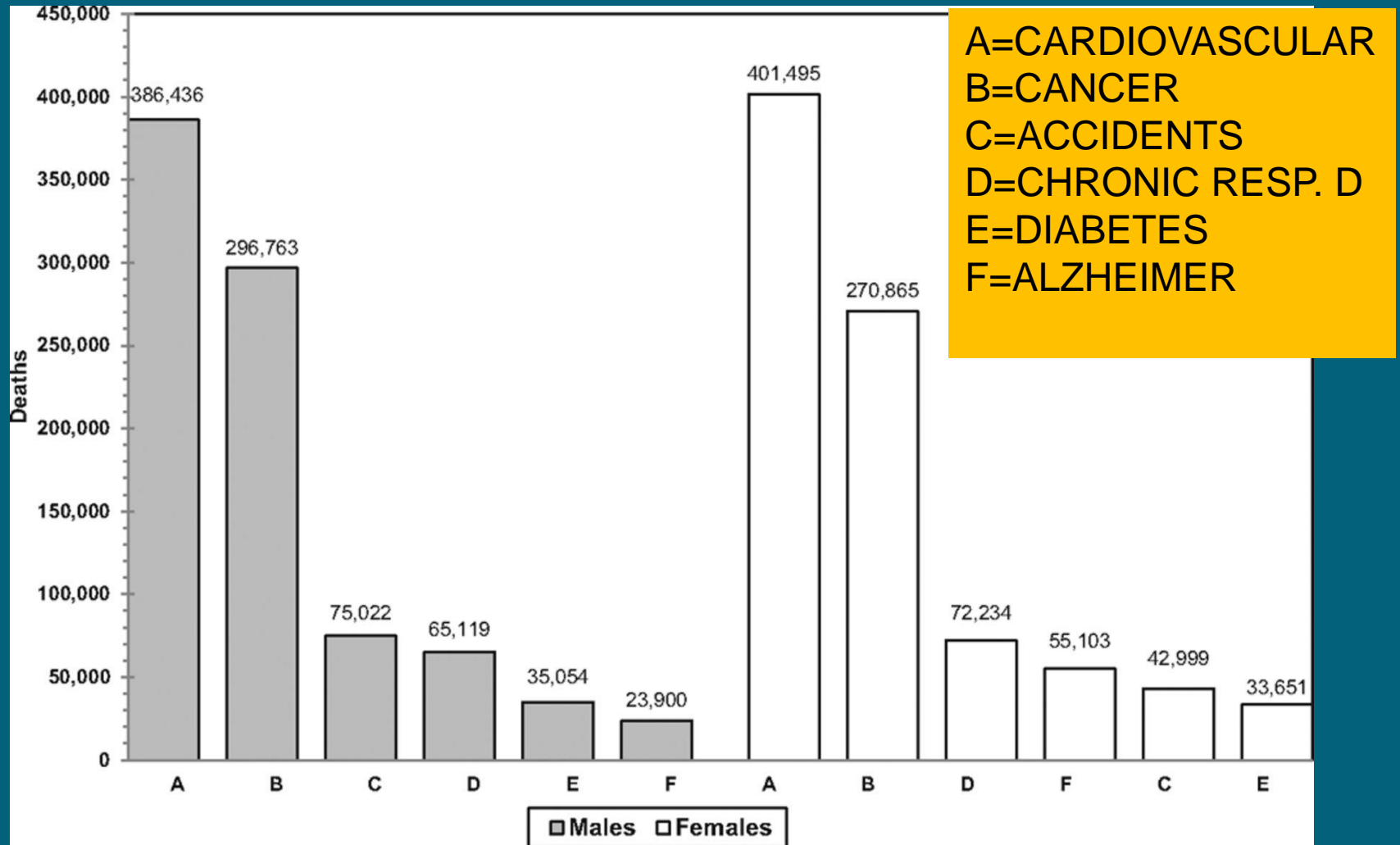
Donato F Romagnolo
Department of Nutritional Sciences and Arizona Cancer Center
October 20, 2022
The University of Arizona, Tucson, USA
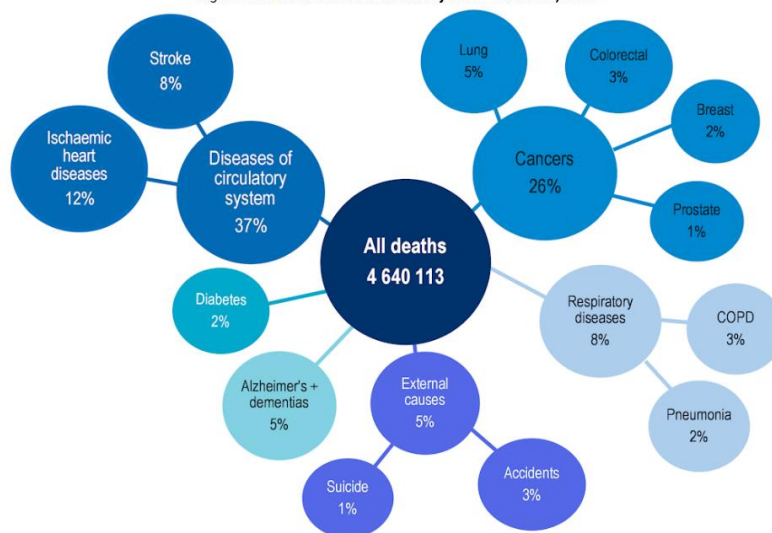
Key Points

➢ Major health issues in the U.S. and Europe

➢ How does the Mediterranean diet work?

➢ What/how much do we eat? US vs Europe

Cardiovascular disease (CVD) and other major causes of death for all males and females (United States: 2009).

A=CARDIOVASCULAR
B=CANCER
C=ACCIDENTS
D=CHRONIC RESP. D
E=DIABETES
F=ALZHEIMER

American Heart Association
Learn and Live

Figure 3.7. **Main causes of mortality in EU countries, 2017**

Note: Data refer to 2016 for France.

Source: Eurostat Database.

StatLink https://stat.link/fyc0lq

Figure 3.8. **Main causes of mortality by country, 2017**
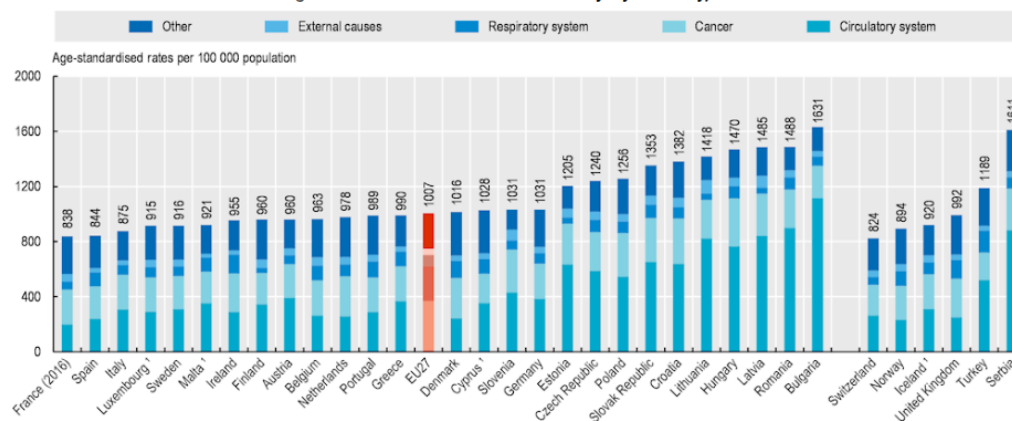
Note: External causes of death include accidents, suicides, homicides and other causes. The EU average is weighted (using imputed estimates for France for 2017). Data for France refer to 2016. 1. Three-year average.
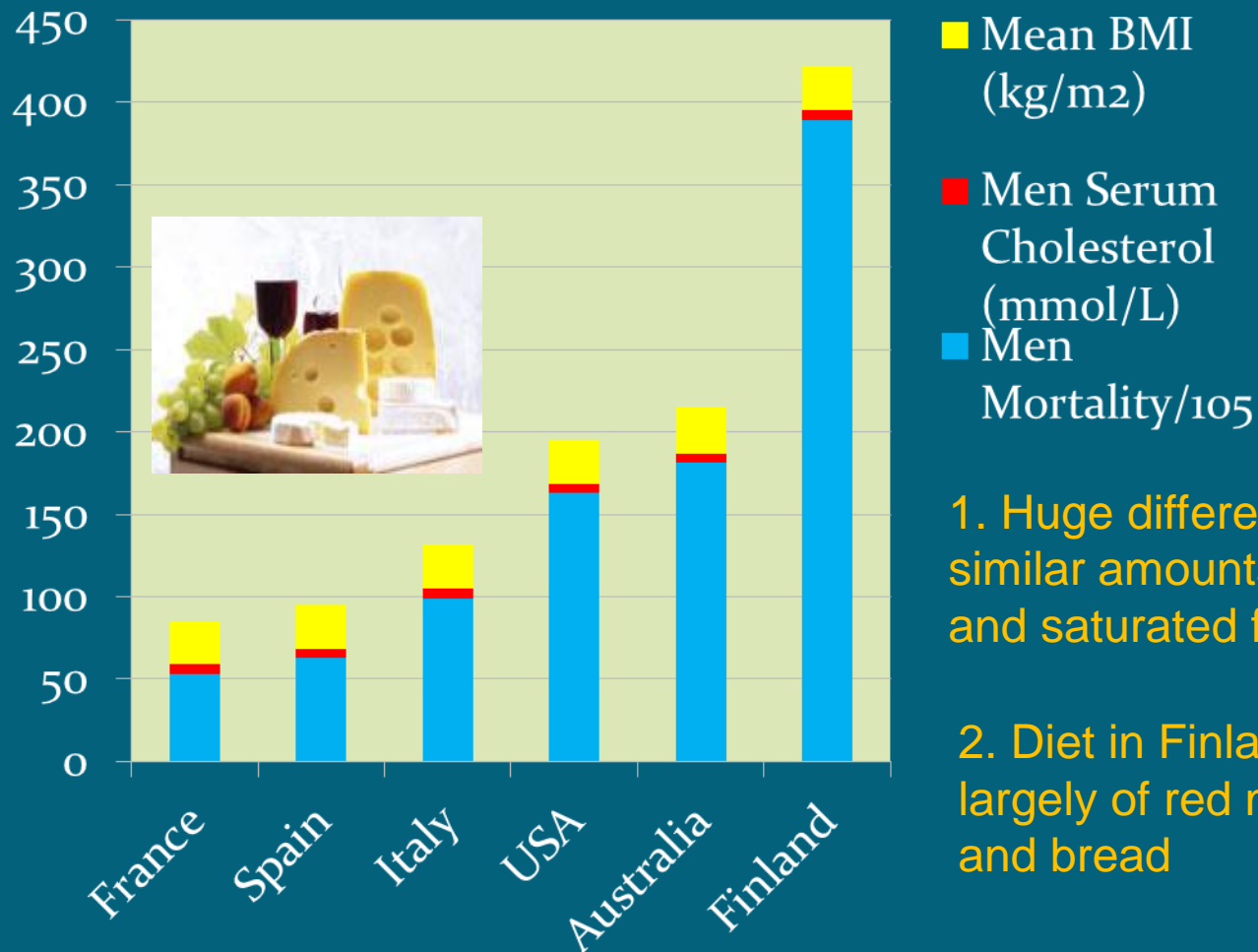
Source: Eurostat Database.

StatLink https://stat.link/jktro3

Mortality from CAD and risk factors: MONICA Study =MONItoring System for Cardiovascular disease

7 million men and women from 21 countries for 10 years

Legend:
- ■ Mean BMI (kg/m2)
- ■ Men Serum Cholesterol (mmol/L)
- ■ Men Mortality/105

1. Huge differences in CAD risk with similar amounts of serum cholesterol and saturated fats

2. Diet in Finland consists largely of red meat, butter, and bread

(Adapted from Cordova et al., J Am Coll Surg 2011.09.23:97)
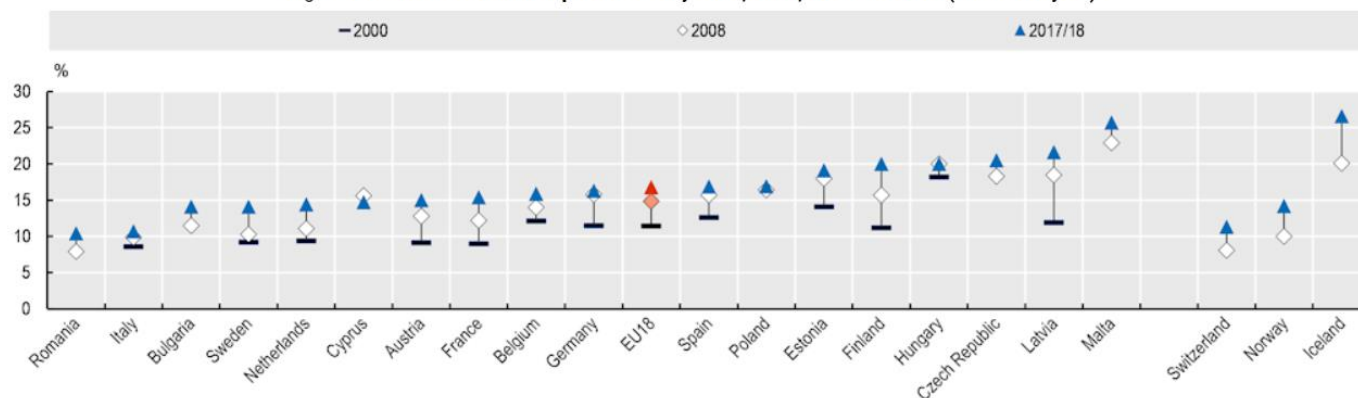
Obesity Trends Among U.S. Adults

(*BMI ≥30, or about 30 lbs. overweight for 5'4" person)

1990

2000

2010

Legend: No Data | <10% | 10%–14% | %–19% | 20%–24% | 25%–29% | ≥30%
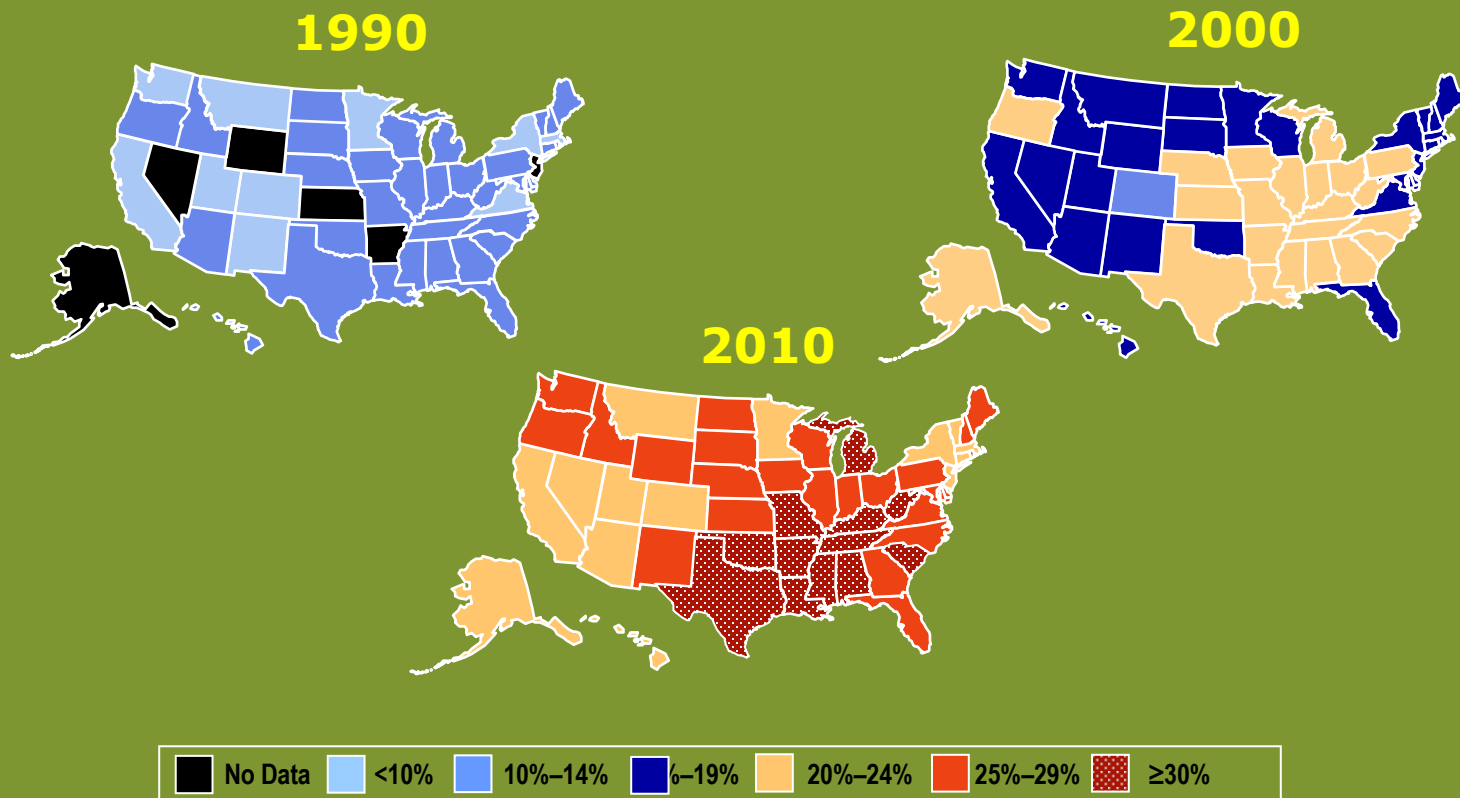
Source: Behavioral Risk Factors Surveillance System, Center for Disease Control and Prevention.

Figure 4.19. **Increase in self-reported obesity rates, 2000, 2008 and 2018 (or nearest year)**
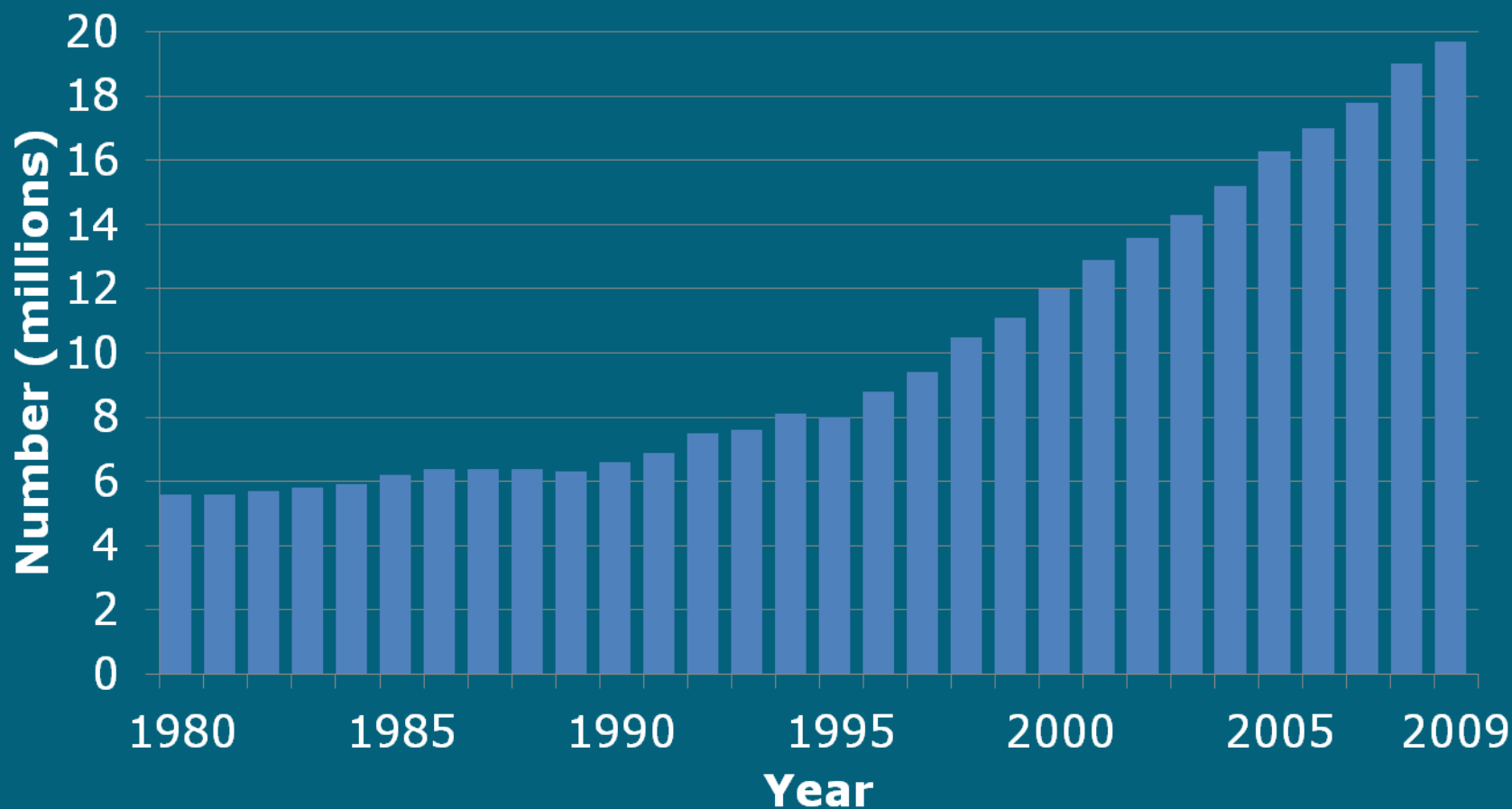
— 2000   ◇ 2008   ▲ 2017/18

Note: The EU average is unweighted.

Source: OECD Health Statistics 2020, complemented with EU-SILC 2017 and EHIS 2008 for several countries.

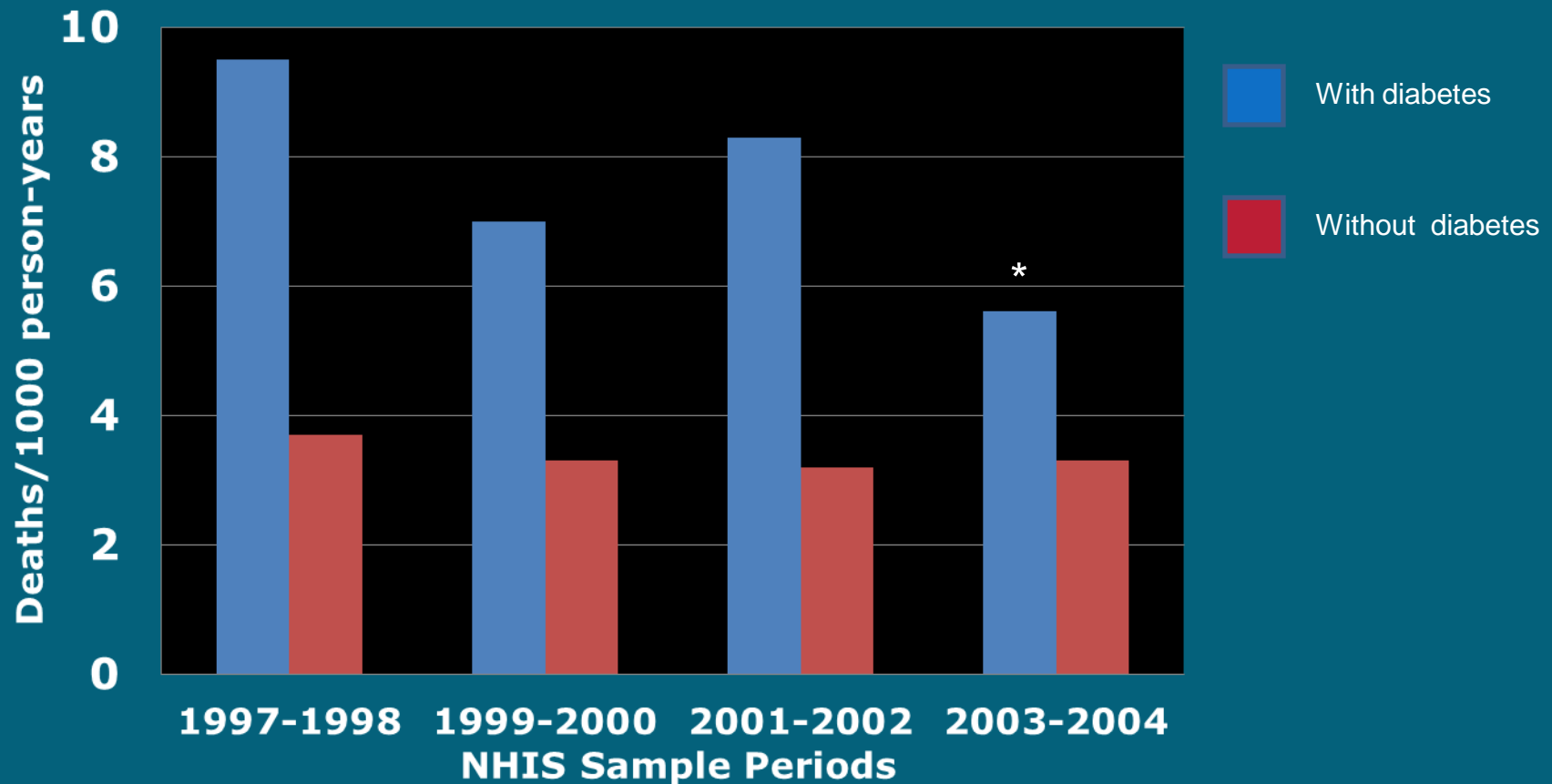StatLink https://stat.link/7odcak

Health Issues: Diabetes, 1980-2009

CVD mortality rate increases 2X with diabetes

*Rate difference between 1997/1998 and 2003/2004, –4.0; *P* < 0.001 for trend

Gregg et al., Diabetes Care 35: 1252—1257, 2012

Diagnosed and Undiagnosed Diabetes

Estimated percentage of people ages ≥20 years with diagnosed and undiagnosed diabetes, by age group, United States, 2005-2008
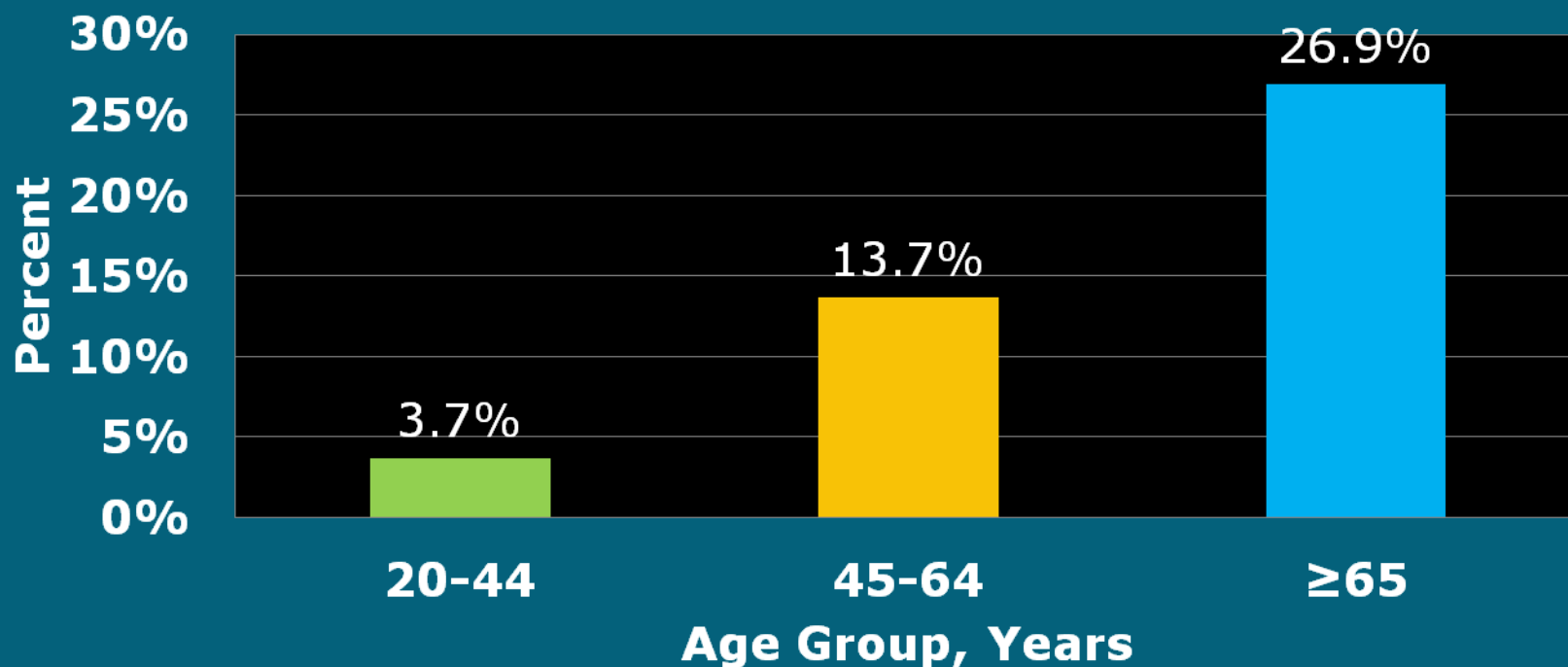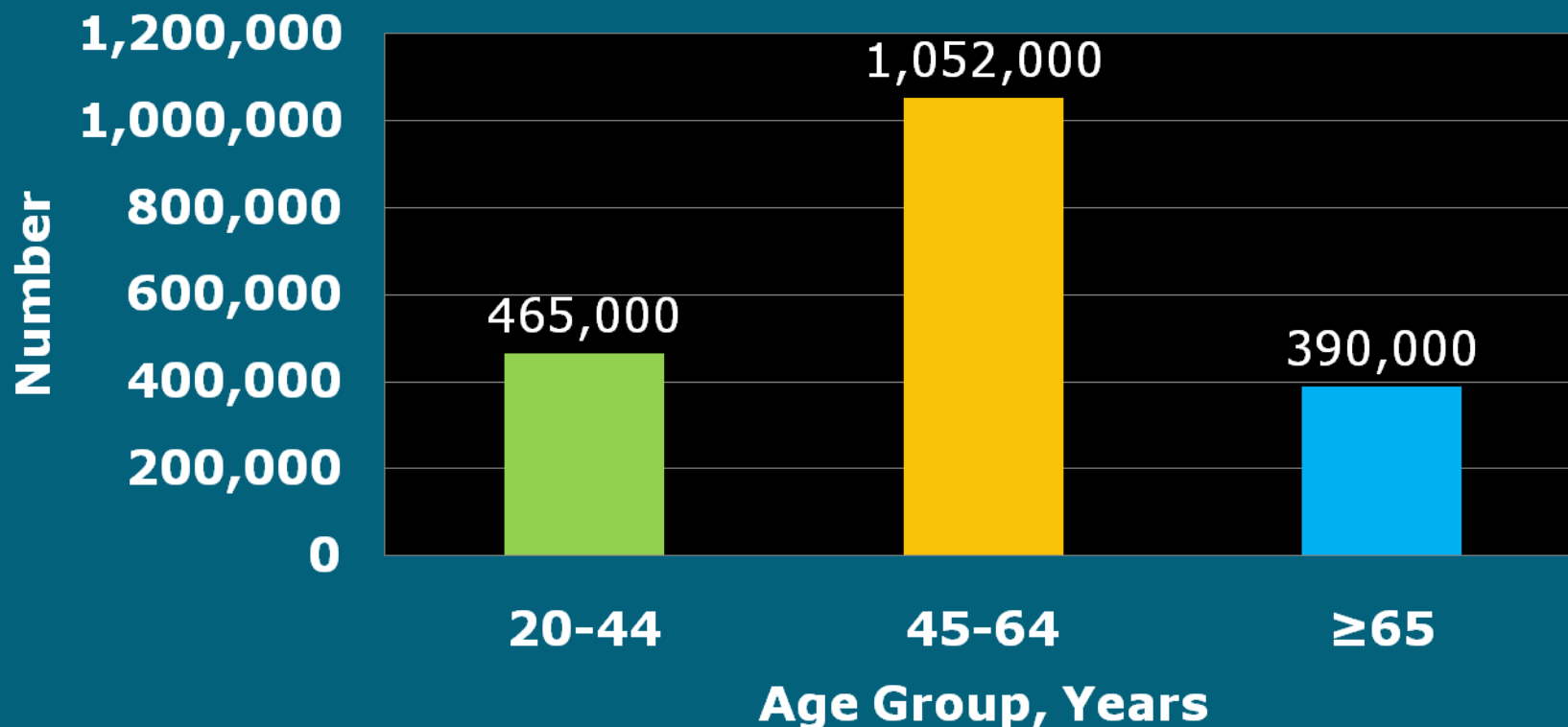
Source: 2005-2008 National Health and Nutrition Examination Survey

National Diabetes Information Clearinghouse. National Diabetes Statistics, 2011. Available at: http://diabetes.niddk.nih.gov/dm/pubs/statistics/

New Cases of Diagnosed Diabetes in younger people we are aging faster

Estimated number of new cases of diagnosed diabetes among people ≥20 years, by age group, 2010

Age Group, Years	Number
20-44	465,000
45-64	1,052,000
≥65	390,000

Figure 3.26. **People with diabetes in EU27, by gender and age group, 2019**

◆ Women   ● Men
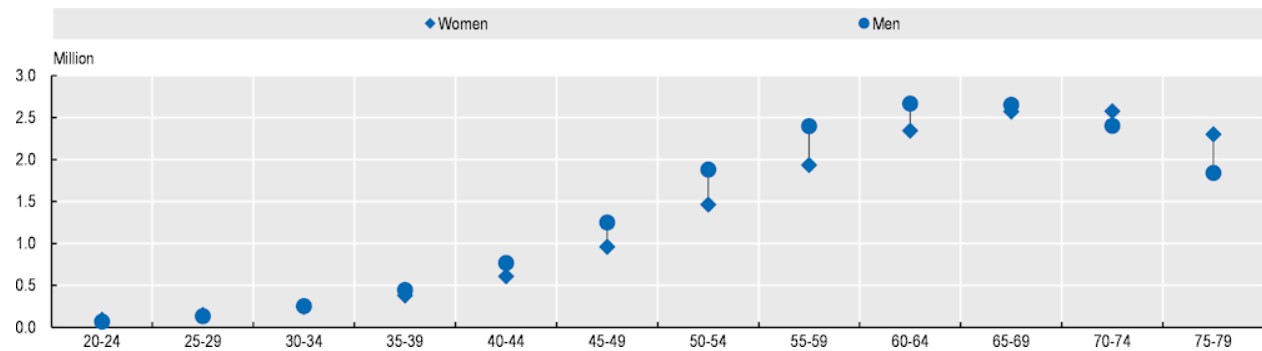
Note: Population with Type 1 or Type 2 diabetes. Data are only available up to 79 years old.
Source: IDF Atlas, 9th Edition, 2019.

StatLink https://stat.link/n1dm63

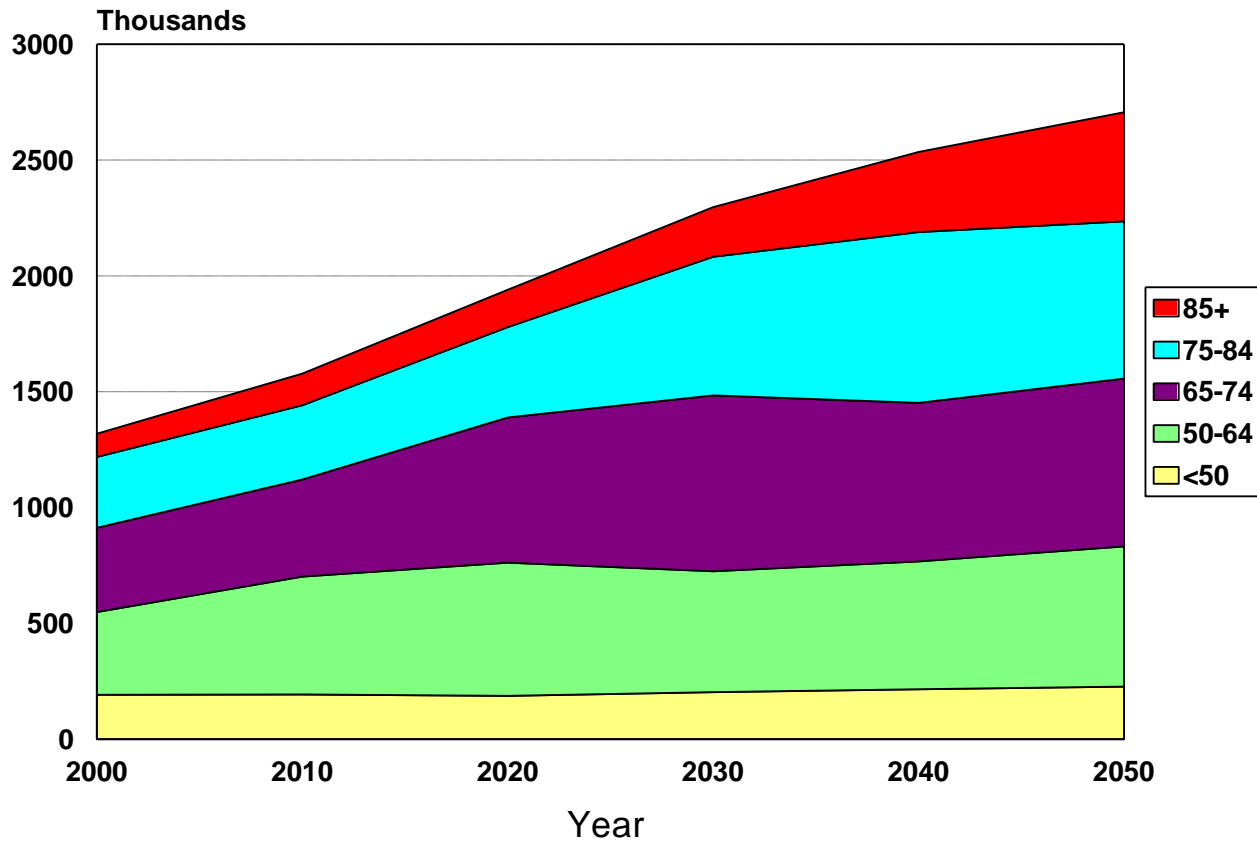Figure 3.27. **Share of adults with diabetes, 2019**
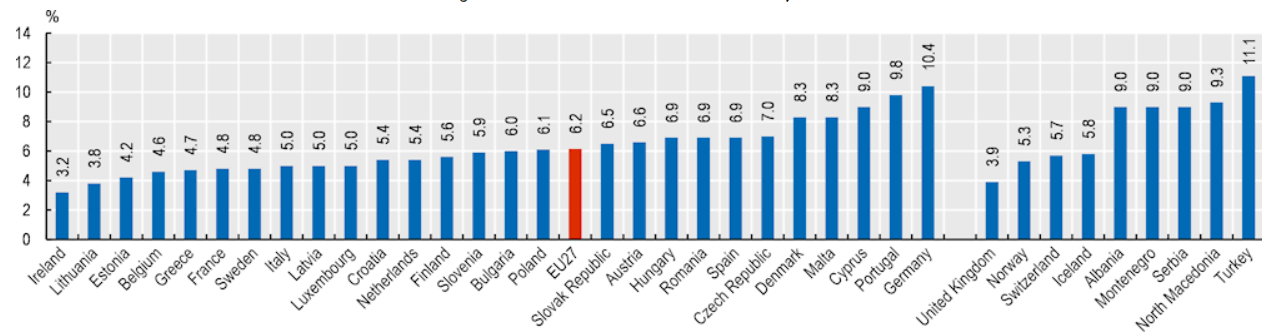
Note: Age-standardised prevalence of population aged 20-79 with Type 1 or Type 2 diabetes. The EU average is unweighted.
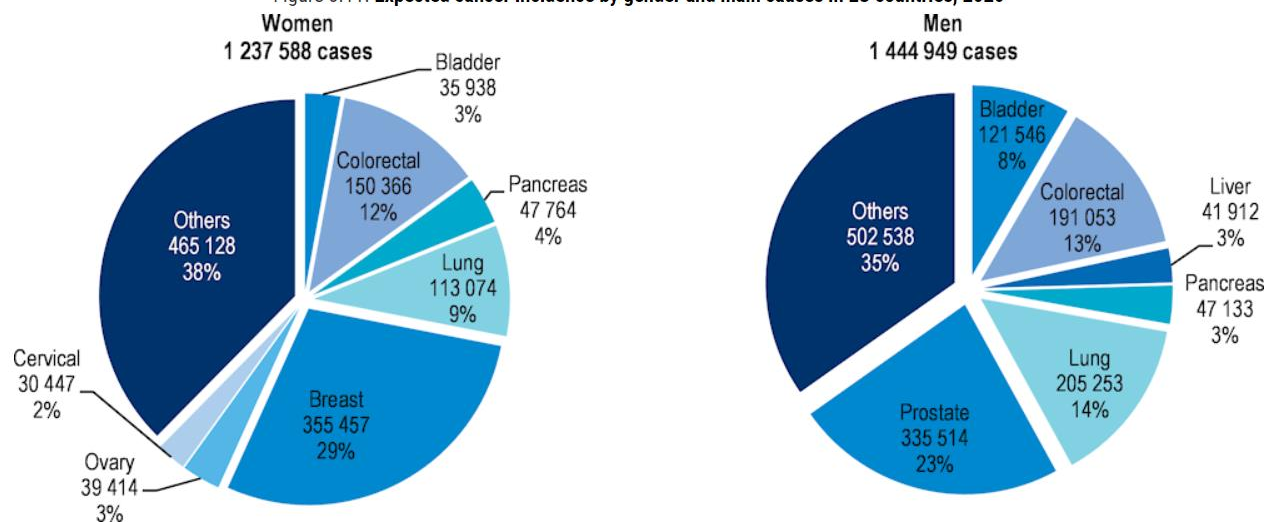Source: IDF Atlas, 9th Edition, 2019.

StatLink https://stat.link/lqs2vc

Health Issues: Cancer

Projections of Cancer Cases between 2000 to 2050 by Age

Source: SEER program, NCI and population projections from US Census Bureau

Figure 3.11. **Expected cancer incidence by gender and main causes in EU countries, 2020**
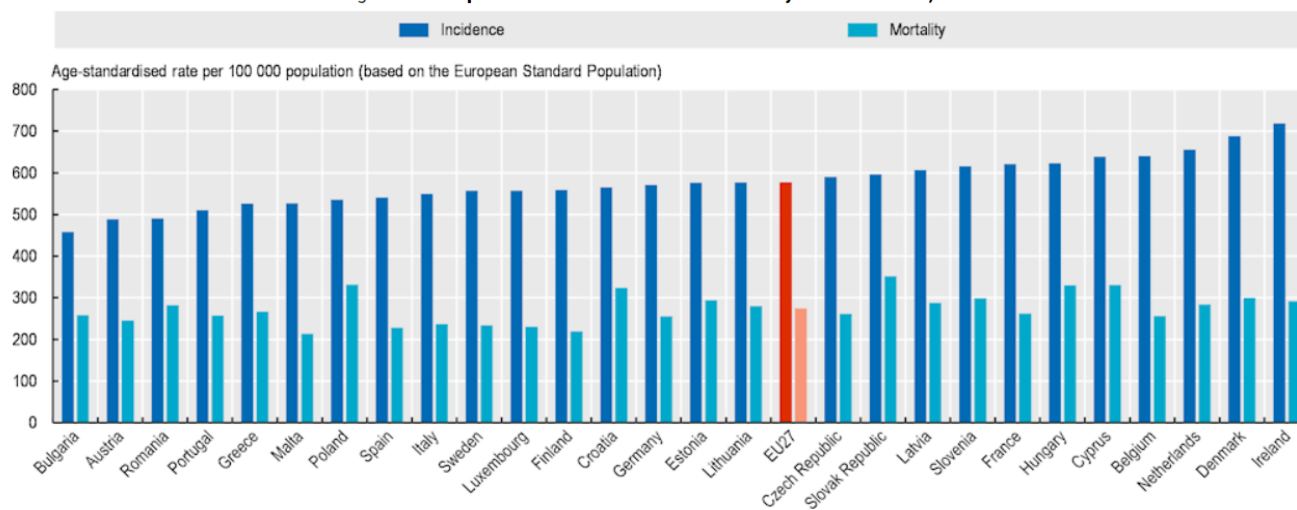
Women
1 237 588 cases

- Bladder 35 938 3%
- Colorectal 150 366 12%
- Pancreas 47 764 4%
- Lung 113 074 9%
- Breast 355 457 29%
- Ovary 39 414 3%
- Cervical 30 447 2%
- Others 465 128 38%

Men
1 444 949 cases

- Bladder 121 546 8%
- Colorectal 191 053 13%
- Liver 41 912 3%
- Pancreas 47 133 3%
- Lung 205 253 14%
- Prostate 335 514 23%
- Others 502 538 35%

Note: Data include all cancer sites except non-melanoma skin cancer.

Source: ECIS – European Cancer Information System.

StatLink https://stat.link/lwjsmz

Figure 3.12. **Expected cancer incidence and mortality in EU countries, 2020**

■ Incidence   ■ Mortality

Age-standardised rate per 100 000 population (based on the European Standard Population)

Bulgaria, Austria, Romania, Portugal, Greece, Malta, Poland, Spain, Italy, Sweden, Luxembourg, Finland, Croatia, Germany, Estonia, Lithuania, EU27, Czech Republic, Slovak Republic, Latvia, Slovenia, France, Hungary, Cyprus, Belgium, Netherlands, Denmark, Ireland
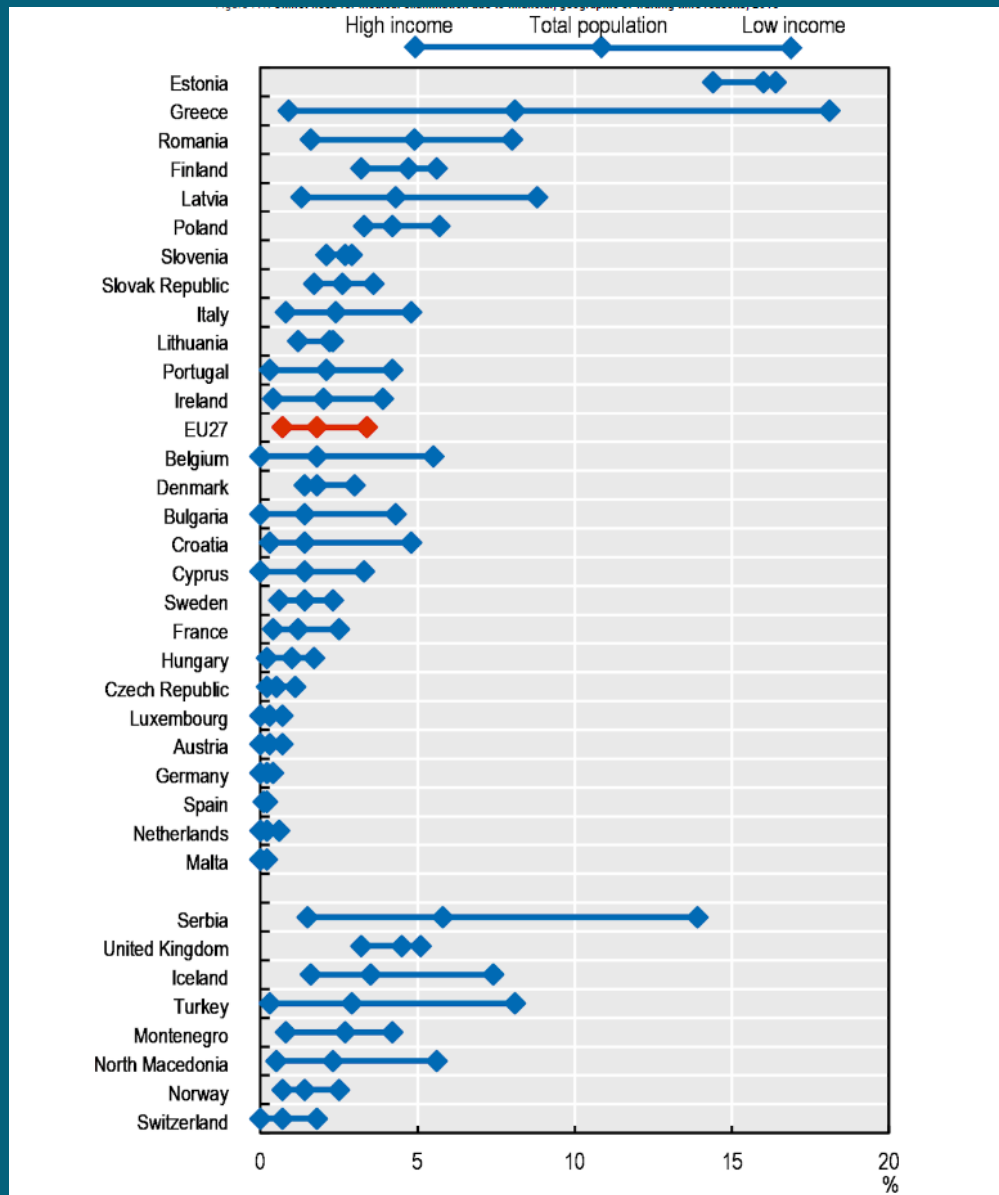
Note: The EU average is weighted. Data include all cancer sites except non-melanoma skin cancer.

Source: ECIS – European Cancer Information System.

StatLink https://stat.link/ys3jcg

Figure 7.1. **Unmet need for medical examination due to financial, geographic or waiting time reasons, 2018**
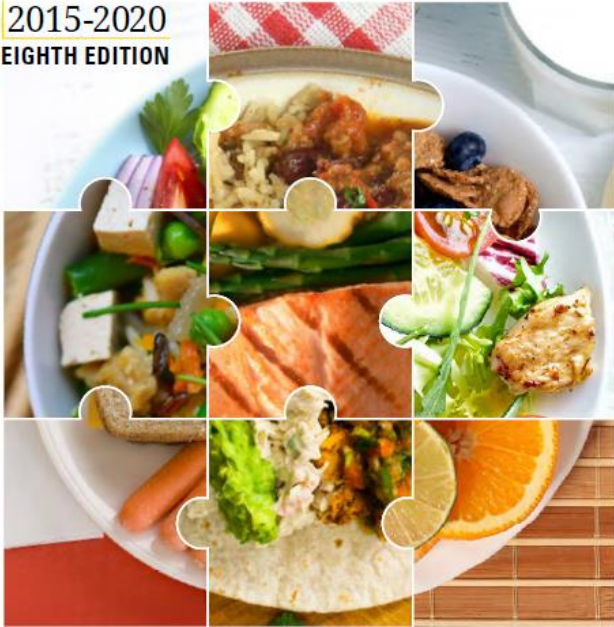
02/20/2019

Survival curves for individual subjects with Mediterranean diet score up to 3 and 4 or more.
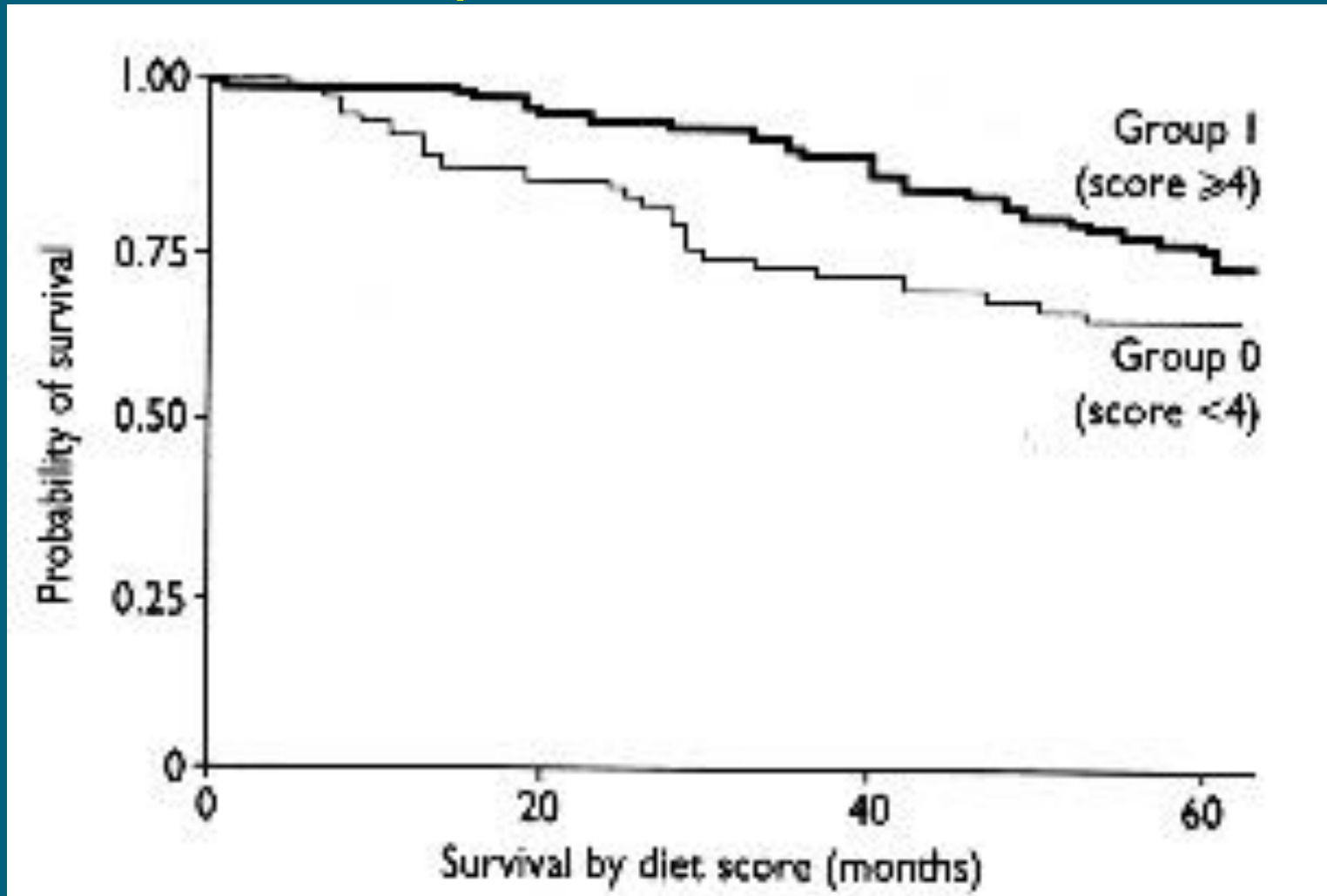
Trichopoulou A et al. BMJ 1995;311:1457-1460

Reduced Risk of all cause mortality and CVD with (two points) increase in adherence score to Mediterranean diet
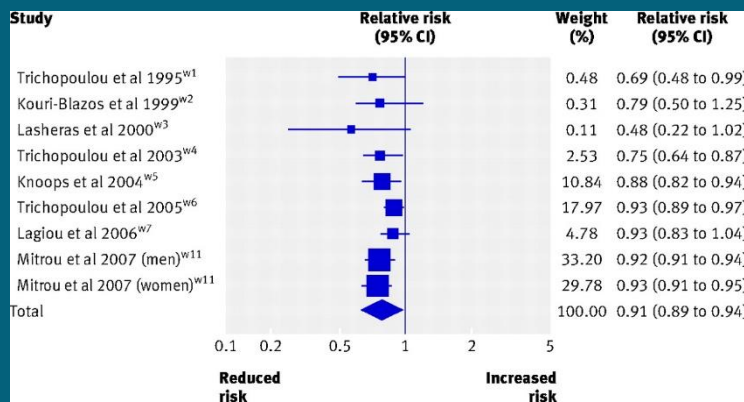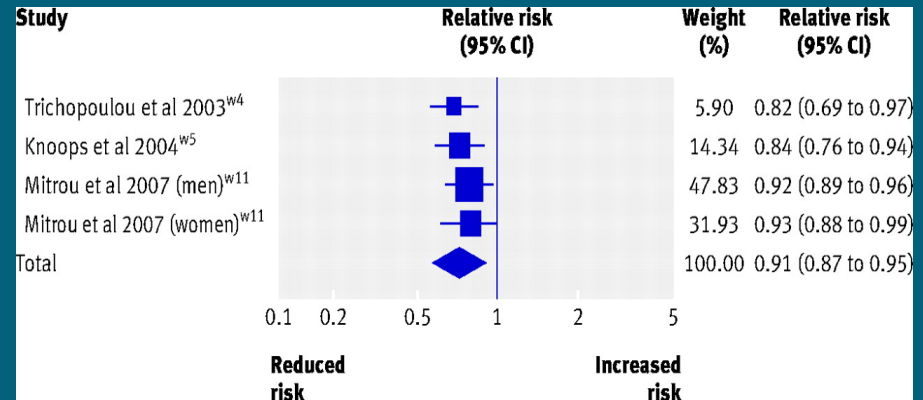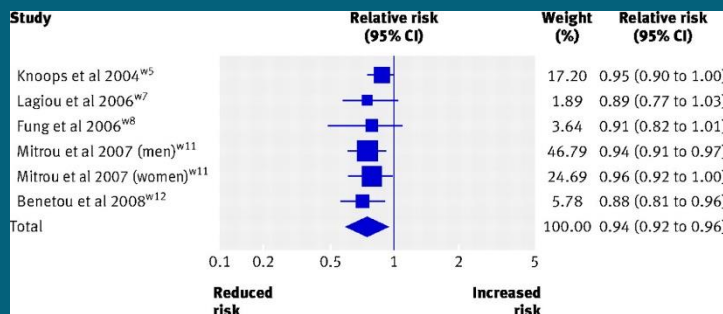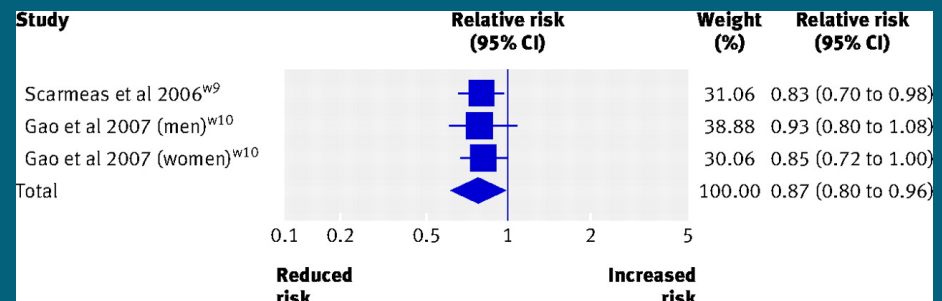
Sofi F et al. BMJ 2008;337:bmj.a1344

Mediterranean Food Pyramid
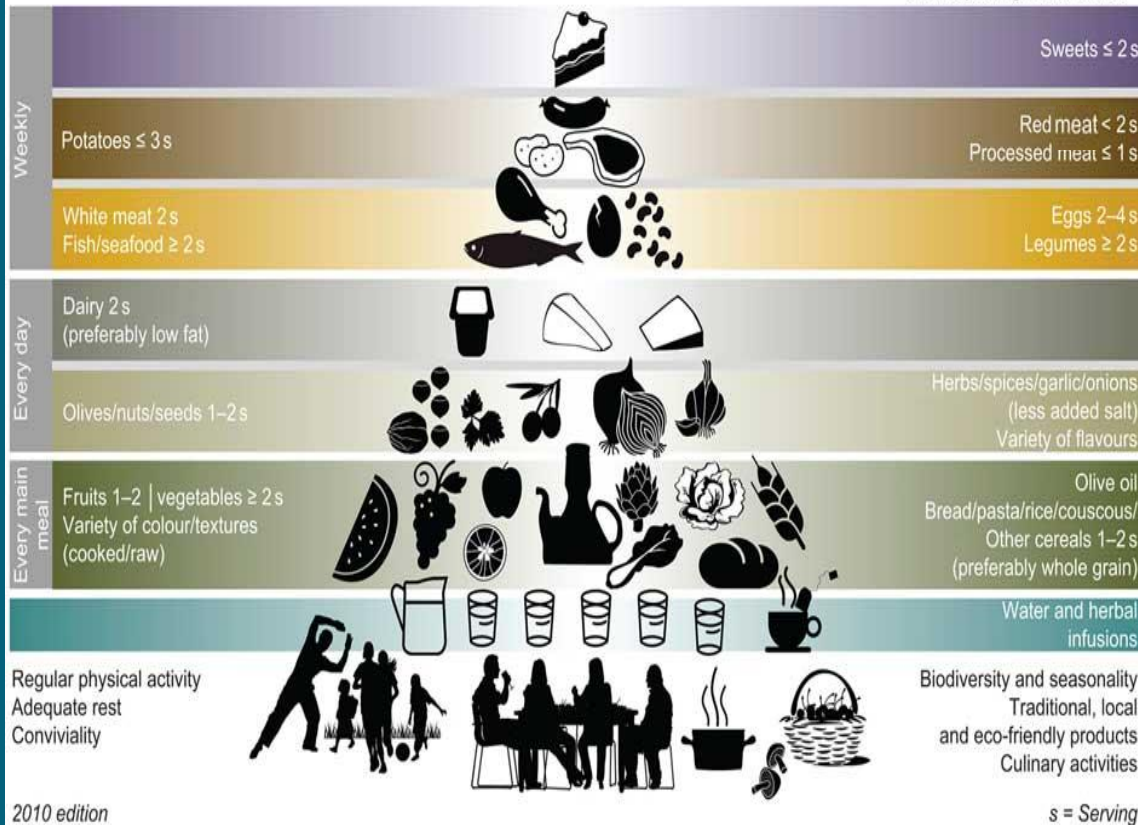
Mediterranean Food Pyramid

Every Main Meal

Vegetable-pesto pasta
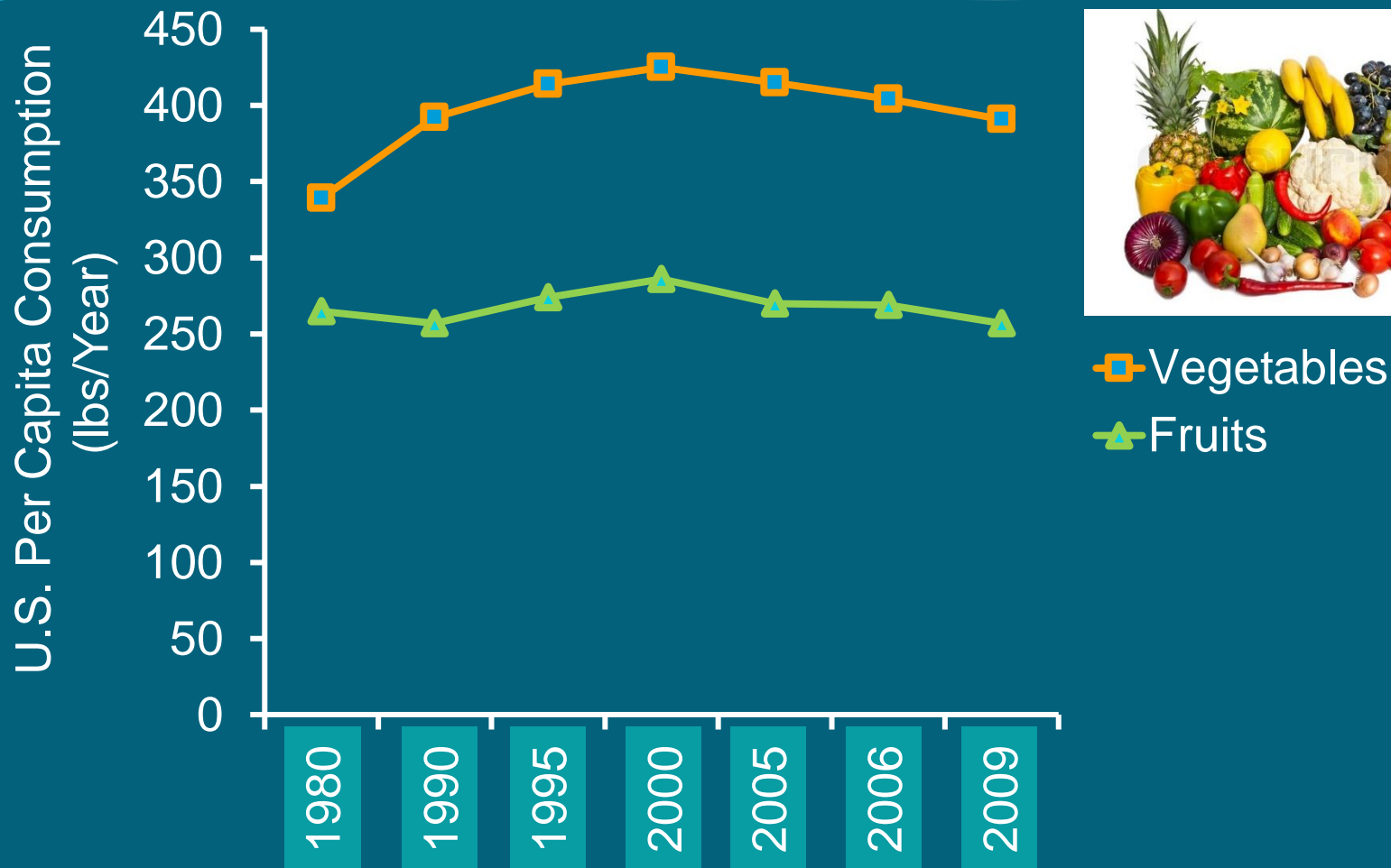
Every main meal

Fruits 1–2 | vegetables ≥ 2 s
Variety of colour/textures
(cooked/raw)

Olive oil
Bread/pasta/rice/couscous/
Other cereals 1–2 s
(preferably whole grain)

Water and herbal infusions

Regular physical activity
Adequate rest
Conviviality

Biodiversity and seasonality
Traditional, local
and eco-friendly products
Culinary activities

2010 edition

s = Serving

What/how much do we eat?

Chart: U.S. Per Capita Consumption (lbs/Year)

Y-axis: 0, 50, 100, 150, 200, 250, 300, 350, 400, 450

X-axis (years): 1980, 1990, 1995, 2000, 2005, 2006, 2009

Legend:
- Vegetables
- Fruits

- Individuals with lower intakes of fruit and vegetables (particularly rich in vitamin C) tend to have an increased risk of developing inflammatory arthritis (Symmons et al. Rheumatology (Oxford). 2000;39:835–43).
- In the Nurses' Health Study, which identified an association between sugar-sweetened soda and an increased risk of seropositive rheumatoid arthritis in women; no association between protein or meat and the risk of rheumatoid arthritis was noted in the same large cohort
  (Hu et al., Am J Clin Nutr. 2014;100:959–67; Benito-Garcia et al., Arthritis Res Ther. 2007;9:R16)

Figure 4.11. **Share of 15-year-olds not consuming any fruit or vegetable each day, 2018**
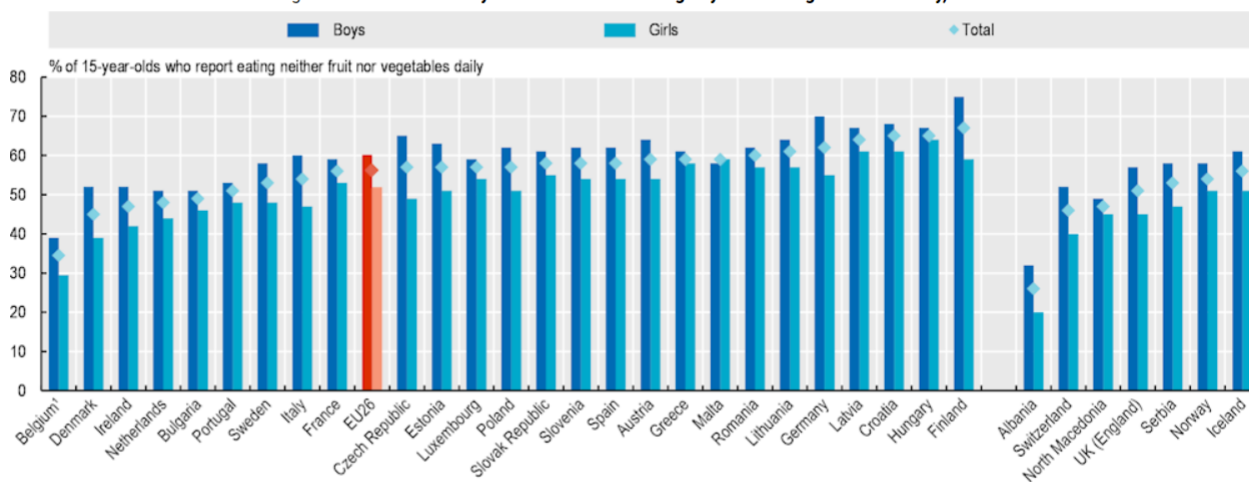
% of 15-year-olds who report eating neither fruit nor vegetables daily

Note: The EU average is unweighted. 1. The value for Belgium is the unweighted average of the Flemish and French Communities.

Source: HBSC data from Inchley et al. (2020).

StatLink https://stat.link/y0i8xp

Figure 4.12. **Share of 15-year-olds consuming sugared soft drinks each day, 2014-2018**

% of 15-year-olds who report drinking sugared soft drinks at least once every day

Note: The EU average is unweighted. 1. The value for Belgium is the unweighted average of the Flemish and French Communities.

Source: HBSC data from Inchley et al. (2020).

StatLink https://stat.link/86pms9

Fats: the Mediterranean diet is richer in MUFA and n-3

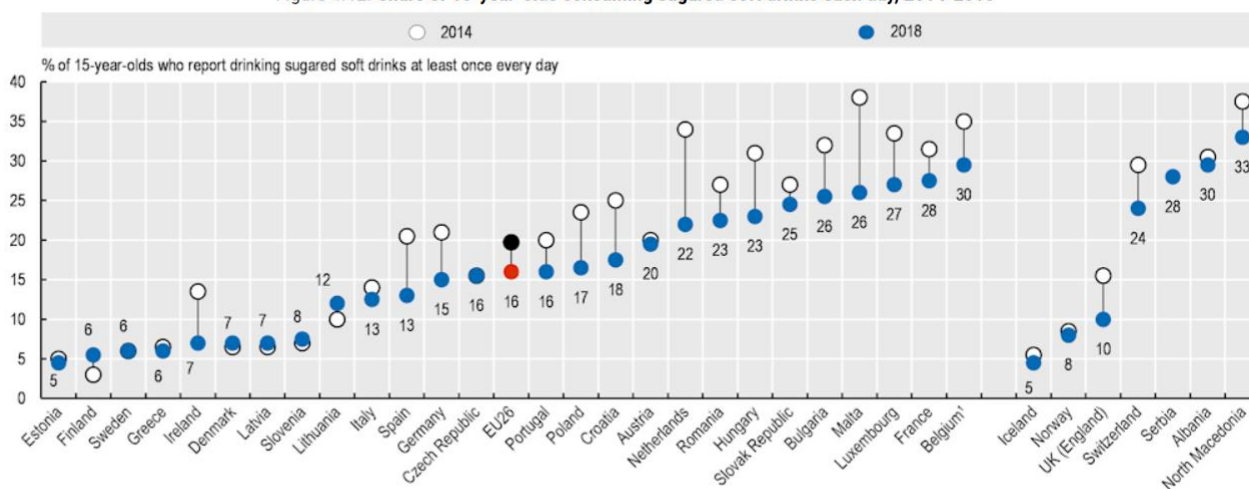| Diet Component	Model MD	Crete	Greece	Spain	Southern Italy	U.S.
Total fat	36–40	39.3 ± 1.3	40.9 ± 0.2	39.3 ± 6.8	34.7 ± 7.7	32.9 ± 0.4
SFA	7–10	11.4 ± 0.5	12.1 ± 0.1	11.8 ± 2.6	10.2 ± 2.9	11.0 ± 0.2
MUFA	19–25	18.9 ± 1.2	20.6 ± 0.1	18.8 ± 4.3	20.5 ± 5.1	12.4 ± 0.2
PUFA	3–6	4.9 ± 0.4	5.3 ± 0.1	6.0 ± 1.7	4.0^{a}	6.9 ± 0.1

TABLE 1 Dietary Estimates of Fat Intake (as % Total Energy Intake) in Mediterranean Countries and the United States Compared to a Model MD[7]

[a]By subtraction.
Abbreviations: ...edite..., MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids; SFA, saturate... ...acids.

MUFA

n-3

n-6

(Romagnolo, Selmin. Nutr Today 08/2017)

Oils in our diet

A line chart titled with y-axis "U.S. Per Capita Consumption (lbs/Year)" ranging from 0 to 60, and x-axis showing years 1980, 1990, 1995, 2000, 2005, 2006, 2009. The green line labeled "Cooking Oils" shows values rising from about 21 in 1980 to about 25 in 1990, 26 in 1995, 34 in 2000, 43 in 2005, 55 in 2006, and 52 in 2009.
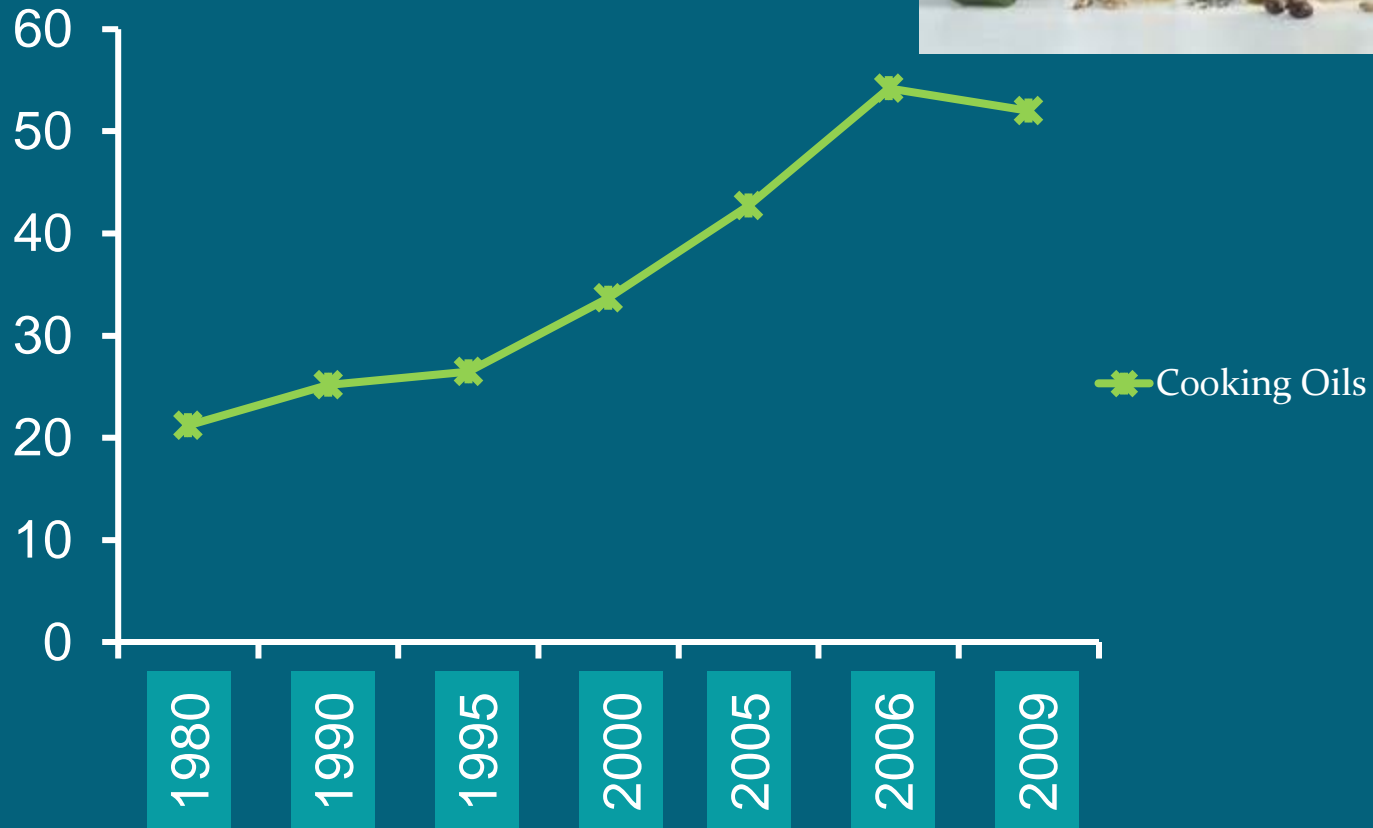
Consumption of seed oils, 1909 and 1999

©2011 by American Society for Nutrition

Tanya L Blasbalg et al. Am J Clin Nutr 2011;93:950-962
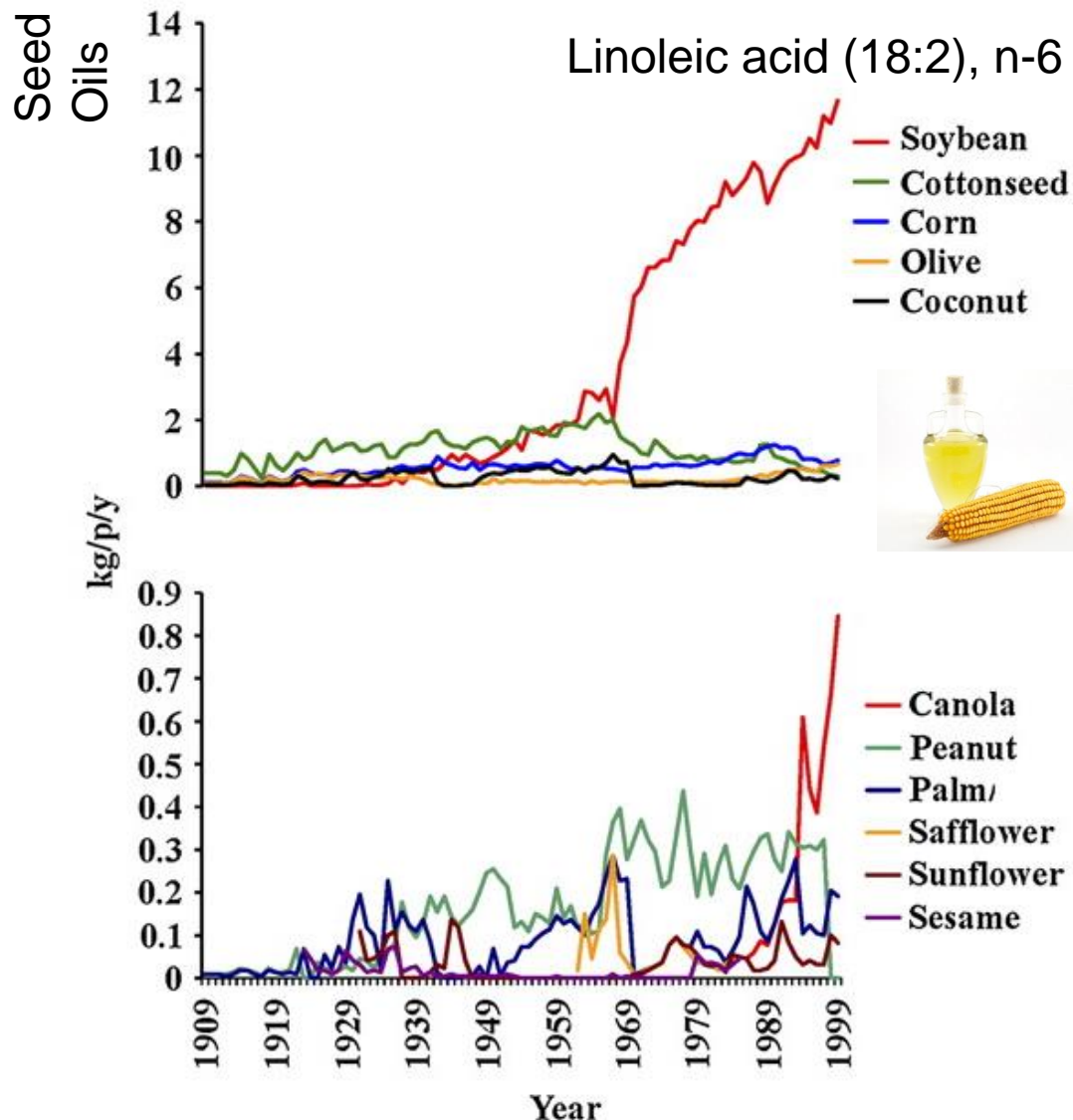
Omega-3 ANTI-INFLAMMATORY ⟵⟶ **Omega-6 PRO-INFLAMMATORY**

Dietary factors in relation to rheumatoid arthritis: a role for olive oil and cooked vegetables?[1-3]

Athena Linos, Virginia G Kaklamani, Evangelia Kaklamani, Yvonni Koumantaki, Ernestini Giziaki, Sotiris Papazoglou, and Christos S Mantzoros

Mediterranean Food Pyramid

Every day

Dairy 2 s
(preferably low fat)

Every day

Olives/nuts/seeds 1–2 s

Herbs/spices/garlic/onions
(less added salt)
Variety of flavours
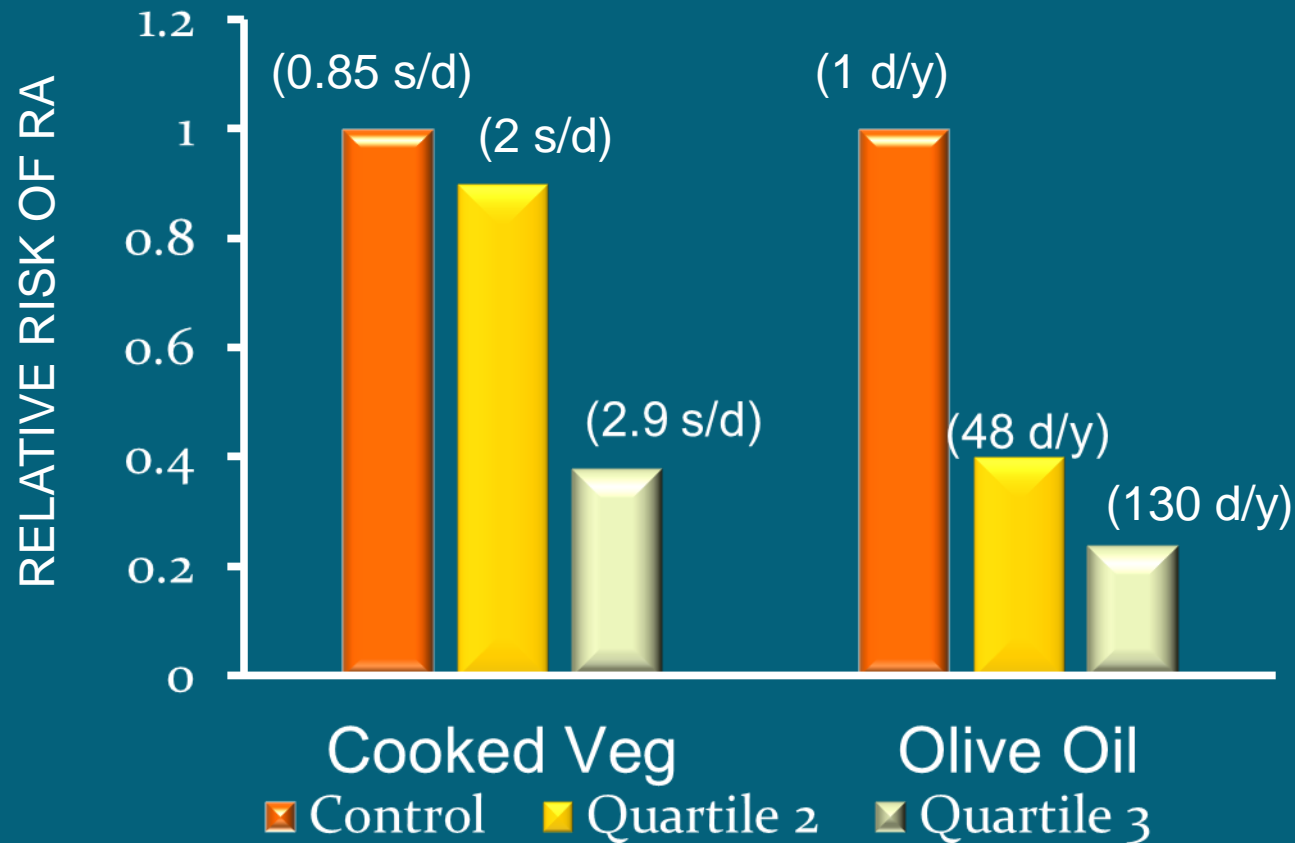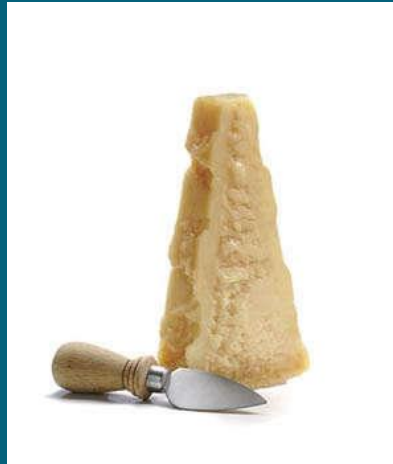
Osteoporosis

• One out of every two women and one in four men ages 50 years and older will have an 20 osteoporosis-related fracture in their lifetime.

• About 85 to 90 percent of adult bone mass is acquired by the age of 18 in girls and the age 21of 20 in boys. Adequate <u>nutrition and regular participation in physical activity</u> are important factors in achieving and maintaining optimal bone mass.

Calcium & Decreased Colorectal Cancer (7 cohort studies)

Relative risk (95% CI)

Study	Relative risk (95% CI)
Bostick 1993 Women	0.66 (0.43–1.02)
Kampman 1994	0.95 (0.50–1.79)
Wu 2002 Men	0.70 (0.43–1.14)
McCullough 2003 Men	0.60 (0.33–1.10)
McCullough 2003 Women	0.73 (0.30–1.76)
Feskanich 2004 Women	0.87 (0.69–1.11)
Lin 2005 Women	1.30 (0.90–1.87)

Relative risk, highest vs lowest exposure category

(x-axis: 0.2 0.5 1 2 5)
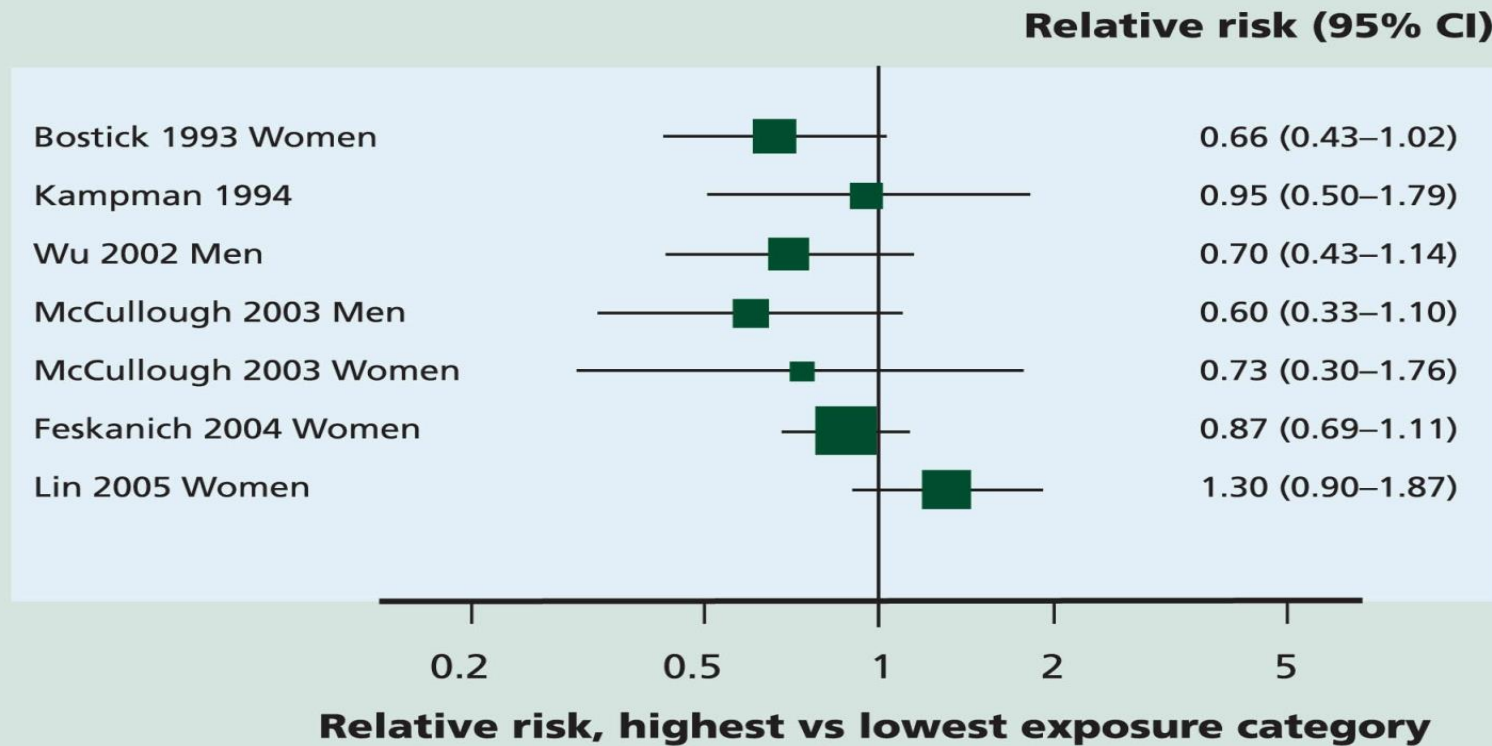
Summary Effect Estimate 0.78

Cholesterol → 7-Dehydrocholesterol $\xrightarrow{uv}$ Cholecalciferol (D3)

Ergosterol $\xrightarrow{uv}$ Ergocalciferol (D2)
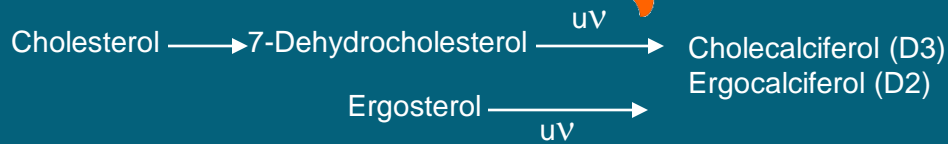
VD → *P450C25* Liver

sterol complex with VDBP

25(OH)VD

P450C1   *P450C24*

Target Tissues/Cells
- Intestine
- Bone
- Parathyroid
gene expression

1,25(OH)VD

circulation
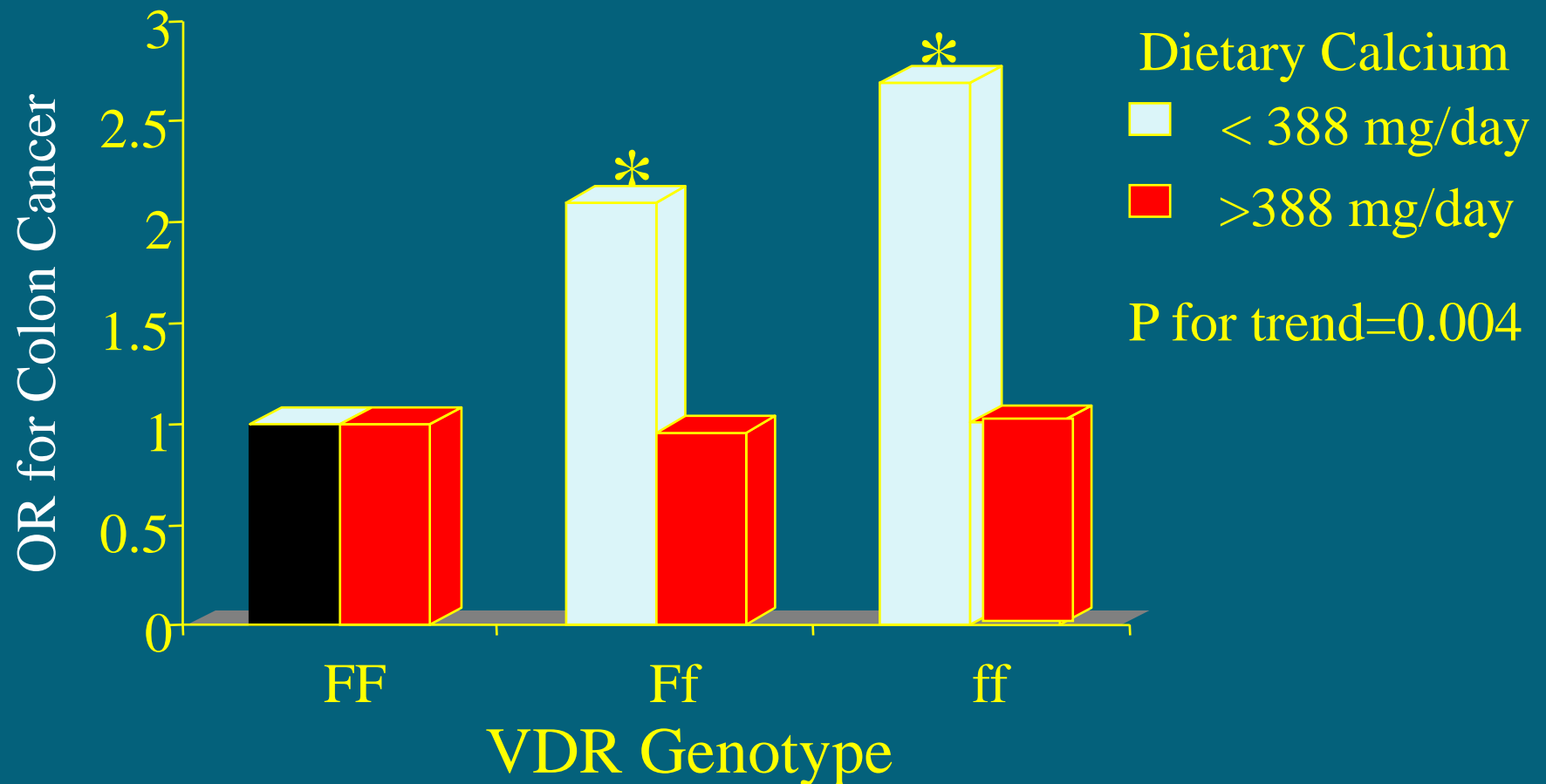
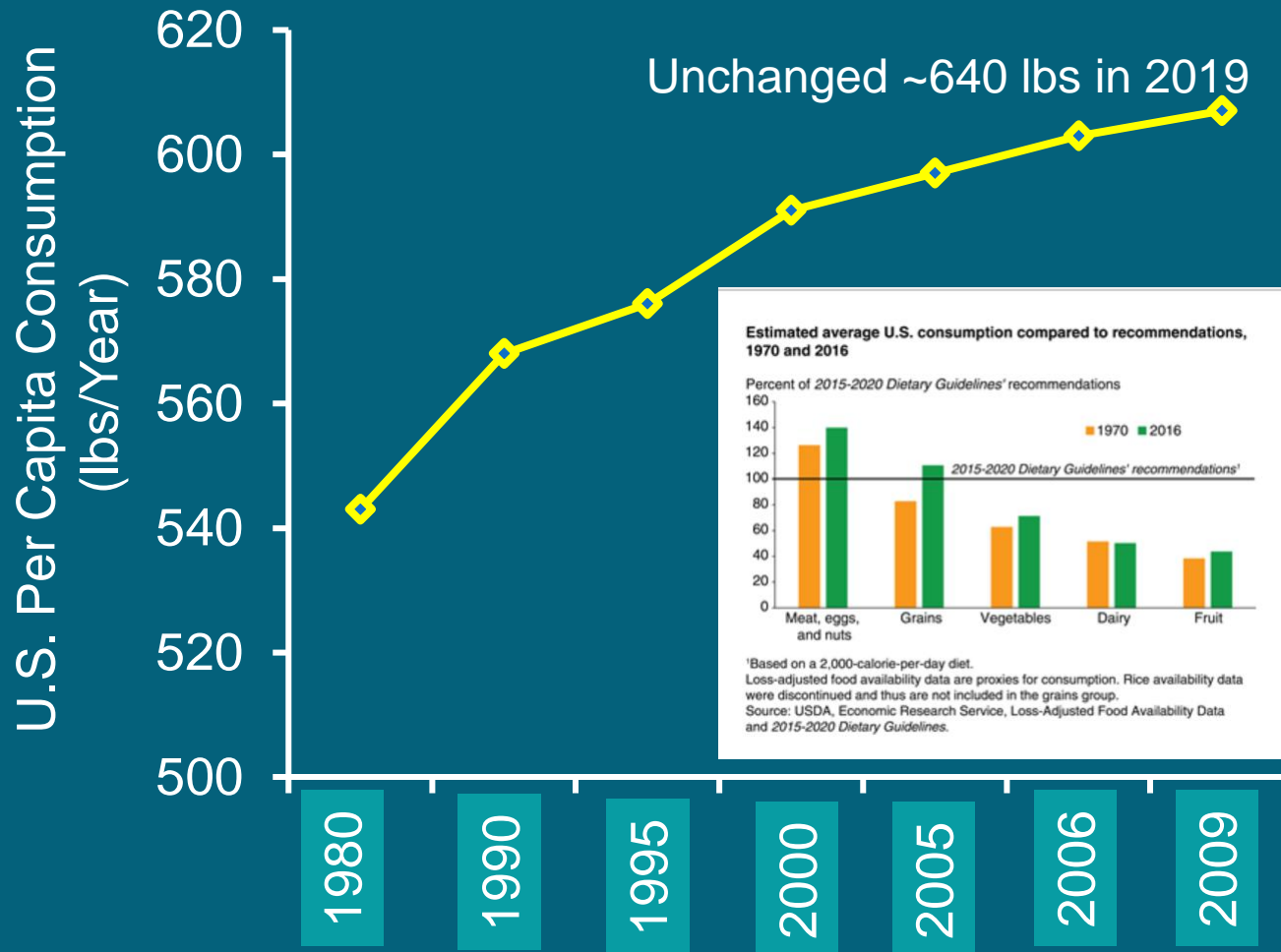1,25(OH)VD   24,25(OH)VD

Renal Genes

P450C24

Kidney

Calcitroic acid

Excretion

Precision Nutrition and Genetic Information

Wong et al. Carcinogenesis, 24: 1091-1095, 2003

What/how much do we eat?

U.S. Per Capita Consumption (lbs/Year)

Unchanged ~640 lbs in 2019

Dairy

1980 1990 1995 2000 2005 2006 2009

Estimated average U.S. consumption compared to recommendations, 1970 and 2016

Percent of *2015-2020 Dietary Guidelines'* recommendations

2015-2020 Dietary Guidelines' recommendations[1]

1970 2016

Meat, eggs, and nuts — Grains — Vegetables — Dairy — Fruit

[1]Based on a 2,000-calorie-per-day diet.
Loss-adjusted food availability data are proxies for consumption. Rice availability data were discontinued and thus are not included in the grains group.
Source: USDA, Economic Research Service, Loss-Adjusted Food Availability Data and *2015-2020 Dietary Guidelines.*

- Individuals with lower intakes of fruit and vegetables (particularly rich in vitamin C) tend to have an increased risk of developing inflammatory arthritis (Symmons et al. Rheumatology (Oxford). 2000;39:835–43).
- In the Nurses' Health Study, which identified an association between sugar-sweetened soda and an increased risk of seropositive rheumatoid arthritis in women; no association between protein or meat and the risk of rheumatoid arthritis was noted in the same large cohort
  (Hu et al., Am J Clin Nutr. 2014;100:959–67; Benito-Garcia et al., Arthritis Res Ther. 2007;9:R16)

Consumo Formaggio in Italia: 23 Kg/capita, (quinto nel mondo)

Spesa domestica per latticini:
62% Spesa riservata ai formaggi (Freschi+stagionati)
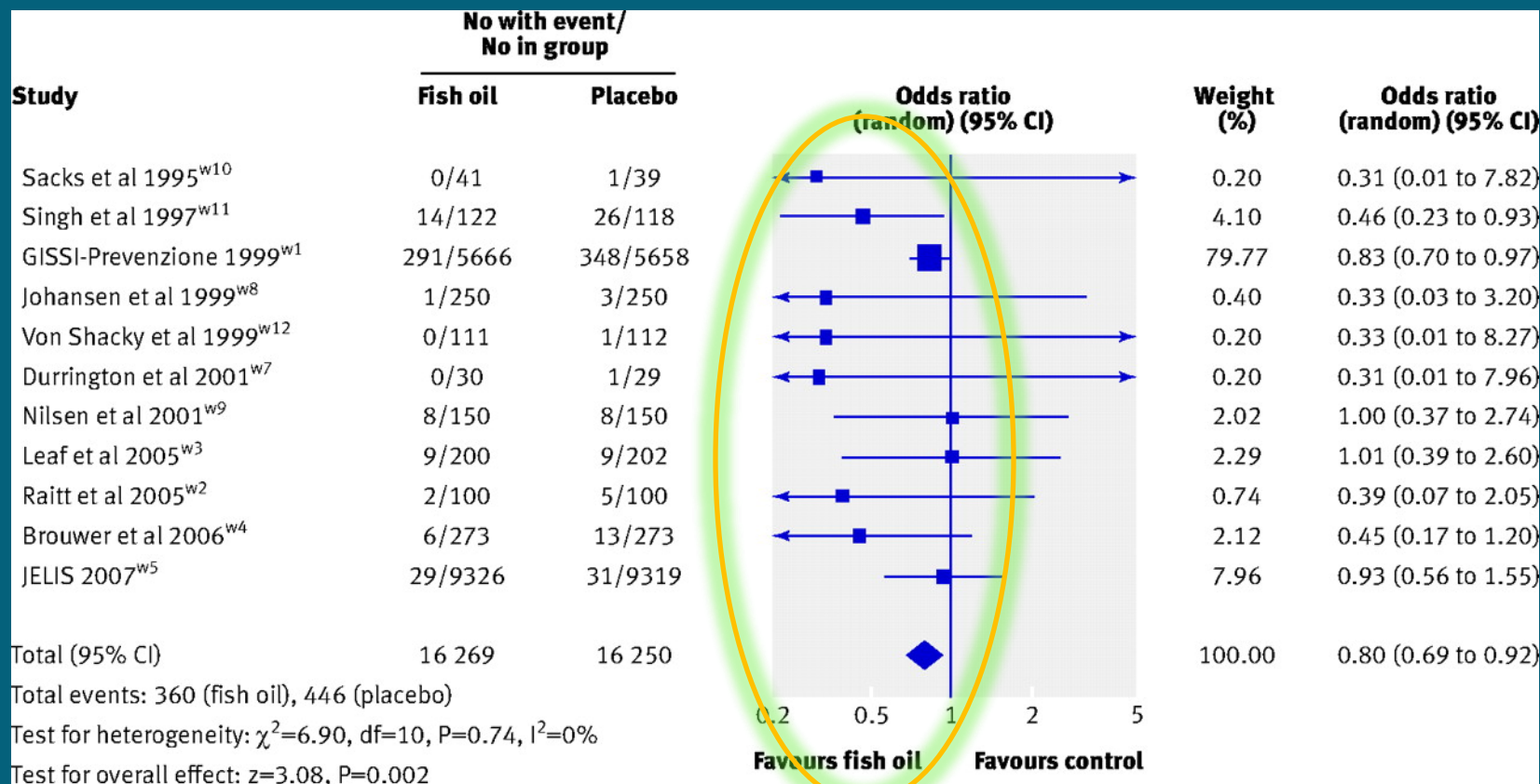12 Yogurth
6 % Butter and cream

Vegetable "minestrone" soup

Weekly

Weekly

Potatoes ≤ 3 s

White meat 2 s
Fish/seafood ≥ 2 s

Sweets ≤ 2 s

Red meat < 2 s
Processed meat ≤ 1 s

Eggs 2–4 s
Legumes ≥ 2 s

Vegetables "au gratin"

Meta analysis: fish oil reduces by 20% the risk of death from cardiac causes

	No with event / No in group		Odds ratio (random) (95% CI)	Weight (%)	Odds ratio (random) (95% CI)
Study	Fish oil	Placebo			
Sacks et al 1995[w10]	0/41	1/39		0.20	0.31 (0.01 to 7.82)
Singh et al 1997[w11]	14/122	26/118		4.10	0.46 (0.23 to 0.93)
GISSI-Prevenzione 1999[w1]	291/5666	348/5658		79.77	0.83 (0.70 to 0.97)
Johansen et al 1999[w8]	1/250	3/250		0.40	0.33 (0.03 to 3.20)
Von Shacky et al 1999[w12]	0/111	1/112		0.20	0.33 (0.01 to 8.27)
Durrington et al 2001[w7]	0/30	1/29		0.20	0.31 (0.01 to 7.96)
Nilsen et al 2001[w9]	8/150	8/150		2.02	1.00 (0.37 to 2.74)
Leaf et al 2005[w3]	9/200	9/202		2.29	1.01 (0.39 to 2.60)
Raitt et al 2005[w2]	2/100	5/100		0.74	0.39 (0.07 to 2.05)
Brouwer et al 2006[w4]	6/273	13/273		2.12	0.45 (0.17 to 1.20)
JELIS 2007[w5]	29/9326	31/9319		7.96	0.93 (0.56 to 1.55)
Total (95% CI)	16 269	16 250		100.00	0.80 (0.69 to 0.92)

Total events: 360 (fish oil), 446 (placebo)

Test for heterogeneity: $\chi^2=6.90$, df=10, P=0.74, $I^2=0\%$

Test for overall effect: z=3.08, P=0.002

Favours fish oil — Favours control

León H et al. BMJ 2008;337:bmj.a2931

BMJ

Breast Cancer
n-3 Reduce the Risk Compared n-6

Case-Control Study, n = 329,
ratio of long chain n-3/total n-6

P for trend 0.0002

Adjusted OR
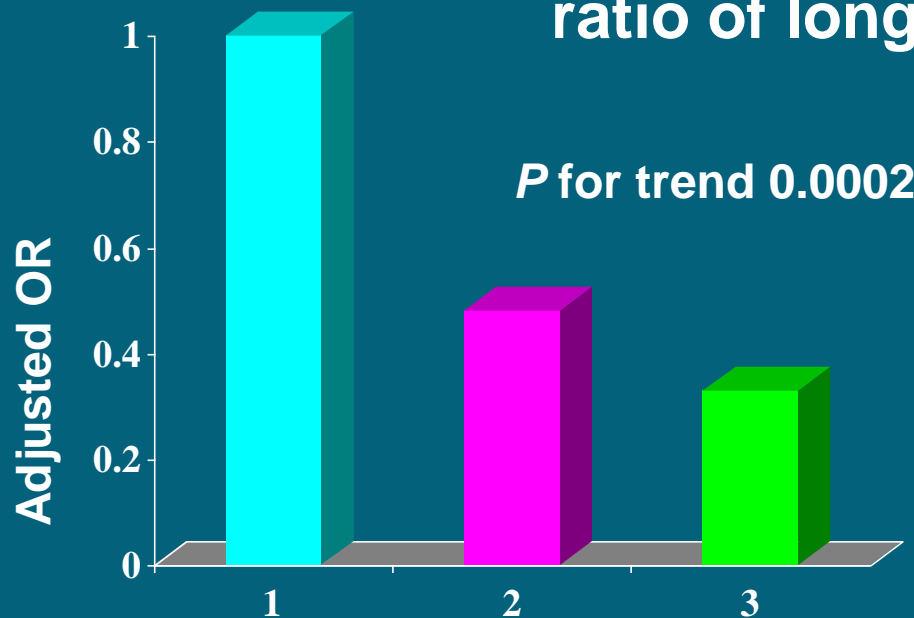
Tertile of Breast Tissue Fatty Acid n-3:n-6 ratio

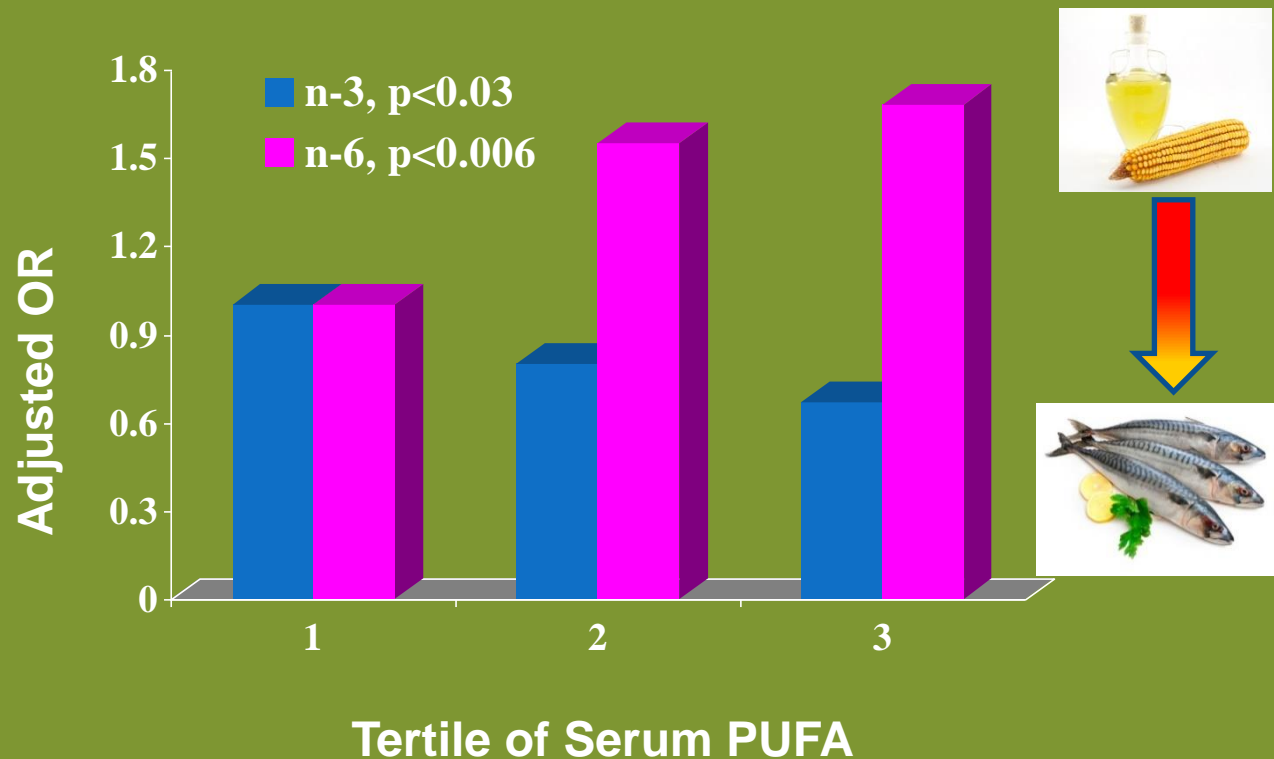Maillard et al. Int. J. Cancer 98: 78-83, 2002

Prostate Cancer: 47,866 U.S men in the Health Professionals Follow-Up Study

Range of Intakes: Ala: < 0.37 to >0.58 % KCAL; EPA + DHA: < 0.057 to >0.214 % KCAL

Legend:
- ALA — $p < 0.0001$
- EPA + DHA — $p < 0.04$

Y-axis: Adjusted RR
X-axis: Quintile of Intake

Leitzman et al. Am J. Clin Nutr. 80: 204-216, 2004
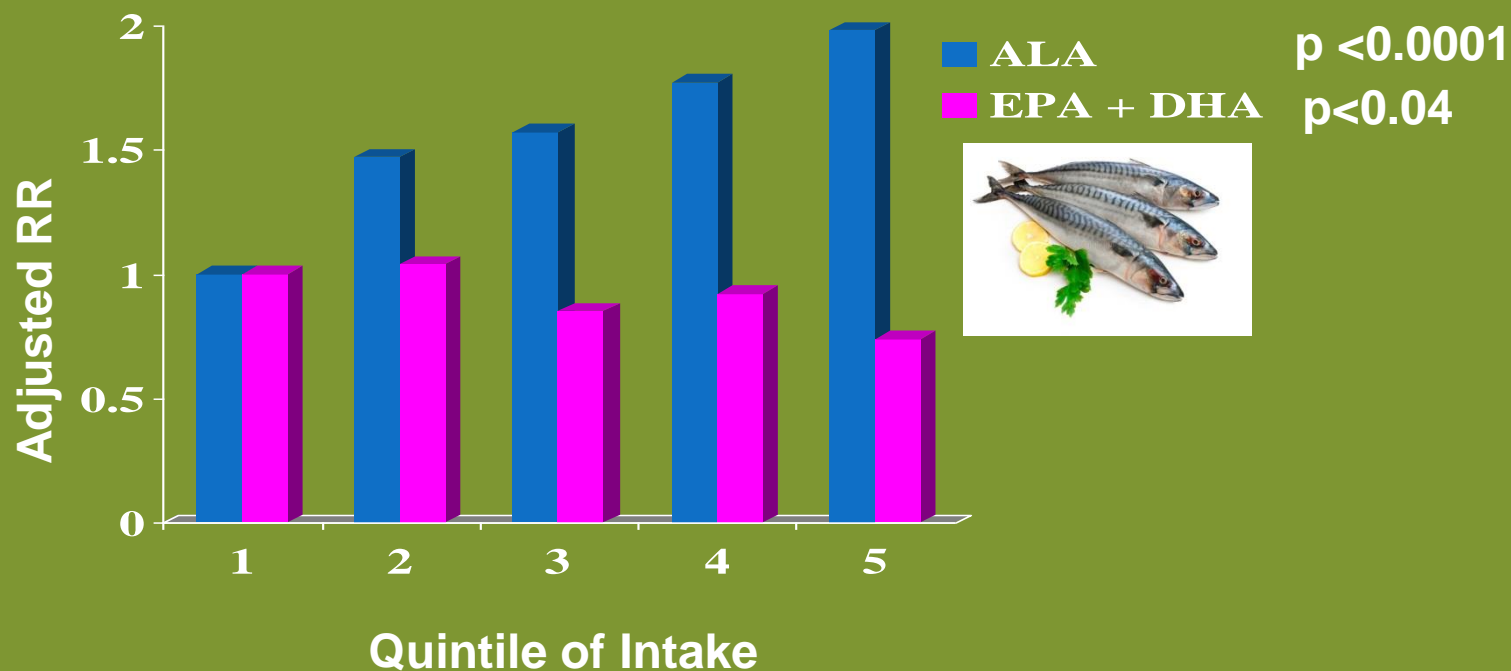
Colorectal Cancer:
Opposing Effects of n-3 and n-6 Fatty Acids

Endoscopy based case-control study, 363 cases and 498 controls

Pot et al. Int. J Cancer, 123: 1974-1977, 2009

Donato Romagnolo, PhD, MSc – The University of Arizona

Rheumatoid Arthritis:
N-3 in Fish Reduce the Risk in a Prospective Cohort

57,053 individuals who participated in a prospective cohort (Danish National Patient Registry).

RESULTS: The average time of follow-up in the cohort was 5.3 years
In patients (n=69) with RA, an increase in intake of 30 g fish (> or = 8 g fat/100 g fish) per day was associated with 49% reduction in the risk of RA (p = 0.06),
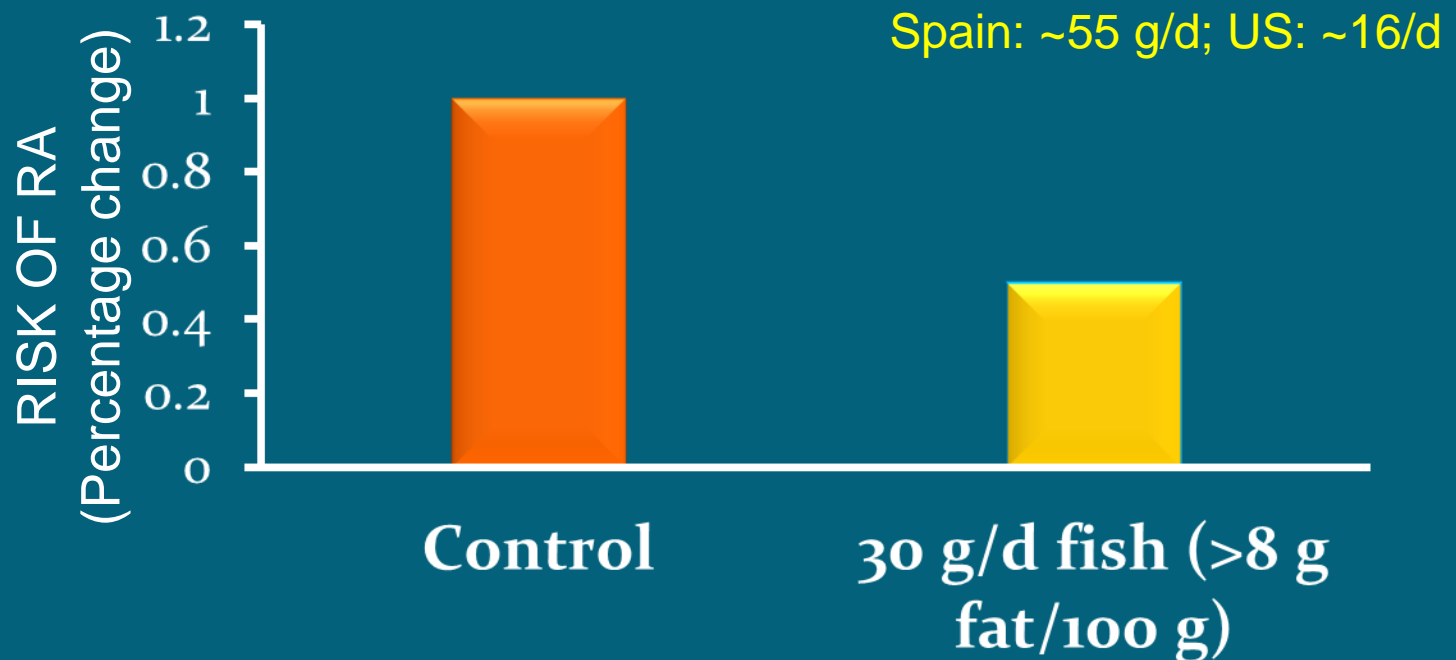
Spain: ~55 g/d; US: ~16/d

(Pedersen et al. . The Journal of Rheumatology July 2005, 32 (7) 1249-1252)
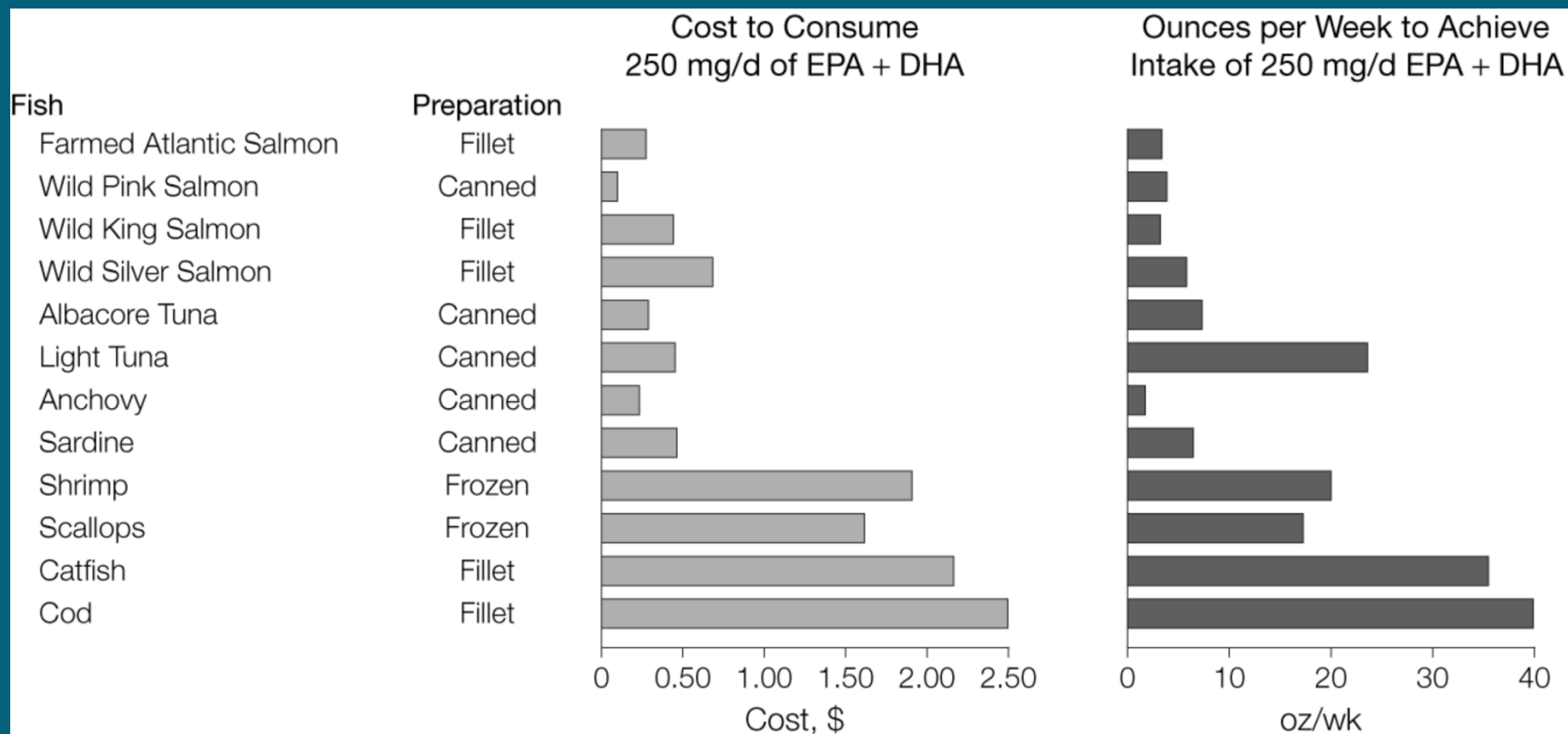
Costs were calculated for commonly consumed seafood species, based on retail prices (averaging the most commonly sold items in each of 6 US cities in the east, midwest, and south from a national online grocery store or, for wild king and silver salmon, from online retailers) and on species-specific eicosapentaenoic acid (EPA) + docosahexaenoic acid (DHA) content. Least expensive was canned pink salmon (9 cents/250 mg of EPA + DHA); the average cost per 250 mg of EPA + DHA for these 12 types of seafood was 92 cents. The corresponding ounces per week needed to achieve 250 mg/d of EPA + DHA is also shown.

What/how much do we eat?

What/how much do we eat?

~258# in 2014

110 lbs in 2019

U.S. Per Capita Consumption (lbs/Year)

300
250
200
150
100
50
0

1980 1990 1995 2000 2005 2006 2009
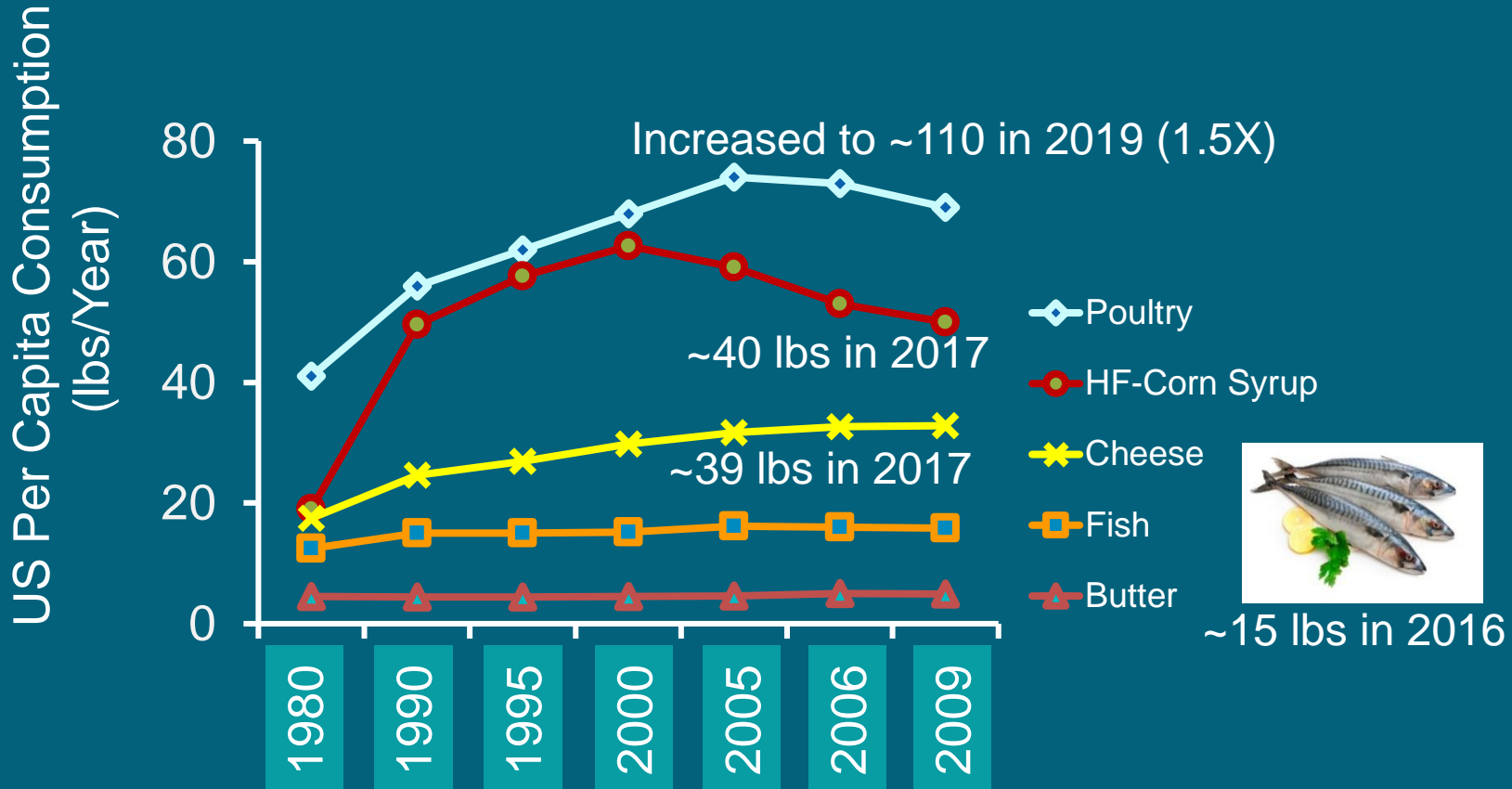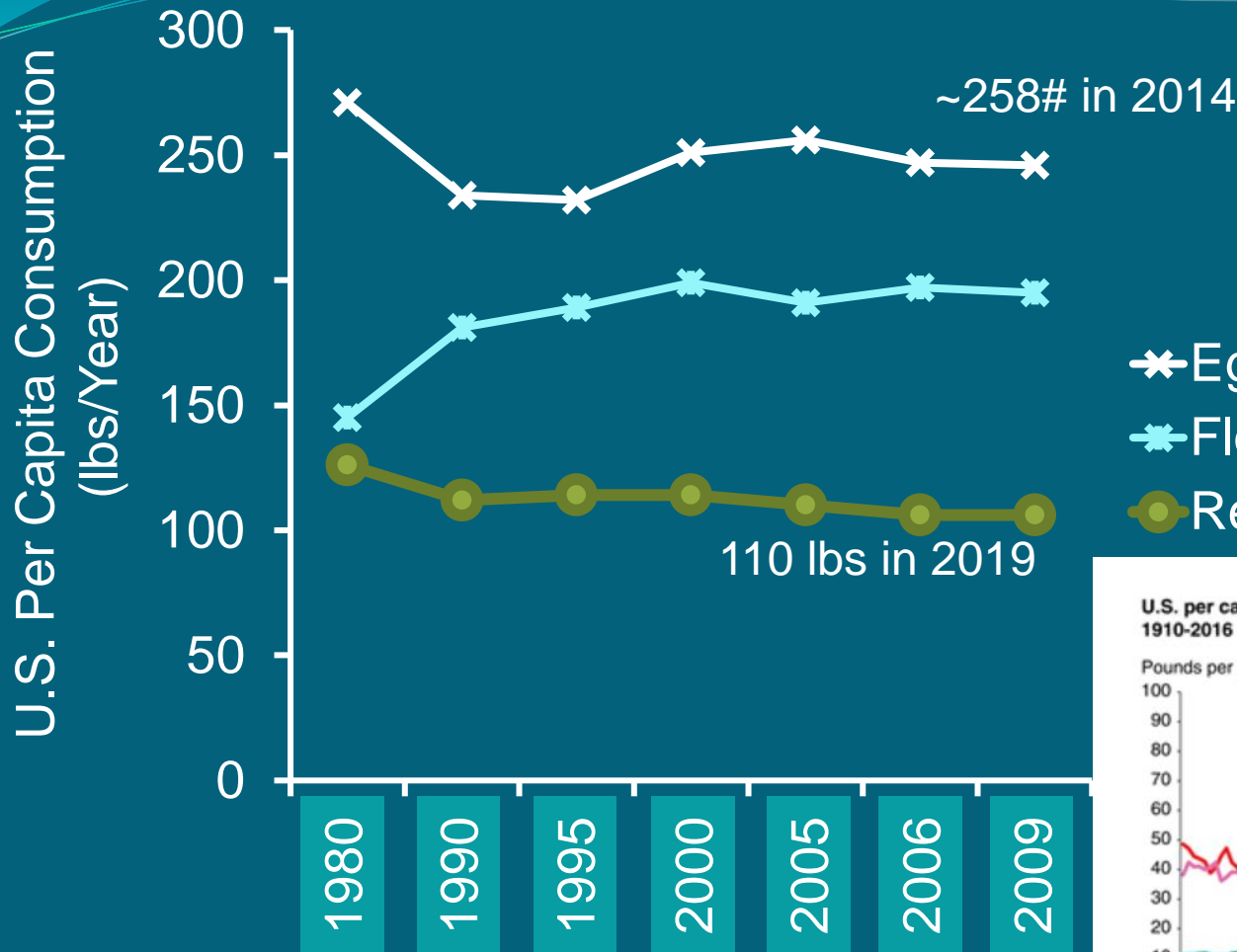
✖ Eggs (#)
✖ Flour, Cereals
● Red Meat

U.S. per capita availability of beef, pork, chicken, and fish/shellfish, 1910-2016

Pounds per person[1]

— Beef — Pork — Chicken — Fish and shellfish

100
90
80
70
60
50
40
30
20
10
0

1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010
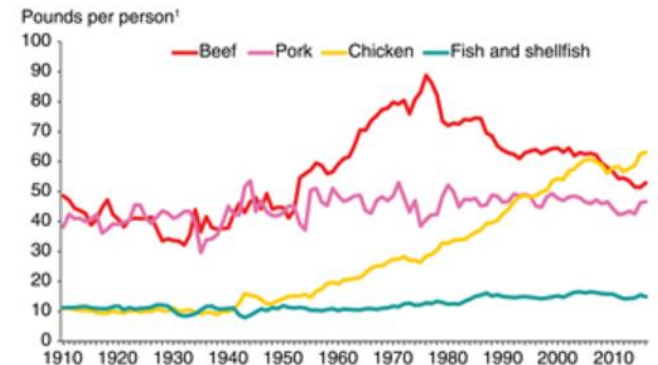
Populations with consumption of red wine, tea, and a Mediterranean Diet have a lower mortality from coronary artery disease (CAD)

ALL CAUSES   CAD
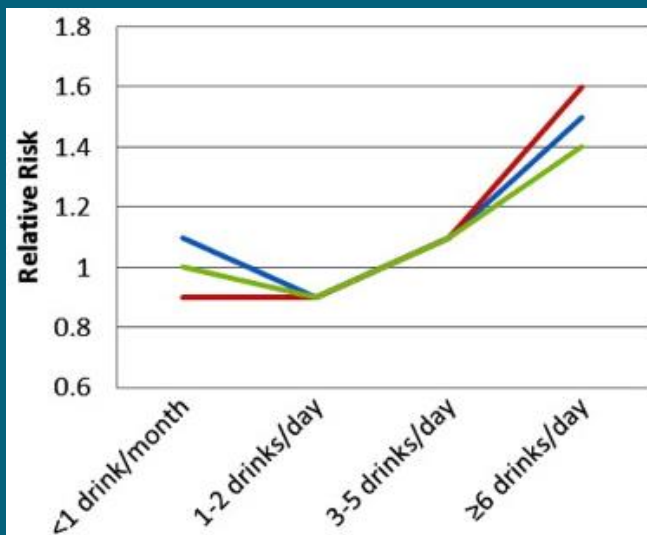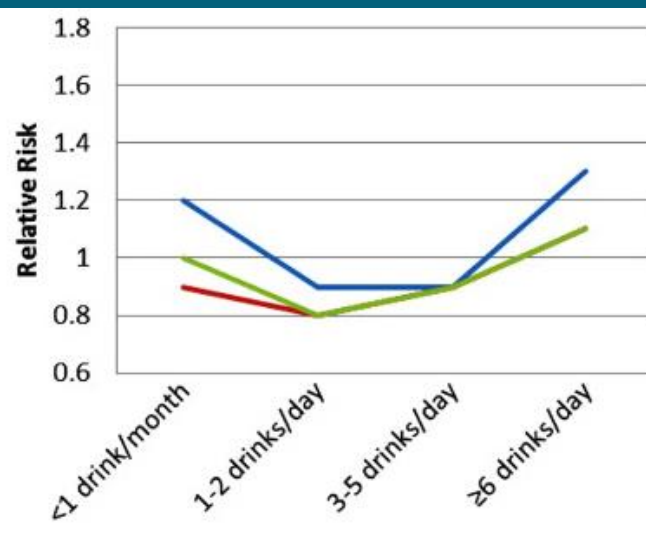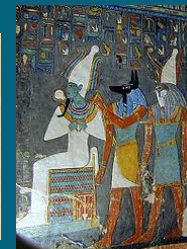
Wine in moderation has a positive effect, however, too much has a negative effect on Mortality due to A) ALL CAUSES B) CAD . **CHECK WITH YOUR DOCTOR** (Cordova et al., J Am Coll Surg 2011.09.23:97)

"I see you've embraced part of my lecture on the benefits of red wine."

FRENCH PARADOX

Figure 4.7. **Overall alcohol consumption among adults, 2008 and 2018 (or nearest years)**

○ 2008 ● 2018

Litres per adult per year
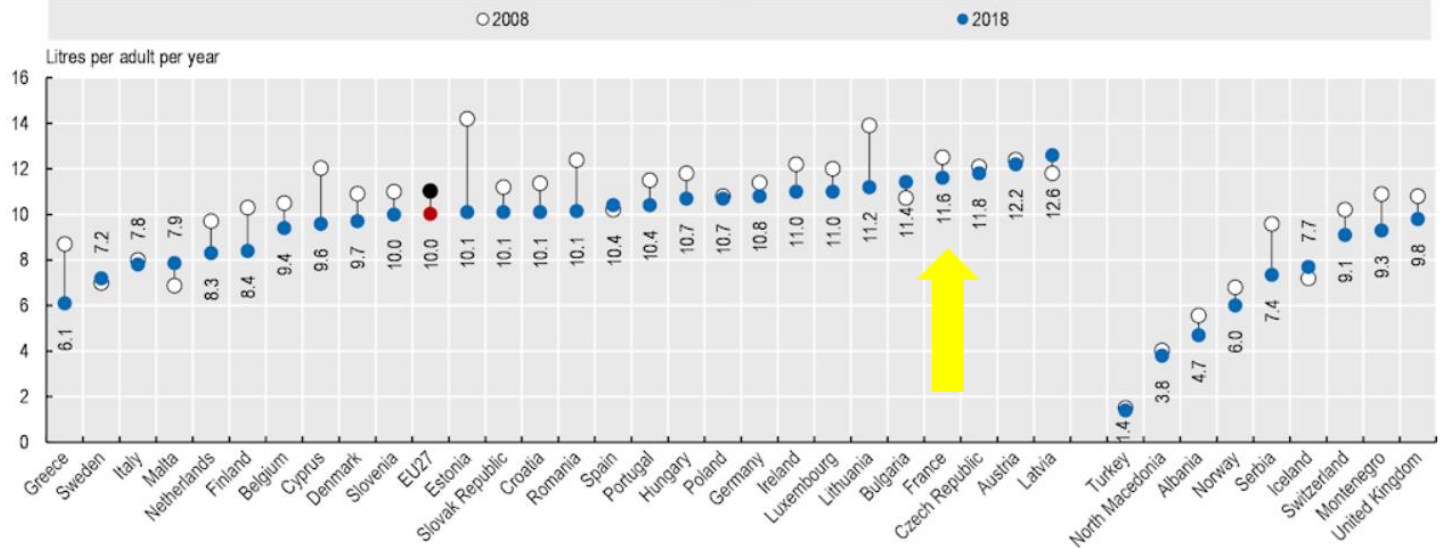
Note: The EU average is unweighted.

Source: OECD Health Statistics 2020, WHO Global Information System on Alcohol and Health for Belgium, Germany, Greece, Italy, Latvia, Portugal and non-OECD countries.

StatLink https://stat.link/zb2sw9

Figure 3. Percentage change in per capita ethanol consumption, United States, 1977–2016.
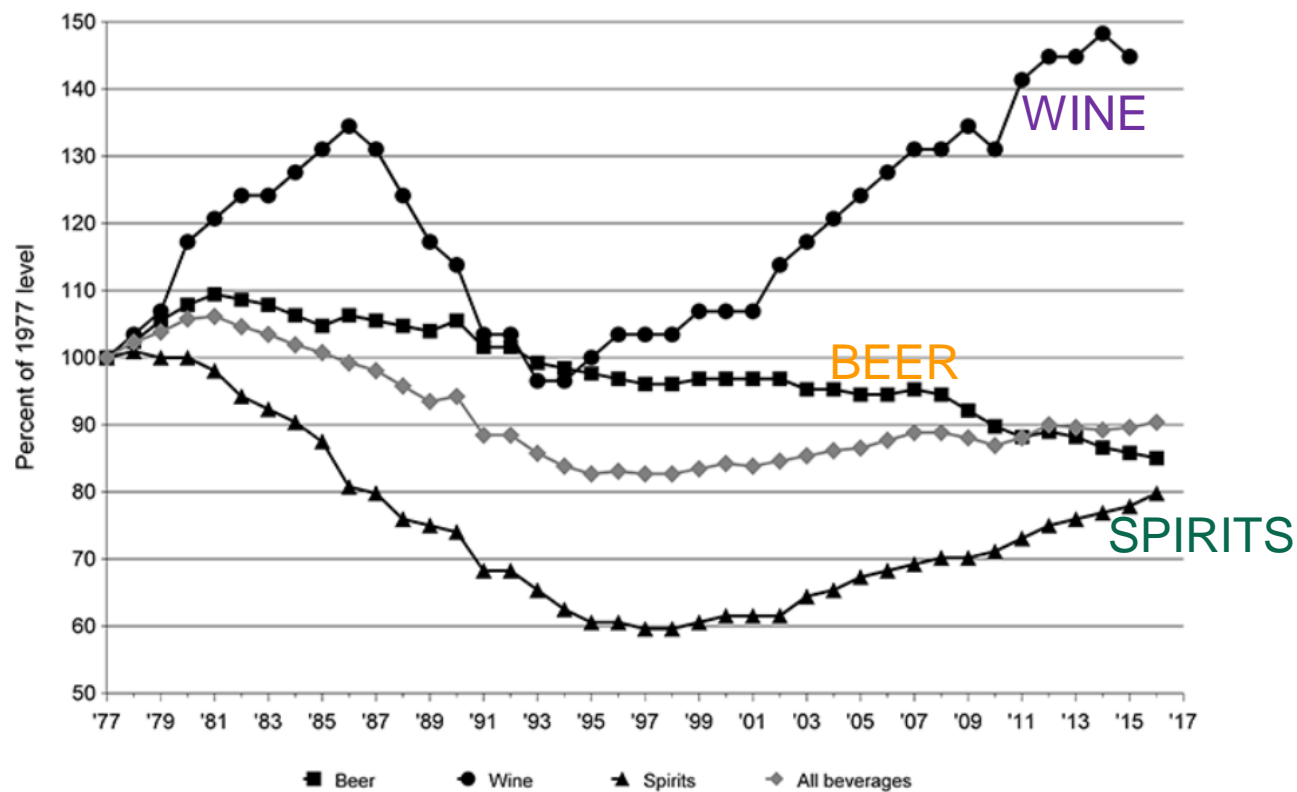
Metabolic syndrome: common features

- Central abdominal obesity

- Insulin resistance, elevated fasting glucose (type 2 diabetes)

- Hypertension

- Increased dyslipidemia: which comprises increased TG, LDL particles, reduced HDL cholesterol

Two-year intervention study: 48% reduction in incidence of metabolic syndrome

Mol. Nutr. Food Res. 2007, *51*, 1268–1274
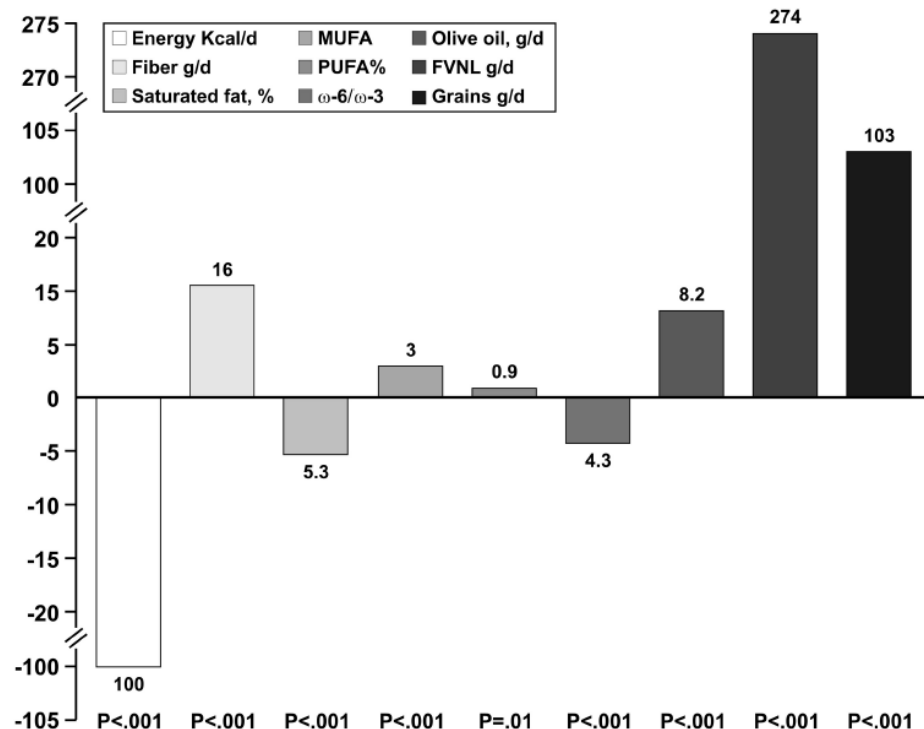
Figure 1. Nutrient indices after two years of a Mediterranean-style diet in subjects with the metabolic syndrome (n = 90). The results are expressed as net changes from the baseline corrected for the changes obtained in a control group (n =9 0) of subjects with the metabolic syndrome following a prudent-cardiac diet. Numbers from 1 to 9 indicate the 9 columns starting from the left. g/d = grams/day; FVNL = fruit, vegetable, nut, legumes. Changes in MUFA and PUFA are expressed in %. Adapted from ref. [40].

Building my Food Plate and Lyfestyle

YES=

NO=

- I am using olive oil, ~4 tbsp./d?
- More than 2 vegetable serving/d (~200 g/serving)?
- Legumes 2-3 servings/wk (1 serving ~150g)
- Number of fruits more than 3/d?
- Physical activity…….
- Dairy 2 serving/d (~30-50 g/serving)
- Ca and Vit D in check?
- Olive/Nuts, 2 servings/ d (~30 g/d)
- Fish, at least 2, better 3 serving/wk
- White meat (2 serving/wk) better than red meat (1 serving/wk) but cooking method is a factor.
- Pasta/rice, 2-3 servings/wk (50-60 g/serving)
- Alcohol(wine) best 1 serving/d max! (risk factor for women and men)
- Forget about sweetened and carbonated beverages!

What Makes Italy the Second Healthiest Country in the World?

On Bloomberg's Global Health Index, Italy ranks a close second on the list of the world's healthiest countries.

https://worldpopulationreview.com/country-rankings/healthiest-countries

May 15-June 18, 2023
(Verona – Italy)

Nutrition and Health
Series Editor: Adrianne Bendich

Donato F. Romagnolo
Ornella I. Selmin   *Editors*

Mediterranean Diet

Dietary Guidelines and Impact on Health and Disease

☼ Humana Press

Mediterranean Diet and Prevention of Chronic Diseases

Donato F. Romagnolo, PhD, MSc
Ornella I. Selmin, PhD

A large body of research data suggests that traditional dietary habits and lifestyle unique to the Mediterranean region (Mediterranean diet, MD) lower the incidence of chronic diseases and improve longevity. These data contrast with troubling statistics in the United States and other high income countries pointing to an increase in the incidence of chronic diseases and the projected explosion in cost of medical care associated with an aging population. In 2013, the MD was inscribed by UNESCO in the "Representative List of the Intangible Cultural Heritage of Humanity." The *2015–2020 Dietary Guidelines for Americans* included the MD as a healthy dietary pattern. Therefore, specific objectives of this article are to provide an overview of the nutritional basis of this healthful diet, its metabolic benefits, and its role in multiple aspects of disease prevention and healthy aging. Whereas recommendations about the MD often focus on specific foods or bioactive compounds, we suggest that the eating pattern as a whole likely contributes to the health promoting effects of the MD. Nutr Today. 2017;52(5):208–222

Mortality attributable to chronic diseases is projected to increase as the US population ages. At the same time, calorie, carbohydrate, and portion size intake have risen along with greater amounts of food and calories per meal, while the population has adopted lifestyles that are more sedentary. Together, these factors have contributed to the increase in noncommunicable diseases. The 48 million individuals (~15% of households) in the United States who are unable to acquire adequate food to meet their needs must also be considered because poverty can exacerbate the risk of some chronic diseases.[1] During the last 3 decades, various dietary strategies and visual representations (ie, pyramids, plates) have been developed by US and health organizations elsewhere in the world to promote the rebalancing of sources of calories with more physical activity to ensure dietary adequacy and reduce the burden of chronic diseases. The Scientific Report of the 2015–2020 Dietary Guidelines of the US Department of Health and Human Services and US Department of Agriculture (USDA)[2] recognized that dietary patterns of the American public are suboptimal and causally related to poor individual and population health, as well as higher chronic disease rates.

The *Dietary Guidelines for Americans*[1] suggested the adoption of healthy eating patterns characterized by higher consumption of fruits, vegetables, and whole grains and lower intake of calories, saturated fat, sodium, refined grains, and added sugars. Moreover, such a pattern would help address underconsumption of vitamin D, calcium, potassium, and fiber, nutrients that have been identified as of public concern for most of the US population. One such healthy eating pattern contributing to overall health is the Mediterranean diet (MD). This article describes how many different foods and beverages act together in this pattern to contribute to overall health outcomes. The MD is a dietary pattern or model that integrates a number of variations on a basic theme adapted to an individual country's heritage and cultures. Compared with western dietary patterns, the MD favors local and seasonal food production to a

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