Practical Class 5

Burden of Disease — Medico-Social Aspects

Conspectus topic (20)

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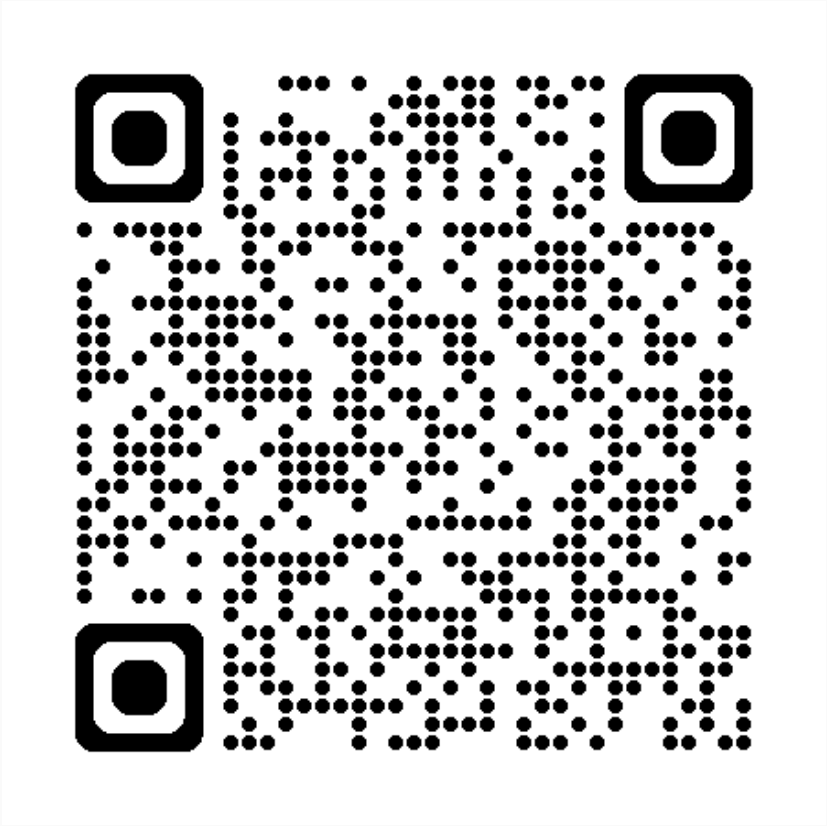
Academic Year 2025/2026

Department of “Social Medicine and Public Health”

download the presentation from https://tinyurl.com/social-med-class-05

15-minutes reading assignment



https://kostadinoff.github.io/learning.html

Group tasks

https://kostadinoff.github.io/tasks.html

Outline

1. Definition and Criteria
2. Measuring the Burden of Disease
3. Advanced Indicators
4. Epidemiological Transition Model
5. Disease Burden in Bulgaria
6. Risk Factors

Definition and Criteria

Burden of Disease — Definition (20)

The **burden of disease** describes the total, cumulative consequences of a defined disease or range of harmful diseases with respect to disabilities in a community, encompassing:

- Health dimensions — mortality, morbidity, disability, and reduced quality of life
- Social dimensions — disrupted family dynamics, social isolation, loss of productive capacity
- Economic dimensions — direct costs of diagnosis, treatment, and rehabilitation; indirect costs from lost productivity

The concept identifies the **gap** between an ideal state — where everyone lives free of disease and disability — and the cumulated current health status of a population.

Criteria for Substantial Disease Burden (20)

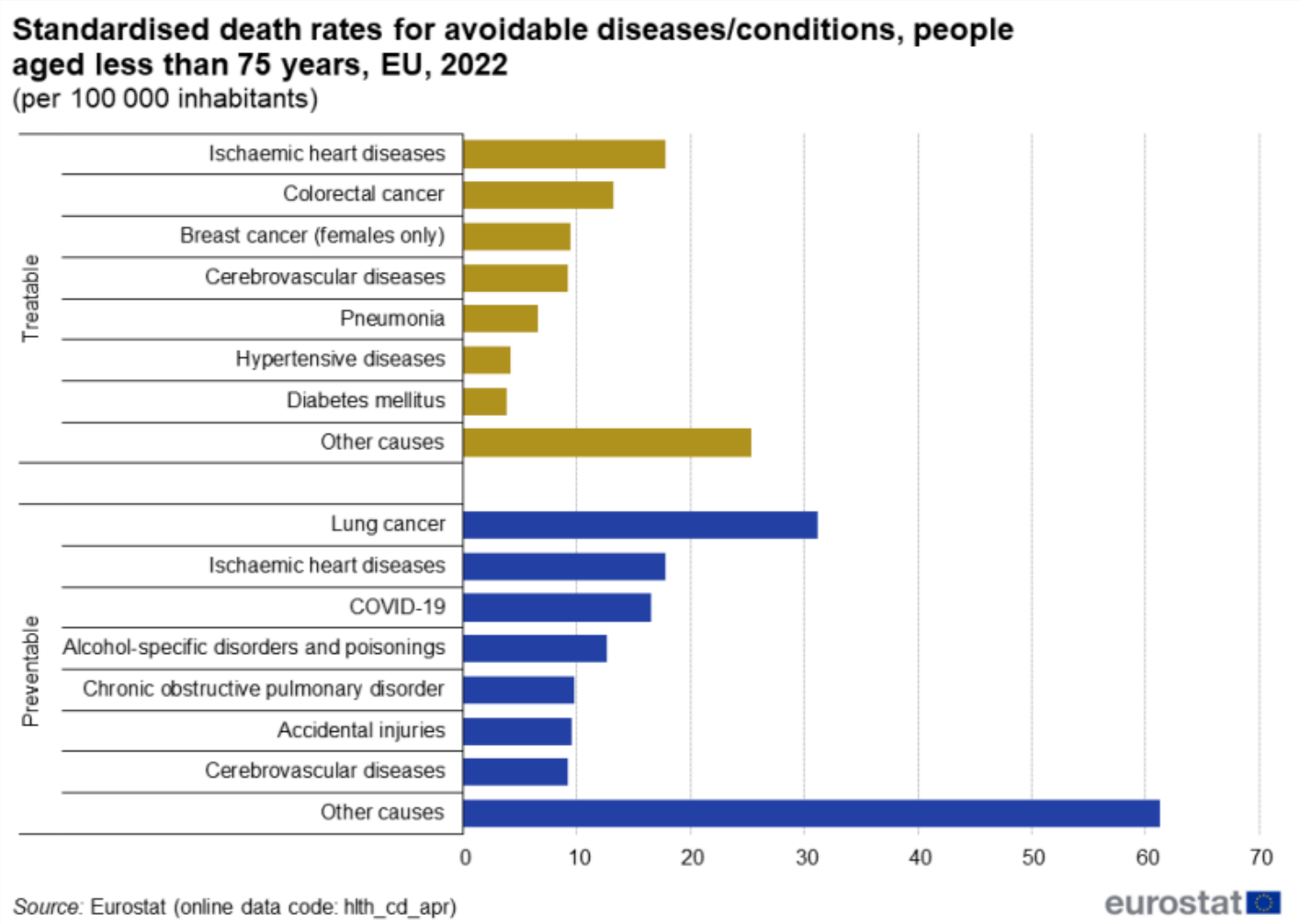
A disease or condition imposes substantial burden when it satisfies one or more of the following criteria:

- **High mortality rates** combined with **poor prognosis** — conditions that kill and offer limited opportunity for effective intervention
- **High prevalence and incidence** combined with poor therapeutic prospects
- **Significant share in the structure of causes of death** — demographic effects, reduced life expectancy
- **Major contribution to morbidity**, temporary and permanent incapacity to work, and hospital morbidity
- **High socioeconomic costs** — diagnosis, treatment, follow-up, rehabilitation, and burden to public funds
- **Psychological and social burden** to patients and their families

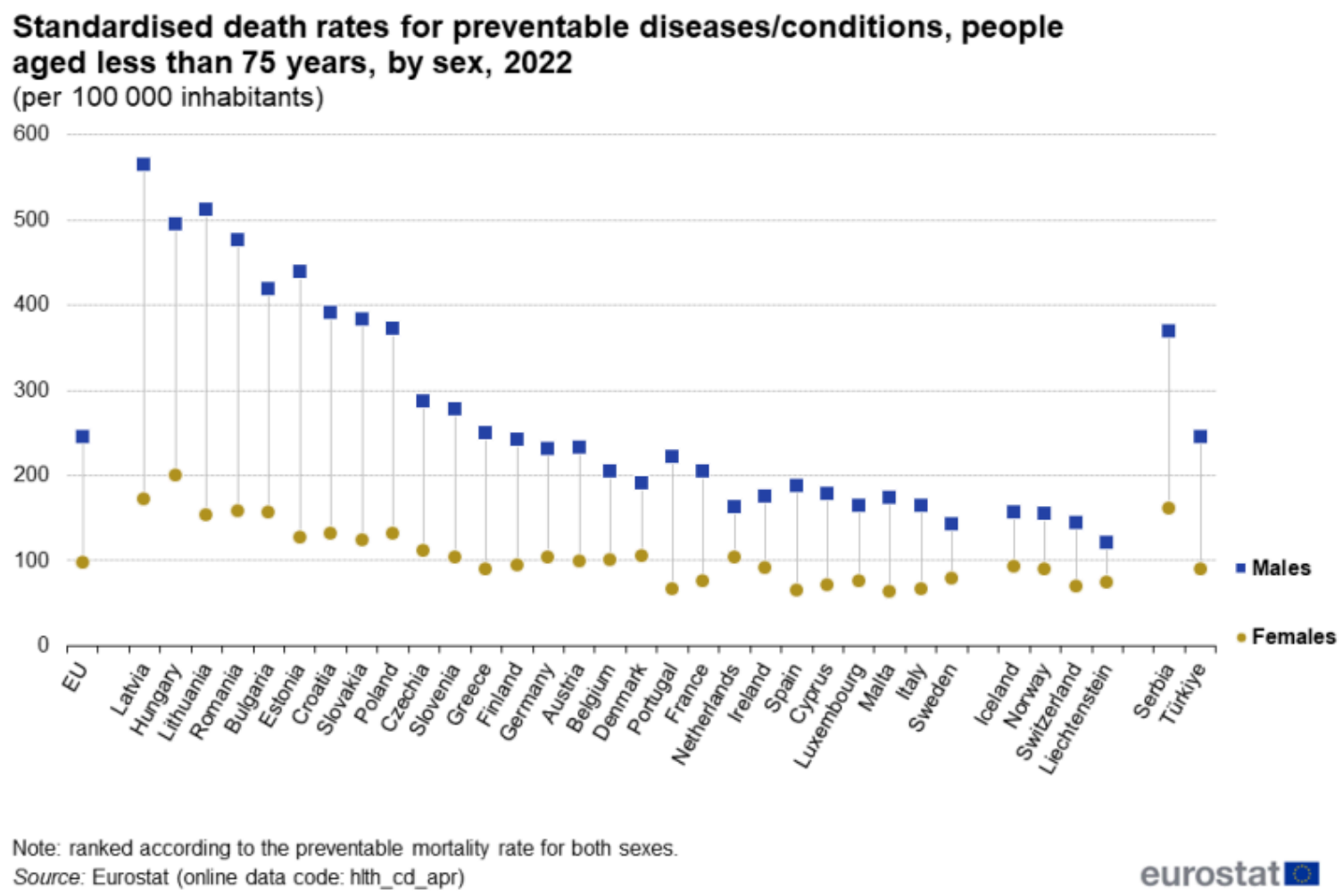
Key Concepts: Preventable and Amenable Deaths (20)

- Premature death — death occurring before an expected age, conventionally set at 65/75 years; represents lost years of potential life
- Amenable / treatable death — a death avoidable through **good quality healthcare**; in light of medical knowledge and technology at the time of death, all or most deaths from that cause could be avoided, subject to age limits
- Preventable death — a death avoidable through **public health interventions** in the broadest sense; reflects the role of determinants beyond the healthcare sector
- Avoidable death — encompasses all deaths defined as preventable, amenable, or both; each death is counted only once

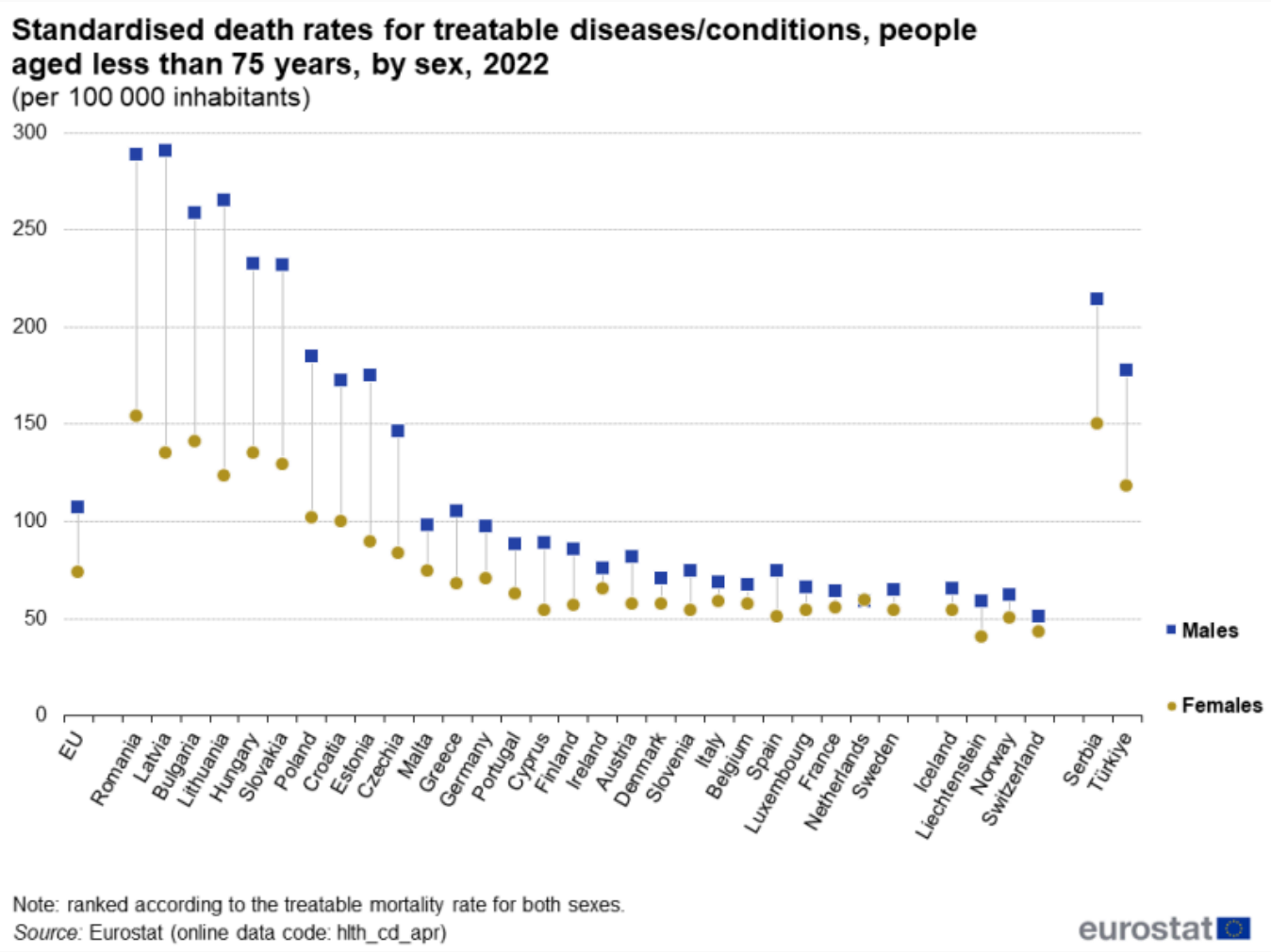
Avoidable Deaths — Europe (20)



Preventable Deaths — Europe (20)



Treatable Deaths — Europe (20)



Impairment, Disability, and Handicap (20)

Three related concepts articulate the progression from biological dysfunction to social consequence:

- Impairment — any disorder or lack of normal structure, usually at the level of an organ
- Disability — lack of function considered normal for a person of a given age and sex; translates impairment into functional limitations
- Handicap — lack or limitation of activities that impair social function; the ultimate social consequence of disease

Disease	Impairment	Disability	Handicap
Brain injury	Intellectual delay	Difficulty learning	Social isolation
Poliomyelitis	Paralysis	Inability to walk	Unemployment

Measuring the Burden of Disease

Global Burden of Disease — Overview (20)

- The **Global Burden of Disease (GBD)** study, launched in the early 1990s, is the most comprehensive effort to quantify disease burden worldwide; regularly updated with new data.
- Objectives of disease burden measurement:
  1. Determine the **gap** between actual and potential health status of a population
  2. Quantify the **socioeconomic burden** — direct healthcare costs and indirect costs from lost productivity
  3. Provide the empirical foundation for **health policy formulation**, priority-setting, and resource allocation
  4. Support **health technology assessment** for diagnostic tests, medicinal products, and medical services

Years of Life Lost (YLL) (20)

YLL measures the burden of disease by quantifying years of life lost due to **premature mortality**.

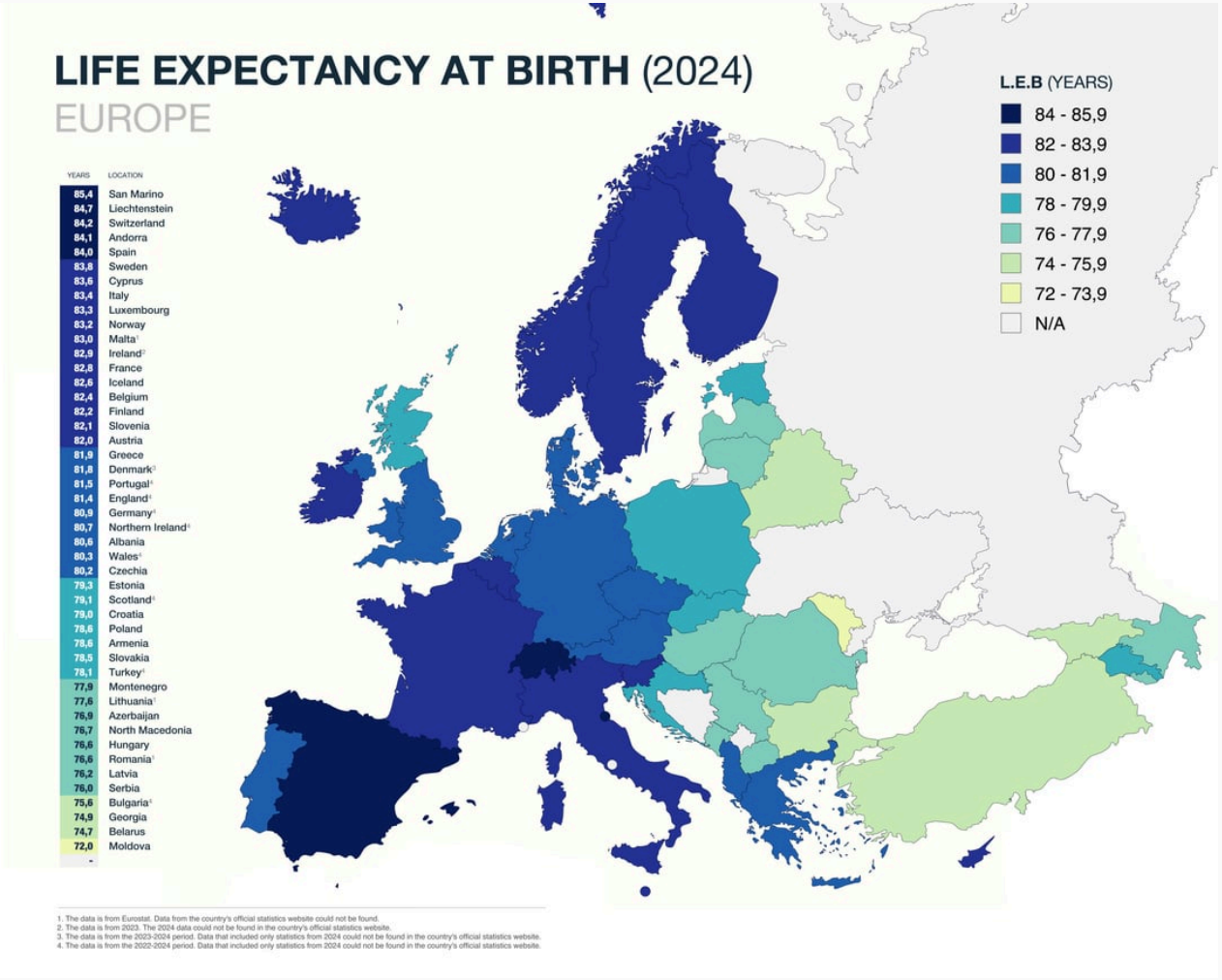
$$\text{YLL} = \sum \text{Deaths}_i \times (\text{Life expectancy at age}_i - \text{Age at death}_i)$$

- GBD standard reference life expectancy: 82.5 years (females) and 80 years (males)
- Accounts not only for the **number** of deaths but for the **age** at which they occur — a death at 30 contributes far more YLL than a death at 70
- Illustrates the high social cost of diseases killing children and young adults (infectious diseases, injuries)

Example: 100 deaths at age 60, with standard life expectancy of 70 years at that age:

$$\text{YLL} = 100 \times 10 = 1,000 \text{ years}$$

Life Expectancy at Birth (20)



Years Lived with Disability (YLD) (20)

YLD complements YLL by measuring burden arising from **non-fatal health outcomes**.

$$\text{YLD} = \text{Cases} \times \text{Disability Weight} \times \text{Duration (years)}$$

- **Disability weights** range from 0 (perfect health) to 1 (health state equivalent to death); derived from population-based preference surveys
- Examples: terminal-stage cancer 0.70–1.00 mild anaemia 0.02
- YLD captures the suffering and functional limitation of conditions that do not kill

Example: 500 cases, disability weight 0.6, mean duration 10 years:

$$\text{YLD} = 500 \times 0.6 \times 10 = 3,000 \text{ years}$$

Disability-Adjusted Life Year (DALY) (20)

DALYs integrate premature mortality and non-fatal outcomes into a single metric of overall disease burden:

$$\mathrm{DALY} = \mathrm{YLL} + \mathrm{YLD}$$

- Enables **direct comparison** of diseases with very different profiles — e.g., a highly fatal acute condition vs. a chronic condition with high morbidity but low mortality
- Expresses burden in a **common unit**, facilitating priority-setting and cross-disease resource allocation
- One DALY = **one year of healthy life lost** to disease, disability, or premature death

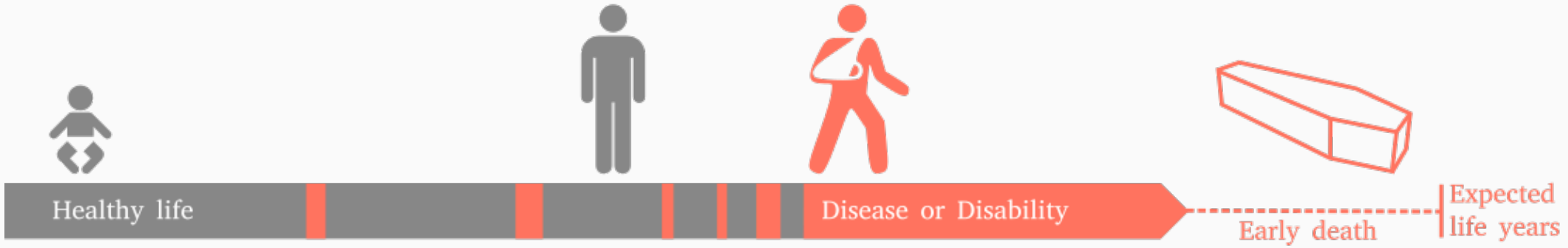
Disability-Adjusted Life Year (DALY) (20)

DALY

Disability Adjusted Life Year is a measure of overall disease burden, expressed as the cumulative number of years lost due to ill-health, disability or early death

= YLD
Years Lived with Disability

\+ YLL
Years of Life Lost



Quality-Adjusted Life Year (QALY) (20)

QALYs combine the **quantity** and **quality** of life into a single number; widely used in health economics and cost-effectiveness analysis.

$$\text{QALY} = \sum \text{Utility value}_i \times \text{Time in health state}_i \text{ (years)}$$

- Utility values range from 0 (death) to 1 (perfect health); obtained from population-based preference surveys
- Health states defined by dimensions: **mobility, self-care, usual activities, pain/discomfort, anxiety/depression**

Example: 6 months at utility 0.7, then 6 months at utility 0.6:

$$\text{QALY} = (0.7 \times 0.5) + (0.6 \times 0.5) = 0.65$$

Health-Related Quality of Life (HRQOL) (20)

HRQOL refers to an individual's perceived physical, mental, and social well-being as affected by health status and medical interventions.

- Multidimensional construct: physical functioning, pain/discomfort, emotional well-being, social functioning, life satisfaction
- Used in clinical trials, health policy evaluation, and clinical practice to promote **patient-centred care**

EQ-5D (EuroQol-5 Dimensions) — the most widely used standardised HRQOL instrument:

Five dimensions	Mobility | Self-care | Usual activities | Pain/discomfort | Anxiety/depression
Response levels	No problems | Some problems | Extreme problems (3L, 5L versions)
Score range	0 (worst health state) to 1 (perfect health)

Advanced Indicators

Mortality-to-Incidence Ratio (MIR) (20)

The **MIR** is a direct indicator of **healthcare quality**: it compares deaths to new cases under fixed incidence conditions.

$$\text{MIR} = \frac{\text{Deaths}}{\text{Incidence}}$$

- **Low MIR** — early detection, timely and effective treatment → most diagnosed patients survive
- **High MIR** — delayed diagnosis, inadequate access, poor treatment quality, or inherently aggressive disease biology
- Global disparities (cancer, 2024–2025): African regions ≈ **67.2%**; North America ≈ **23.0%** — reflecting fundamental inequities in healthcare access, diagnostic capability, and treatment availability

DALYs-to-Prevalence (DPR) & Prevalence-to-Incidence (PIR) (20)

$$\text{DPR} = \frac{\text{DALYs}}{\text{Prevalence}}$$

- Measures **severity of health loss** per prevalent case; higher DPR → greater average burden per person living with the condition

$$\text{PIR} = \frac{\text{Prevalence}}{\text{Incidence}}$$

- Reflects both **prevention efforts** and **management efficacy**
- **High PIR** may indicate improved survival (positive) or inadequate prevention (negative); interpretation requires temporal context and disease-specific knowledge
- Very high PIR in chronic diseases often reflects the **long natural history** of persistent conditions

YLLs-to-YLDs Ratio (YYR) (20)

$$\text{YYR} = \frac{\text{YLLs}}{\text{YLDs}}$$

- **High YYR** — premature death dominates disease burden; may indicate high case fatality rates or deficiencies in survival-prolonging care
- **Low YYR** — disability rather than mortality drives burden; suggests successful prevention of deaths while managing chronic illness, or conditions with high morbidity but relatively low mortality

YLLs-to-YLDs Ratio

- Diseases with **high YYR** → interventions focused on early detection, curative treatment, survival prolongation
- Diseases with **low YYR** → greater emphasis on rehabilitation, disability accommodation, quality-of-life interventions

Indicator	MIR	DPR	PIR	YYR
Numerator	Deaths	DALYs	Prevalence	YLLs
Denominator	Incidence	Prevalence	Incidence	YLDs
Measures	Case lethality	Severity/case	Duration/accum.	Death vs. disability

Epidemiological Transition Model

Epidemiological Transition Model (20)

Developed by WHO in 2004 (based on GBD 1990/2000 data), the model describes how **disease patterns shift** as countries undergo socioeconomic development.

Three major disease groups:

- Group I — Traditional infectious diseases: communicable diseases, perinatal conditions, malnutrition → **burden declines** with development (improved sanitation, nutrition, vaccination, basic healthcare)
- Group II — Modern non-communicable diseases: cardiovascular disease, neoplasms, neuropsychiatric conditions, diabetes → **burden increases** with development (ageing, lifestyle, environmental change)
- Group III — Injuries and trauma: unintentional (accidents, falls, drownings) and intentional (suicide, violence, war) → **relatively constant** throughout development ("non-transient" conditions)

Epidemiological Transition — Summary (20)

Group	Trend with development	Key conditions
I — Infectious/perinatal/nutritional	↓ Declines	TB, diarrhoeal diseases, childhood infections, malnutrition, perinatal conditions
II — Non-communicable	↑ Increases	CVD, cancers, diabetes, chronic respiratory diseases, neuropsychiatric conditions
III — Injuries	→ Stable	Road traffic, falls, drownings; suicide, violence, conflict

Epidemiological Transition — Summary (20)

Countries in **epidemiological transition** face a **double burden**: residual Group I diseases alongside rapidly rising Group II conditions, straining health systems designed for infectious disease management.

- In high-income countries, NCDs account for 86% of total DALYs
- Over 98% of the global infectious disease burden is concentrated in low- and middle-income countries

Disease Burden in Bulgaria

Infectious Diseases — Bulgaria 2024 (20)

Leading notifiable infectious diseases (2024): varicella 430.1, scarlet fever 135.7, whooping cough 42.2 — per 100 000 population

Notable increases vs 2023:

- Whooping cough: 20 → 2 721 cases (×136)
- Lyme borreliosis: 195 → 390 cases; measles: 0 → 27 cases
- Meningococcal meningitis/sepsis: 3 → 7 cases

Notable decreases vs 2023: varicella (31 216 → 27 707), scarlet fever (11 634 → 8 738)

Tuberculosis (2024): 885 new cases and relapses (+16 vs 2023); pulmonary form 91.4%; M:F ratio 64.2%:35.8%; children under 17 — 31 cases

Malignant Neoplasms — Bulgaria 2024 (20)

- New malignant neoplasm cases (2024): 25 225 — a decrease of 983 from 2023
- Leading sites (% of all new cases): skin **17.7%** · breast (women) **11.8%** · prostate **10.6%** · trachea/bronchi/lungs **8.1%** · colon **7.9%**
- **Paediatric cancer** (under 17 years): 49 cases (−3 vs 2023)
  - Lymphatic, haematopoietic and related tissues: **57.1%**
  - Digestive organs, bone/cartilage, urinary system: 8.2% each

Cancer burden reflects concurrent exposures: tobacco, dietary patterns, occupational and environmental carcinogens, HPV, and detection practices.

Hospitalisation — Bulgaria 2024 (20)

- Total hospitalised cases (2024): 3 245 686 — an increase of 291 050 from 2023; day cases (≤24 h): **27.1%**
- **Leading classes (stays >24 h and day cases combined):**
  - Class XXI — Factors influencing health status / contact with health services: **34.2%**
  - Circulatory system: **9.6%** · Digestive system: **7.6%** · Injuries and poisonings: **6.9%** · Respiratory system: **6.7%**
- **Children 0–17 years**: 309 457 cases (+22 017 vs 2023)
  - Respiratory diseases: **28.9%** · Injuries and poisonings: **18.1%** · Perinatal conditions: **9.9%**
  - Day cases in children: injuries and poisonings **72.1%**

Permanent Disability — Bulgaria 2024 (20)

- Adults >16 years certified (2024): 79 238 — rate 14.5‰ (+14 519 vs 2023); disability >50%: **87.0%**; lifetime certification: **46.1%**
  - Leading causes (adults): circulatory system 27.4% · neoplasms 19.1% · musculoskeletal 12.9% · endocrine/metabolic 8.6% · mental and behavioural 7.4%
- **Children under 16 years** certified: 3 721 (3.8‰); disability >50%: 89.0%; lifetime: 18.9%
  - Leading causes (children): mental and behavioural disorders **34.4%** · congenital anomalies **14.5%** · respiratory diseases **12.5%** · nervous system **11.5%** · endocrine/metabolic **7.6%**

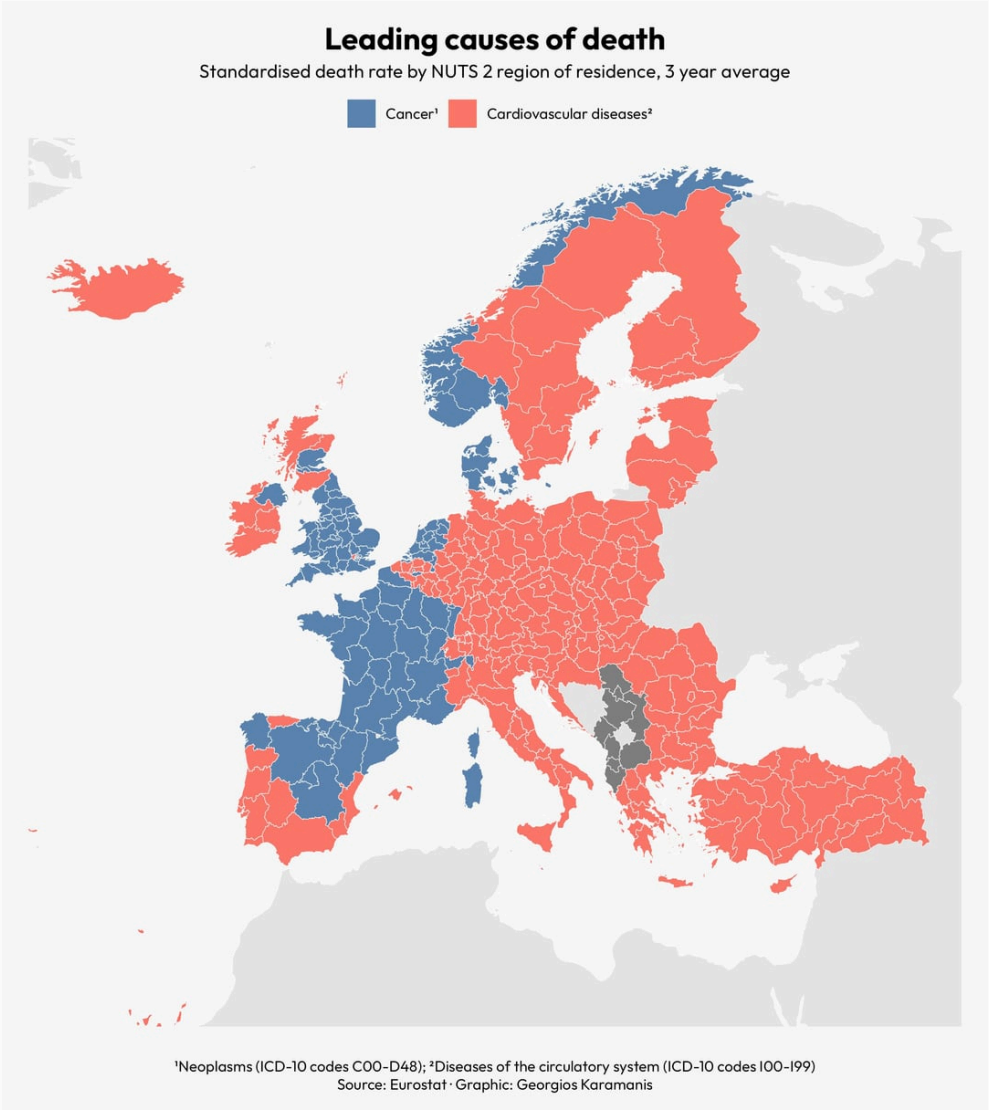
Mortality — Bulgaria (20)

Leading cause of death: diseases of the circulatory system

- Crude death rate: 957.1 per 100 000 population — accounting for **61.1% of all deaths**
- Within circulatory diseases: **cerebrovascular diseases** show the highest frequency, indicating stroke as the most lethal cardiovascular manifestation

This overwhelming cardiovascular dominance reflects both high incidence and high case fatality, and emphasises the critical importance of blood pressure control, atrial fibrillation management, and organised acute stroke care systems.

Reason for Death — Europe (20)



Risk Factors

Tobacco — WHO 2024 / Bulgaria (20)

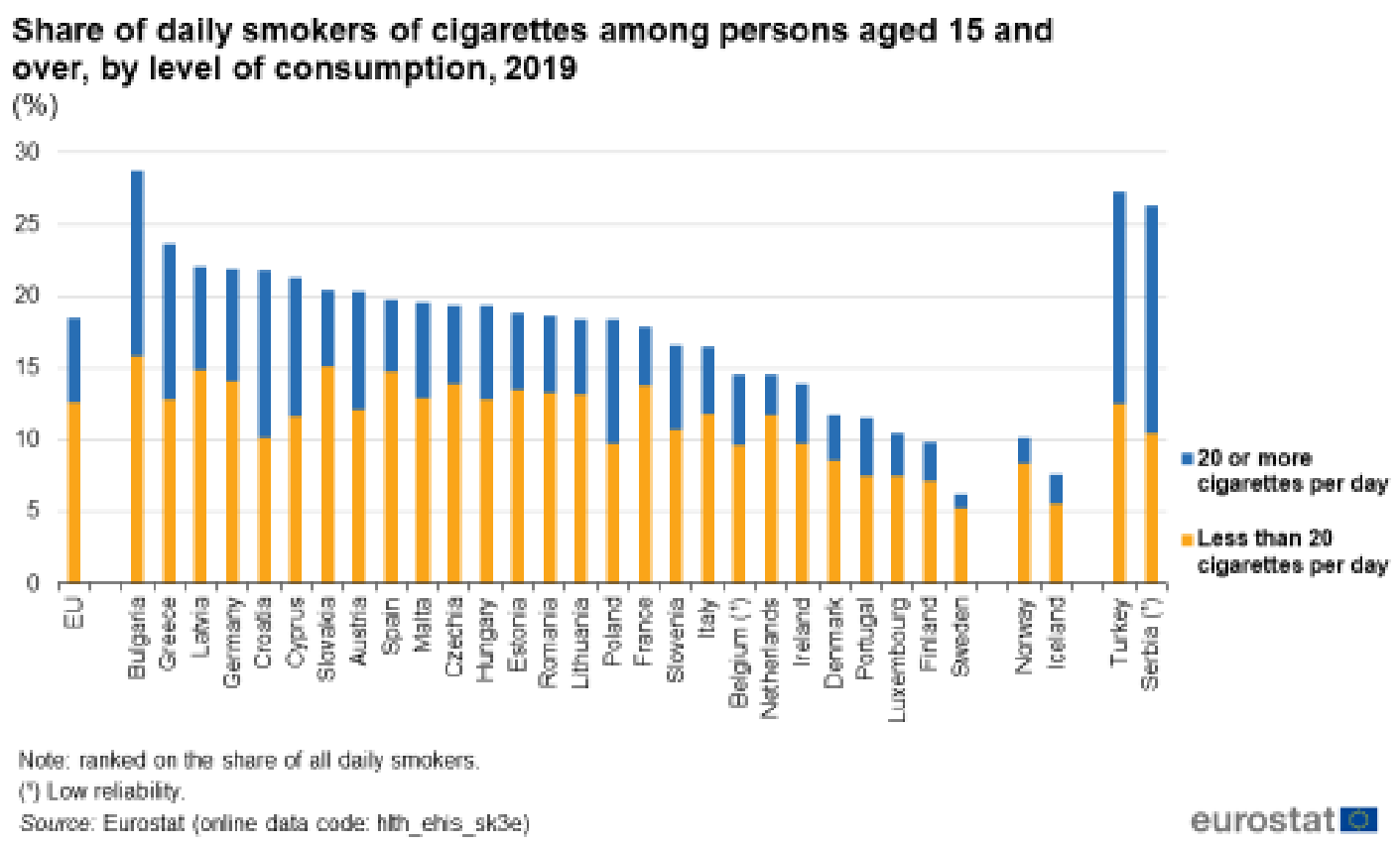
- **WHO European Region**: 179 million adults and 4 million adolescents (13–15 years) currently use tobacco products; tobacco-related diseases cause **>1.2 million deaths/year** in the Region (18% of all NCD deaths)

Current tobacco use — comparative data (WHO, 2024):

Population	Total	Men	Women
World	20.9%	34.4%	7.4%
Europe	25.3%	32.0%	18.5%
Bulgaria	39.5%	40.3%	38.7%

- E-cigarette use among adolescents aged 13–15: 23.3% in Bulgaria (range in WHO European Region: 0.7%–23.3%)

Tabacco — EU 2024 / Bulgaria (20)



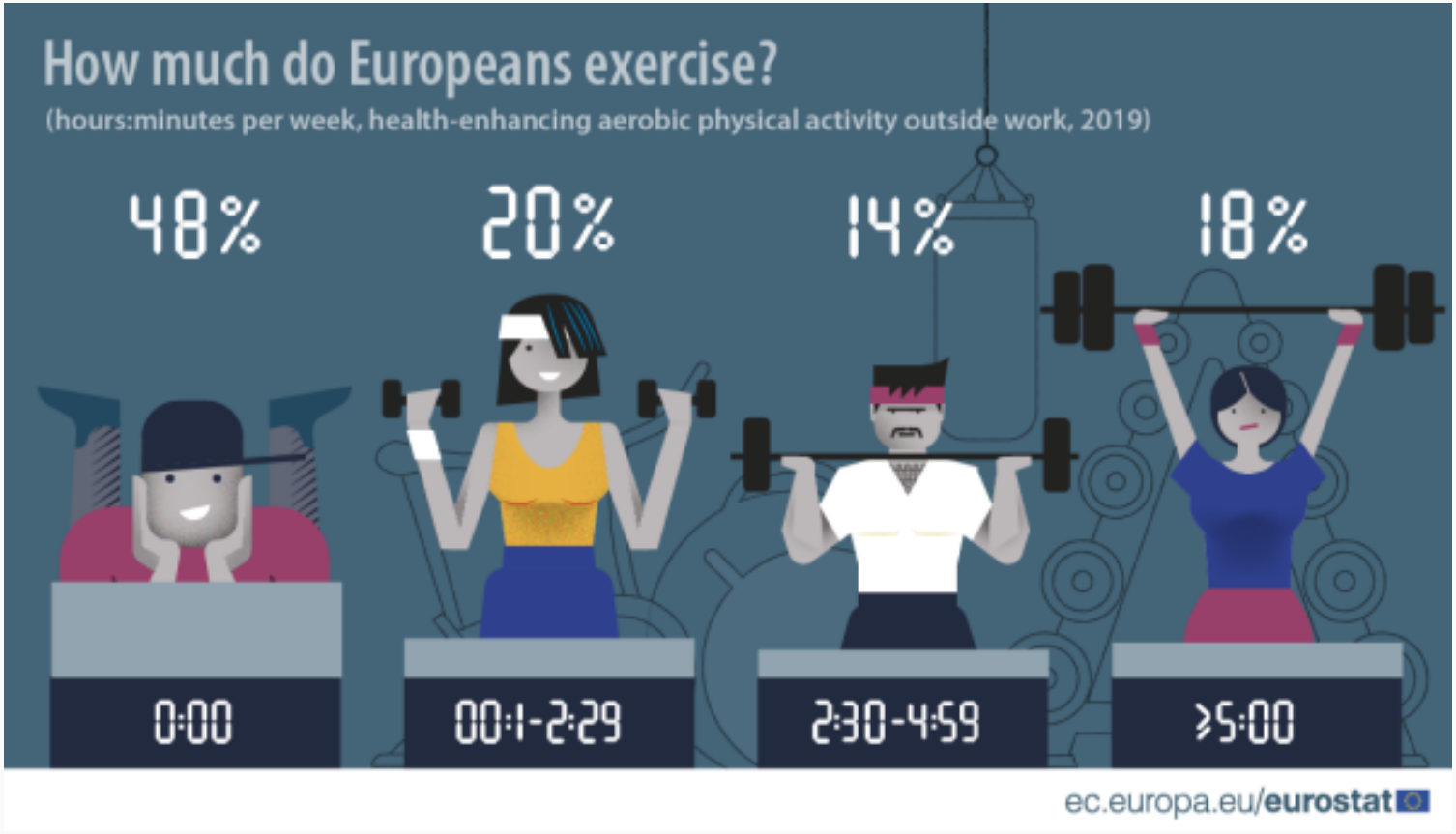
Physical Inactivity — Global and Bulgaria (20)

- **Globally (WHO, 2022)**: **31%** of adults (1.8 billion people) do not meet recommended activity levels (150 min moderate or 75 min vigorous aerobic activity/week) — responsible for **7.2% of all-cause mortality** and 7.6% of cardiovascular deaths
- **Bulgaria — attributable fractions of sedentary lifestyle:**
  - 9.8% of deaths | 6.8% of new IHD and stroke cases | 6.2% of type 2 diabetes | 4.1% of colorectal cancer | 3.6% of breast cancer

Physical Inactivity — Global and Bulgaria (20)

- **Eurobarometer (EU-27, 2022)**: 45% of Europeans do not exercise at all; Bulgaria — **61% report no physical activity** (5th most inactive in EU, alongside Portugal 73%, Greece 68%, Poland 65%, Romania 62%)
- **Bulgaria — National Survey 2020**: 60% of adults insufficiently active; 53% report no vigorous-intensity effort in a typical week; 2 in 5 (predominantly women) spend >300 min/day seated

Physical Inactivity — EU 2024 / Bulgaria (20)



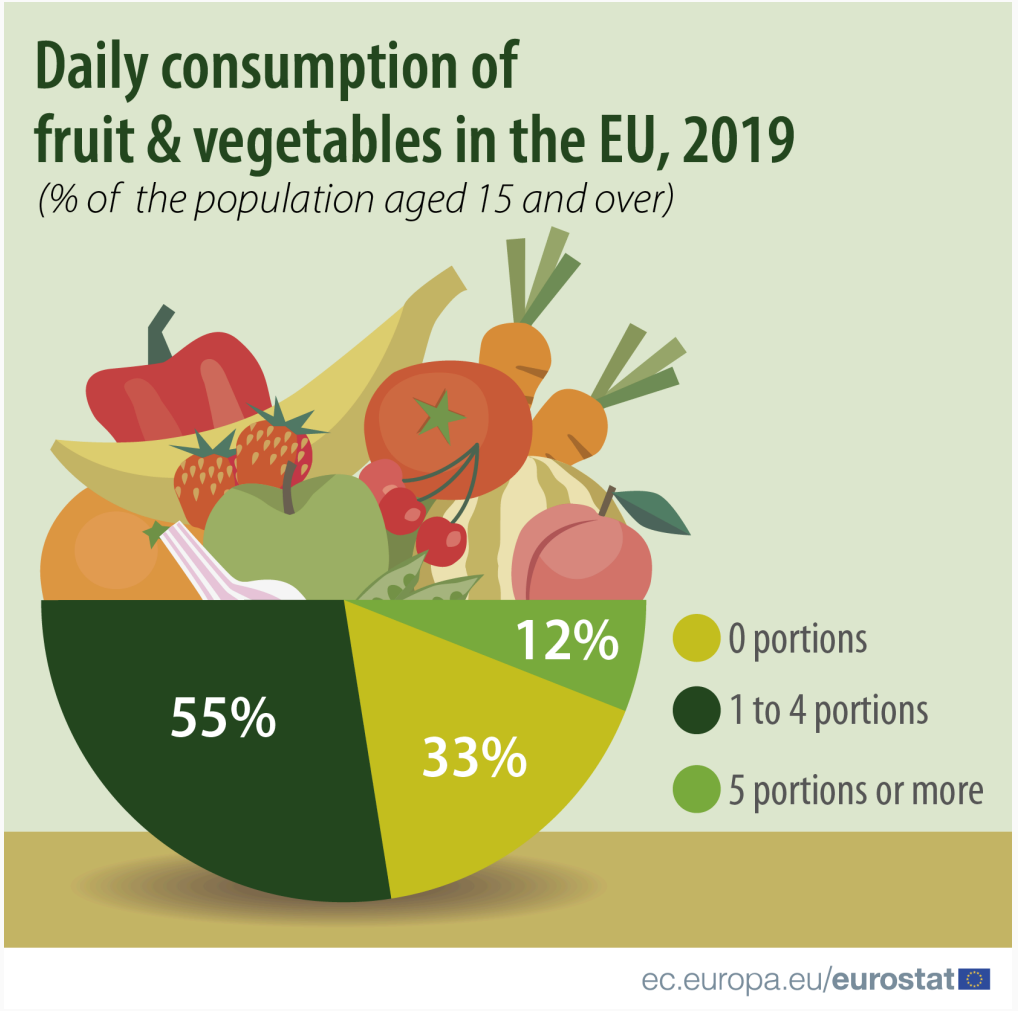
Alcohol Consumption — WHO 2024 / Bulgaria (20)

- **WHO, 2024**: alcohol causes **2.6 million deaths/year** (4.7% of all deaths) — 1.6 million from NCD (474 000 CVD; 401 000 cancers); 724 000 from injuries; adults aged 20–39 bear the highest proportional burden (**13%** of alcohol-related deaths)
- WHO European Region average: **9.2 litres** pure alcohol/capita/year
- **Bulgaria**: 11.9 litres — one of the highest in the European Region (+0.7 L vs previous WHO reporting period); 66.2% of population currently consumes alcohol (men 76.5%; women 56.7%); household consumption ↑ 27.8% over 2014–2024
- **Adolescents 15–19 years (Bulgaria)**: **50.2%** are current alcohol users; **20.2%** report heavy episodic drinking (≥60 g pure alcohol on at least one occasion in the past 30 days)

Nutrition — Bulgaria 2024 (NSI Household Survey) (20)

Dietary component	2024 data and trend (vs 2015)
Bread and bakery products	194.1 g/day — ↓ 22.8% since 2015
Fruits + vegetables (total)	360.6 g/day — **below** WHO 400 g recommendation
Meat (total)	110.7 g/day — ↑ 23.9%; pork ↑ 29.5%; processed meat **46.8 g/day** — significantly exceeds recommendations
Fish and fish products	19.2 g/day — still below recommended 30 g/day
Nuts	4.9 g/day — far below recommended 30 g/day minimum
Added table salt	4.3 g/day — ↓ 11.1%; now meets WHO recommendation
Alcoholic beverages	↑ driven by beer +29.9% since 2015

Fruit and Vegetable Consumption — EU 2024 / Bulgaria (20)



Thank you for your attention!