

Cancer Epidemiology

IVANA HOLCATOVA

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What do you expect from this seminar?

What do you want to learn?

OCCURRENCE OF CANCER

OCCURRENCE OF CANCER

Incidence



OCCURRENCE OF CANCER

Incidence

Prevalence



OCCURRENCE OF CANCER

Incidence

Prevalence

Mortality



OCCURRENCE OF CANCER

Incidence

Prevalence

Mortality

Trends

OCCURRENCE OF CANCER

Incidence

Prevalence

Mortality

Trends

Comparison

ASR (age-standardised rate or age-adjusted rate)

ASR is a summary measure; it is the rate that a population would have if it had a standard age structure.

Standardization is necessary when comparing several populations that differ with respect to age structure, because age has a powerful influence on the risk of cancer. The most frequently used standard population is the World standard population. The calculated incidence rate is then called the World Standardised incidence Rate. It is also expressed per 100,000. The World standard population used in this application is as proposed by Segi (1960) and modified for the first volume of the series by Doll and *al.* (1996).

OCCURRENCE OF CANCER

Incidence

Prevalence

Mortality

Trends

Comparison

RISK FACTORS

Non-modifiable

OCCURRENCE OF CANCER

Incidence

Prevalence

Mortality

Trends

Comparison

RISK FACTORS

Non-modifiable

Modifiable

OCCURRENCE OF CANCER

Incidence

Prevalence

Mortality

Trends

Comparison

RISK FACTORS

Non-modifiable

Modifiable

PREVENTION

Primary, secondary, tertiary,...

Primary prevention

- Prevent occurrence of the disease

Secondary prevention

- Early diagnose – optimally pre-cancerosis

Tertiary prevention

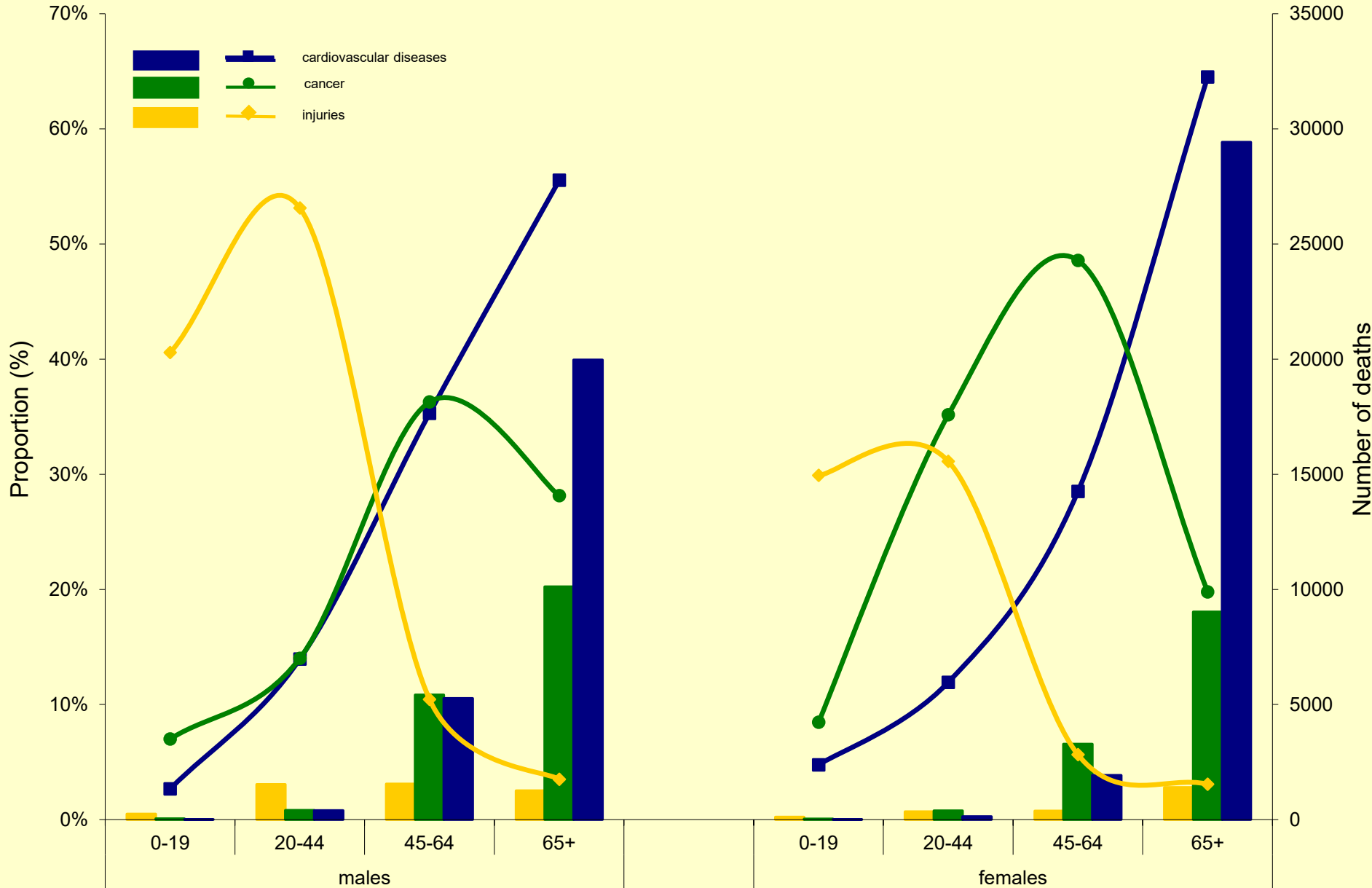
- To find recurrence of the disease or distant metastases

If we are not successful, we have to do our best to improve or at least keep as long as possible the quality of life of the patients.

Cancer

**ON THE 2ND PLACE OF THE
CAUSE OF DEATH IN MOST
DEVELOPED COUNTRIES**

Changes in the structure of the cause of death with the age in Czech Republic. 2002



Where can you find information concerning incidence/mortality of cancer?

Cancer register

HEALTH INSURANCE SYSTEM

World Health Organisation

International Agency for Research on Cancer, Lyon, France

WWW.IARC.FR

 **International Association of Cancer Registries**



International Agency for Research
on Cancer
World Health Organization



International Association of
Cancer Registries

Cancer Incidence in Five Continents Vol. I to VIII

A stylized world map in white, showing the outlines of the continents. It is centered on the Atlantic Ocean and serves as a background for the text 'CI5 I-VIII'.

CI5 I-VIII

D.M. Parkin, S.L. Whelan, J. Ferlay and H. Storm

IARC CancerBase No. 7



The Global Cancer Observatory (GCO) is an interactive web-based platform presenting global cancer statistics to inform cancer control and research.

CANCER TODAY

Provides data visualization tools that present current national estimates of the incidence, mortality, and prevalence of 36 cancer types in 185 countries, by sex and age group.

[Go to website.](#)

CANCER OVER TIME

Undergoing further development; will provide data visualization tools that document the changing rates of cancer incidence and mortality over the course of half a century, based on high-quality data from 40 countries.

[Go to website.](#)

CANCER TOMORROW

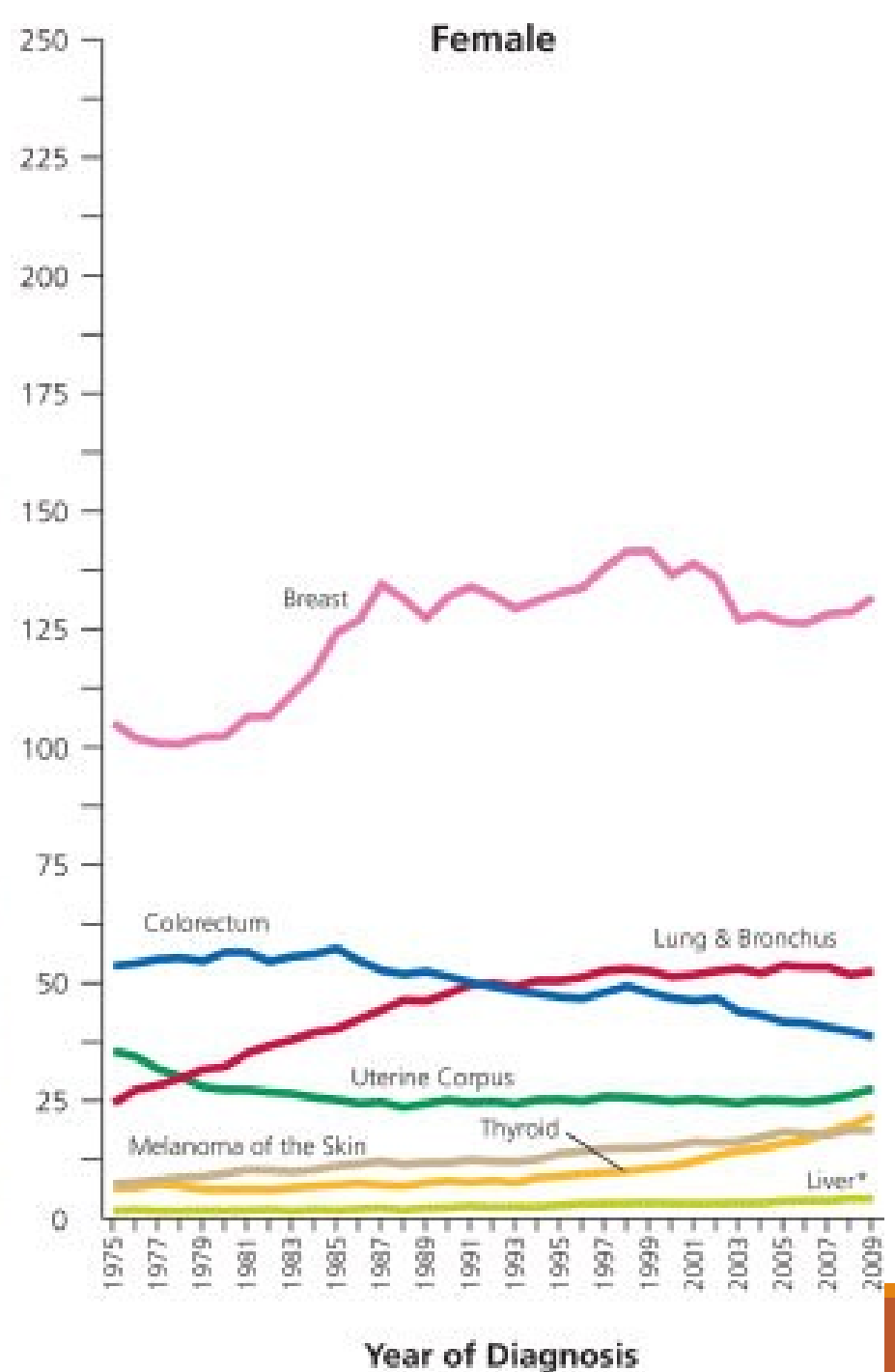
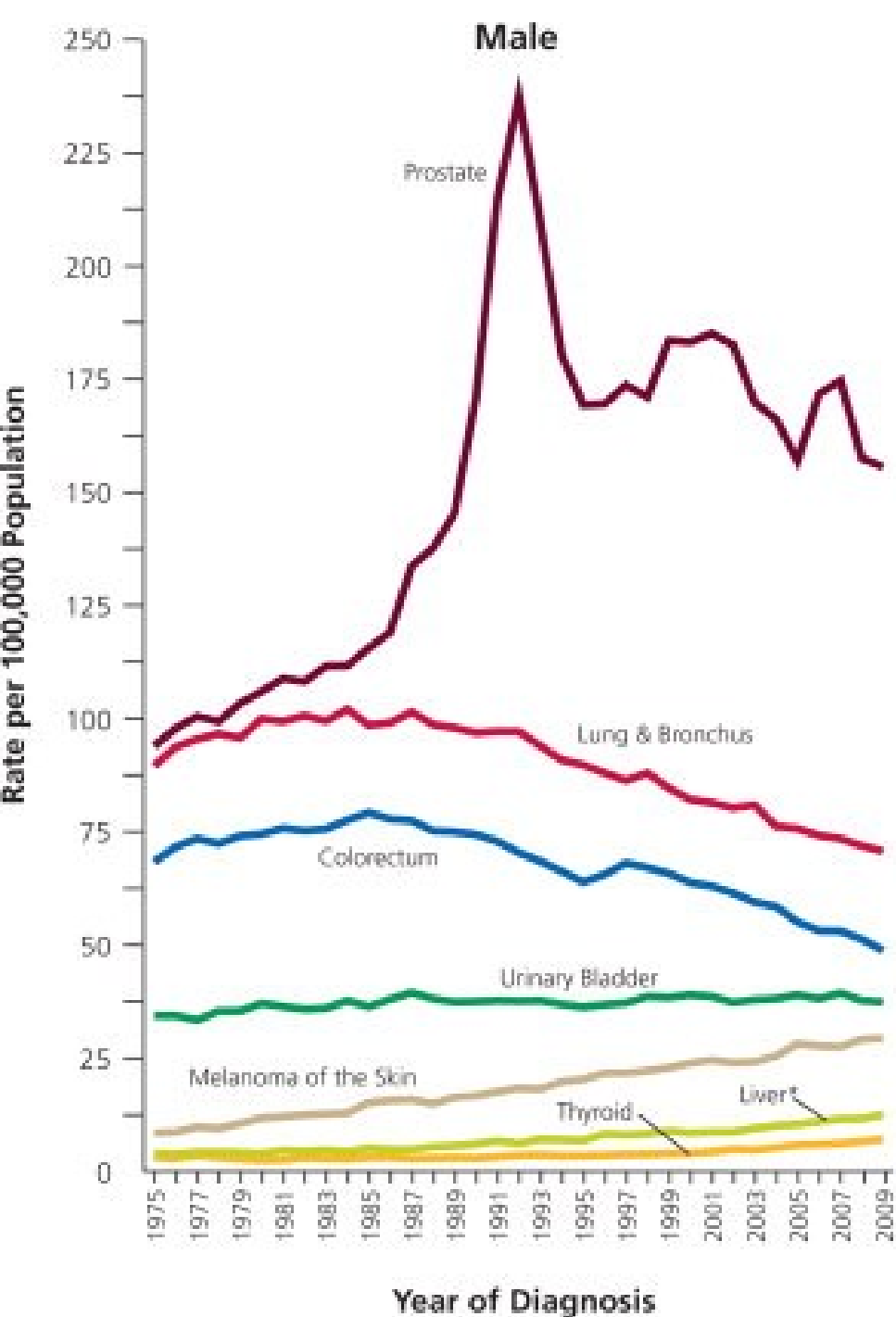
A tool that predicts the future cancer incidence and mortality burden worldwide from the current estimates in 2018 up until 2040.

[Go to website.](#)

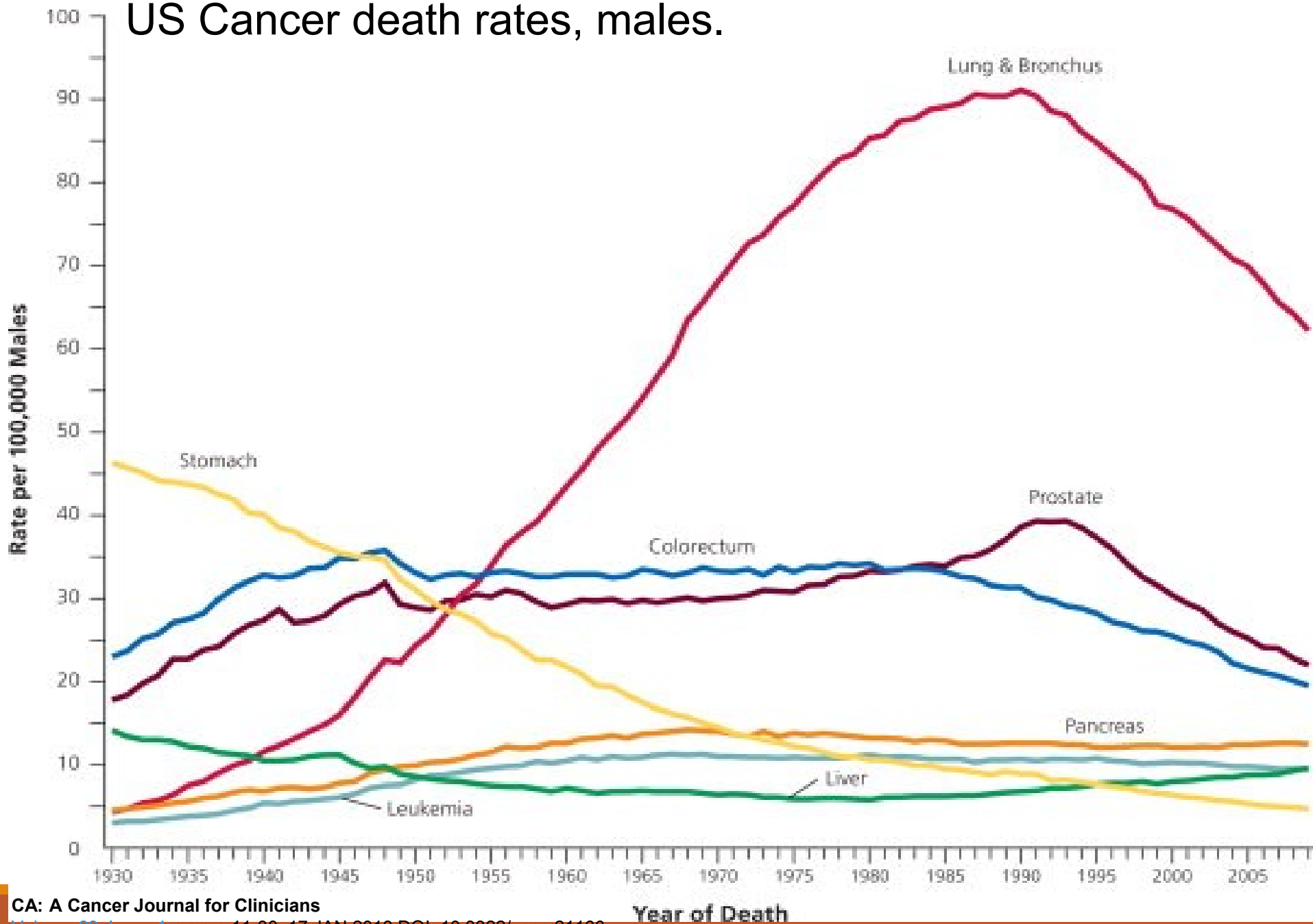
CANCER CAUSES

An expanding set of visualization tools that links the cancer burden to underlying causes, quantifying the extent to which different cancers are attributable to key lifestyle and environmental risk factors worldwide.

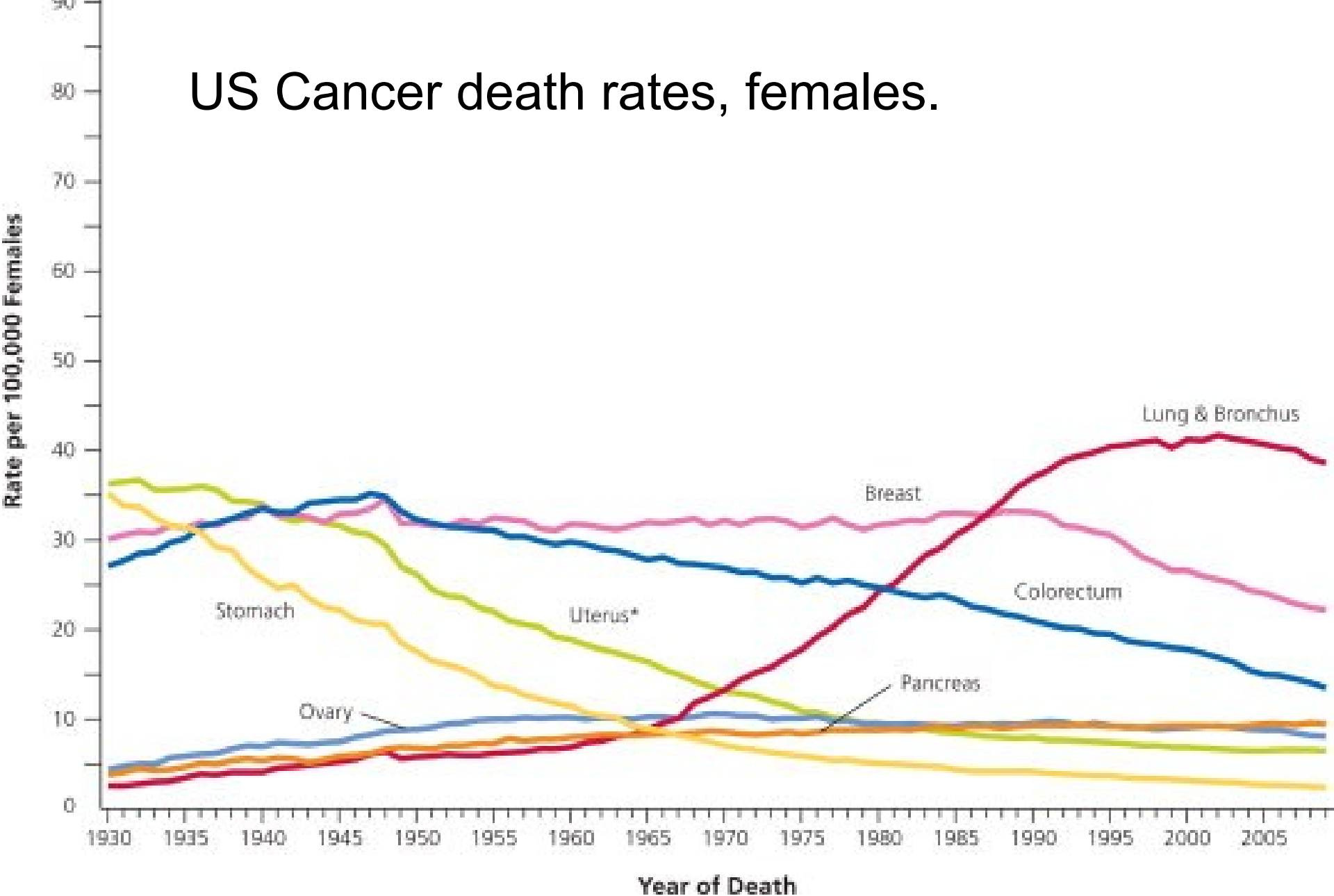
[Go to website.](#)



US Cancer death rates, males.



US Cancer death rates, females.



CA: A Cancer Journal for Clinicians

Volume 63, Issue 1, pages 11-30, 17 JAN 2013 DOI: 10.3322/caac.21166

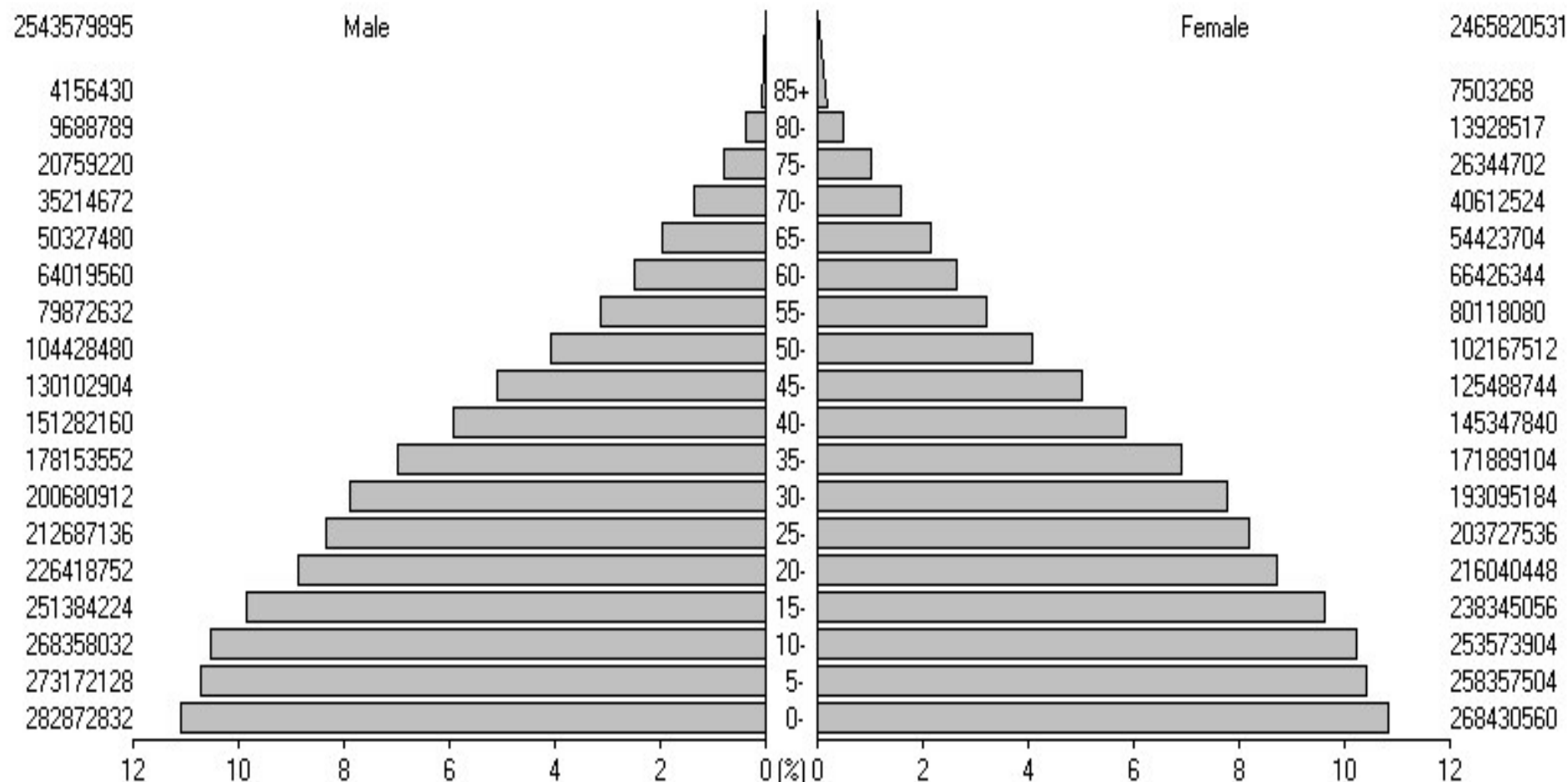
<http://onlinelibrary.wiley.com/doi/10.3322/caac.21166/full#fig4>

Do you know any risk factor of cancer - risk factors for nearly all cancers?

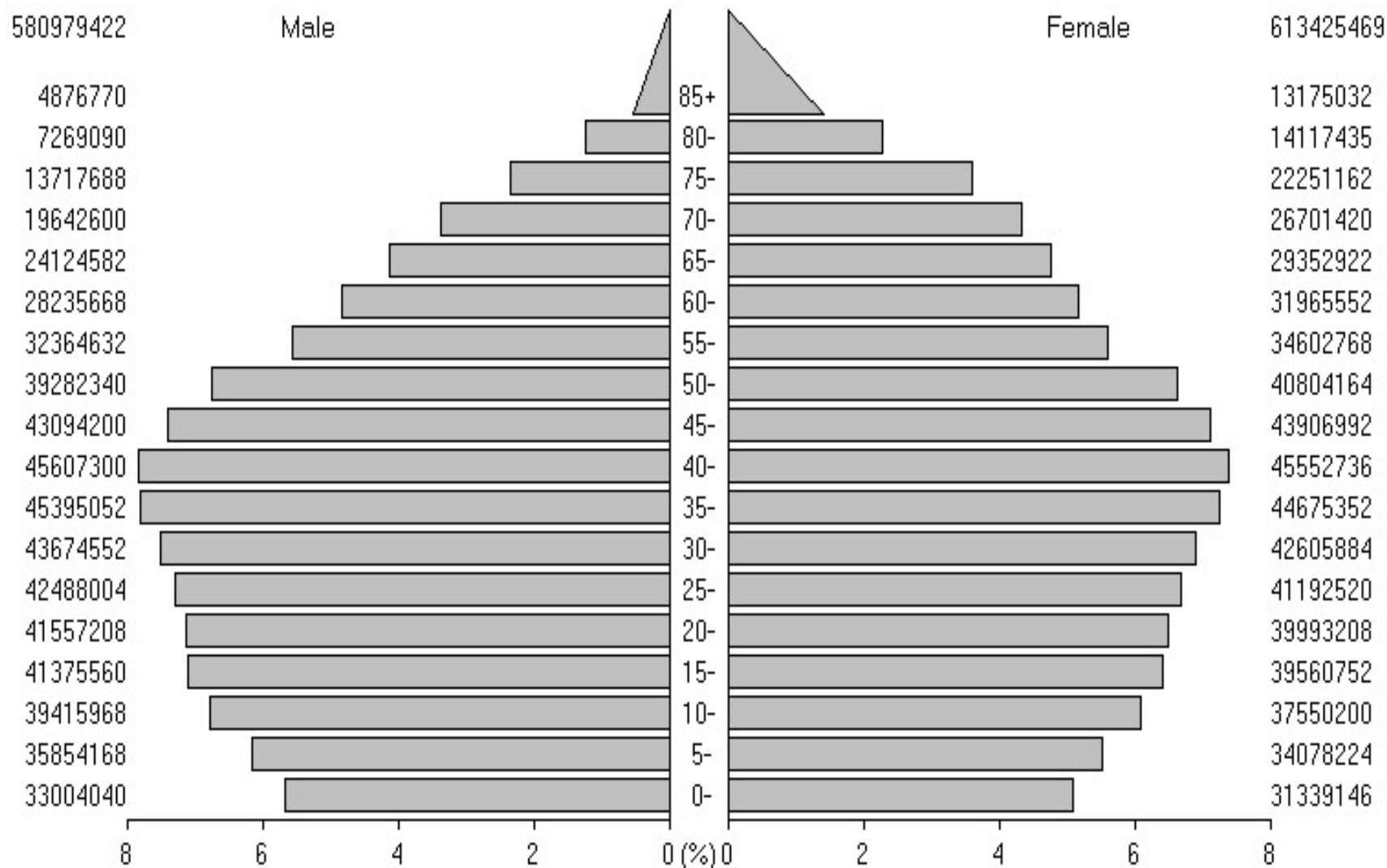
AGE

GENETICS

Less developed countries (2002)



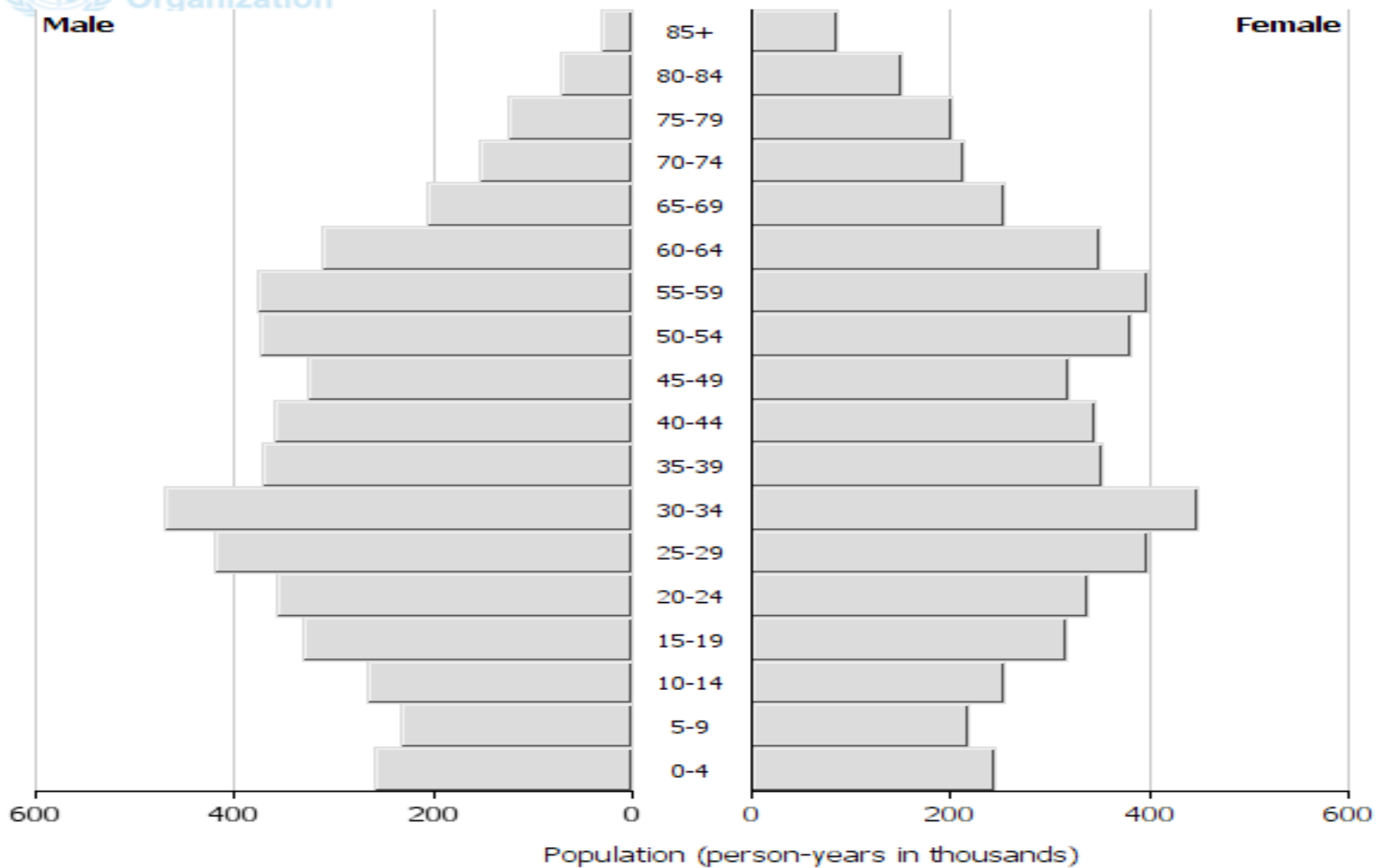
More developed countries (2002)





Male

Female

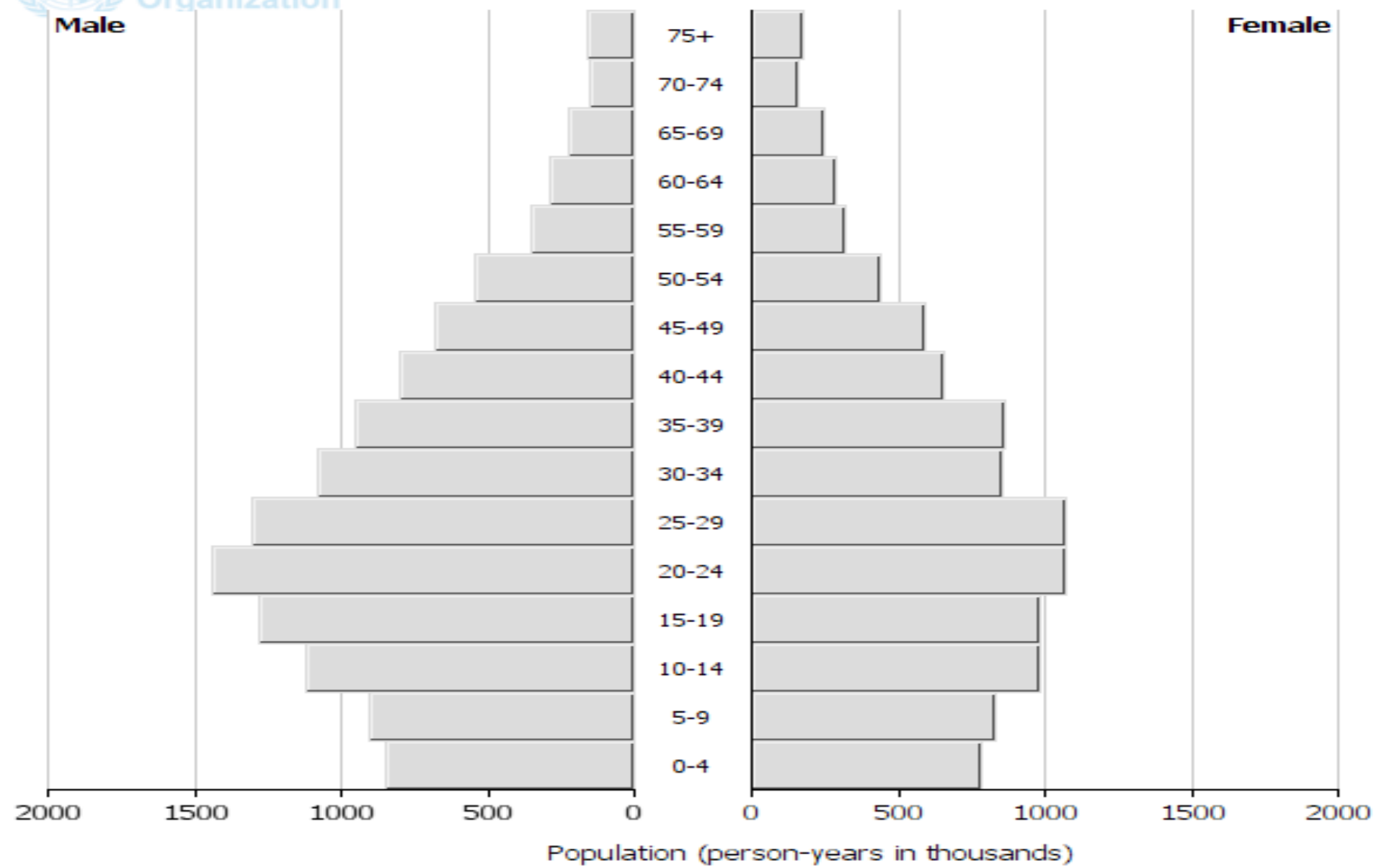


International Agency for Research on Cancer (IARC) - India (3 registries) (2007)



Male

Female

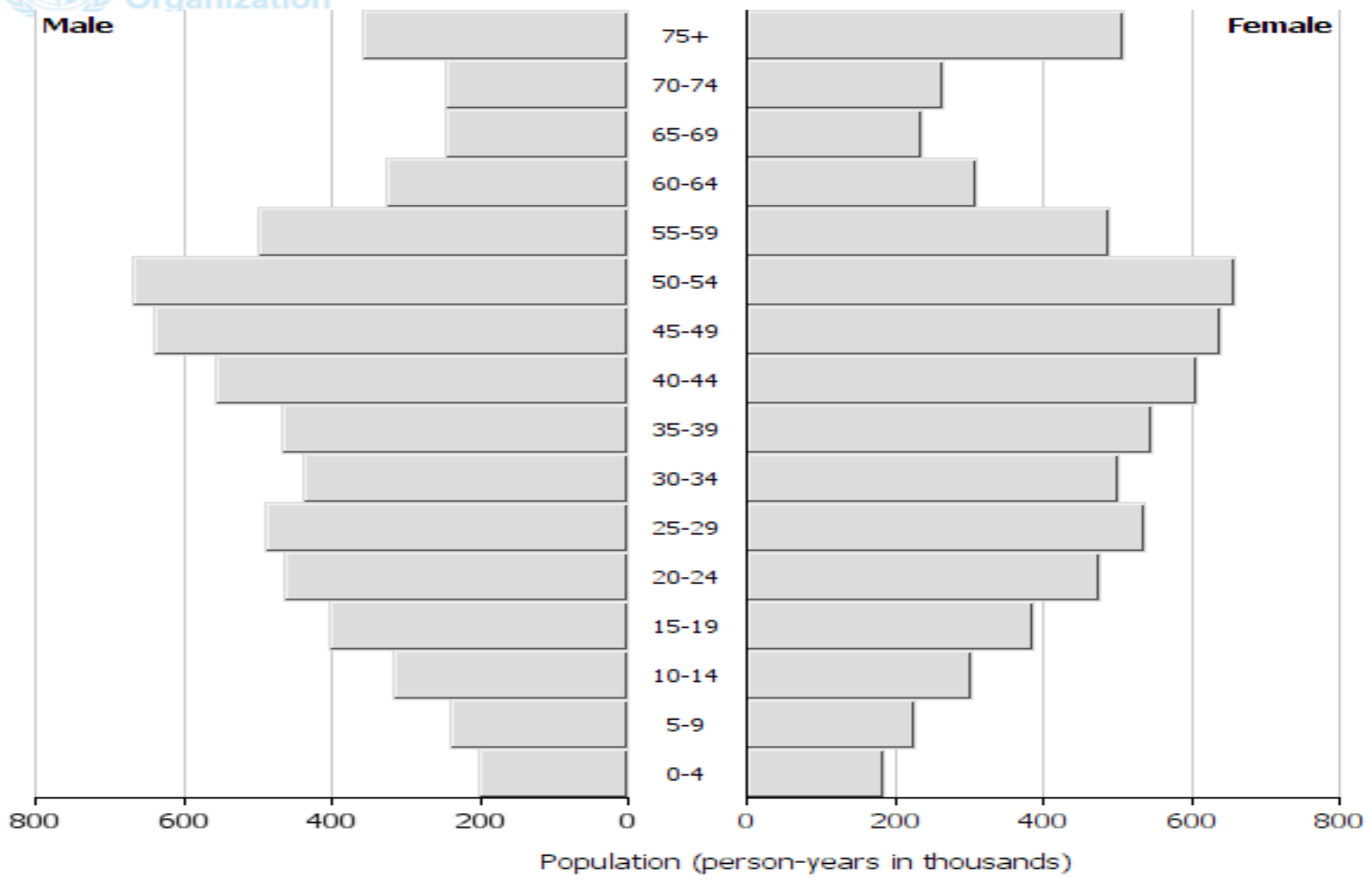


International Agency for Research on Cancer (IARC) (3 registries) (2007)



Male

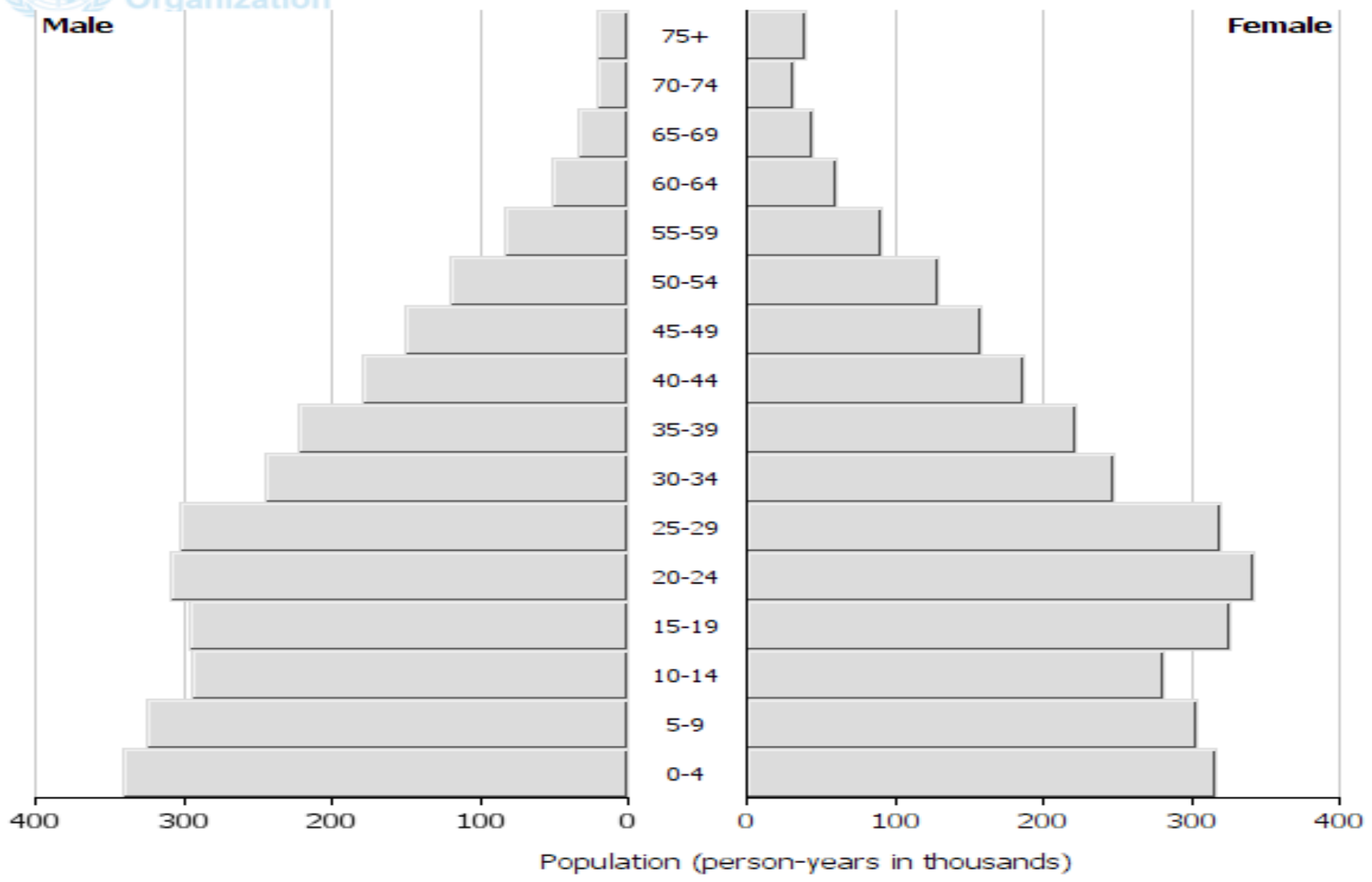
Female



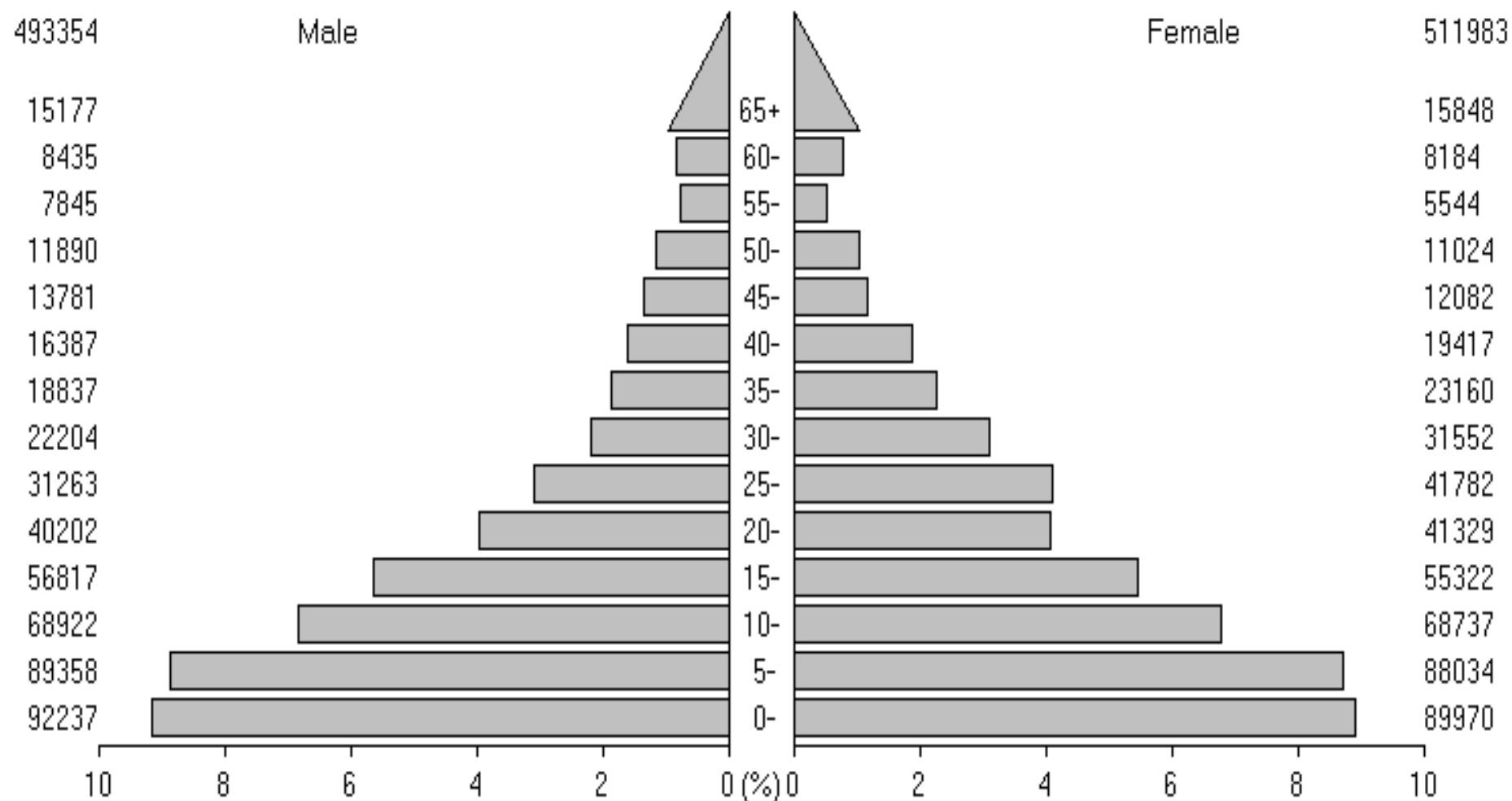


Male

Female



*The Gambia (1997-1998)



CI5V8I

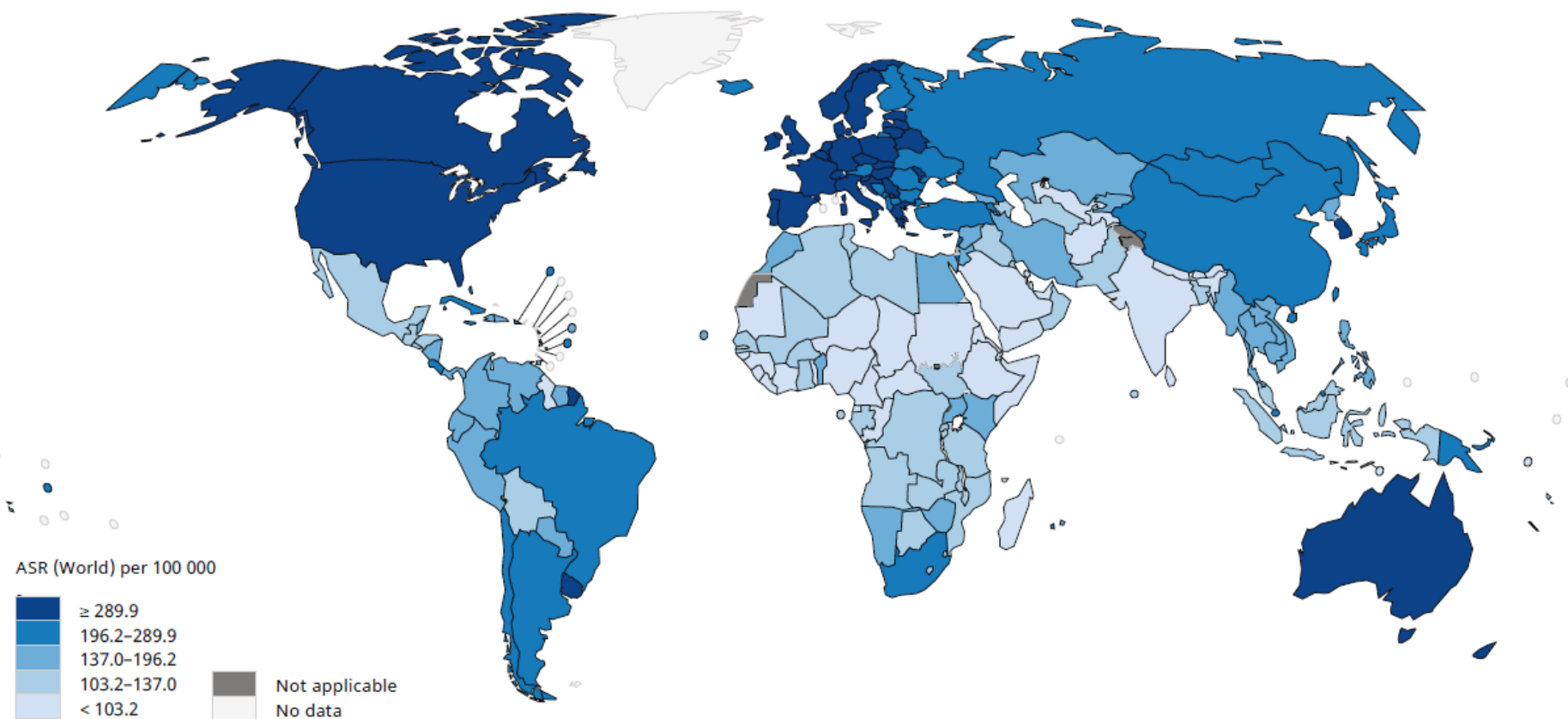
ASR (age-standardised rate or age-adjusted rate)

ASR is a summary measure; it is the rate that a population would have if it had a standard age structure.

Standardization is necessary when comparing several populations that differ with respect to age structure, because age has a powerful influence on the risk of cancer. The most frequently used standard population is the World standard population. The calculated incidence rate is then called the World Standardised incidence Rate. It is also expressed per 100,000. The World standard population used in this application is as proposed by Segi (1960) and modified for the first volume of the series by Doll and *al.* (1996).

Where is the highest incidence & mortality of cancers in the world?

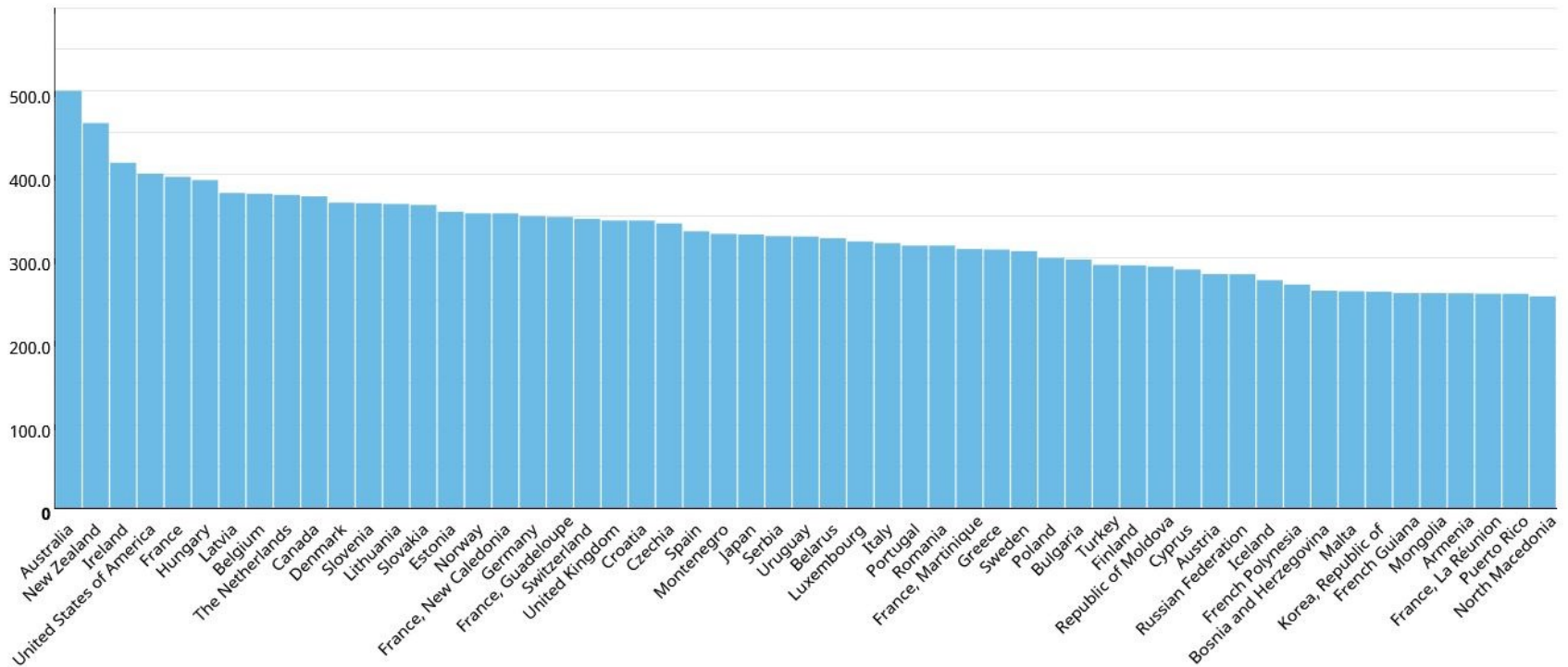
Estimated age-standardized incidence rates (World) in 2018, all cancers, males, all ages



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Data source: GLOBOCAN 2018
 Graph production: IARC
 (<http://gco.iarc.fr/today>)
 World Health Organization

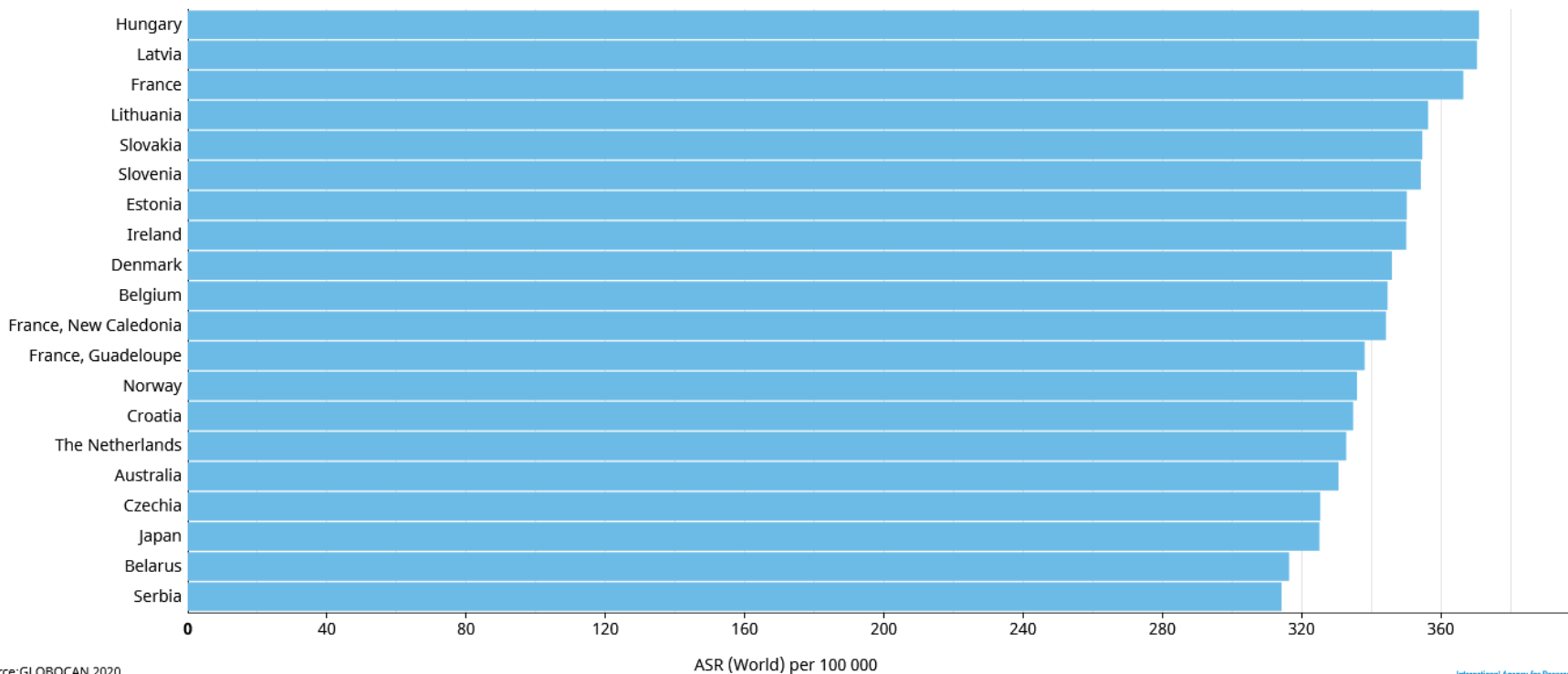
Estimated age-standardized incidence rates (World) in 2020, all cancers, males, all ages



Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

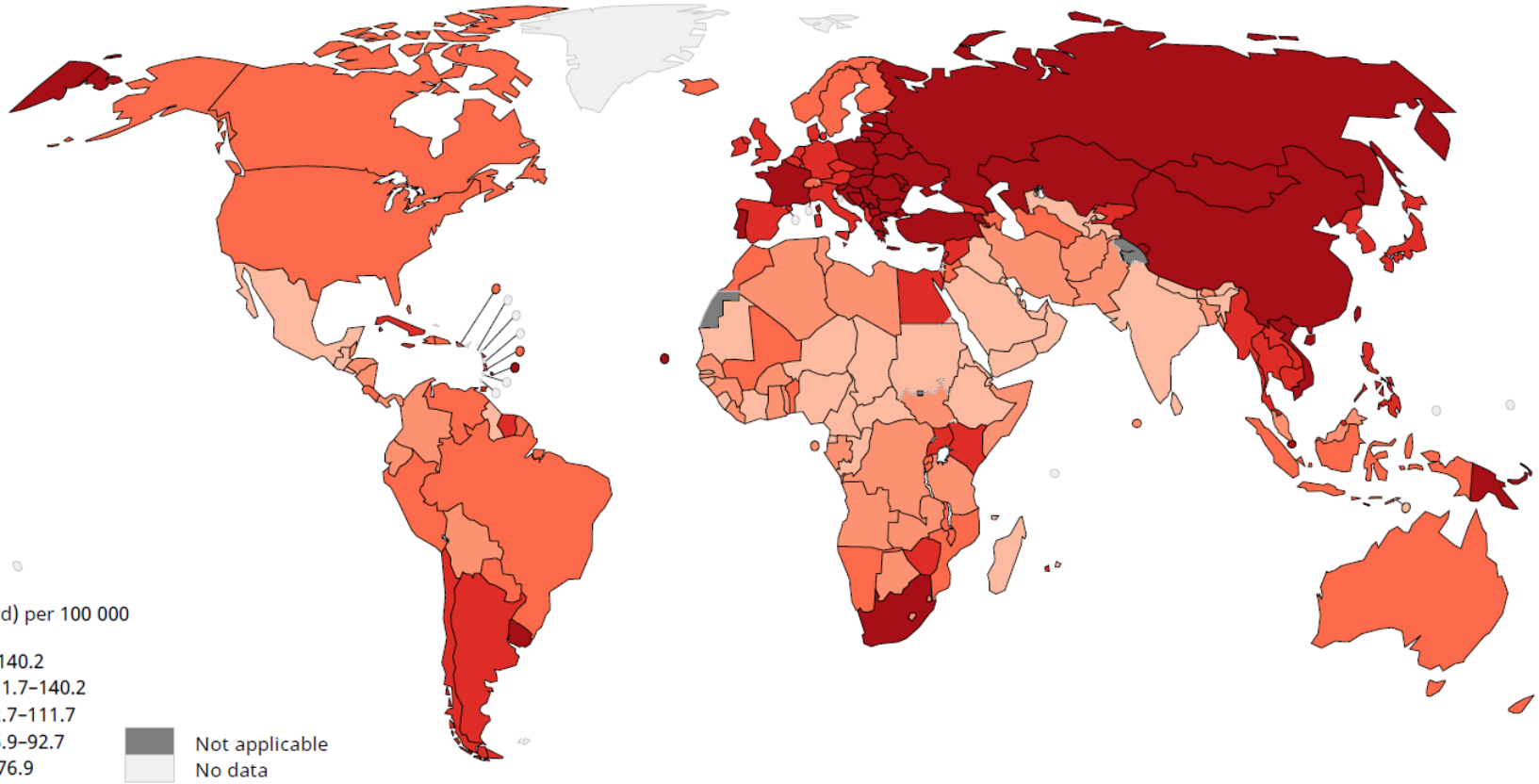
ASR (World) per 100 000

Estimated age-standardized incidence rates (World) in 2020, all cancers excl. non-melanoma skin cancer, males, all ages



Data source: GLOBOCAN 2020
Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
© International Agency for Research on Cancer 2021

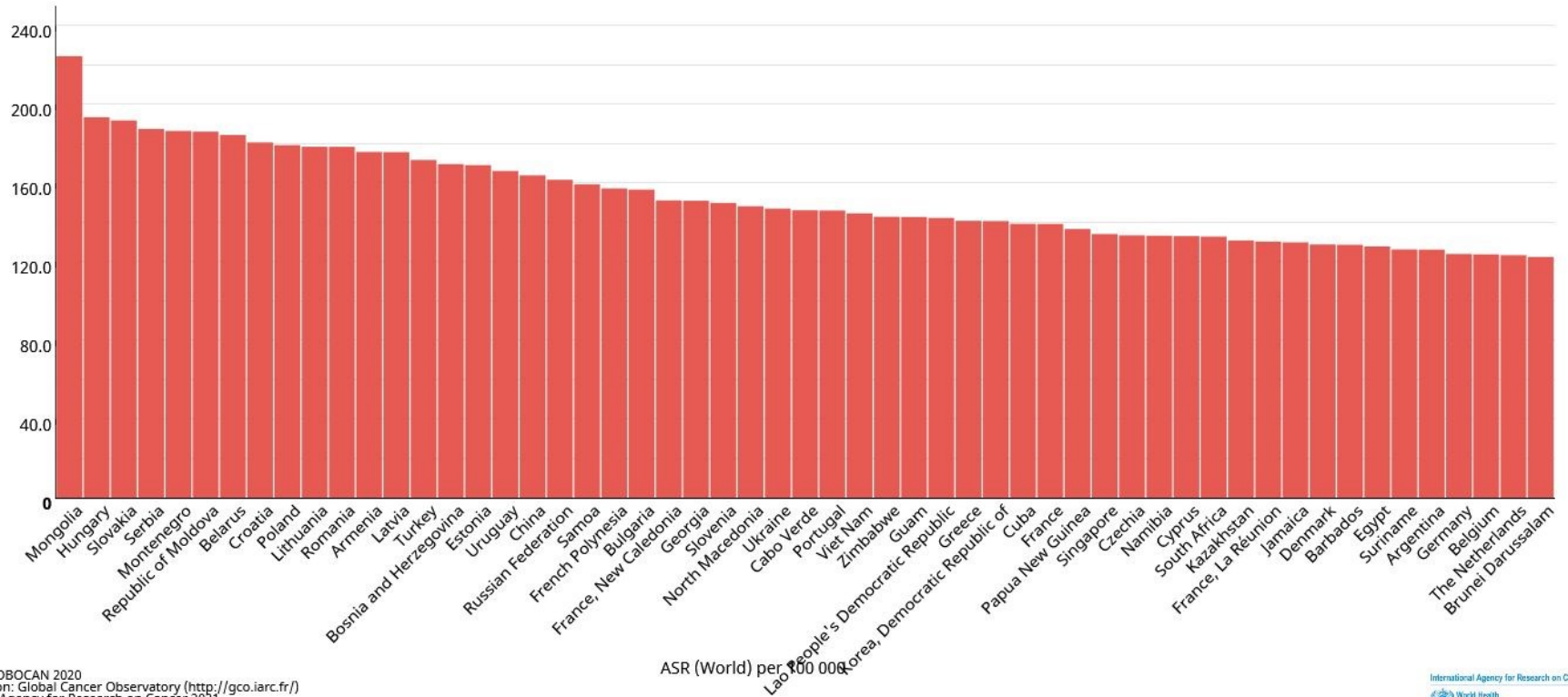
Estimated age-standardized mortality rates (World) in 2018, all cancers, males, all ages



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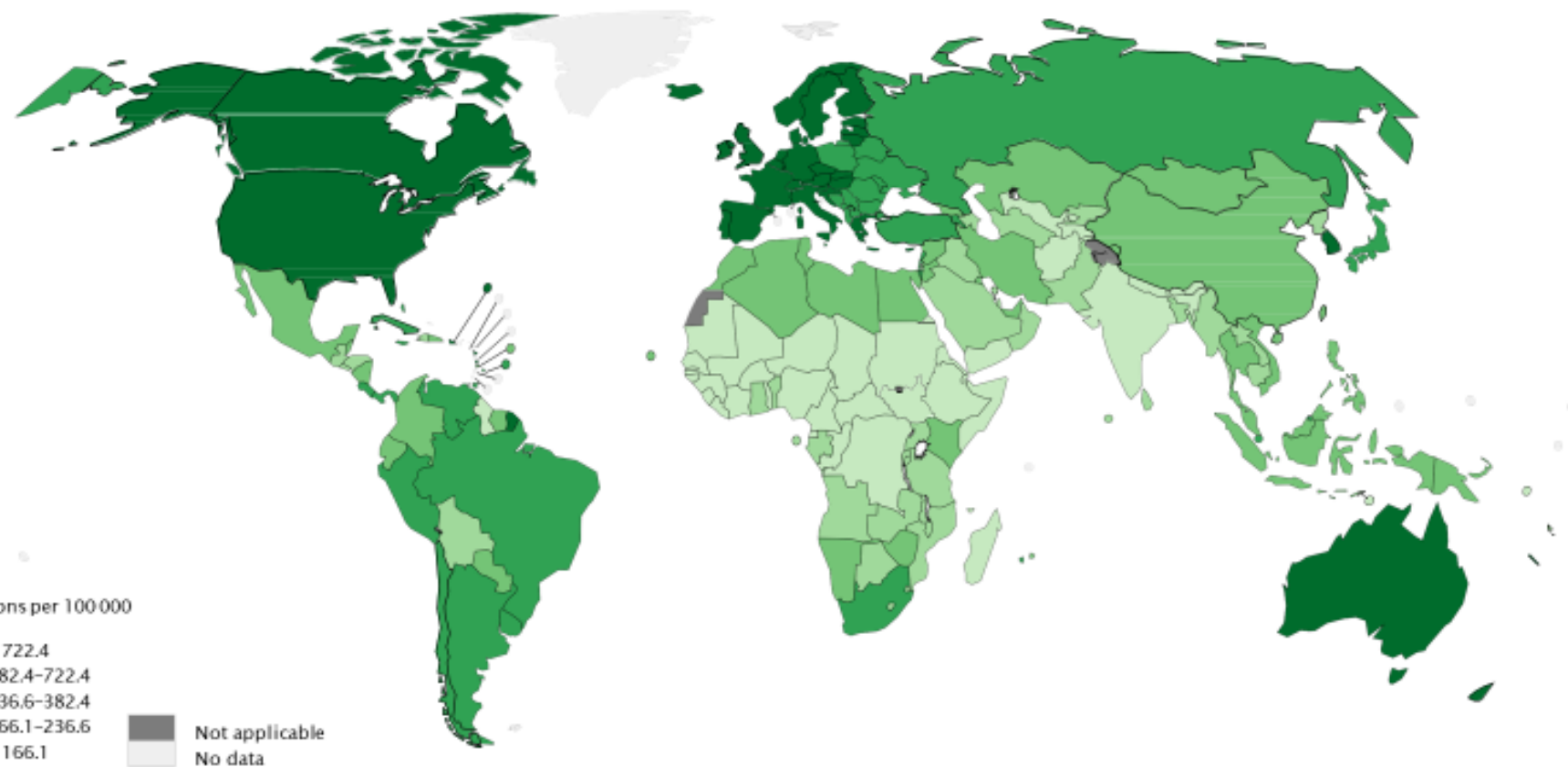
Data source: GLOBOCAN 2018
 Graph production: IARC
 (<http://gco.iarc.fr/today>)
 World Health Organization

Estimated age-standardized mortality rates (World) in 2020, all cancers, males, all ages



Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

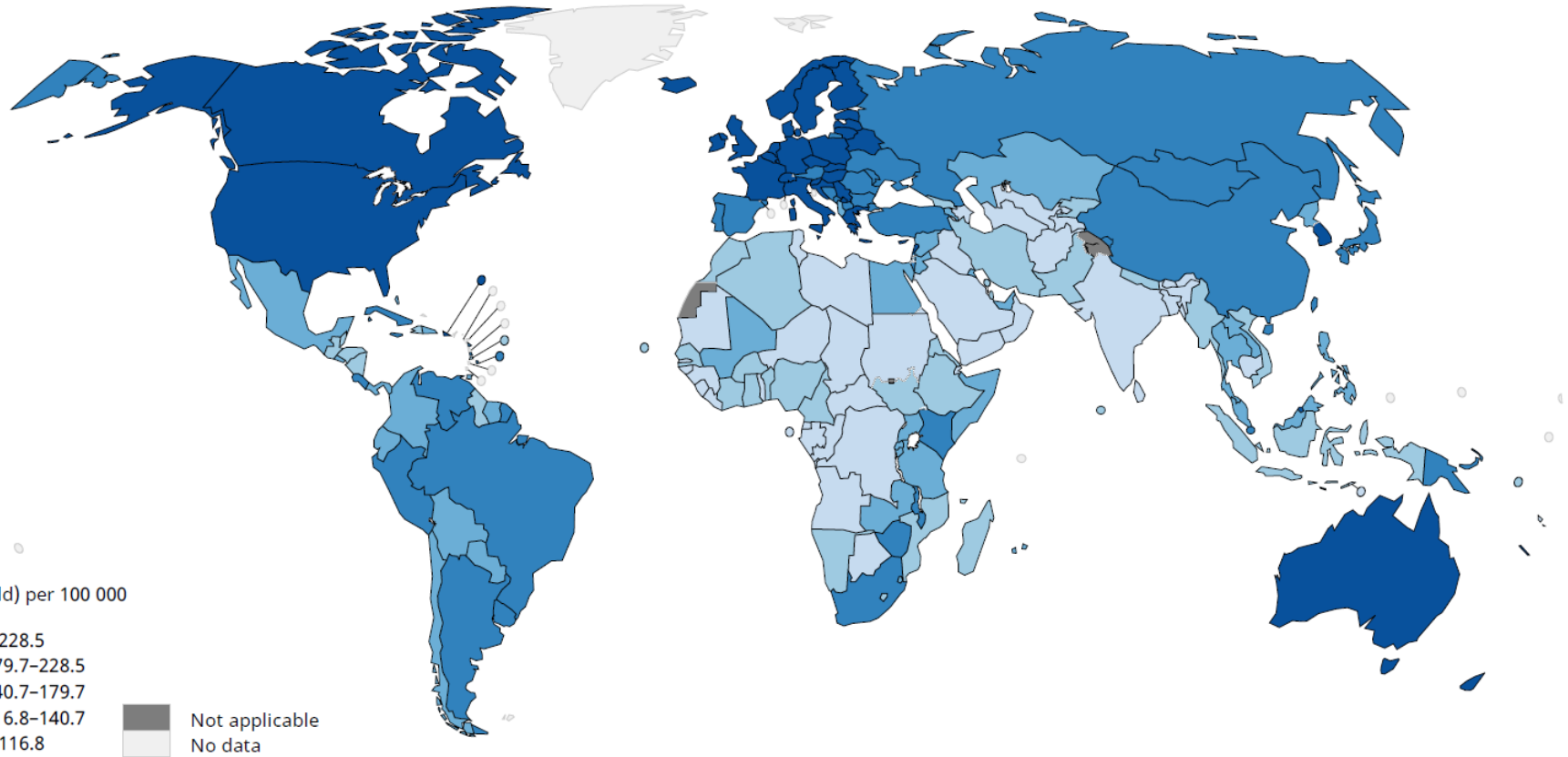
Estimated number of prevalent cases (5-year) as a proportion in 2018, all cancers, males, all ages



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Data source: GLOBOCAN 2018
Graph production: IARC
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World Health Organization

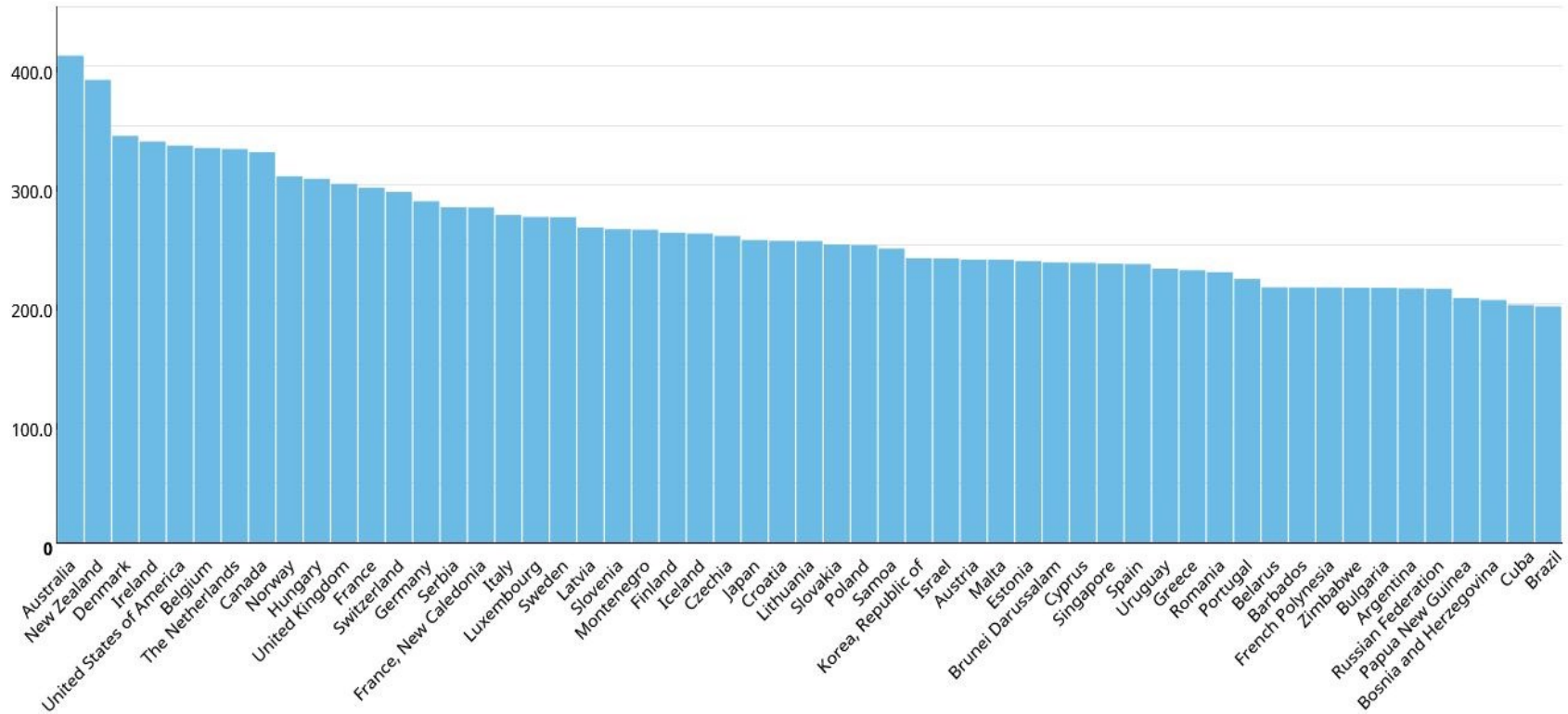
Estimated age-standardized incidence rates (World) in 2018, all cancers, females, all ages



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World Health Organization

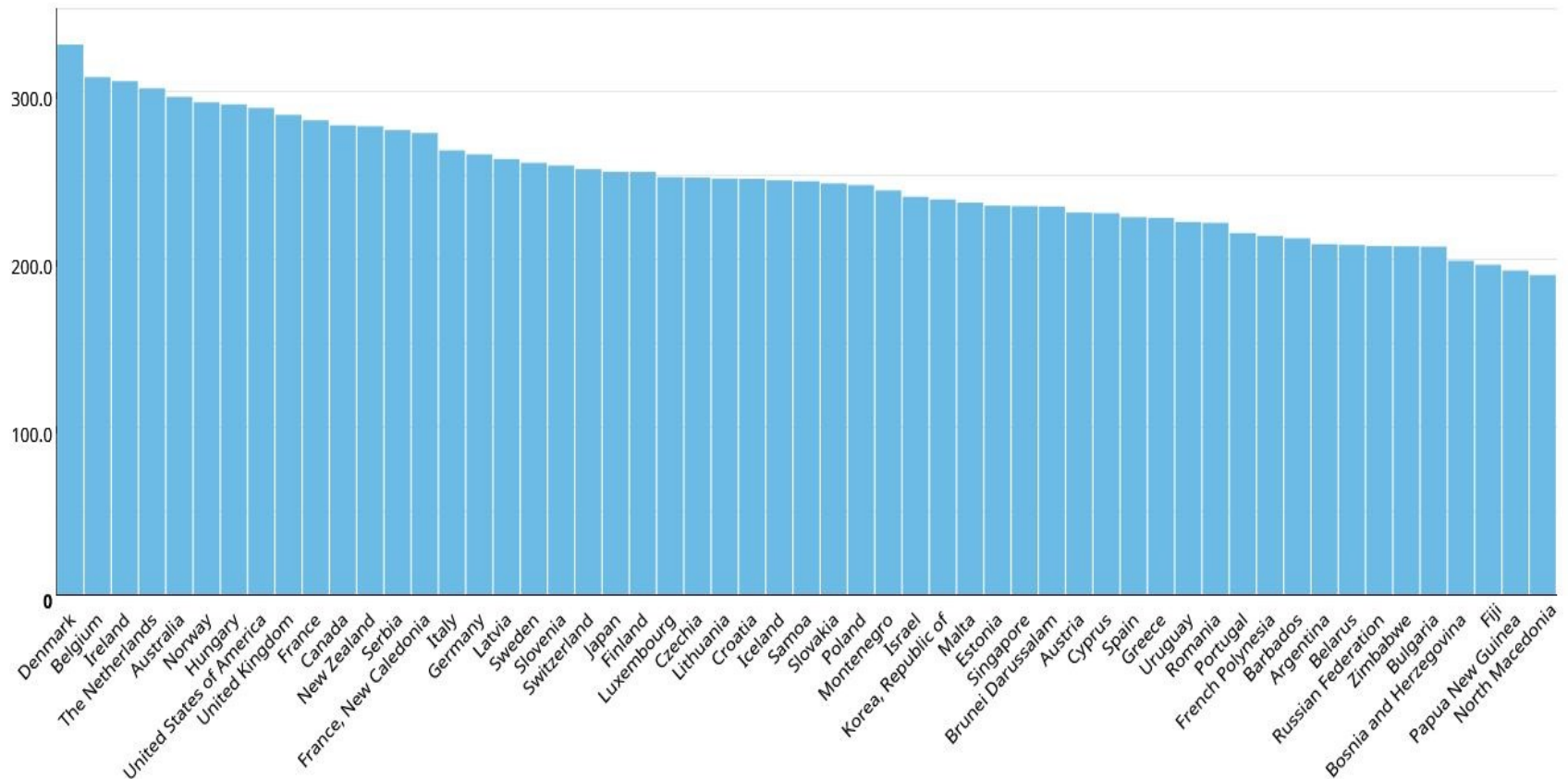
Estimated age-standardized incidence rates (World) in 2020, all cancers, females, all ages



Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

ASR (World) per 100 000

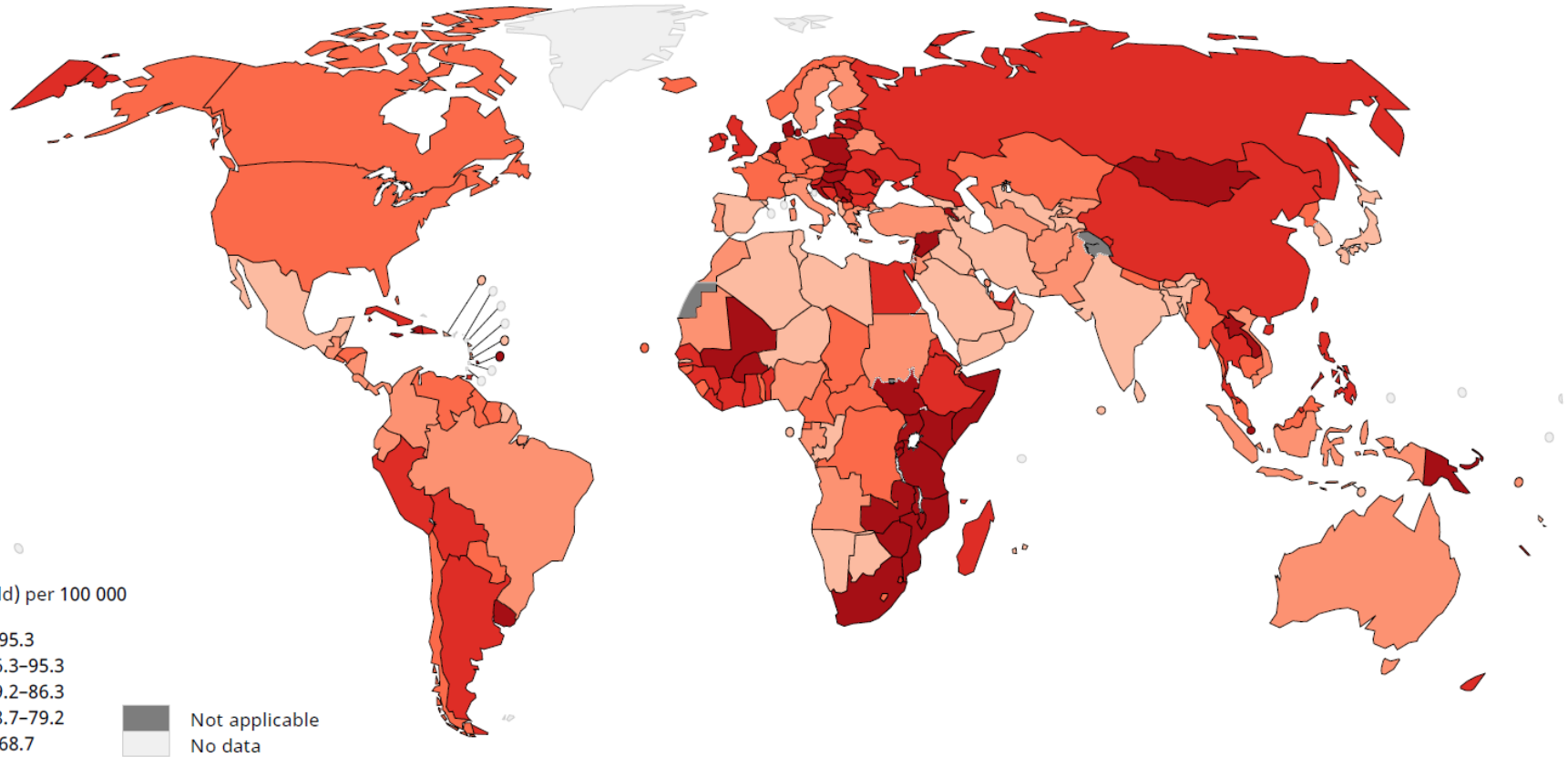
Estimated age-standardized incidence rates (World) in 2020, all cancers excl. non-melanoma skin cancer, females, all ages



Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

ASR (World) per 100 000

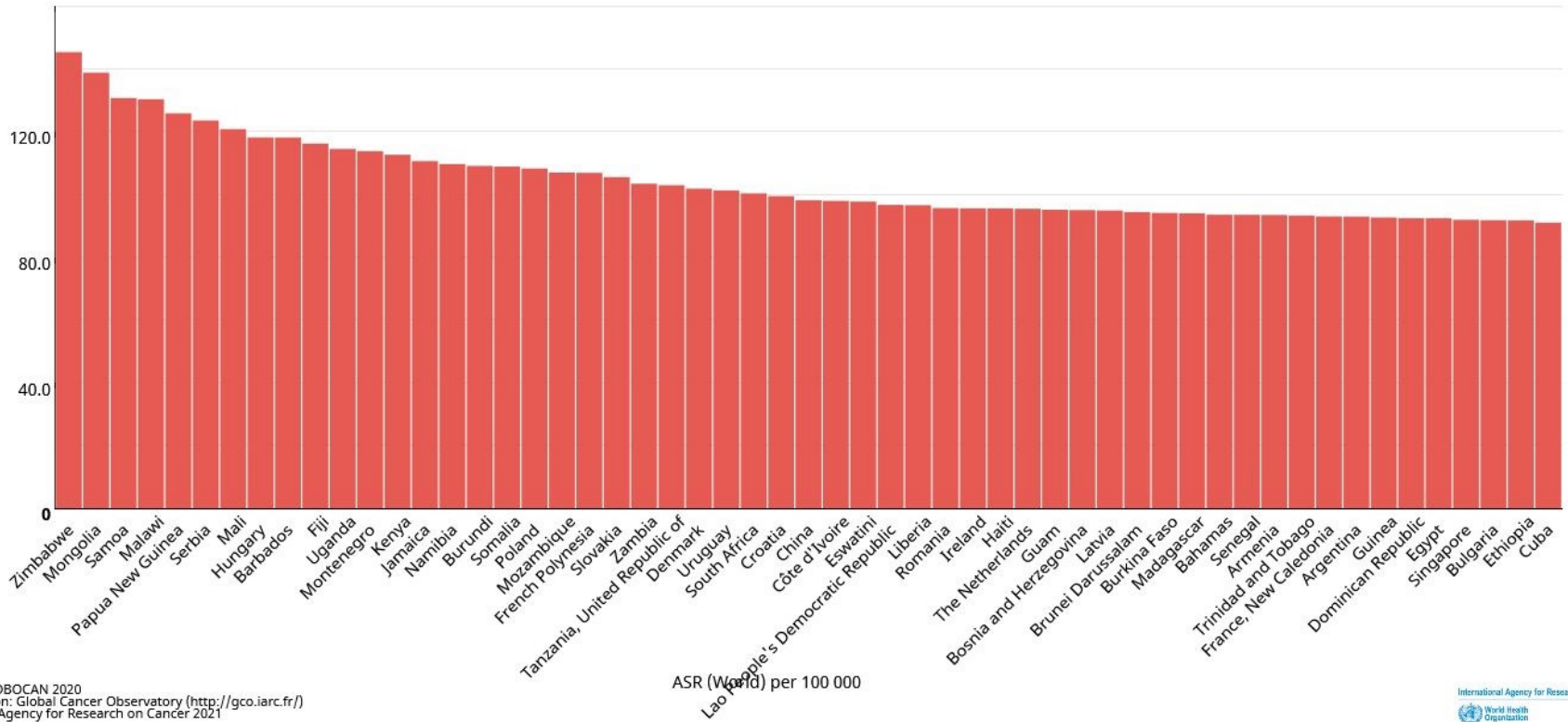
Estimated age-standardized mortality rates (World) in 2018, all cancers, females, all ages



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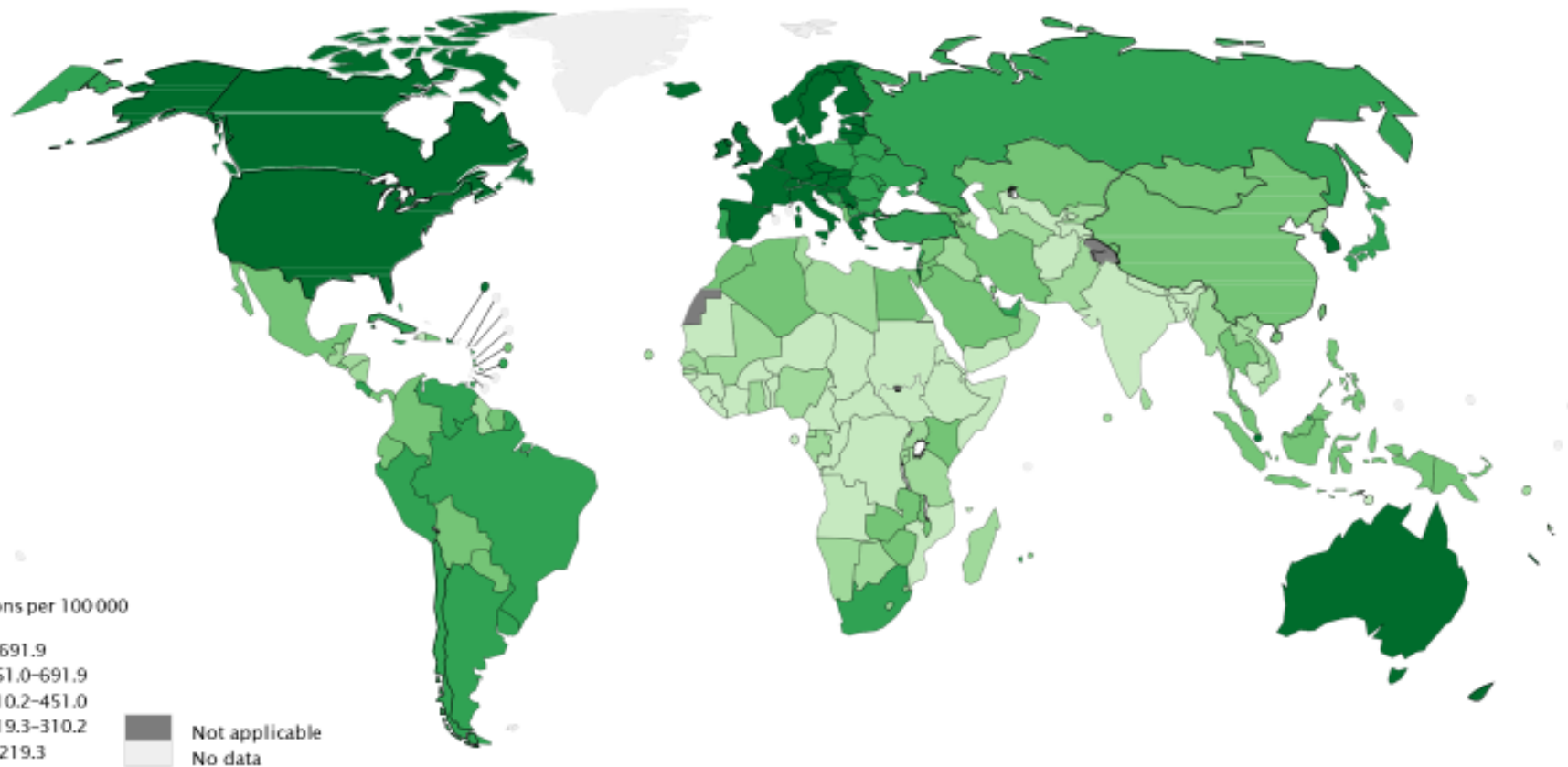
Data source: GLOBOCAN 2018
Graph production: IARC
(<http://gco.iarc.fr/today>)
World Health Organization

Estimated age-standardized mortality rates (World) in 2020, all cancers, females, all ages



Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
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Estimated number of prevalent cases (5-year) as a proportion in 2018, all cancers, females, all ages



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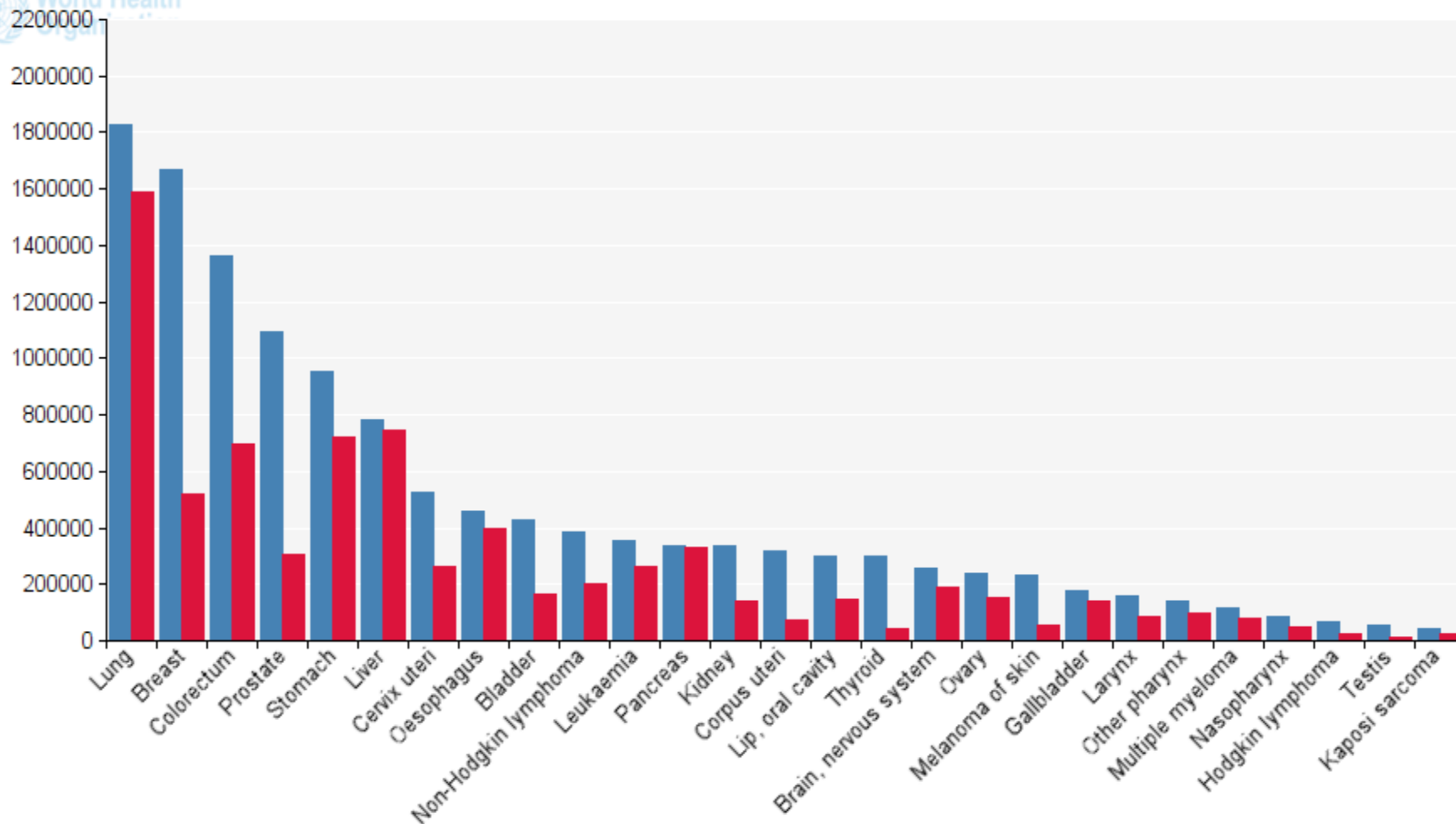
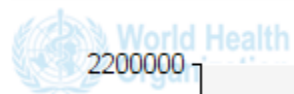
Data source: GLOBOCAN 2018
Graph production: IARC
(<http://gco.iarc.fr/today>)
World Health Organization

Which cancers are
the **most** frequent in the world?

The most frequent cancers in the world (without C44) (absolute numbers)

International Agency for Research on Cancer

World: Both sexes, all ages

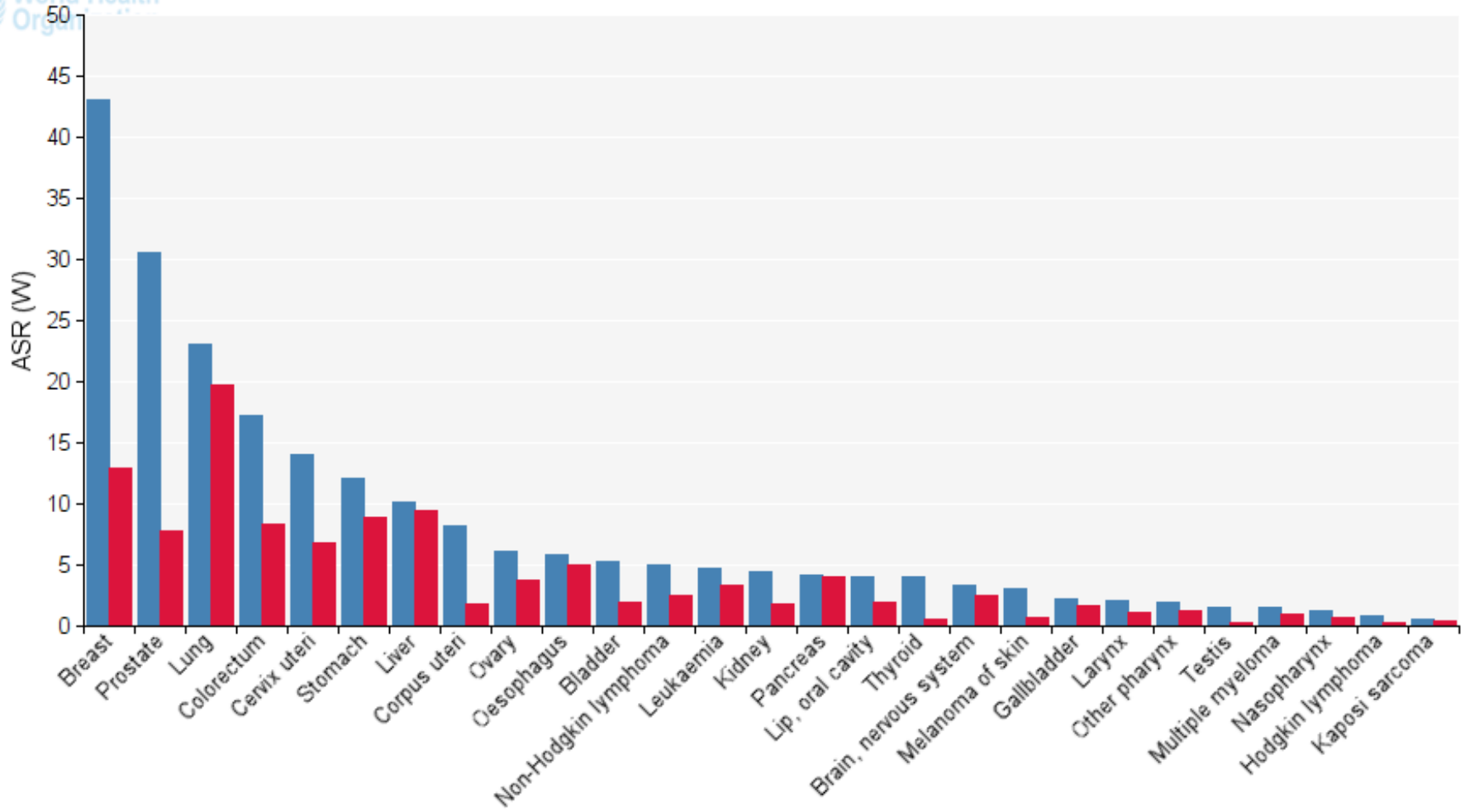


■ Incidence
■ Mortality

The most frequent cancers in the world (without C44) (ASR)

International Agency for Research on Cancer

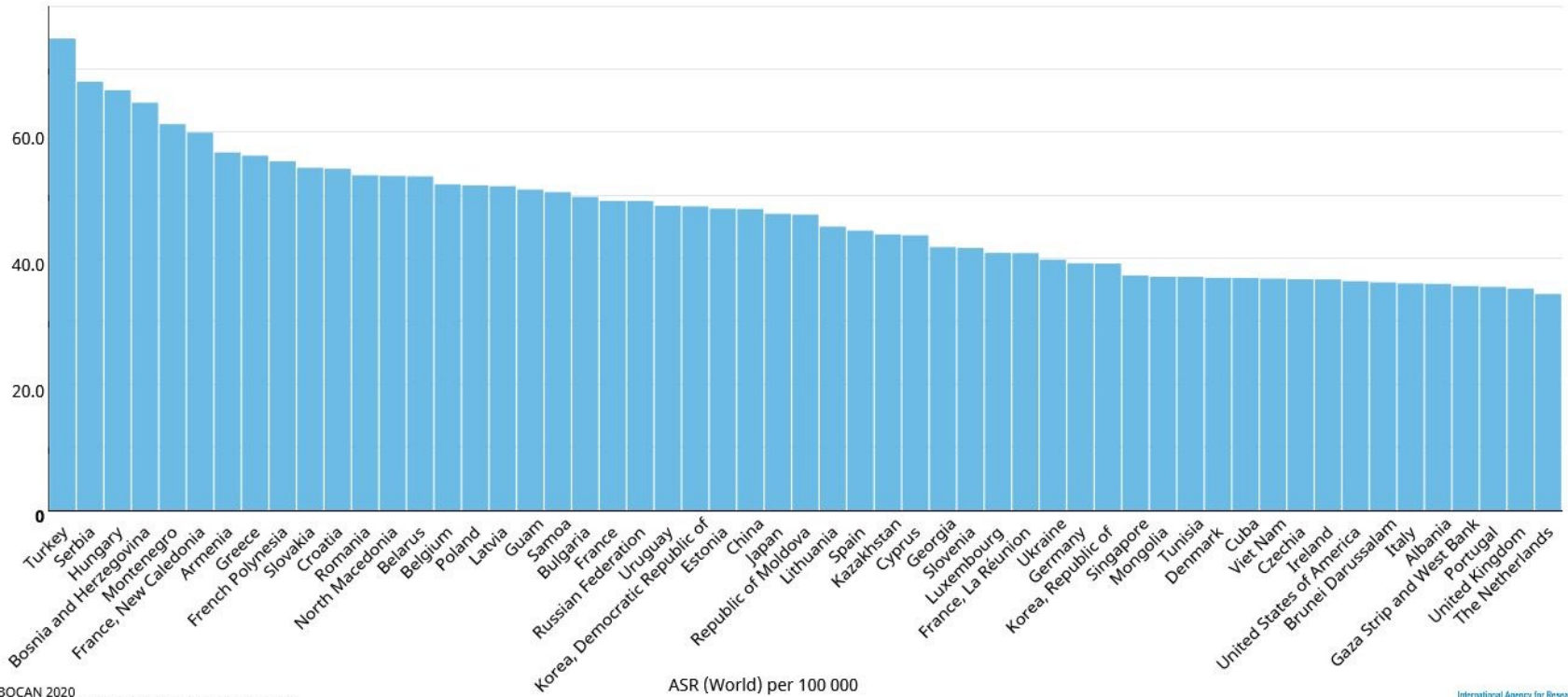
World: Both sexes, all ages



■ Incidence
■ Mortality

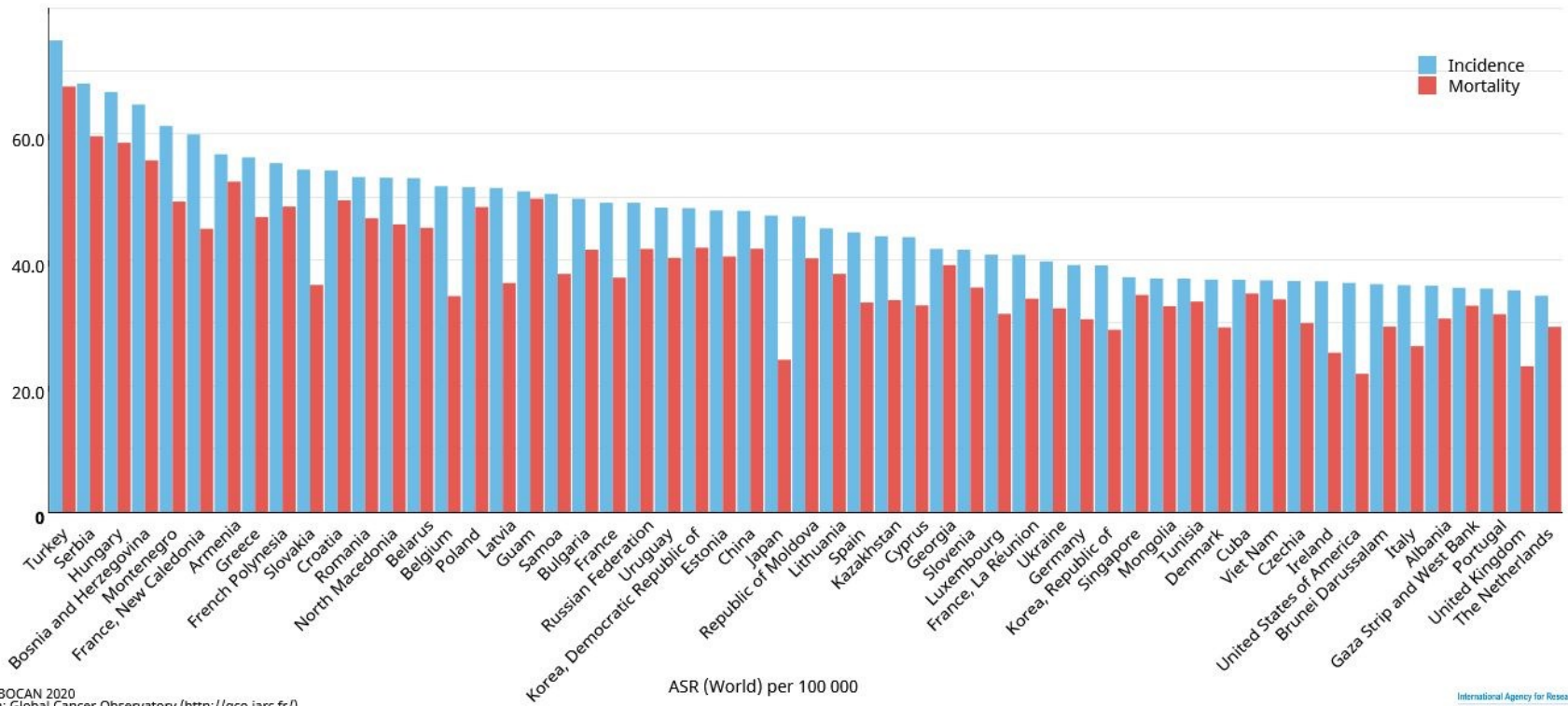
Where is the highest incidence of lung cancer?

Estimated age-standardized incidence rates (World) in 2020, lung, males, all ages



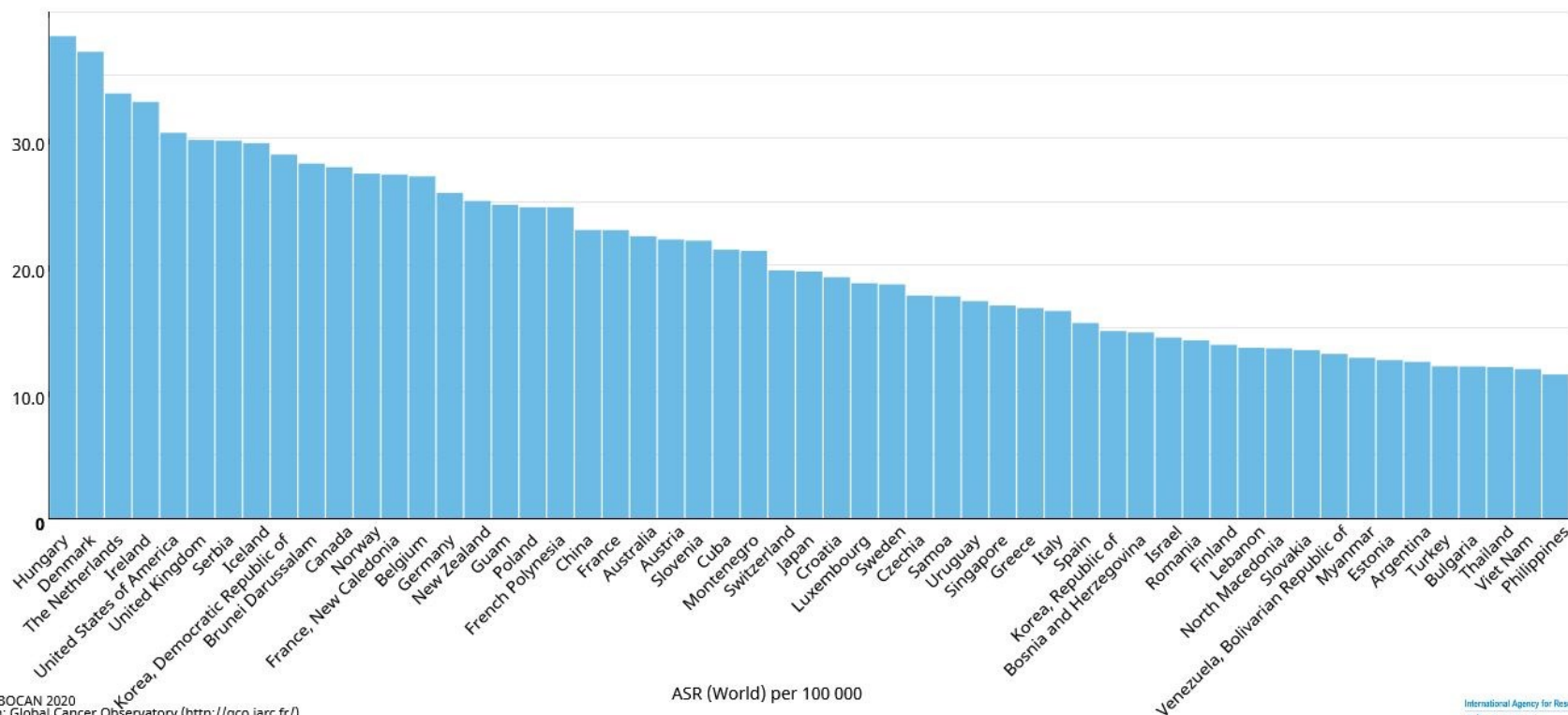
Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

Estimated age-standardized incidence and mortality rates (World) in 2020, lung, males, all ages



Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

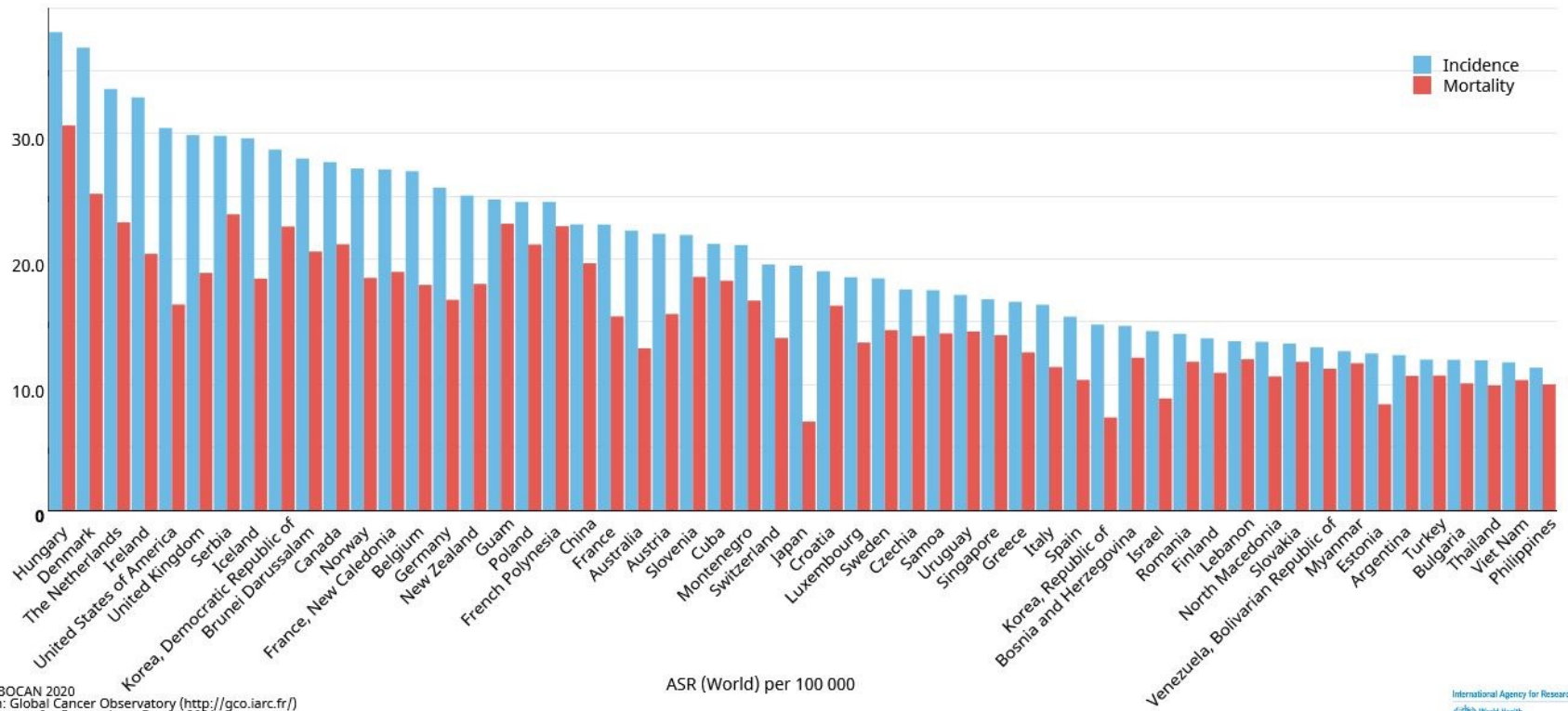
Estimated age-standardized incidence rates (World) in 2020, lung, females, all ages



Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

ASR (World) per 100 000

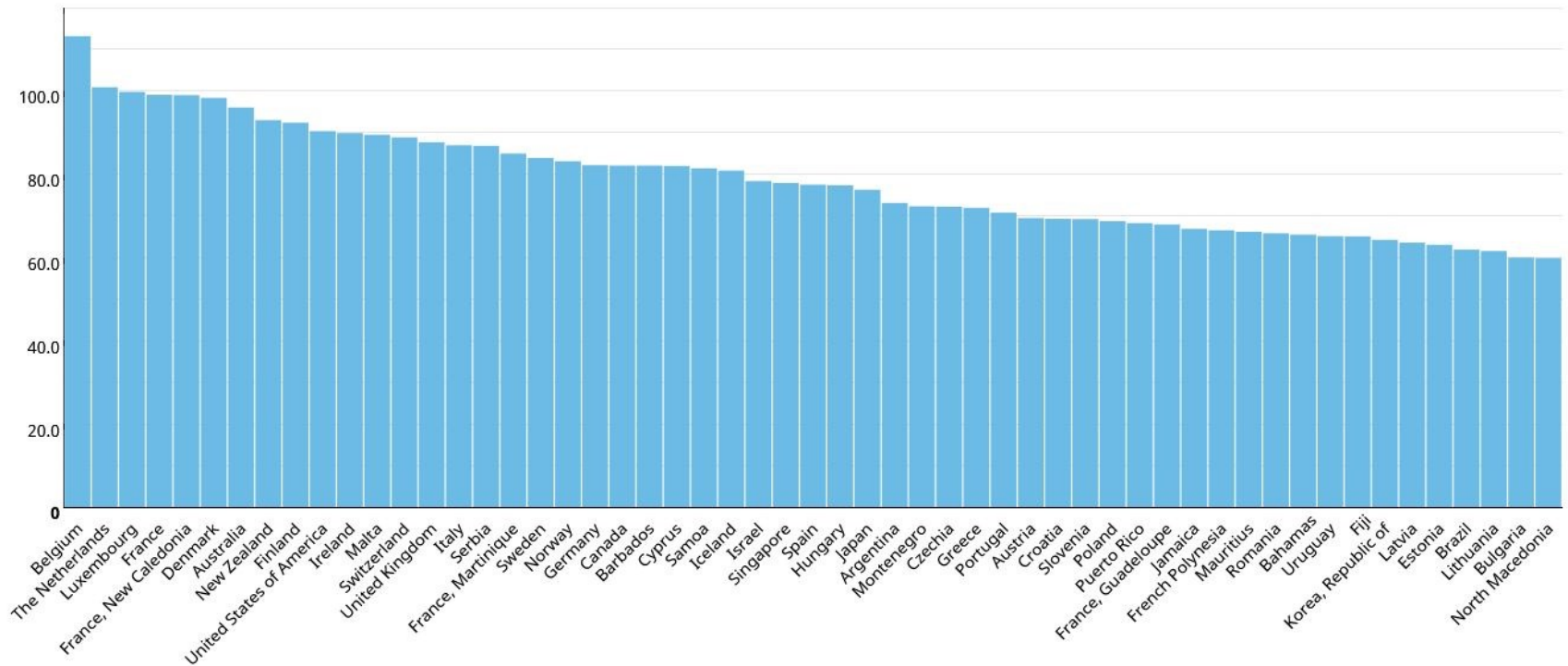
Estimated age-standardized incidence and mortality rates (World) in 2020, lung, females, all ages



Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

**Where is the highest
incidence of breast cancer?**

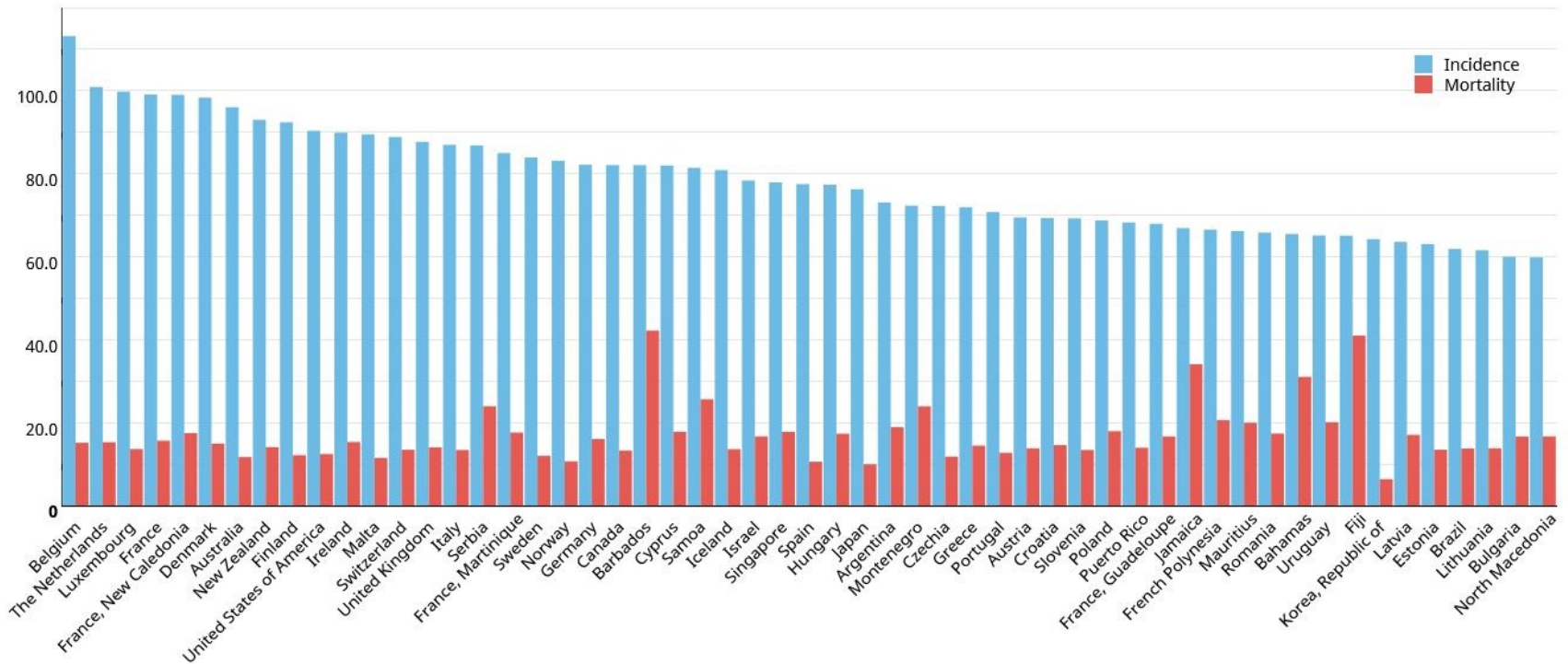
Estimated age-standardized incidence rates (World) in 2020, breast, females, all ages



Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

ASR (World) per 100 000

Estimated age-standardized incidence and mortality rates (World) in 2020, breast, females, all ages

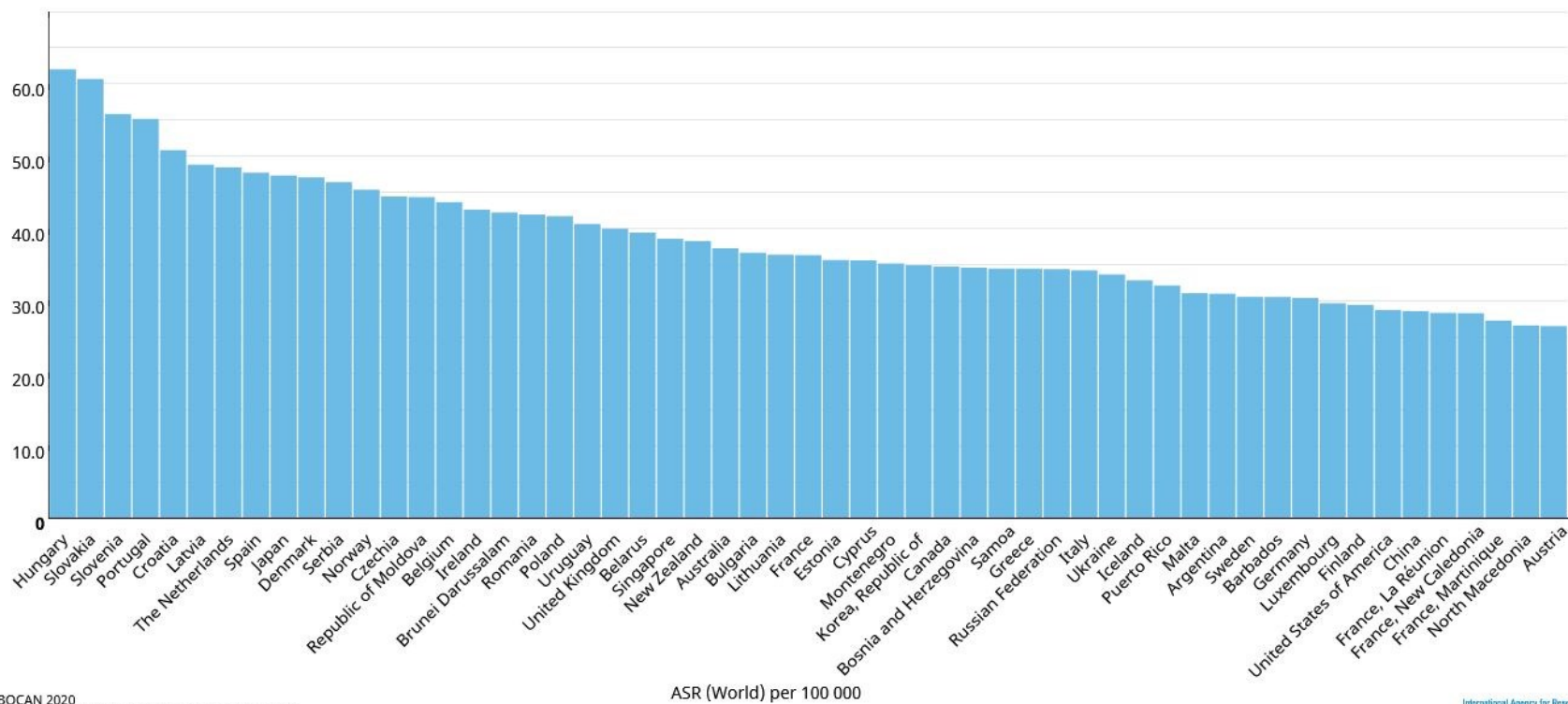


ASR (World) per 100 000

Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

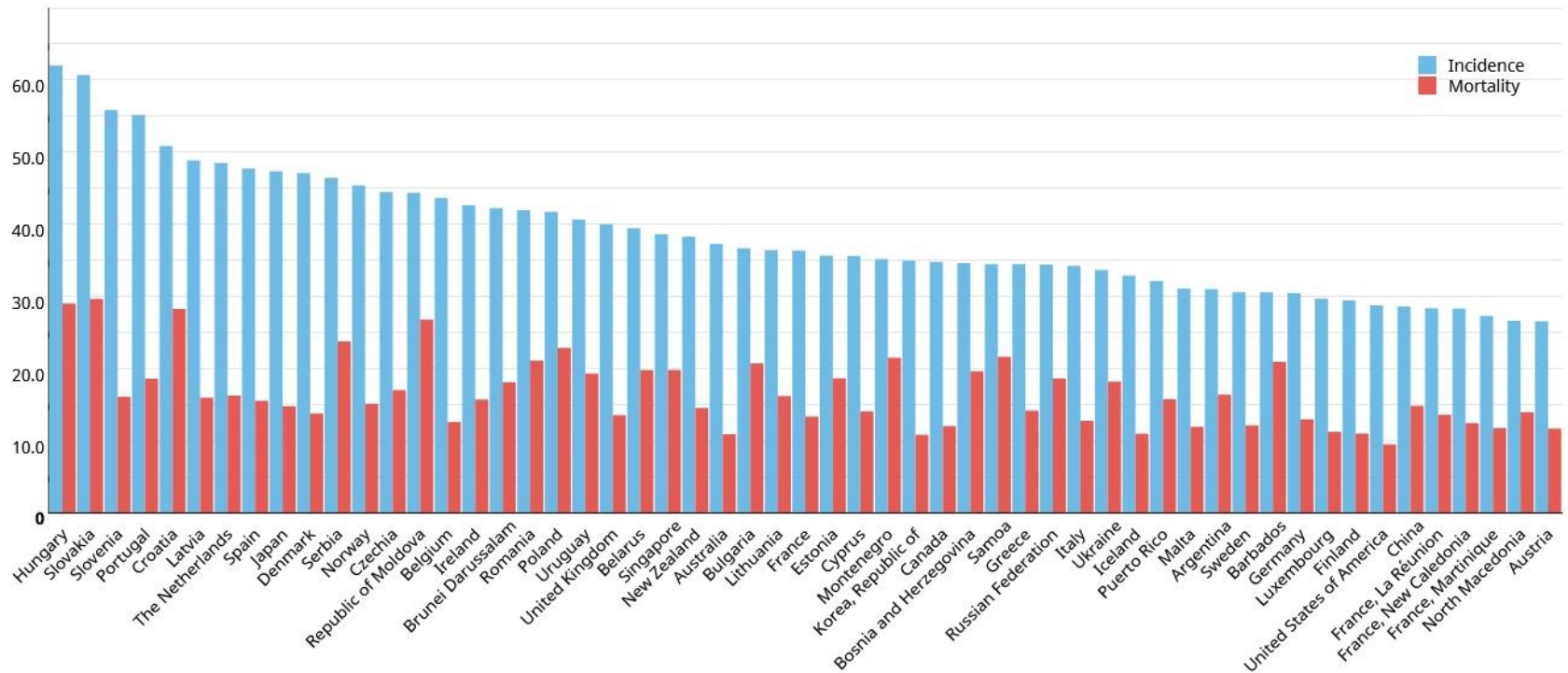
**Where is the highest incidence
of cancer of colon & rectum?**

Estimated age-standardized incidence rates (World) in 2020, colorectum, males, all ages



Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

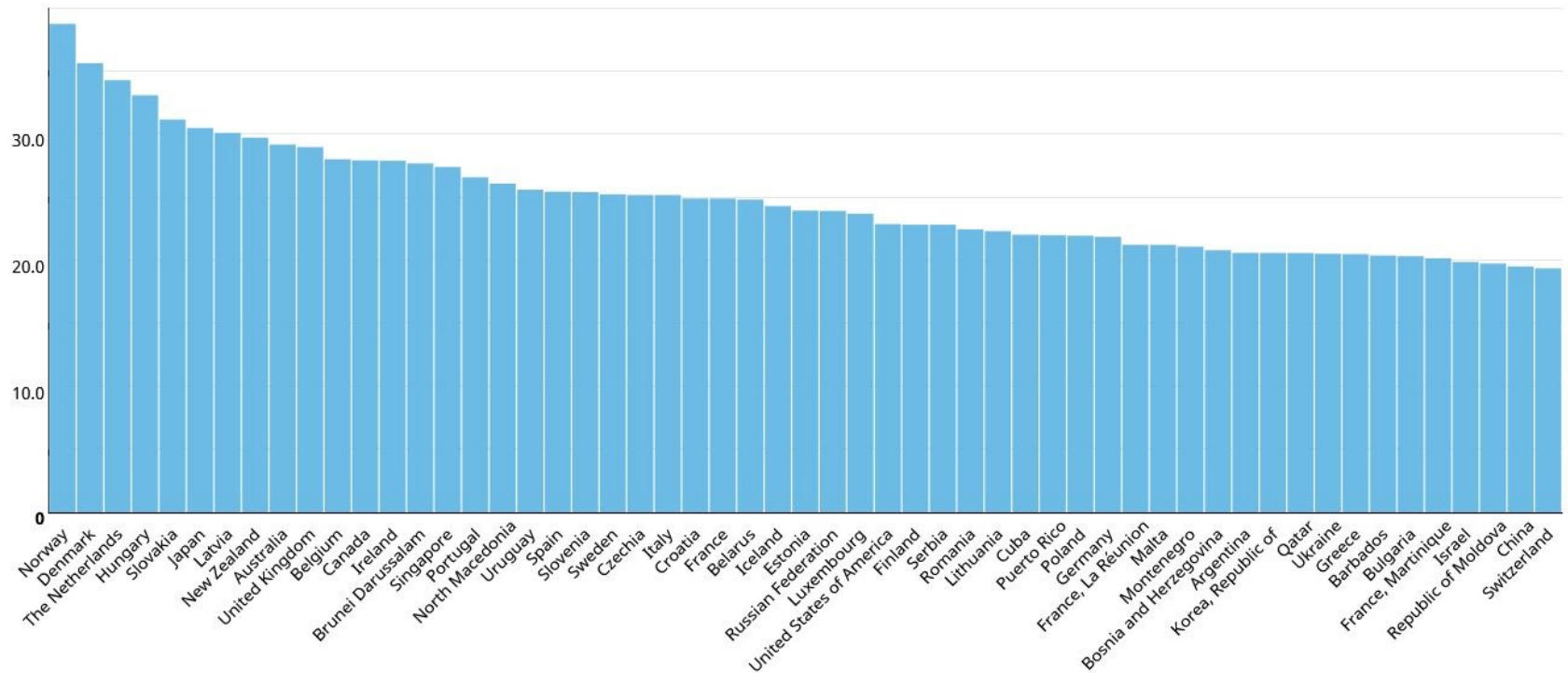
Estimated age-standardized incidence and mortality rates (World) in 2020, colorectum, males, all ages



Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

ASR (World) per 100 000

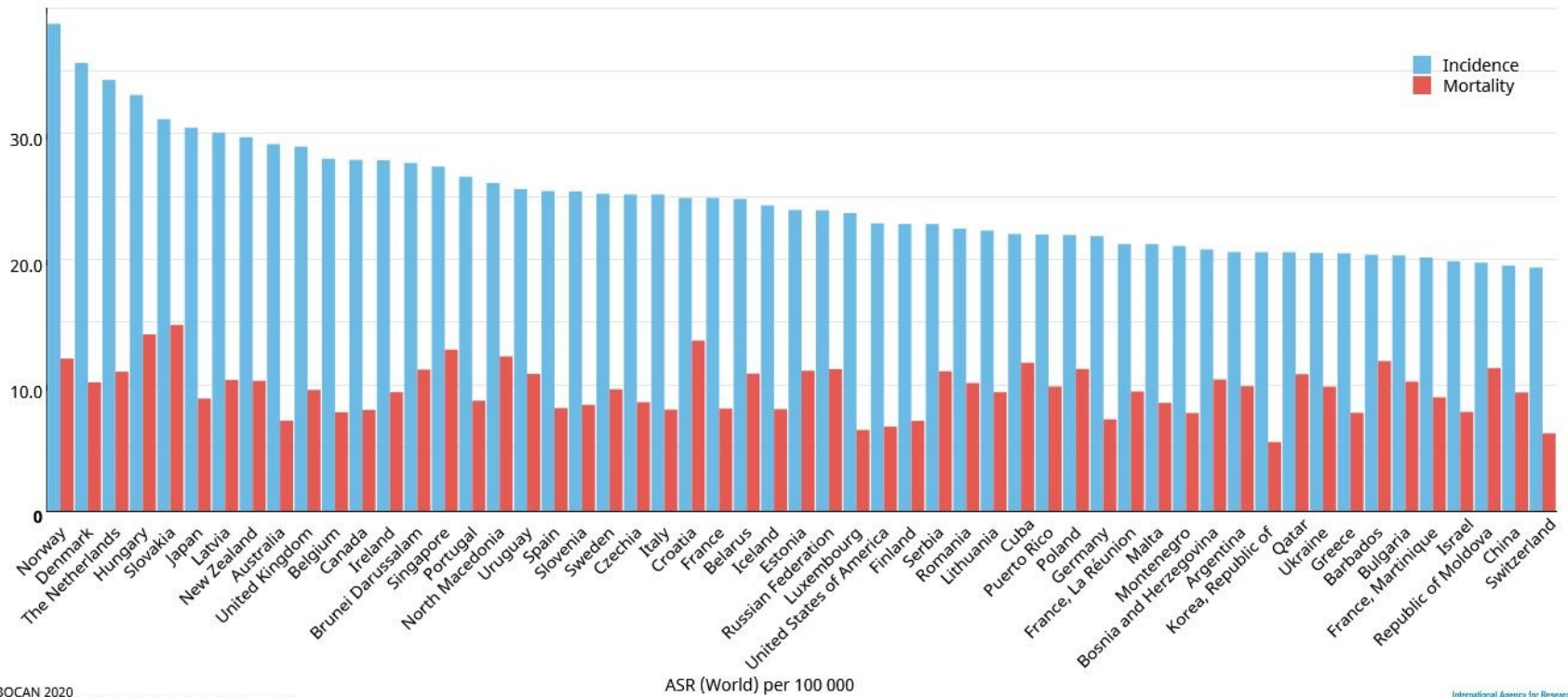
Estimated age-standardized incidence rates (World) in 2020, colorectum, females, all ages



Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

ASR (World) per 100 000

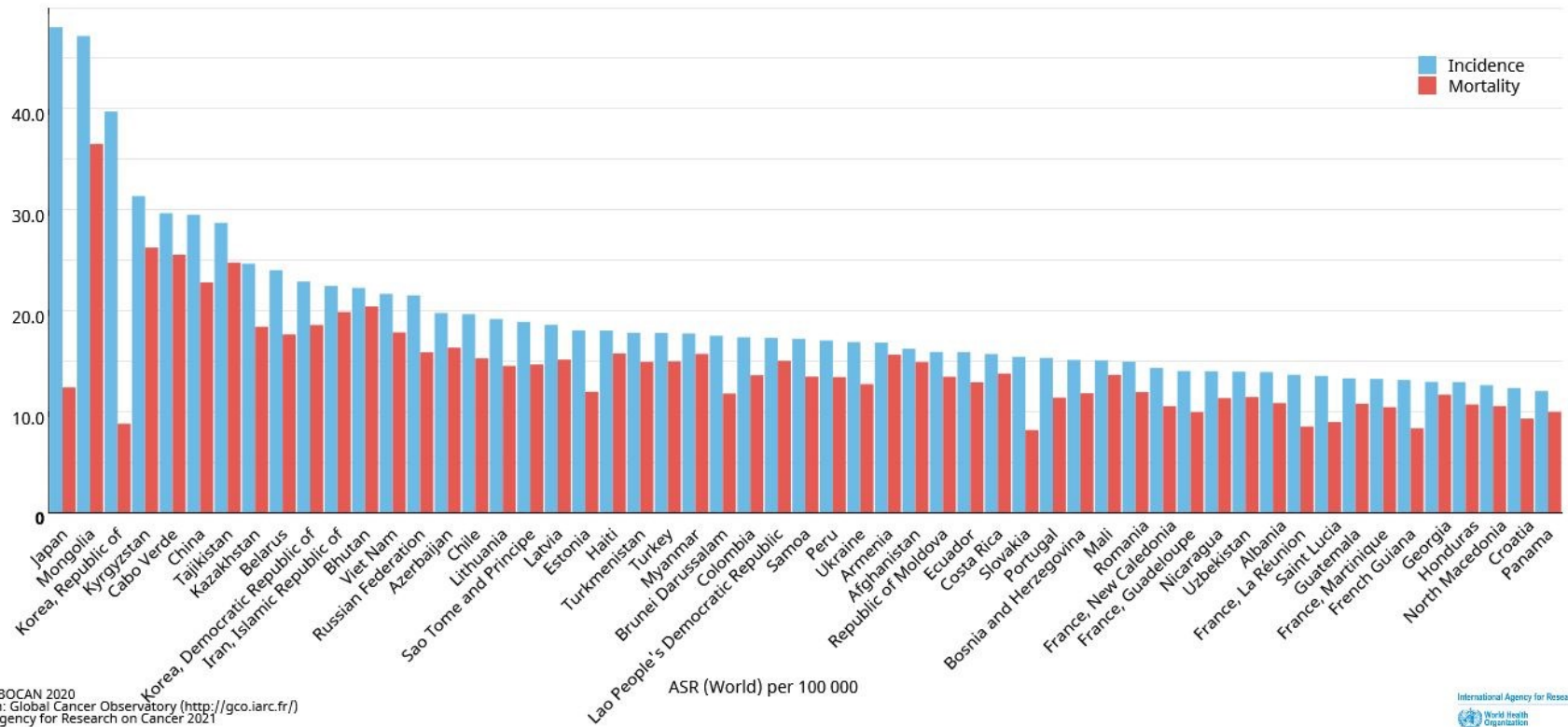
Estimated age-standardized incidence and mortality rates (World) in 2020, colorectum, females, all ages



Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

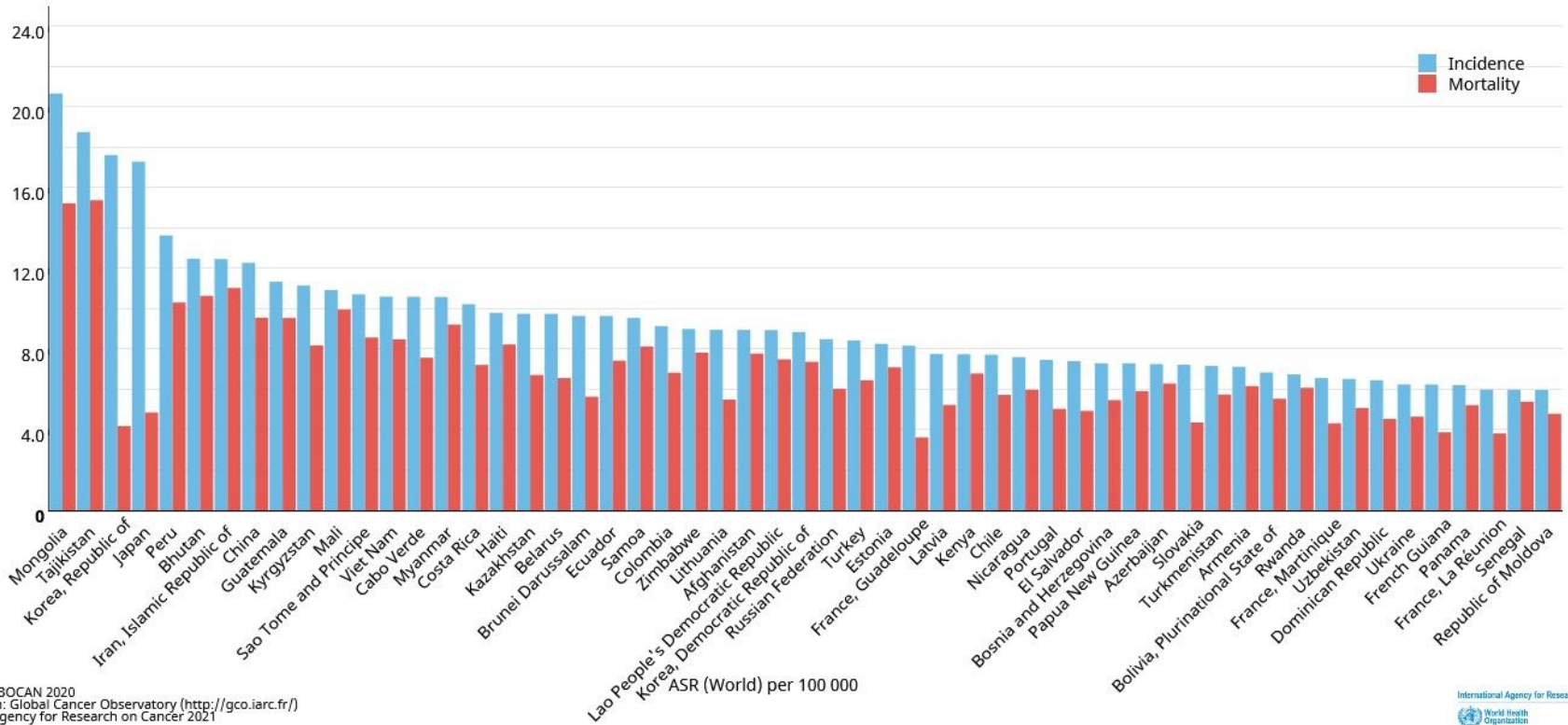
Where is the highest incidence of stomach cancer?

Estimated age-standardized incidence and mortality rates (World) in 2020, stomach, males, all ages



Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

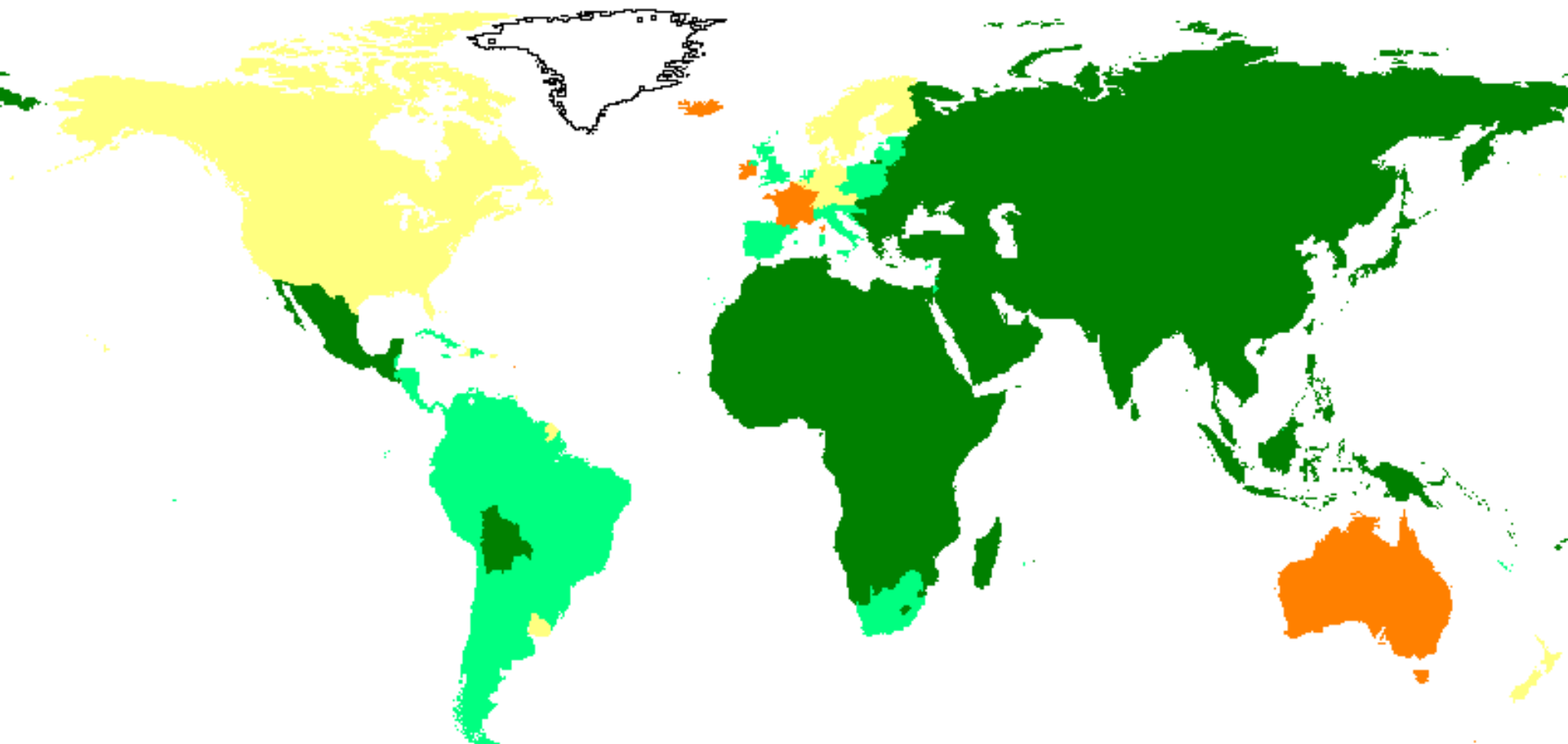
Estimated age-standardized incidence and mortality rates (World) in 2020, stomach, females, all ages



Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

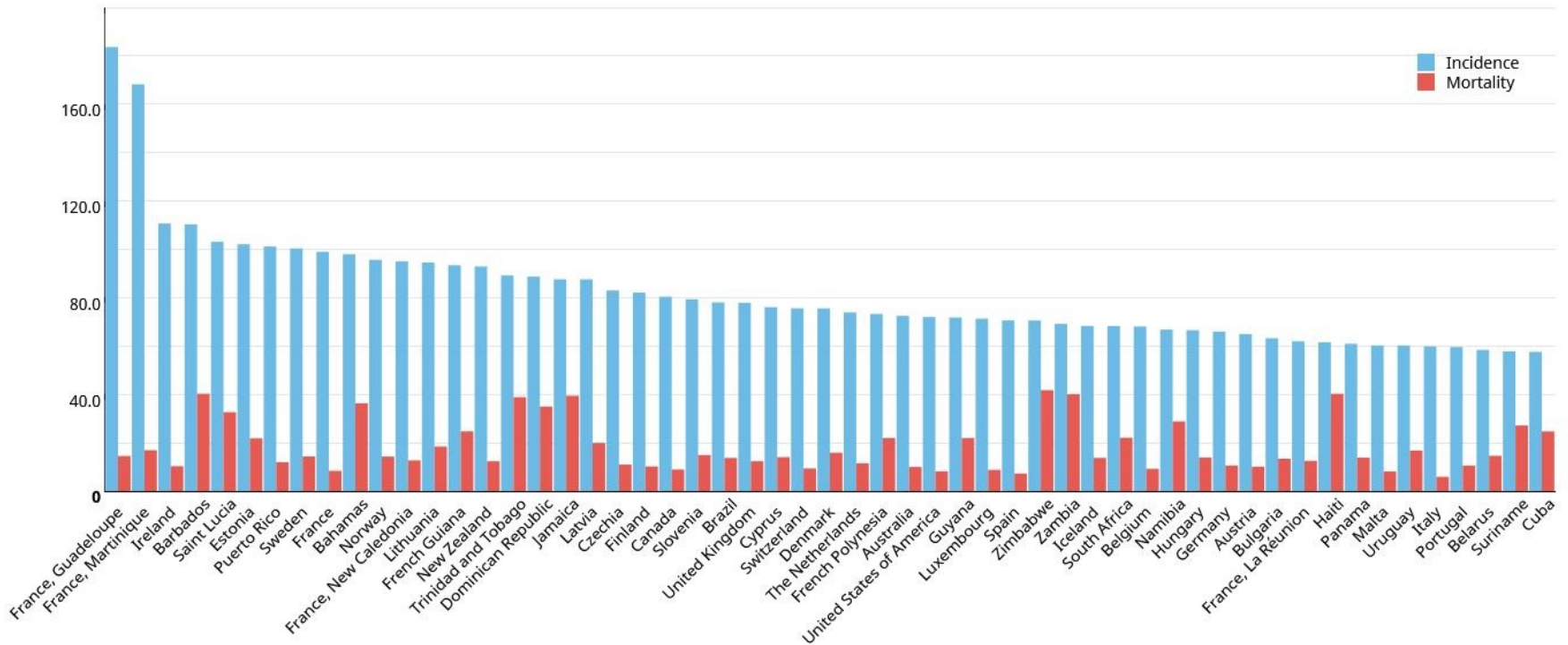
Where is the highest incidence of prostate cancer?

Estimated age-standardised incidence rate per 100,000 Prostate, all ages



■ < 36.1 ■ < 70.5 ■ < 104.9 ■ < 139.3 ■ < 173.7

Estimated age-standardized incidence and mortality rates (World) in 2020, prostate, males, all ages

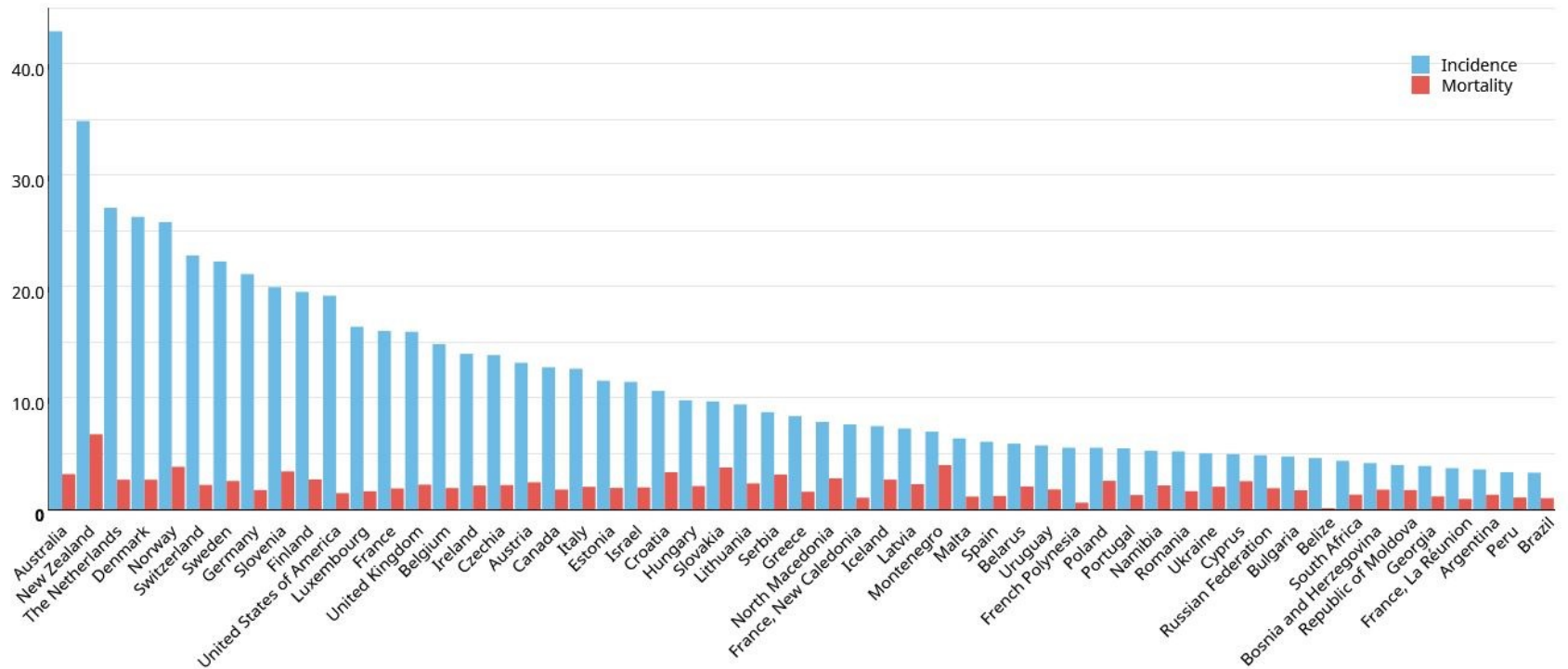


Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

ASR (World) per 100 000

**Where is the highest
incidence of melanoma?**

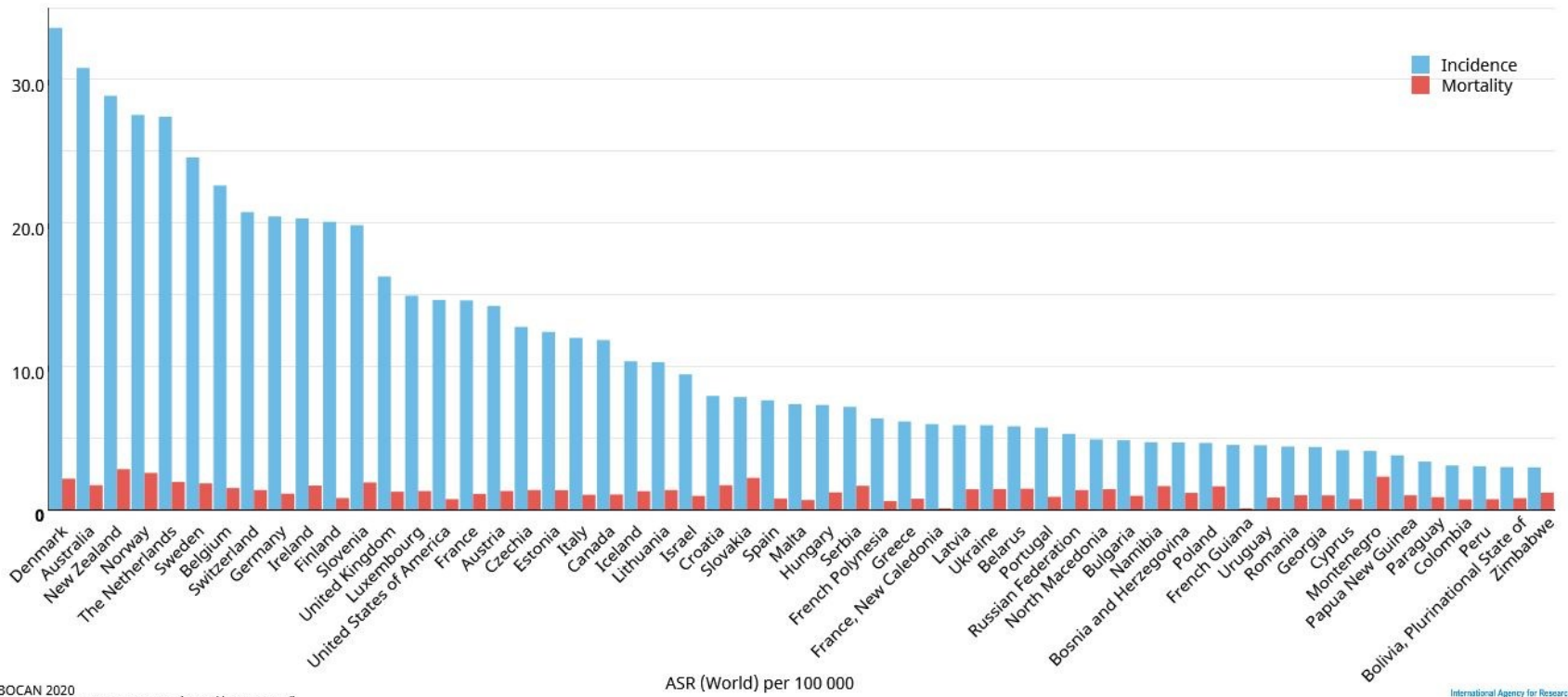
Estimated age-standardized incidence and mortality rates (World) in 2020, melanoma of skin, males, all ages



Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

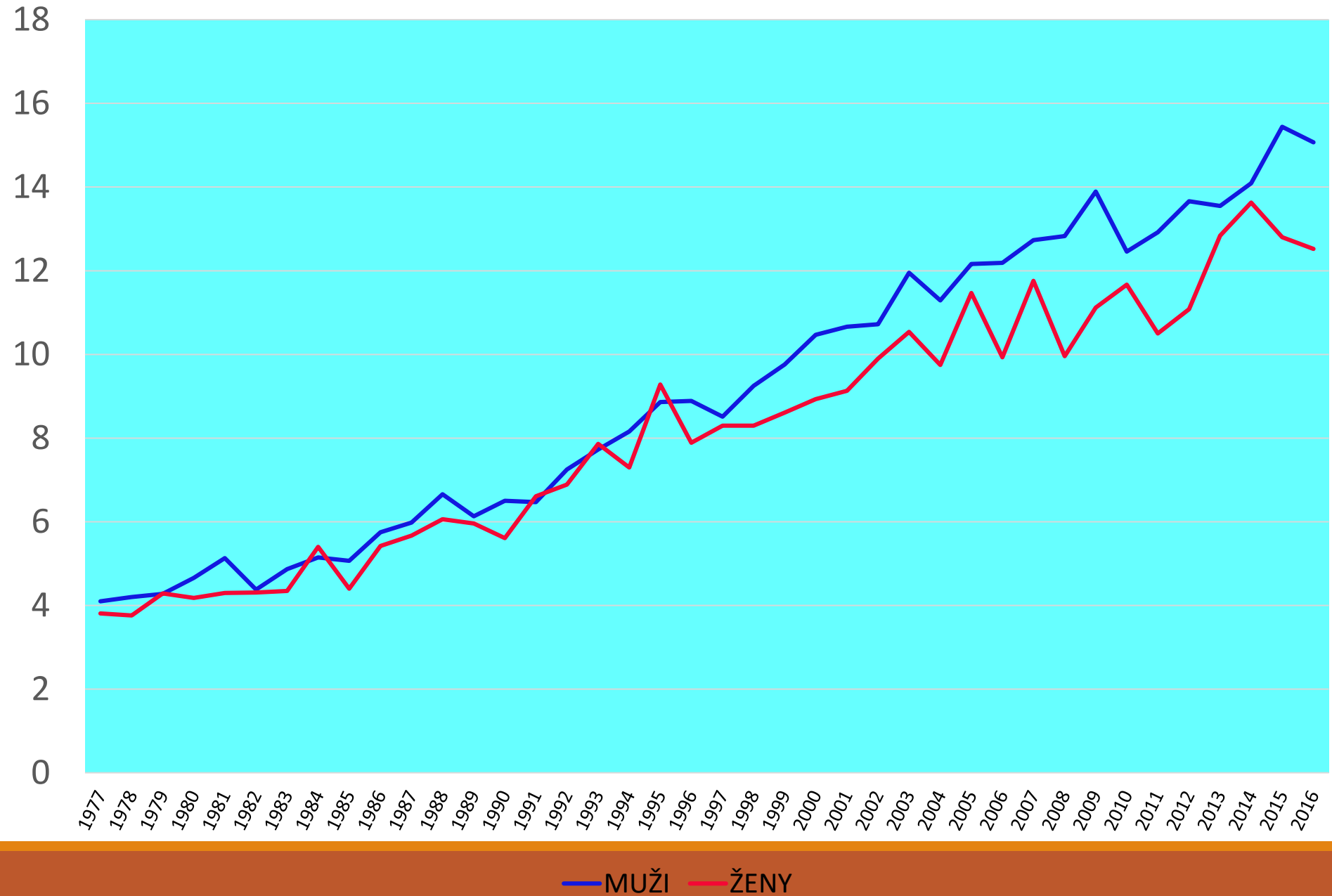
ASR (World) per 100 000

Estimated age-standardized incidence and mortality rates (World) in 2020, melanoma of skin, females, all ages

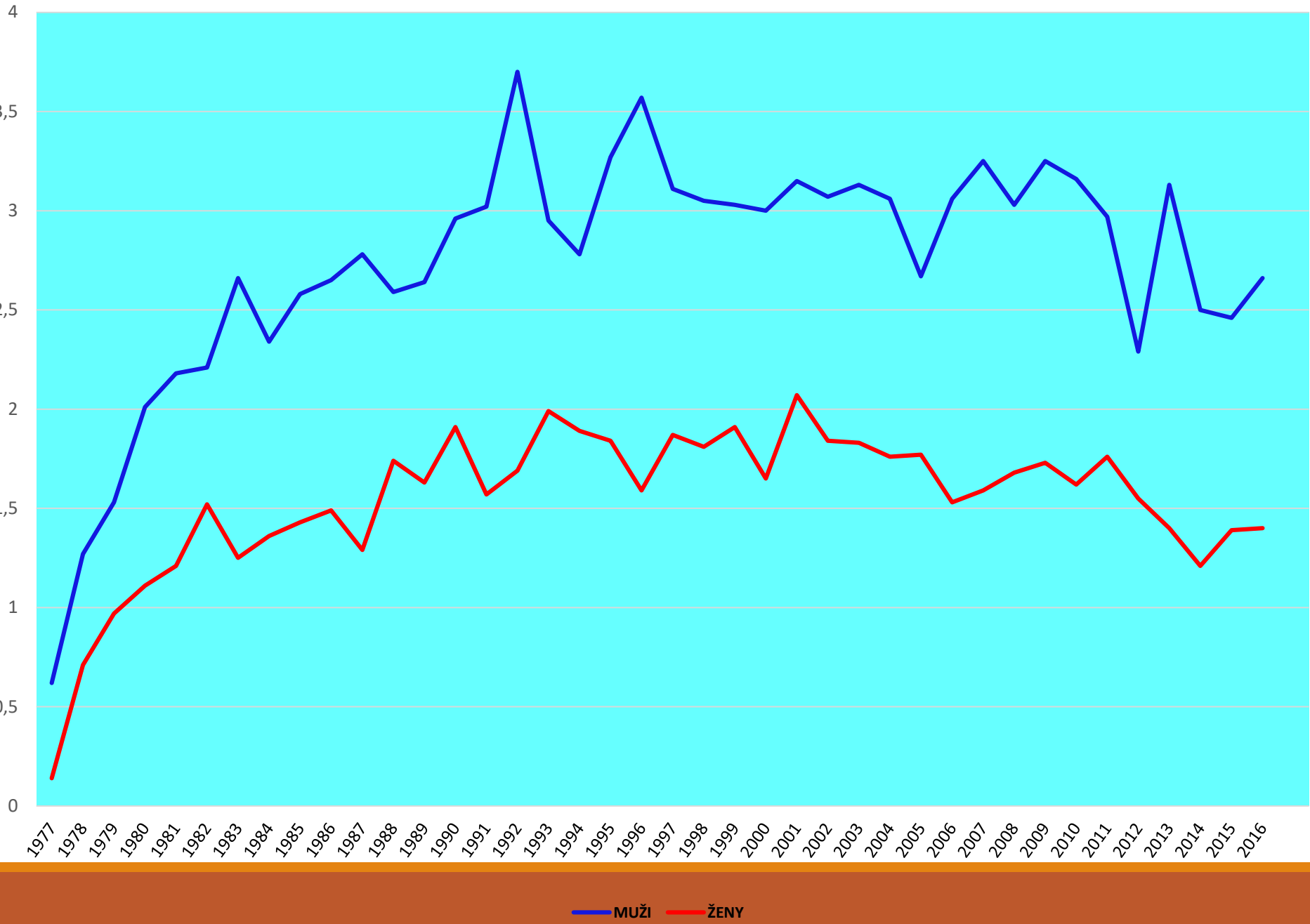


Data source: GLOBOCAN 2020
 Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
 © International Agency for Research on Cancer 2021

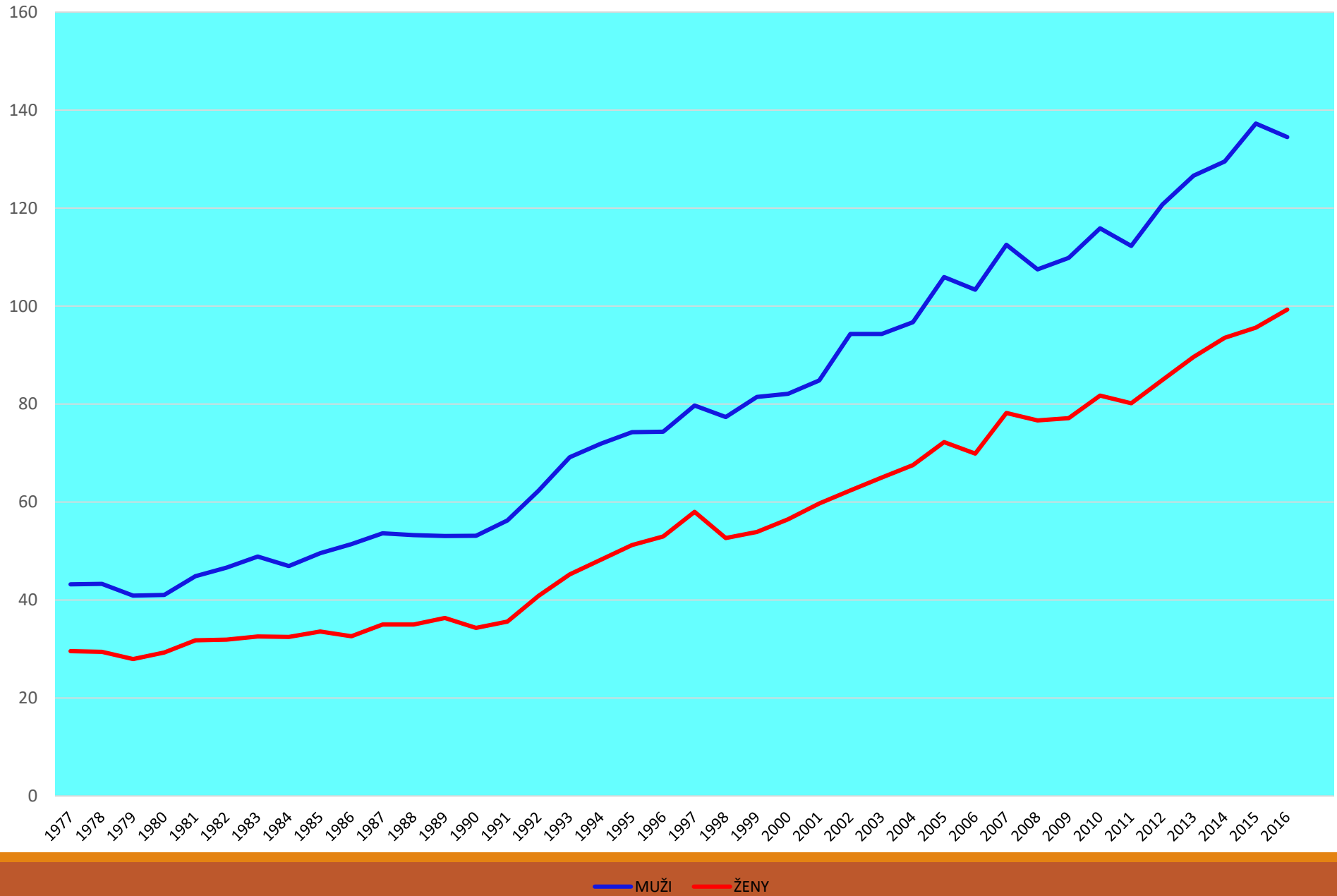
TRENDS OF INCIDENCE C43 (UZIS)



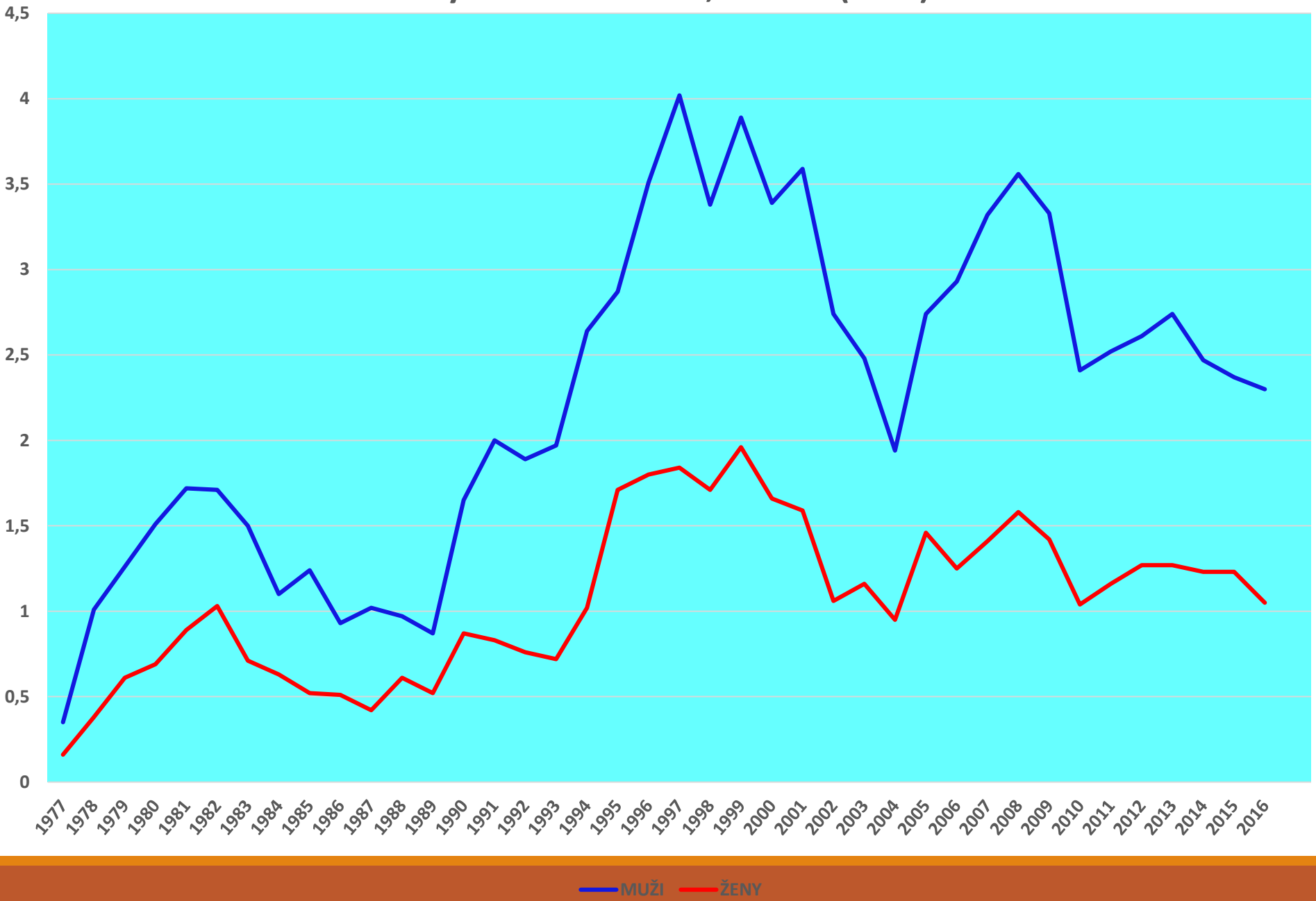
Trends of mortality C43, ASR-W (UZIS)



Trendy v incidenci C44, ASR-W (UZIS)

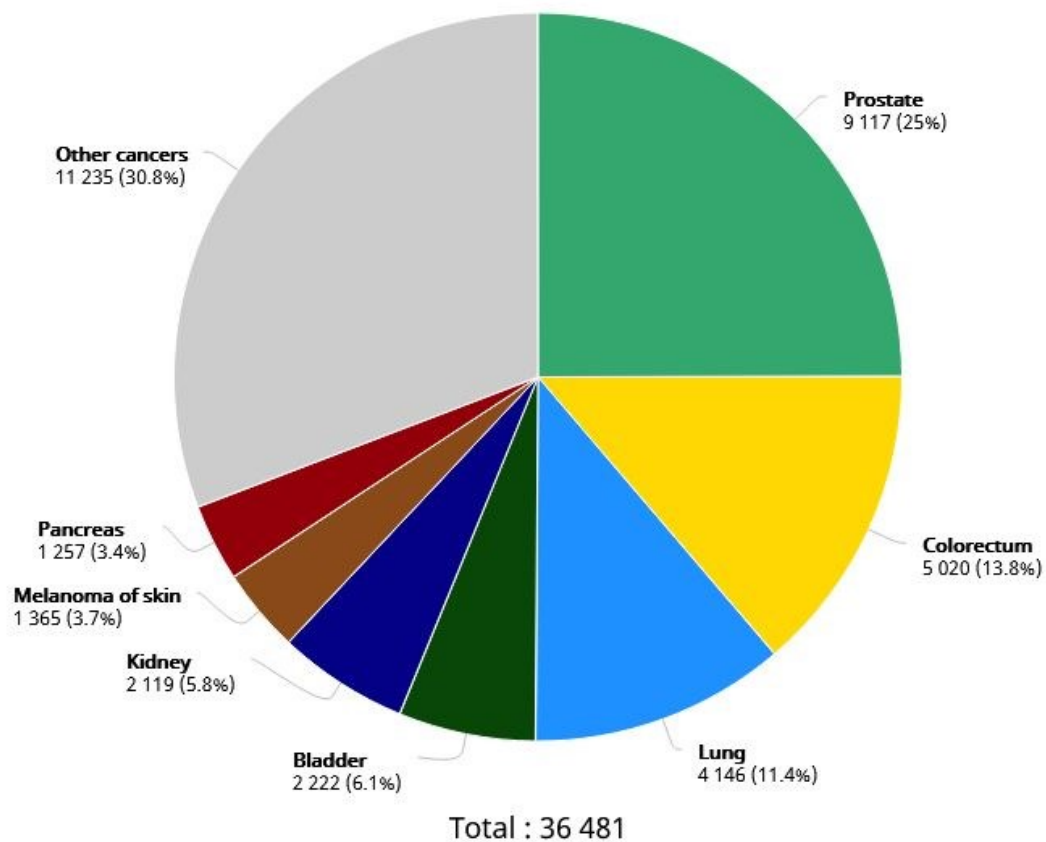


Trendy v mortalitě C44, ASR-W (UZIS)



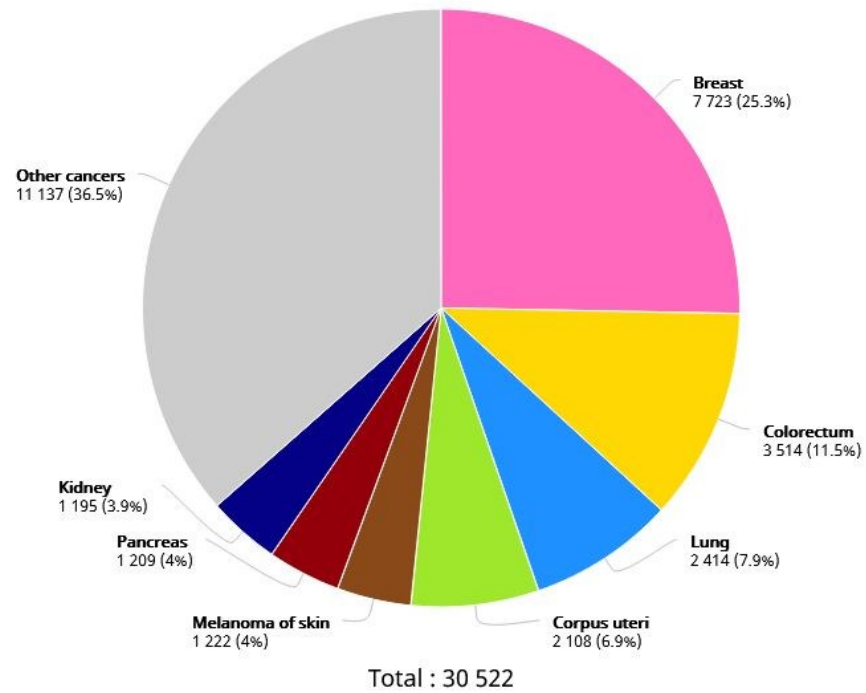
— MUŽI — ŽENY

Estimated number of new cases in 2020, Czechia, males, all ages

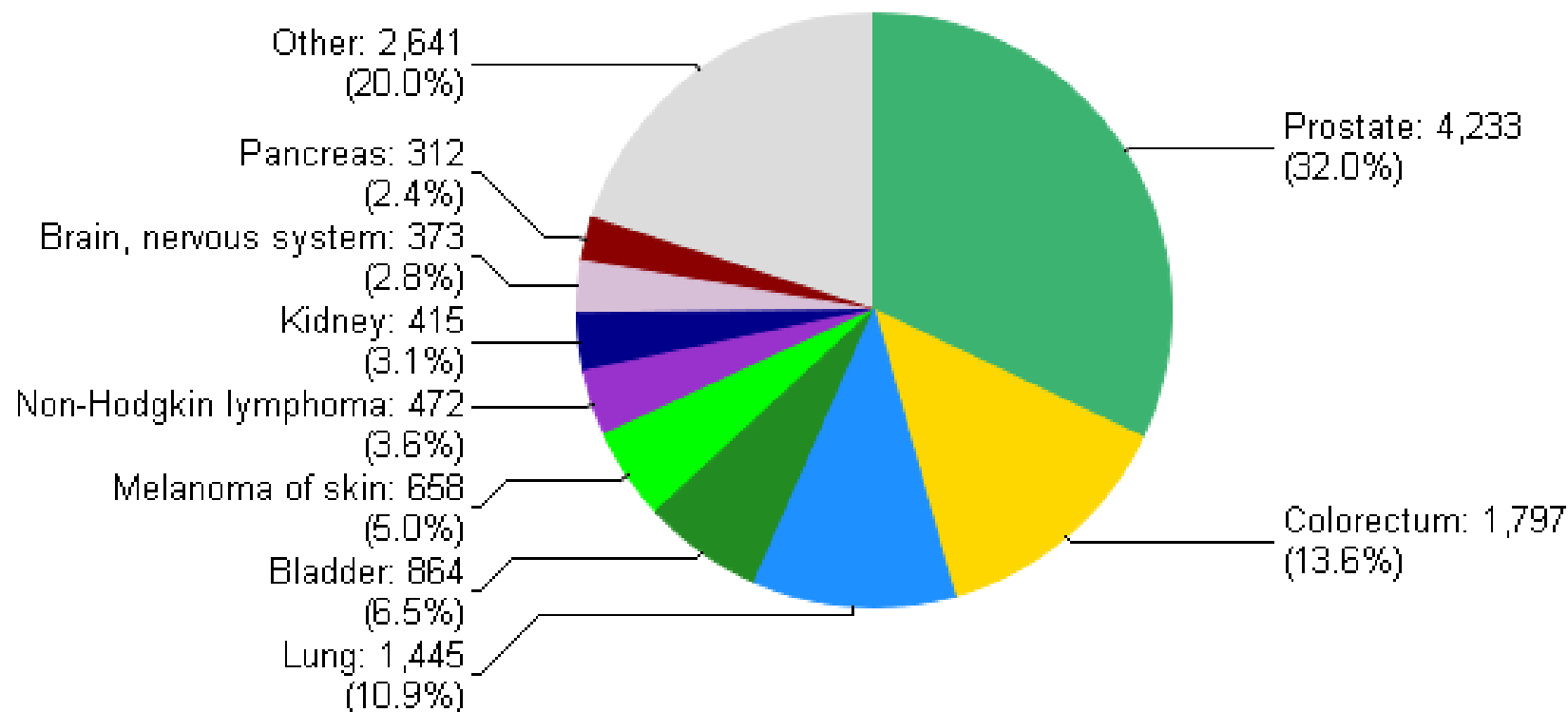
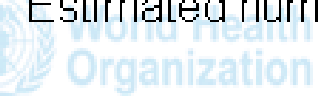


Data source: GLOBOCAN 2020
Graph production: Global Cancer Observatory (<http://gco.iarc.fr/>)
© International Agency for Research on Cancer 2022

Estimated number of new cases in 2020, Czechia, females, all ages

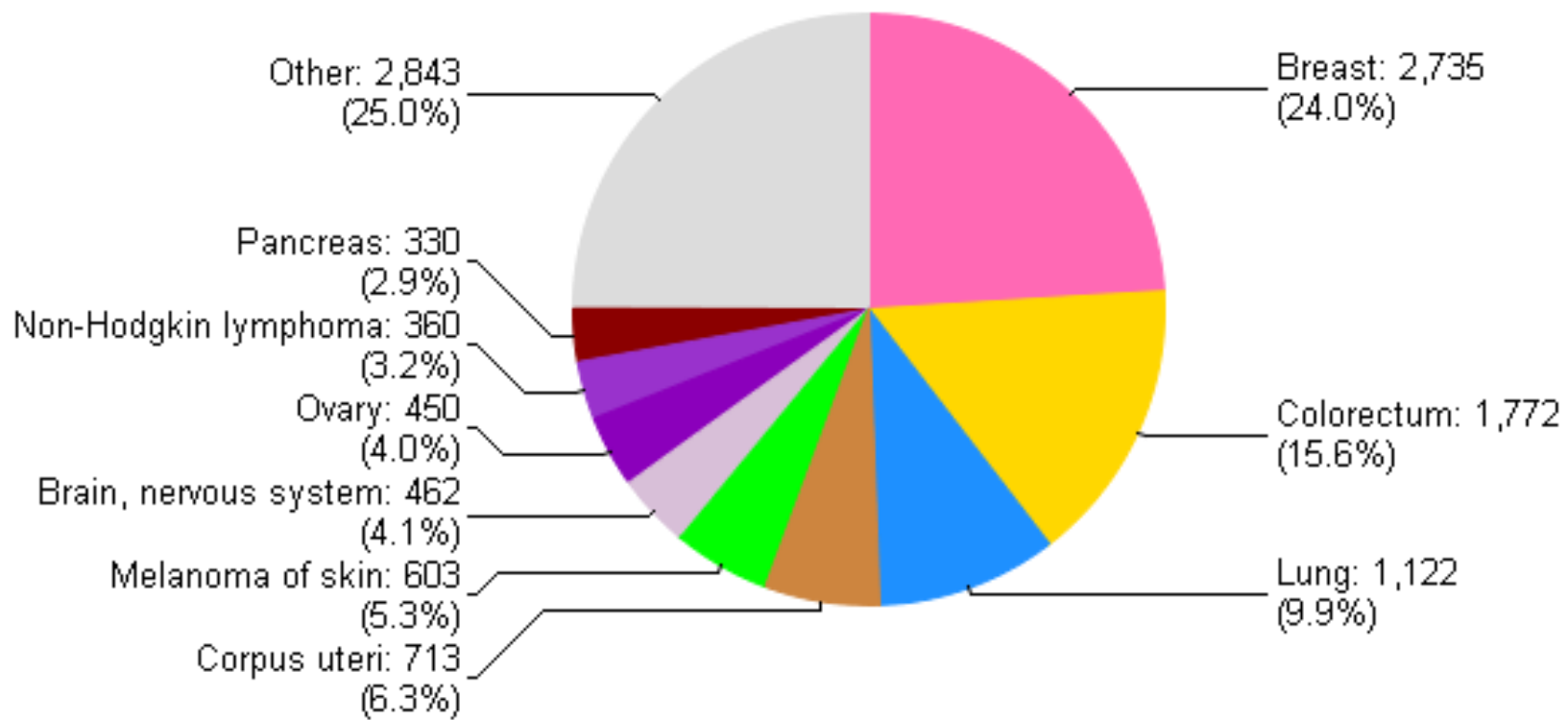


Estimated number of cancer cases, all ages (total: 13,210)

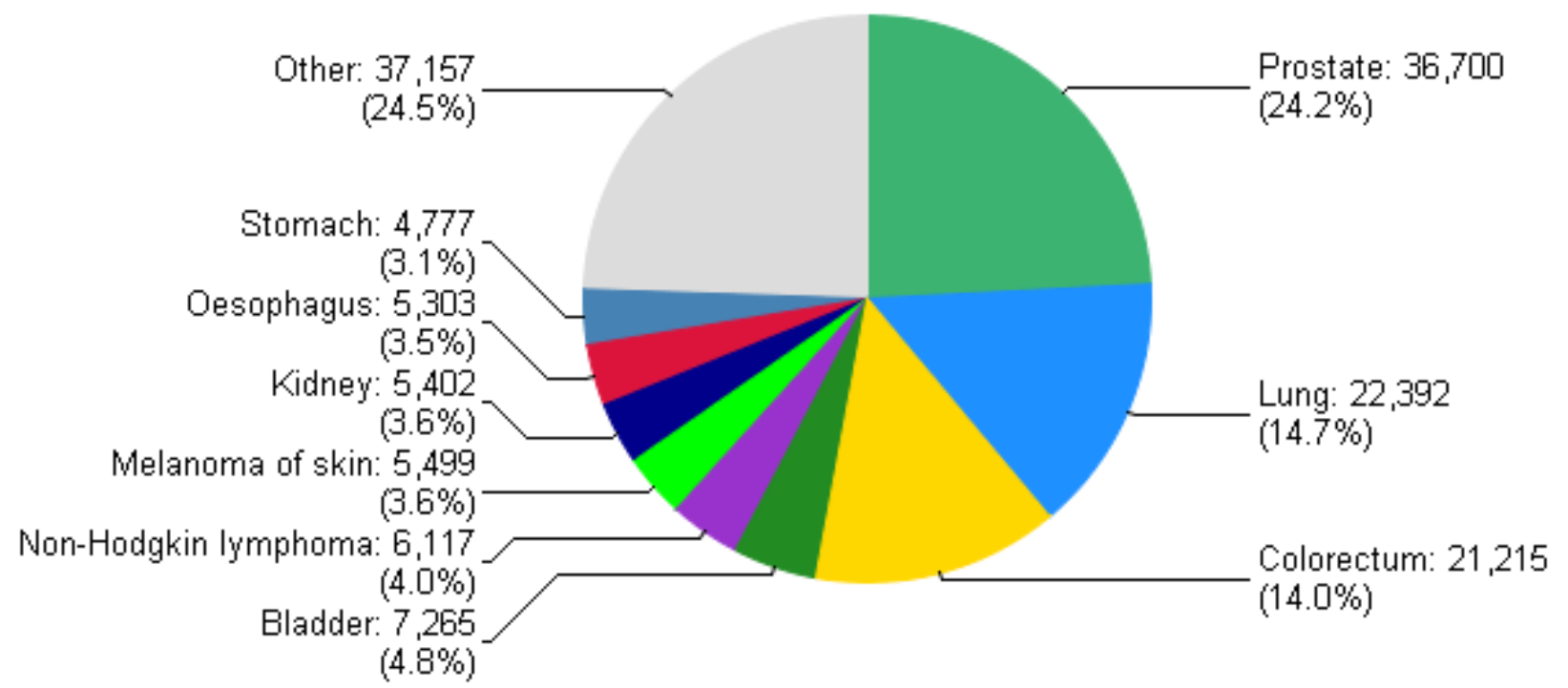


Norway: Women

Estimated number of cancer cases, all ages (total: 11,390)

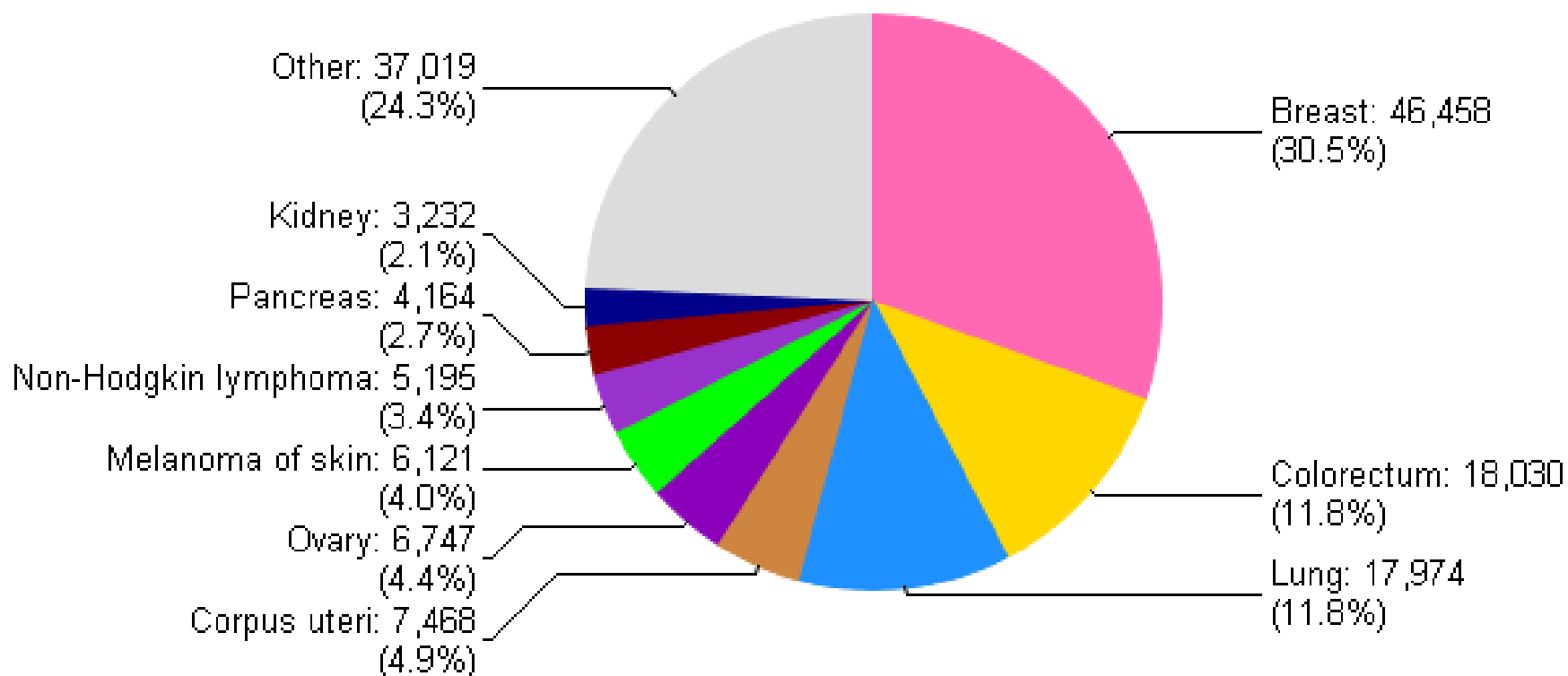


Estimated number of cancer cases, all ages (total: 151,827)



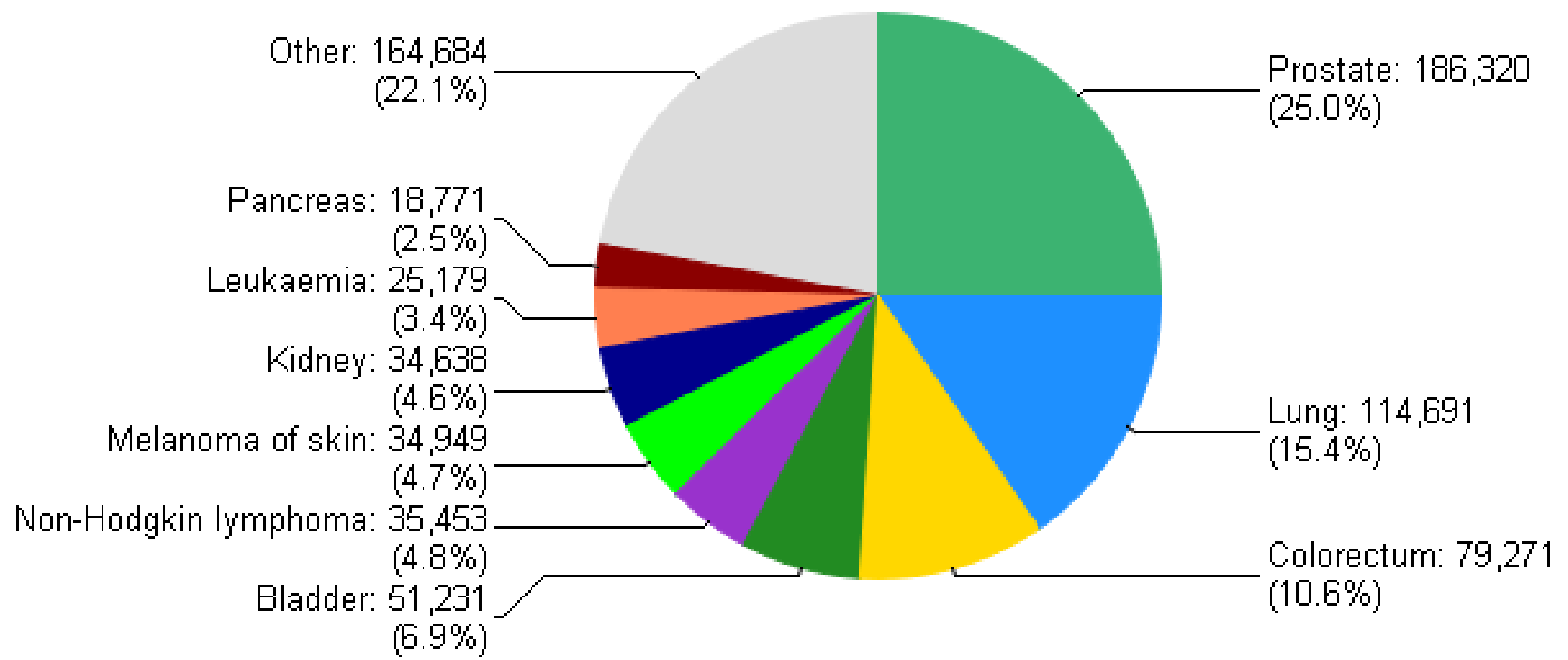
United Kingdom: Women

Estimated number of cancer cases, all ages (total: 152,408)



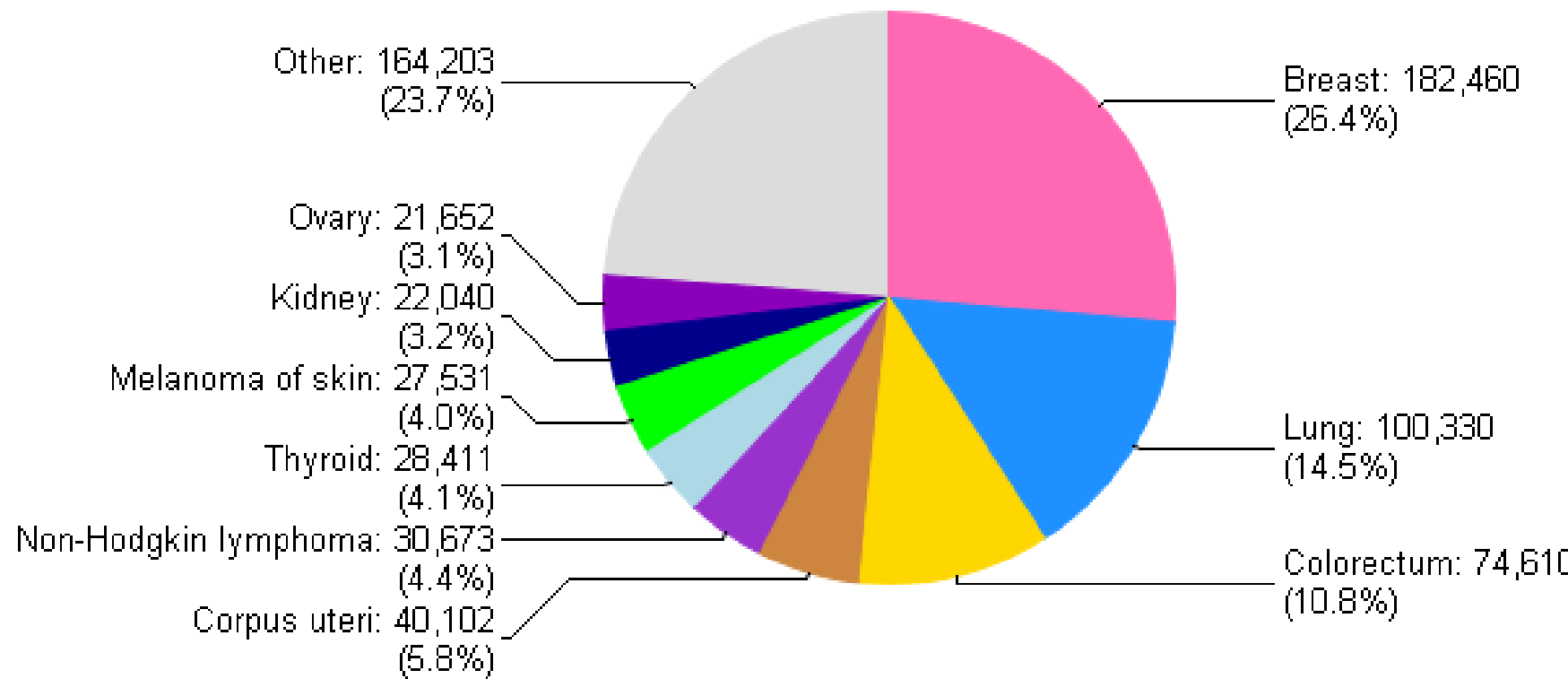


Estimated number of cancer cases, all ages (total: 745,187)

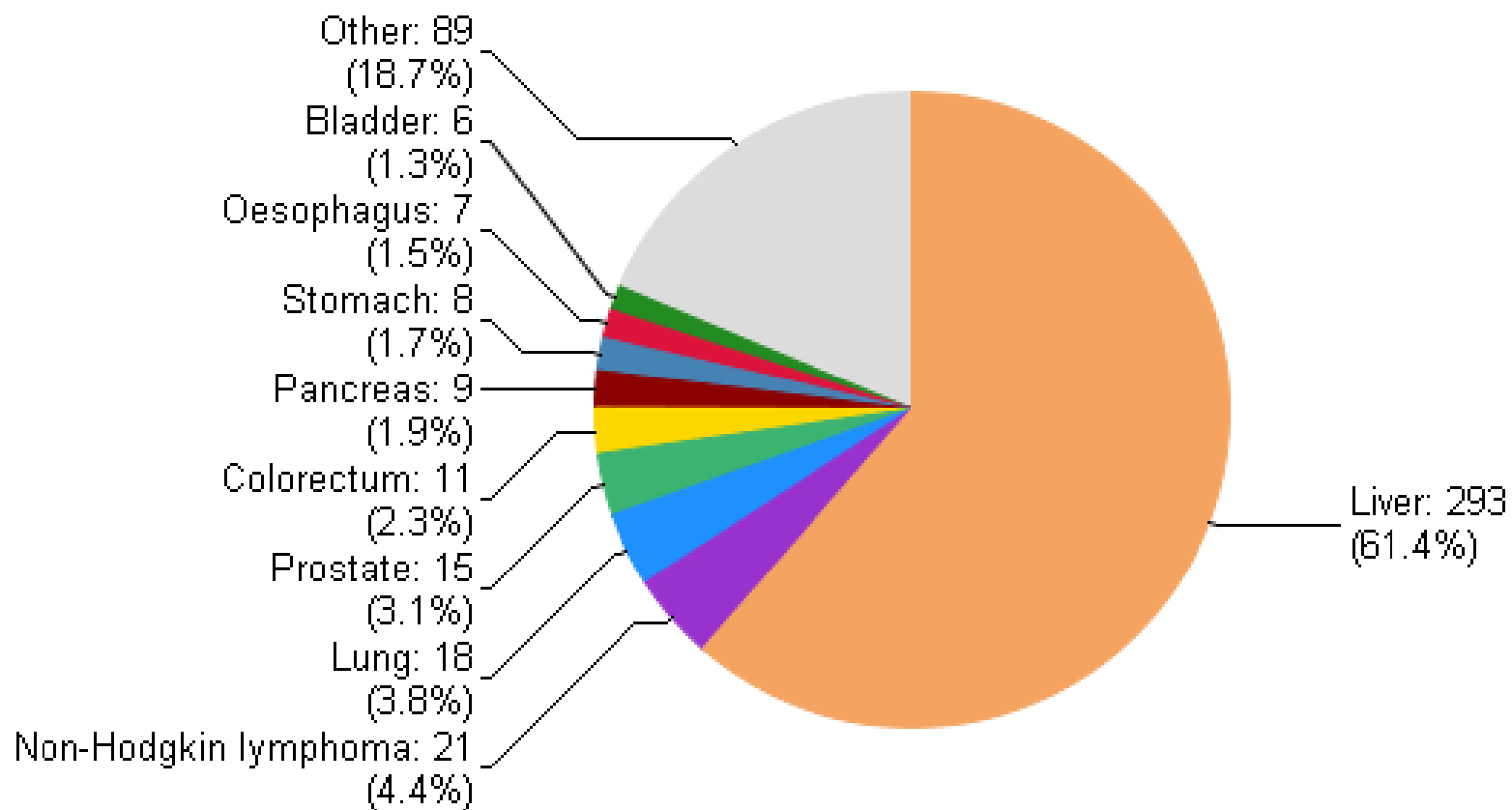


United States of America: Women

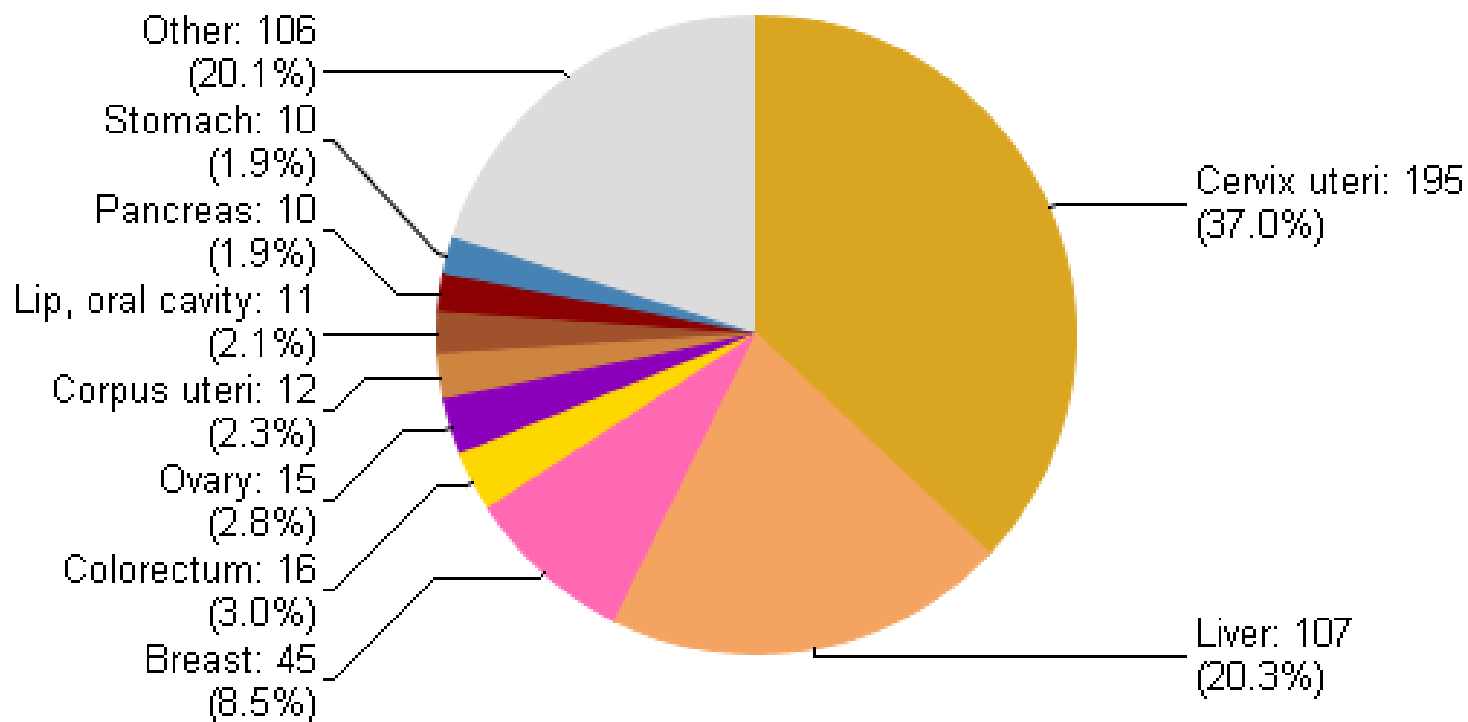
Estimated number of cancer cases, all ages (total: 692,012)



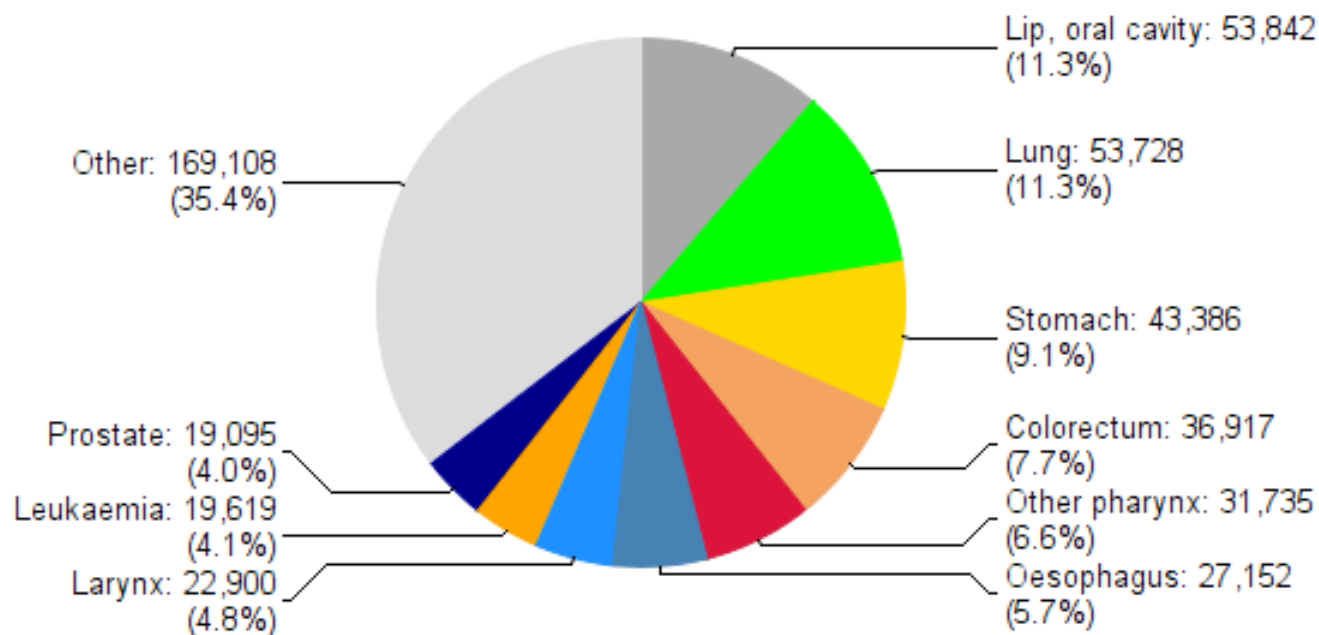
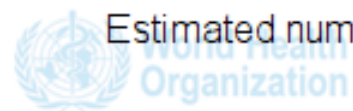
The Gambia: Men
Estimated number of cancer cases, all ages (total: 477)



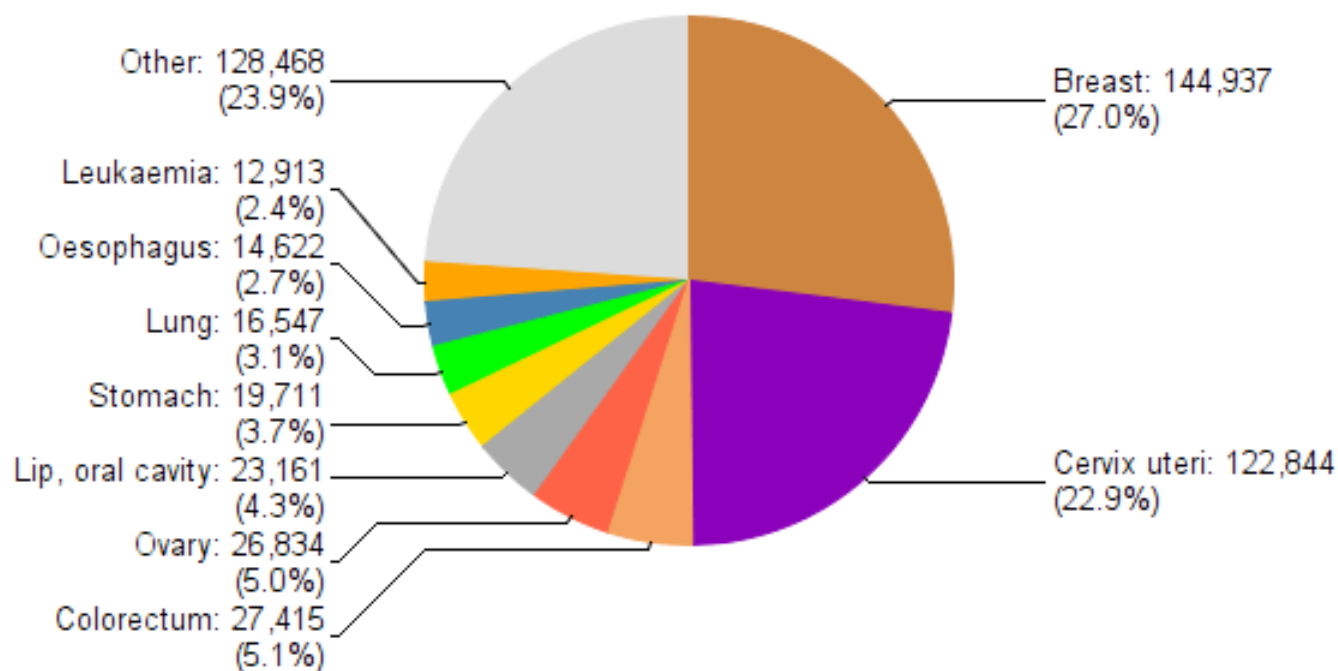
Estimated number of cancer cases, all ages (total: 527)



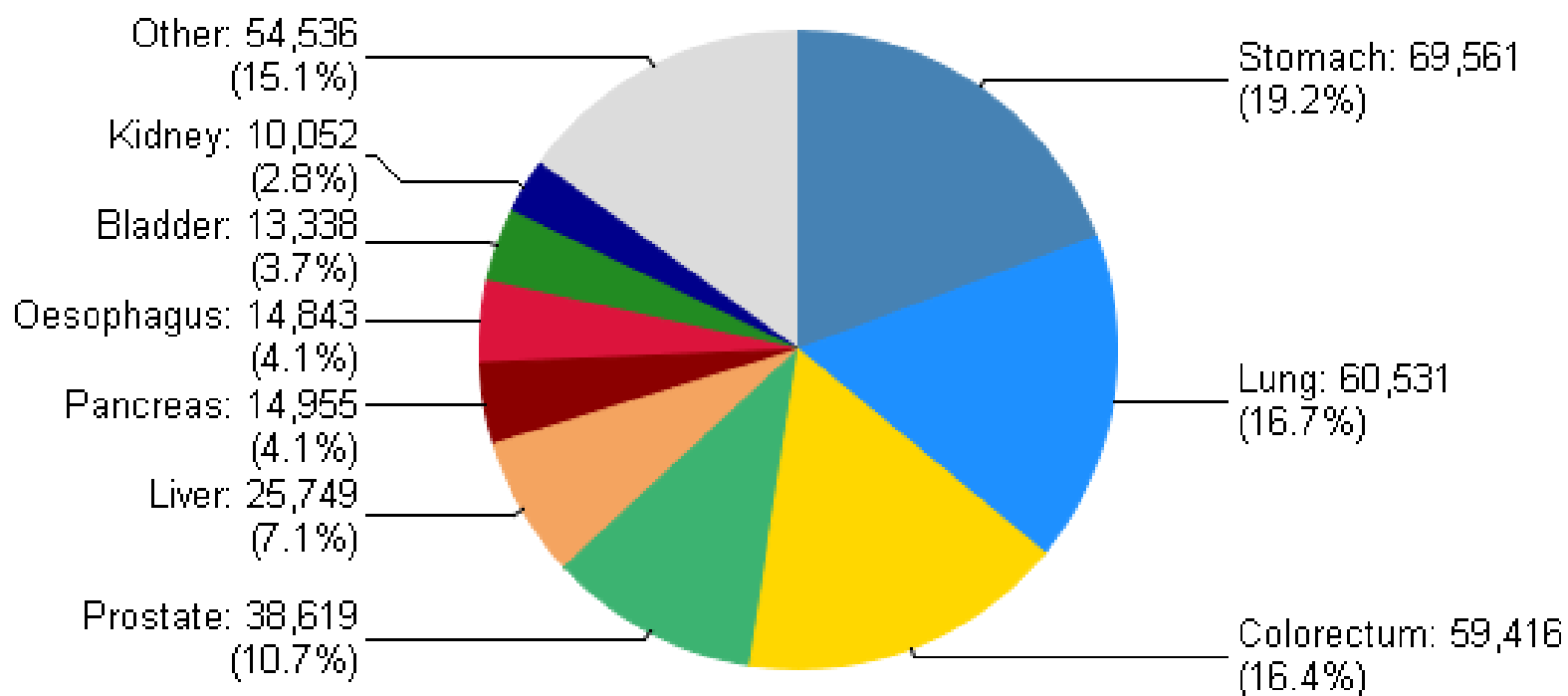
Estimated number of cancer cases, all ages (total: 477,482)



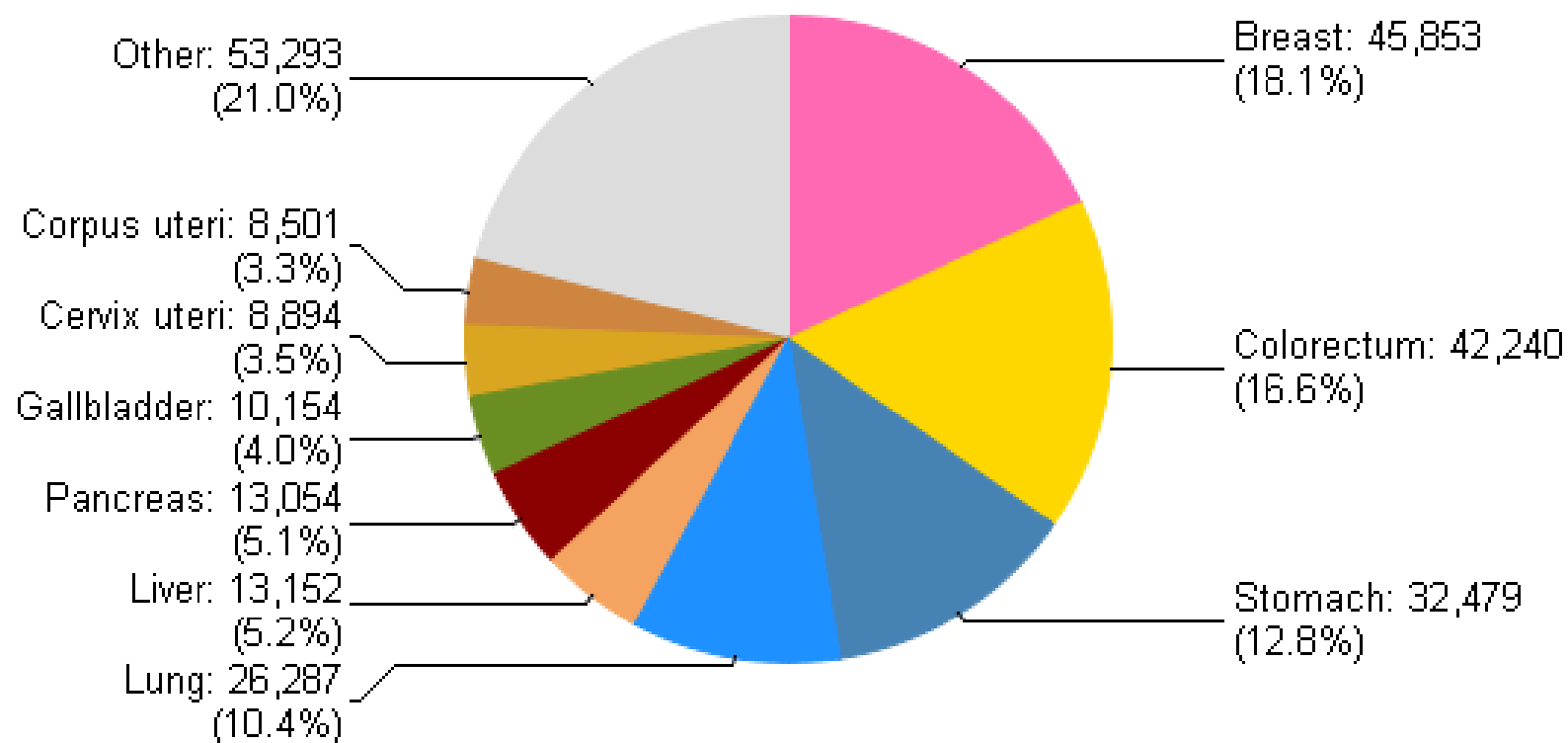
India: Female
Estimated number of cancer cases, all ages (total: 537,452)



Estimated number of cancer cases, all ages (total: 361,600)



Estimated number of cancer cases, all ages (total: 253,907)



Risk factors

Non – avoidable

Avoidable

A solid orange horizontal bar at the bottom of the slide.

Risk factors

Non – avoidable

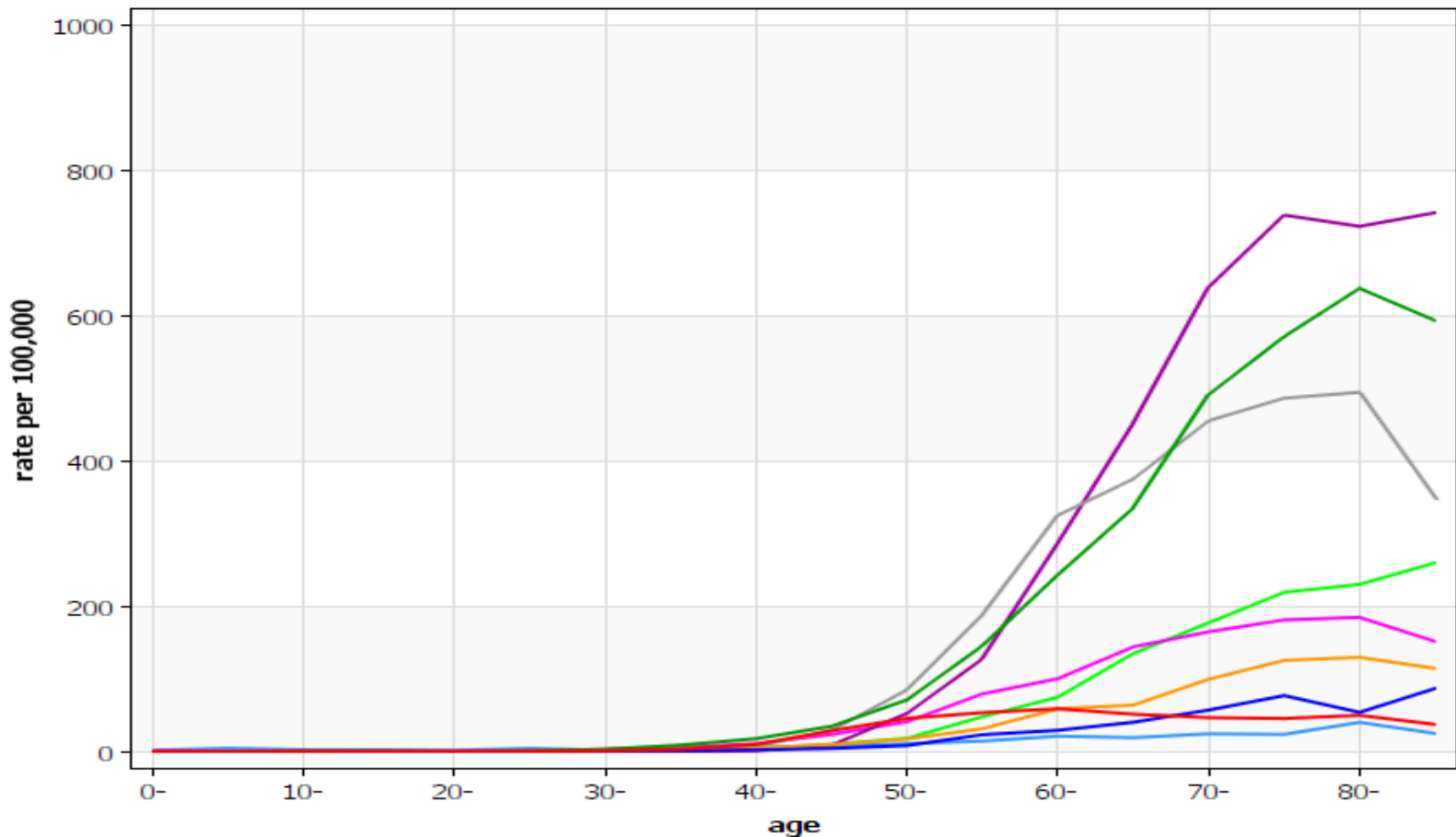
- **Age**

Avoidable

Age-specific curves (CIVIII)

Czech Republic (2007)

Male

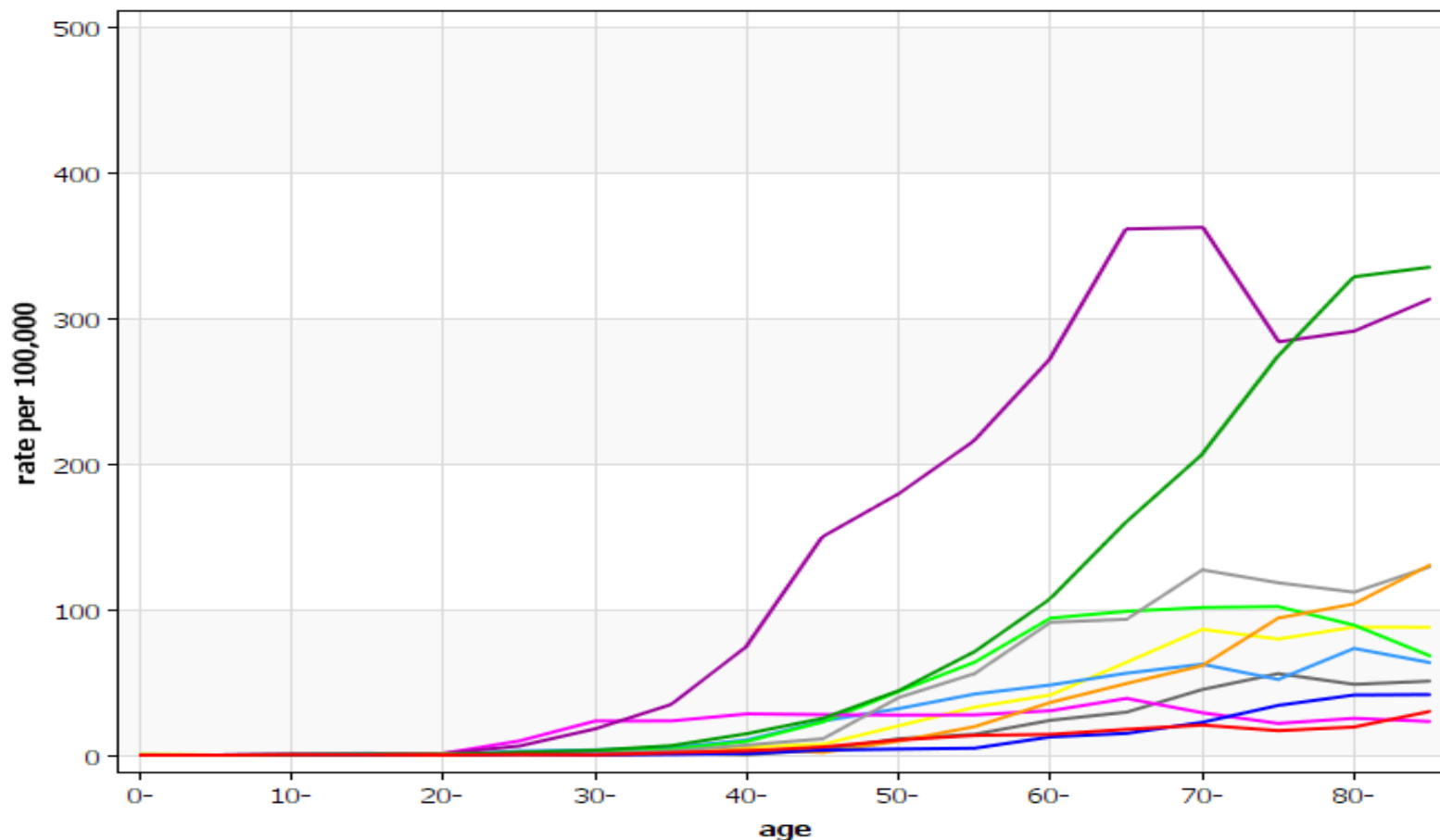


- Oral cavity and pharynx
- Liver
- Lung
- Kidney etc.
- Brain and central nervous system
- Colon, rectum and anus
- Pancreas
- Prostate
- Bladder

Age-specific curves (CIVIII)

Czech Republic (2007)

Female



Risk factors

Non – avoidable ?

- **Age**
- **Genetics**

Avoidable

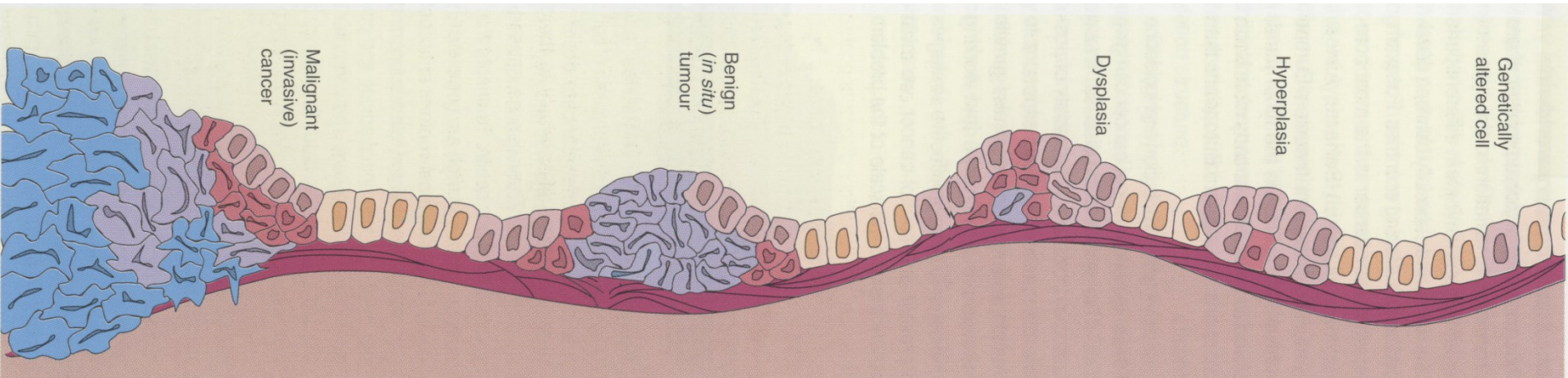
Genetically altered cell

Hyperplasia

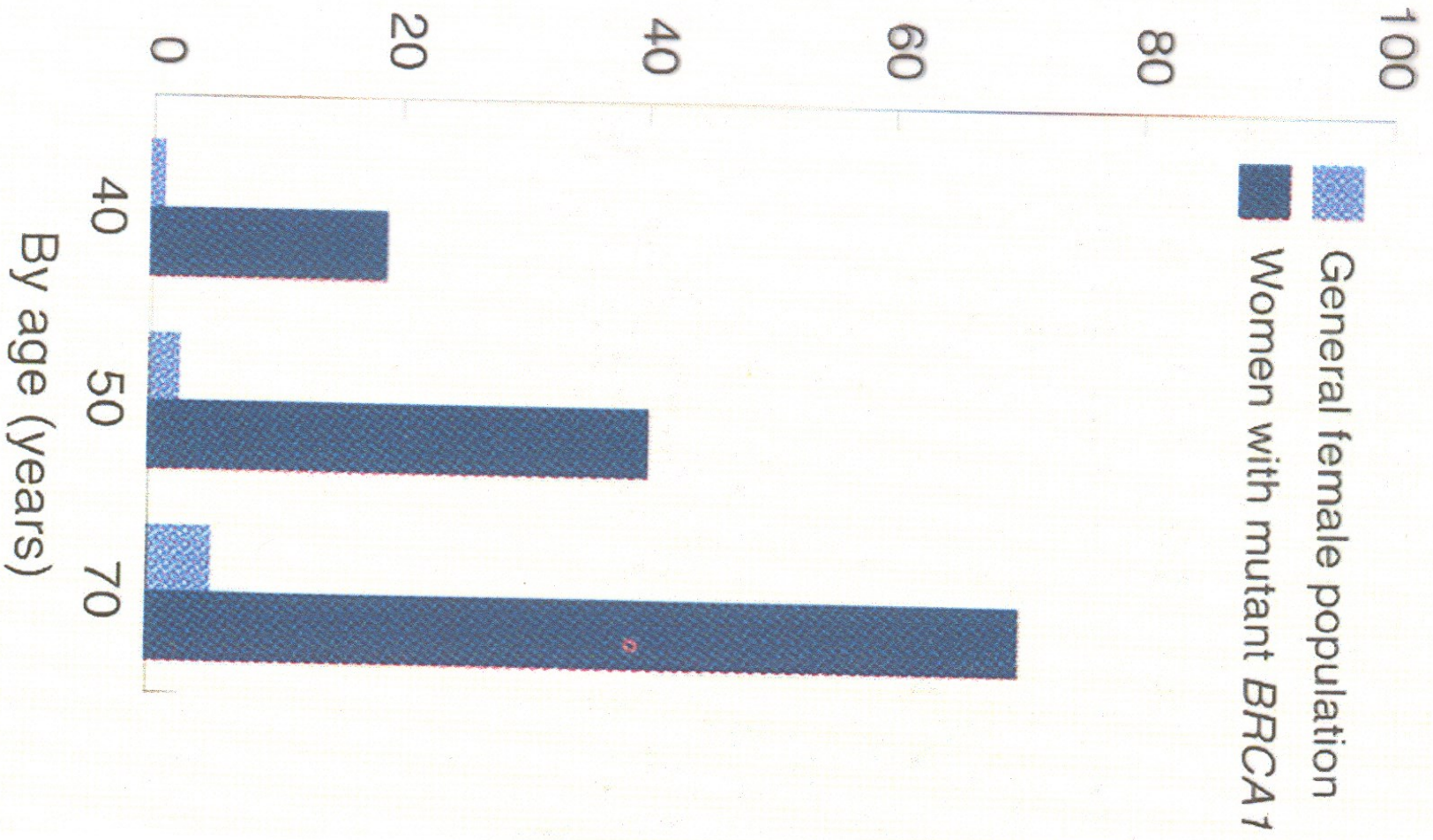
Dysplasia

Benign
(*in situ*)
tumour

Malignant
(invasive)
cancer



Cumulative risk of breast cancer



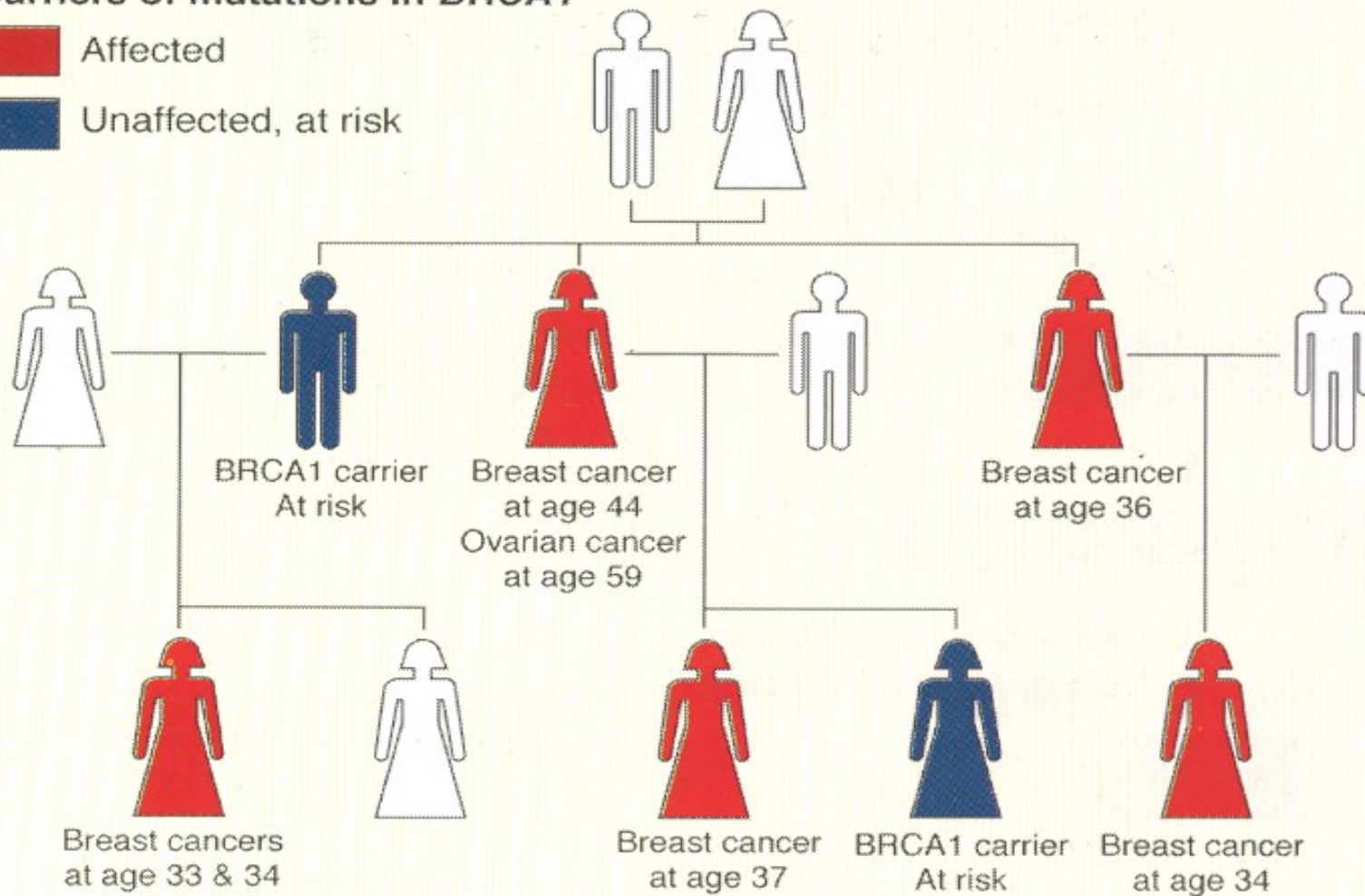
Carriers of mutations in *BRCA1*



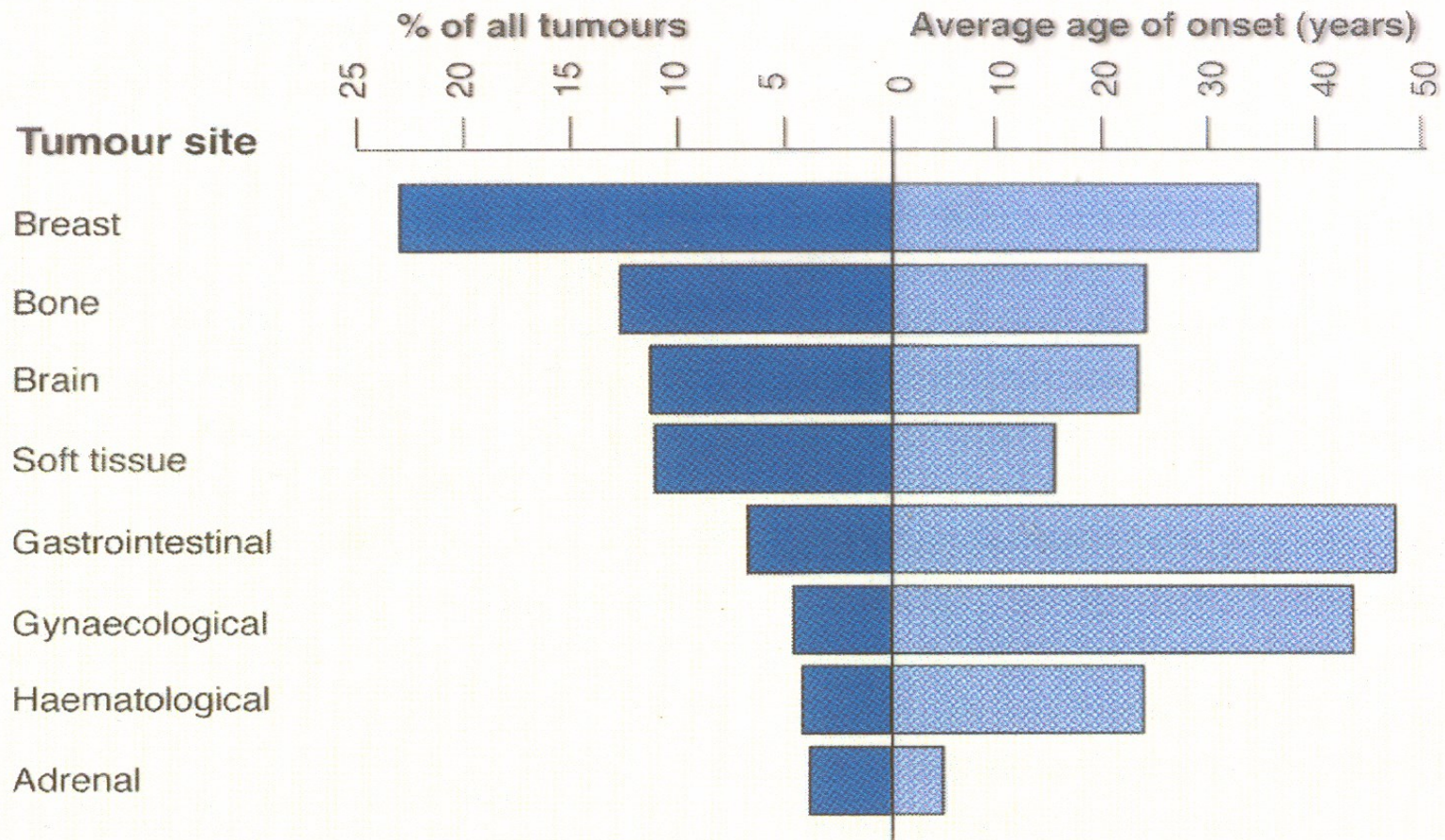
Affected



Unaffected, at risk



Families with mutations in the *BRCA1* gene have a genetic susceptibility to breast and ovarian cancers.



The many cancers seen in Li-Fraumeni syndrome affect a wide spectrum of tissues.

This analysis of 91 families with inherited mutations in the *p53* gene shows the wide range of cancers with a predominance in children and young adults that characterizes the Li-Fraumeni familial cancer syndrome.

Familial adenomatous polyposis (APC)

COLORECTAL CANCER

ALSO NON-CANCER DISEASES,
DESMOID TUMOURS, ODONTOMS,
TUMOURS OF SMALL INTESTINE

IN 100% CASES TUMOUR OCCURS

AUTOSOMAL DOMINANT
HEREDITY

Lynch syndrom I, II

**Hereditary nonpolypose
colorectal cancer**

Autosomal dominant heredity

**Colorectal cancer, gynecological
cancers, stomach, pancreatic
and kidney cancers**

Lynch syndrom I, II

Carrier has the longlofe risk of cancer

Colorectal	70 – 90%
Ovary	12%
Endometrium	50%
Stomach	15 – 20%
Pancreas	5%

Hereditary cancers

- **occur in younger age**
- **are more aggressive**
- **grow quickly**
- **often are multiple**
- **worse treatment results**

Family history !!

- Two or more cancers in one family line
- Cancer occurrence in person younger than 35 years
- Hereditary cancer in the family history

....**recommendation to oncogenetic department**

Risk factors

Non – avoidable ?

- **Age**
- **Genetics**

Avoidable

Cancer causes

Cause	% of all cancers
Tobacco	15-30
Chronic infections	10-25
Nutrition	30
Any other individual cause	<5

Cancer causes

Cause	% of all cancers
Tobacco	15 - 30
Chronic infections	10-25
Nutrition	30
Any other individual cause	<5

Tobacco-induced cancers

Cigarette smoking	Lung Larynx Oesophagus Oral cavity Pharynx Pancreas Bladder Kidney
Cigar or pipe smoking	Lip Oral cavity Lung
Tobacco chewing	Oral cavity
Tobacco and alcohol	Oral cavity Oesophagus Pharynx Larynx

Another risk
factors for lung
cancer?

Carcinogenic agents with sufficient evidence in humans

Aluminum production

Arsenic and inorganic arsenic compounds

Asbestos (all forms)

Beryllium and beryllium compounds

Bis(chloromethyl)ether; chloromethyl methyl ether (technical grade)

Cadmium and cadmium compounds

Chromium(VI) compounds

Coal, indoor emissions from household combustion

Coal gasification

Coal-tar pitch

Coke production

Engine exhaust, diesel

Hematite mining (underground)

Iron and steel founding

Lung cancer & asbestos

Nonsmoker nonexposed to asbestos	RR 1
Smoker nonexposed to asbestos	RR 9
Nonsmoker exposed to asbestos	RR 5
Smoker exposed to asbestos	RR 50 – 90

- RR= relativ risk;

Health effects

Asbestosis (long-term high exposure, latency cca 20 – 30 years)

Hyalinosis of pleura (relatively low exposure)

Mesothelioma of pleura or peritoneum (latency cca 30 – 50 years even after short exposure; aggressive cancer with survival about 4 – 18 months)

Lung cancer (in connection with asbestosis or hyalinosis)



Carcinogenic agents with sufficient evidence in humans

Aluminum production

Arsenic and inorganic arsenic compounds

Asbestos (all forms)

Beryllium and beryllium compounds

Bis(chloromethyl)ether; chloromethyl methyl ether (technical grade)

Cadmium and cadmium compounds

Chromium(VI) compounds

Coal, indoor emissions from household combustion

Coal gasification

Coal-tar pitch

Coke production

Engine exhaust, diesel

Hematite mining (underground)

Iron and steel founding

Carcinogenic agents with sufficient evidence in humans

MOPP (vincristine-prednisone-nitrogen mustard-procarbazine mixture)

Nickel compounds

Outdoor air pollution

Painting

Particulate matter in outdoor air pollution

Plutonium

Radon-222 and its decay products

Rubber production industry

Silica dust, crystalline

Soot

Sulfur mustard

Tobacco smoke, secondhand

Tobacco smoking

X-radiation, gamma-radiation

Agents with limited evidence in humans

Acid mists, strong inorganic

Art glass, glass containers and pressed ware (manufacture of)

Biomass fuel (primarily wood), indoor emissions- household

Bitumens, occupational exposure to oxidized bitumens and their emissions during roofing

Bitumens, occupational exposure to hard bitumens and their emissions during mastic asphalt work

Carbon electrode manufacture

alpha-Chlorinated toluenes and benzoyl chloride

Cobalt metal with tungsten carbide

Creosotes

Frying, emissions from high-temperature

Insecticides, non-arsenical (occupational exposures in spraying and application)

Printing processes

2,3,7,8-Tetrachlorodibenzo-para-dioxin

Welding fumes

CANCER OCCURRENCE, ETIOLOGY AND MECHANISMS

20/11

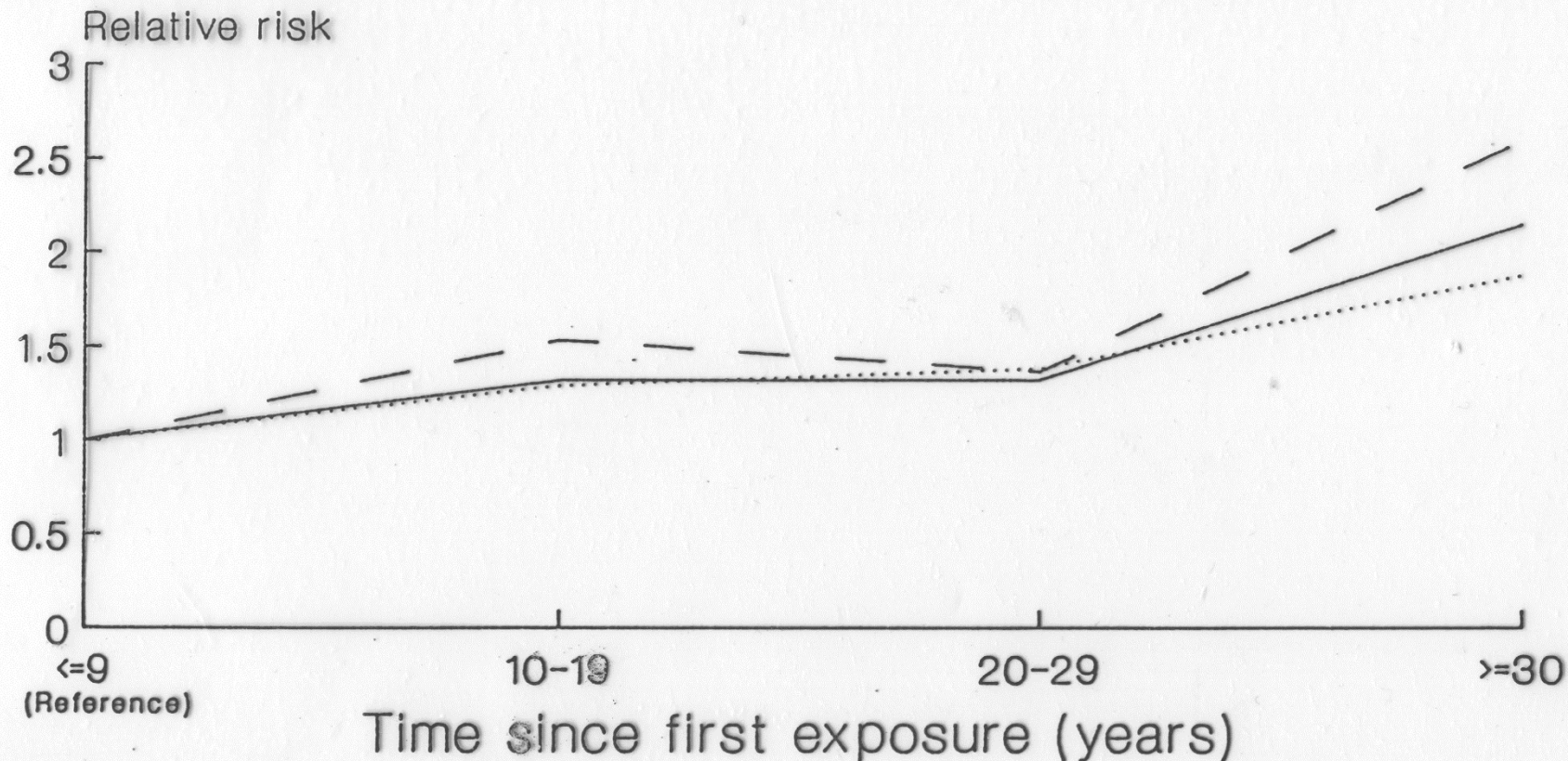


Fig. 6. Relative risk of lung cancer in man-made mineral fibre production workers by time since first exposure. Results of Poisson regression analysis, adjusted for country, age, calendar period, duration of employment and technical phase. — all workers; ... rockwool/slagwool; — — glasswool

Cancer causes

Cause	% of all cancers
Tobacco	15-30
Chronic infections	10-25
Nutrition	30
Any other individual cause	<5

Cancer causes

Cause

% of all cancers

Tobacco

15-30

Chronic infectious

10 - 25

Nutrition

30

Any other individual cause

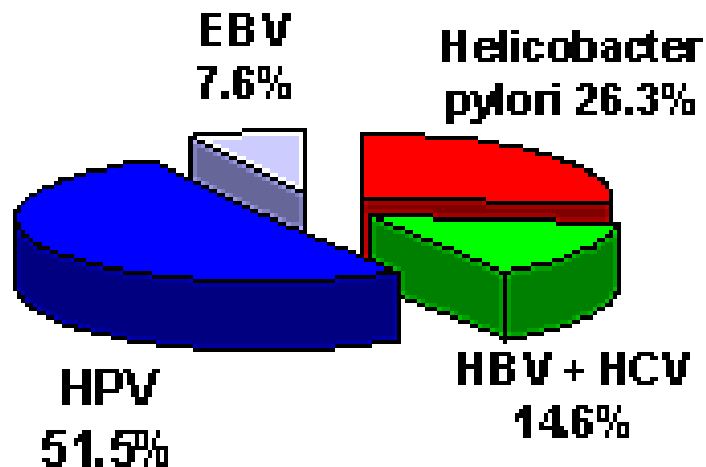
<5

Females: Annual Global Cancer

Incidence due to Infections

1 006 544 = 19.9% of total cancer

incidence in females

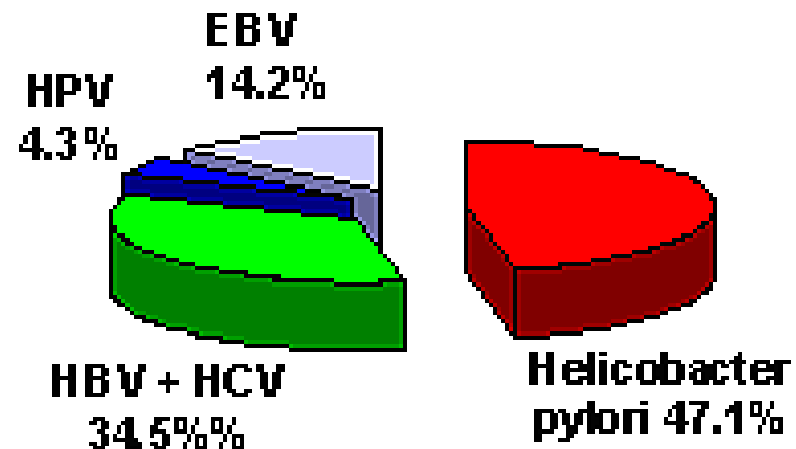


Males: Annual Global Cancer

Incidence due to Infections

1 025 524 = 17.7% of total cancer

incidence in males



Chronic infections and cancer

Cancer	Infectious agent	% Caused by infection
Stomach	<i>Helicobacter pylori</i>	40
Liver	Hepatitis B and C viruses, liver flukes	80
Cervical	Human papillomavirus	99
Anal	Human papillomavirus	80
Vulva & penis	Human papillomavirus	30
Oropharynx	Human papillomavirus	30
Lymphomas	Epstein–Barr virus	10

Estimated percentage of all cancers at site caused by chronic infection.

Chronic infections and cancer

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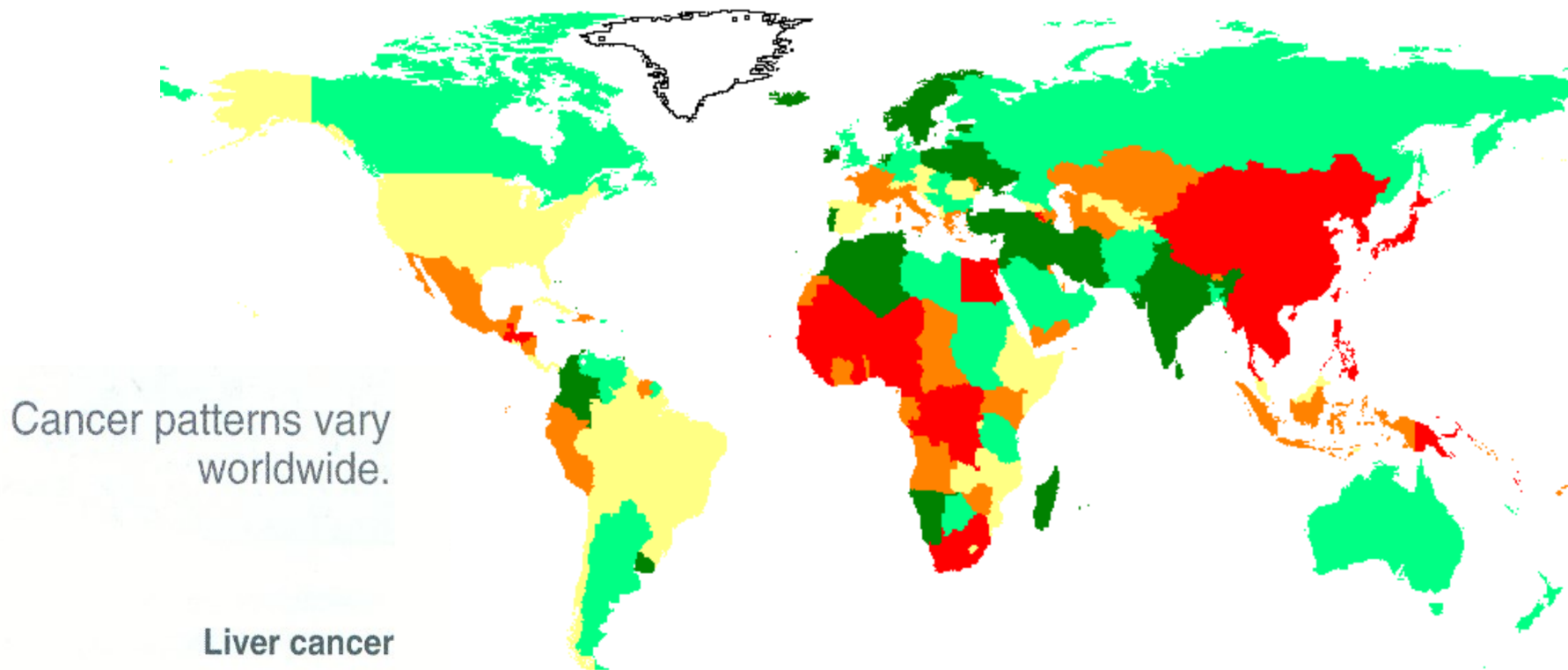
Estimated percentage of all cancers at site caused by chronic infection.

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Estimated percentage of all cancers at site caused by chronic infection.

Estimated age-standardised incidence rate per 100,000
Liver: both sexes, all ages

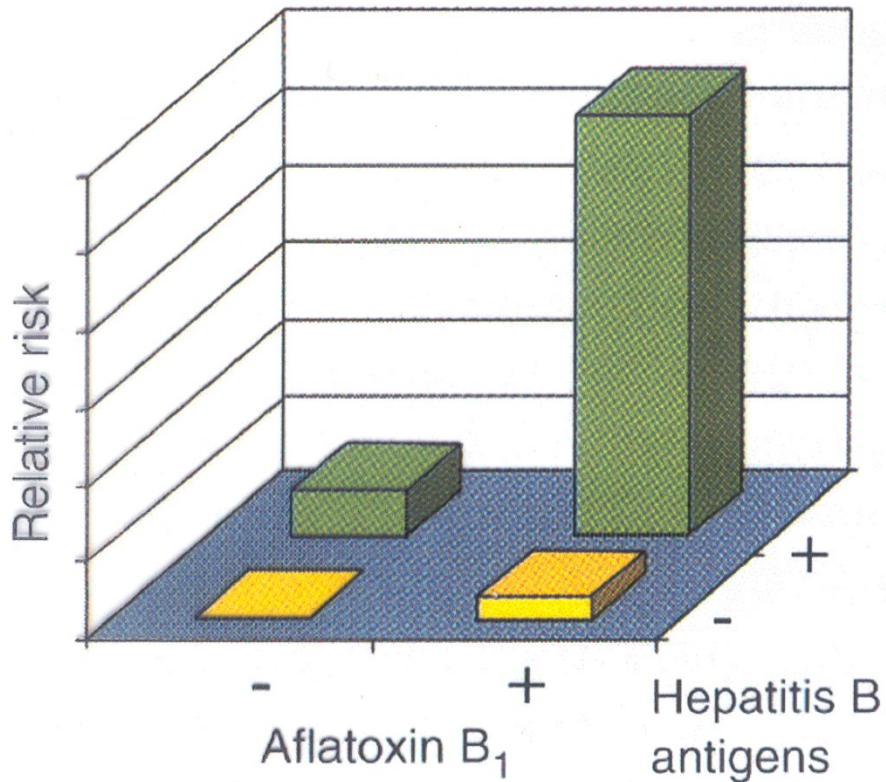


Cancer of the liver is most frequent in western and central Africa and in Asian countries, particularly China. This is due to the high prevalence of chronic hepatitis B virus infection and exposure to a food-borne carcinogen, aflatoxin B₁.

- 27.2.2013

■ < 2.5 ■ < 4.0 ■ < 5.8 ■ < 9.2 ■ < 94.4

Hepatitis B virus (HBV) and aflatoxins act together to cause liver cancer in Africa and south-east Asia.



Chronic infections and cancer

Cancer	Infectious agent	% Caused by infection
Stomach	<i>Helicobacter pylori</i>	40
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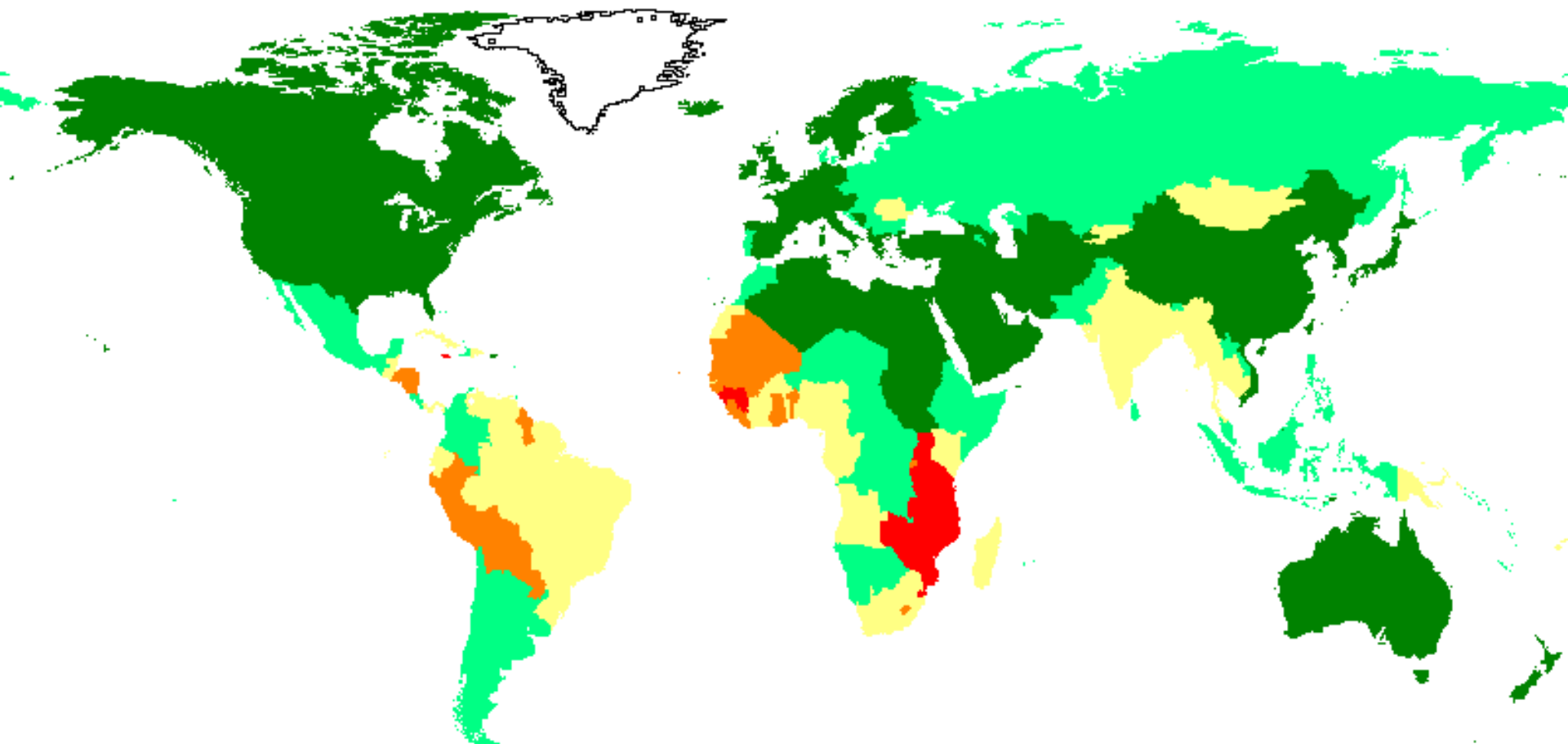
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Chronic infections and cancer

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Oropharynx		30
Lymphomas		10

Estimated percentage of all cancers at site caused by chronic infection.

Estimated age-standardised incidence rate per 100,000 Cervix uteri, all ages

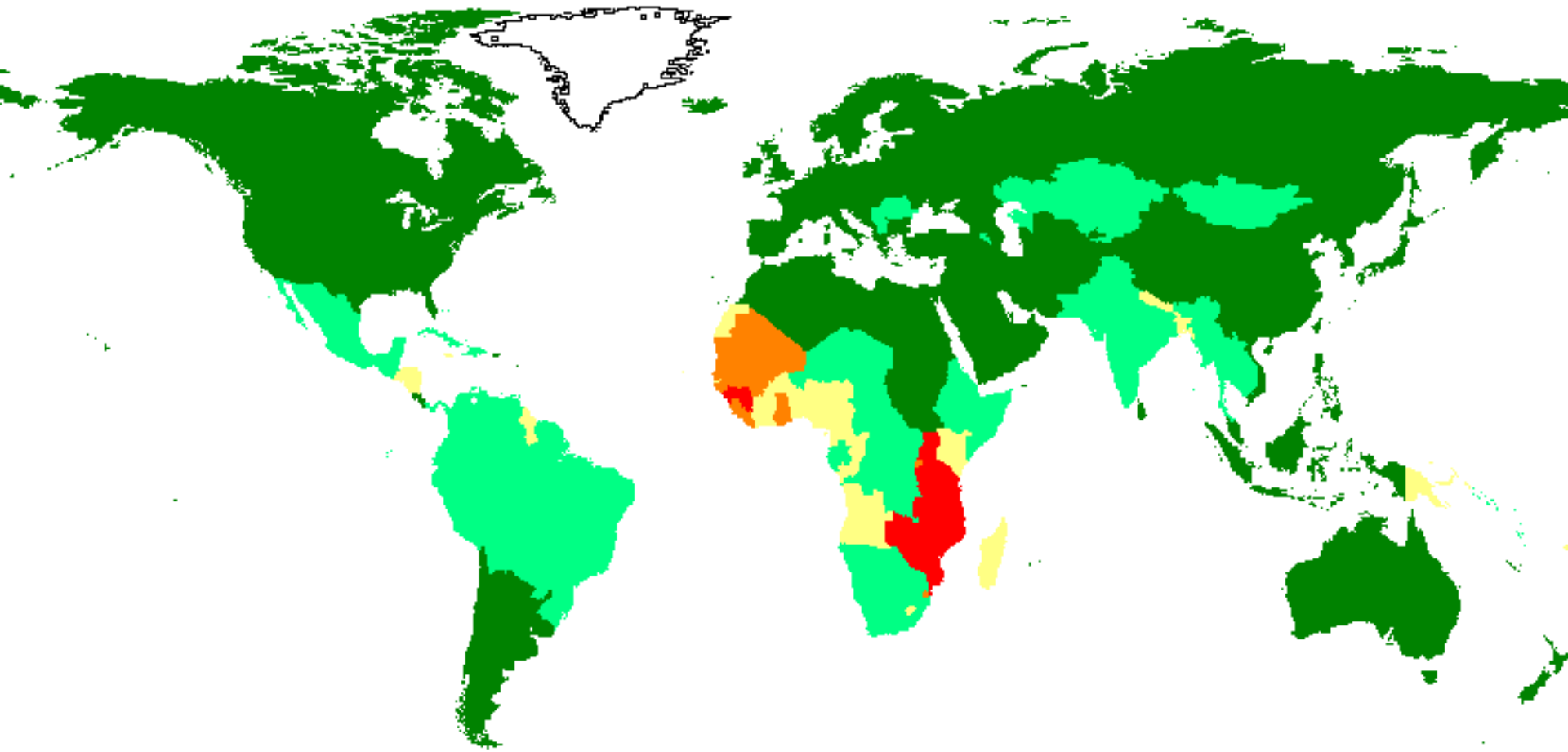


■ < 11.6 ■ < 22.8 ■ < 33.9 ■ < 45.1 ■ < 56.3

International Agency for Research on Cancer
World Health Organization

Estimated age-standardised mortality rate per 100,000

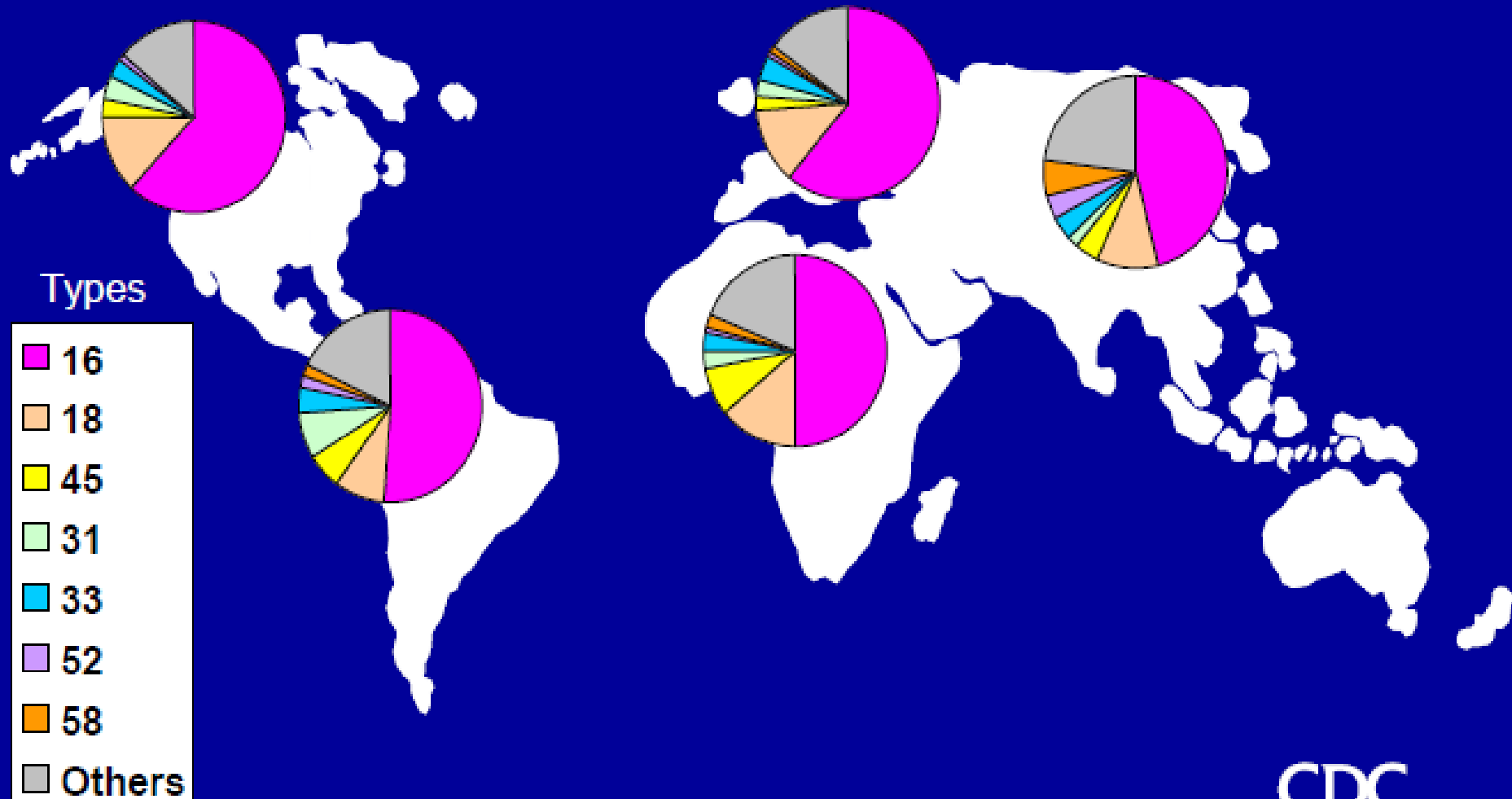
Cervix uteri, all ages



< 8.5 **< 16.8** **< 25.1** **< 33.4** **< 41.7**

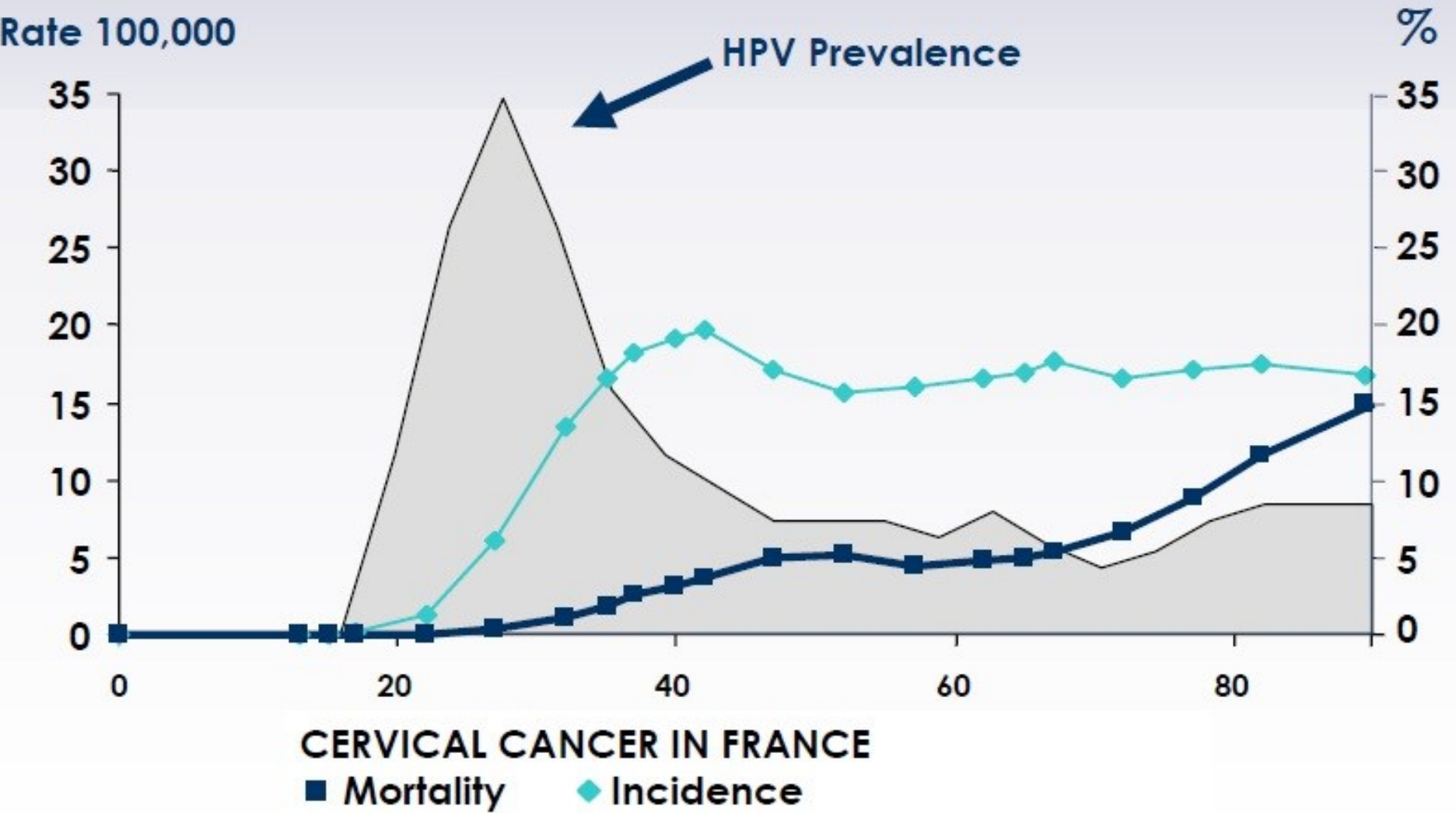
Background: HPV Types in Cases of Cervix Cancer

Different Regions of the World



Clifford: Br J Cancer 2003

PAPILLOMAVIRUS CAUSE INFECTIONS IN YOUNG WOMEN AND CAUSE DEATH IN ADULTS



Prevention?

VACCINATION!

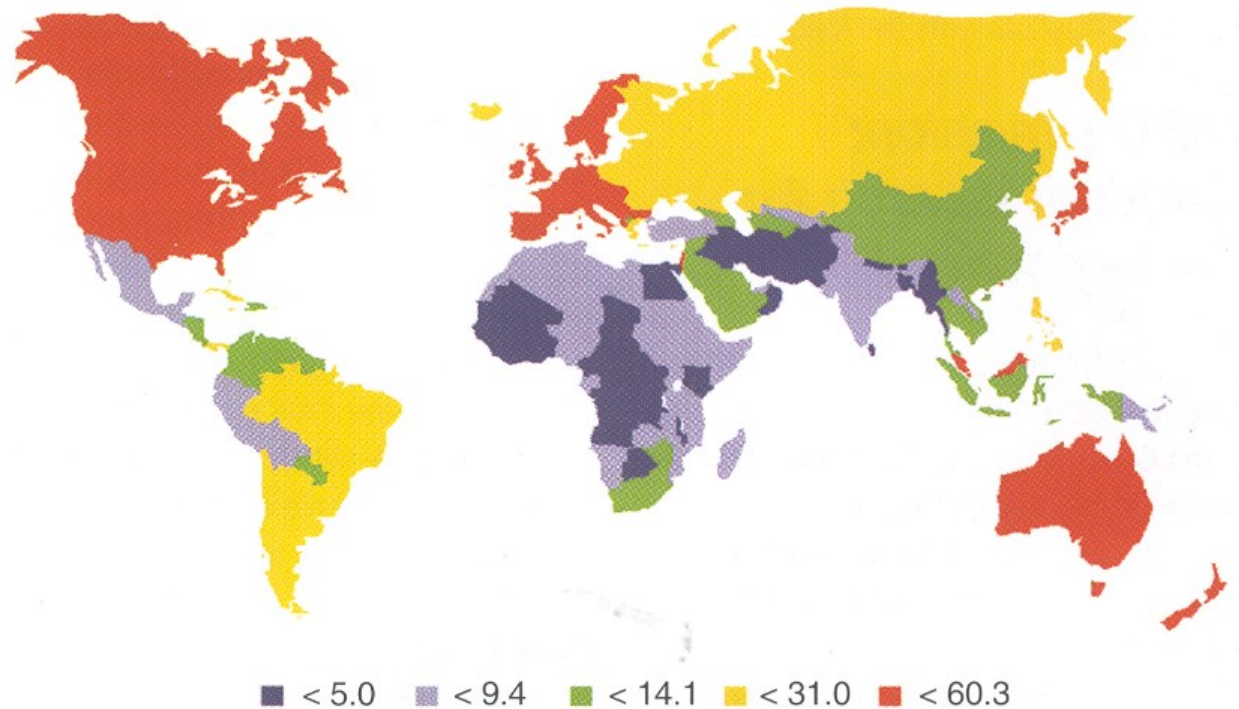
Anti-tumour vaccines?

-AGAINST PAPILOMAVIRUSIS

-AGAINST HEPATITIS B

Colorectal cancer

Cancer of the colorectum is most frequent in North America, in Europe and in Australia. This disease is associated with a western-style diet, typically low in fibre and fresh fruit and vegetables, and high in saturated fat.



Liver and colorectal cancers incidence rates in 2000 (annual cases per 100 000 population).

Strength of the association between some foods and the risk of developing certain types of cancer

Cancer	Vegetables	Fruit	Red Meat	Processed Meat	Salt	Alcohol
Mouth/Pharynx/ Larynx	↓↓↓	↓↓↓	—	—	—	↑↑↑
Oesophagus	↓↓↓	↓↓↓	—	—	—	↑↑↑
Stomach	↓↓↓	↓↓↓	—	↑↑	↑↑	—
Colorectum	↓↓↓	↓	↑↑	↑↑	—	↑↑
Breast	↓	↓	↑	—	—	↑↑
Lung	↓↓↓	↓↓↓	—	—	—	—
Prostate	↓	—	↑	—	—	—

Arrows indicate the strength of the relationship between each type of food and the risk of cancer.

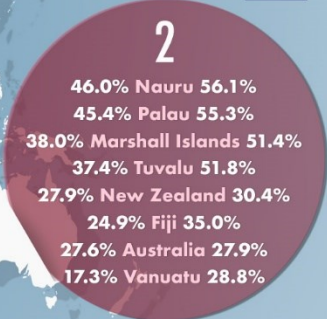
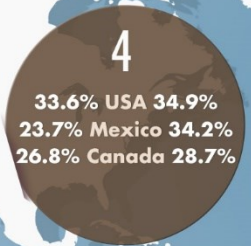
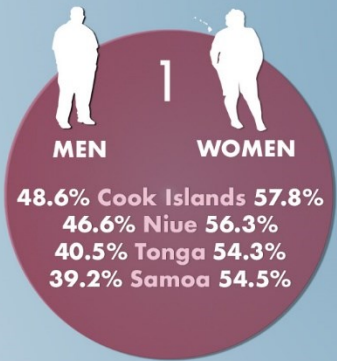


OBESITY hot spots

In 2014, 13% of the world's adult population were obese: 11% of men and 15% of women.

The prevalence of obesity varies across regions and across countries within a region.

Obesity is a major risk factor for cardiovascular diseases, diabetes, and cancer.



International Agency for Research on Cancer



Data Source: WHO/IARC

9 ► Quante volte mangia **INSALATA MISTA**?

N. volte
alla settimana

o

N. volte
al mese

o

N. volte
all'anno

o

Mai

10 ► Normalmente mangia un piatto:

più piccolo

come questo

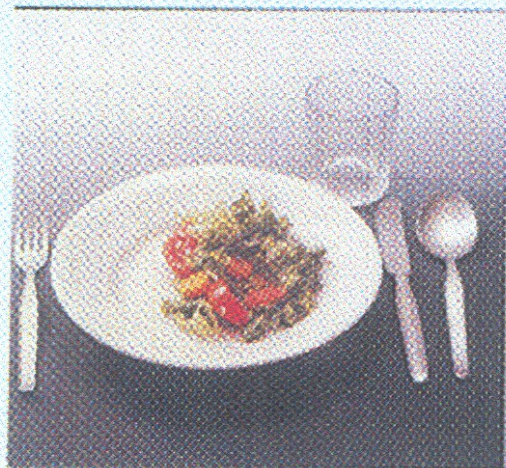
tra i due

come questo

tra i due

come questo

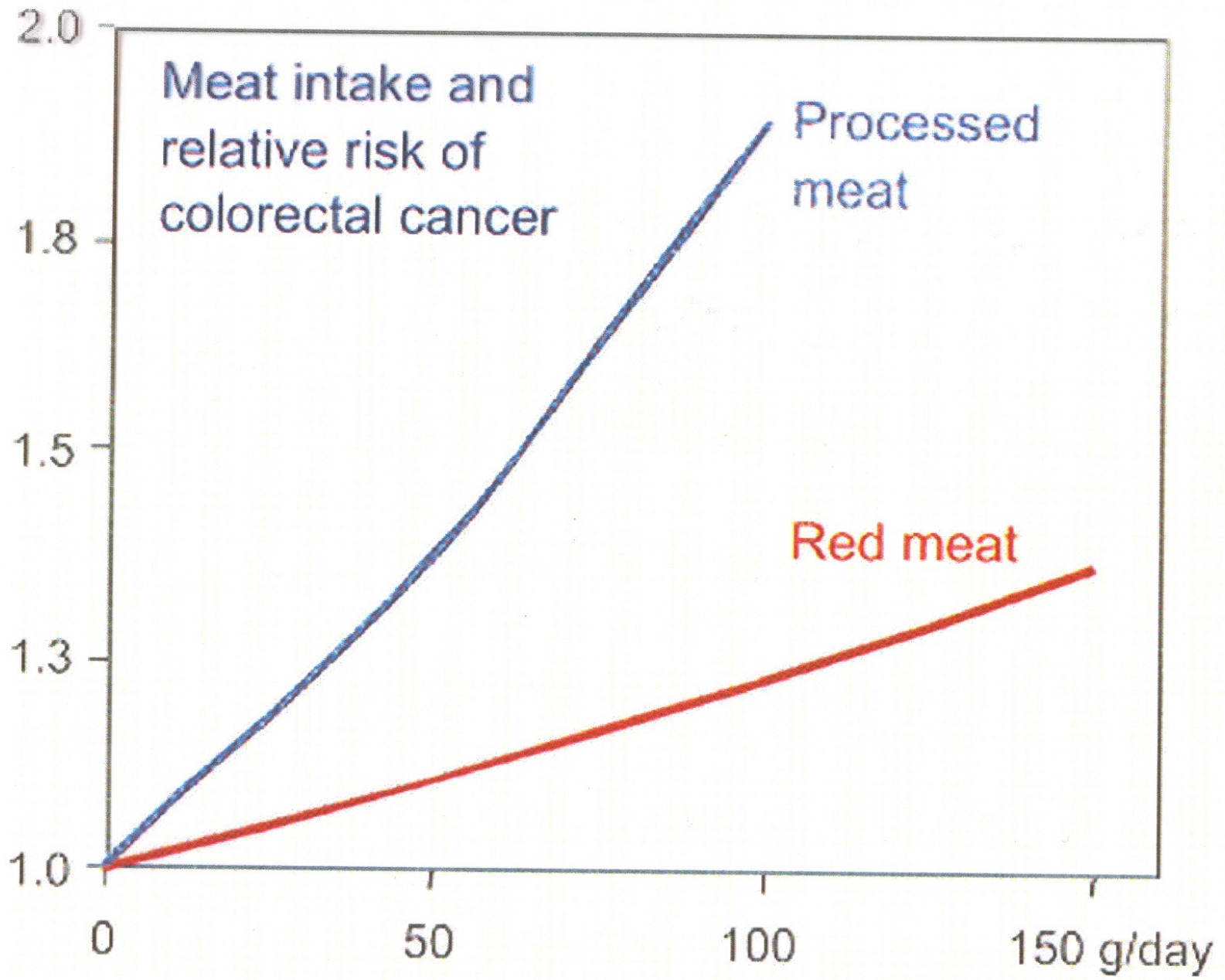
più grande



Generalmente cosa c'è nella sua **INSALATA MISTA**? (risponda con una X ad ogni domanda)

	sempre o quasi	frequentemente	mai o raramente
11 ► POMODORI	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12 ► CAROTE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13 ► INSALATA (foglie)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14 ► PEPERONI	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15 ► ALTRO	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

A questionnaire is used to assess dietary habits and serving size in Italian centres of the EPIC study.

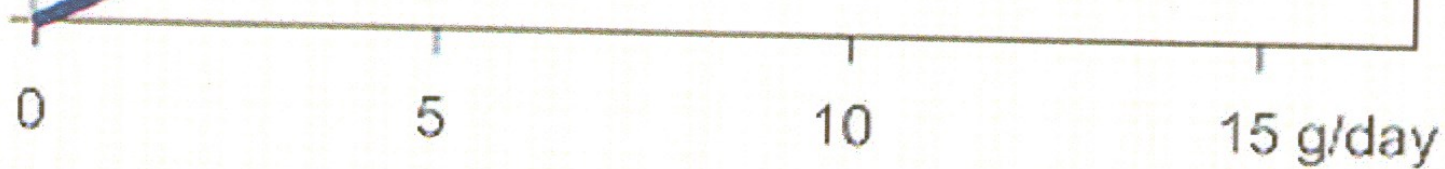


Meat intake and relative risk of colorectal cancer

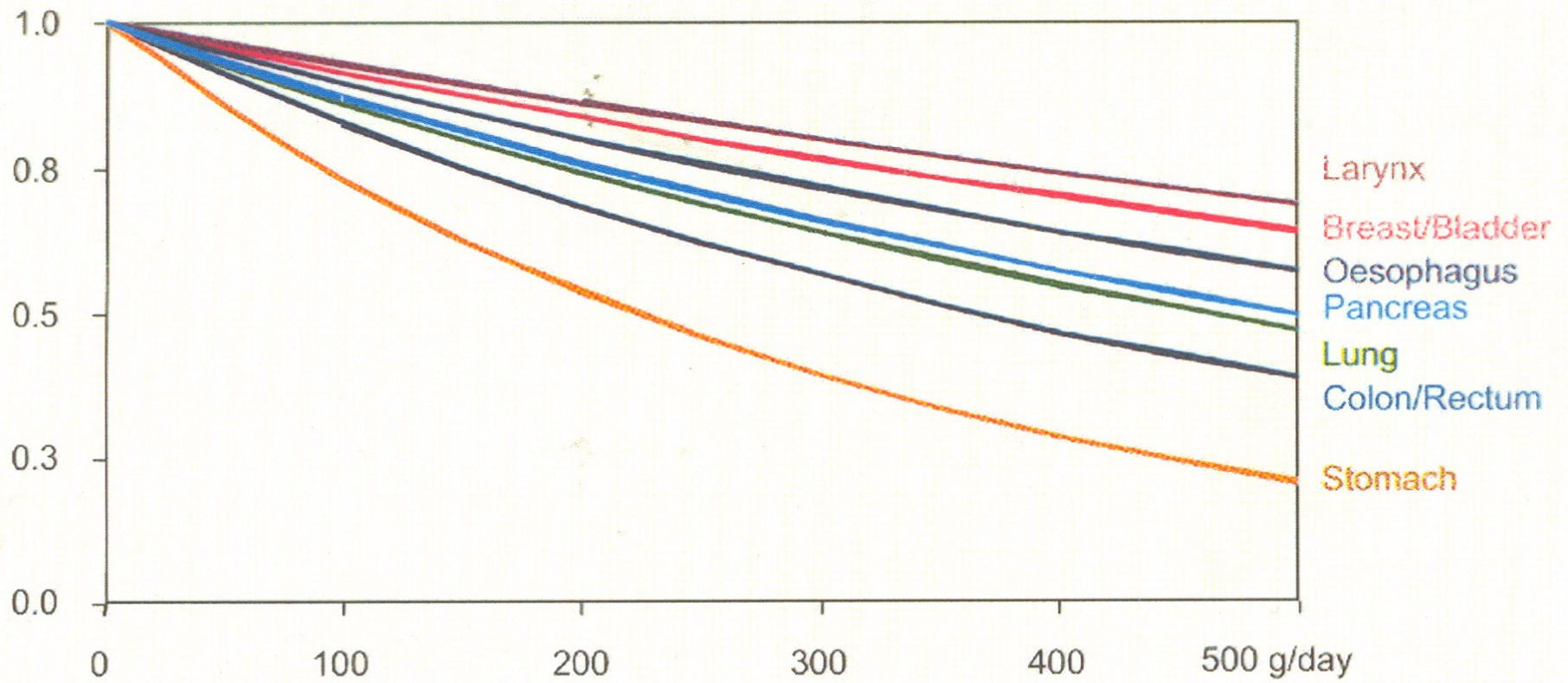
Processed meat

Red meat

Salt intake and
relative risk
of gastric cancer



Vegetable intake and relative risk of cancer



RESEARCHERS HAVE
LONG TOUTED MARGA-
RINE AS A HEALTHY
ALTERNATIVE TO
BUTTER.



IT NOW APPEARS
BUTTER MAY HAVE
BEEN HEALTHIER
THAN MARGARINE
ALL ALONG.



WHAT DOES
THIS ALL
MEAN?



RESEARCHERS MAY
BE HAZARDOUS
TO YOUR HEALTH.



Screening

Screening:

CHEAP

AVAILABLE

EASY

Screening:

CHEAP

AVAILABLE

EASY

HIGH SPECIFICITY

HIGH SENSITIVITY

Screening:

CHEAP

AVAILABLE

EASY

HIGH SPECIFICITY

HIGH SENSITIVITY



Screening:

CHEAP

AVAILABLE

EASY

HIGH SPECIFICITY

HIGH SENSITIVITY

ABLE TO DETECT EARLY STAGE OF TUMOUR

Screening is suitable for tumours:

WITH HIGH FREQUENCY &
IN WHICH WE ARE ABLE TO
PROLONG THE GOOD QUALITY
LIFE OF THE PATIENTS

Which tumours you
suppose to be
suitable for
screening?

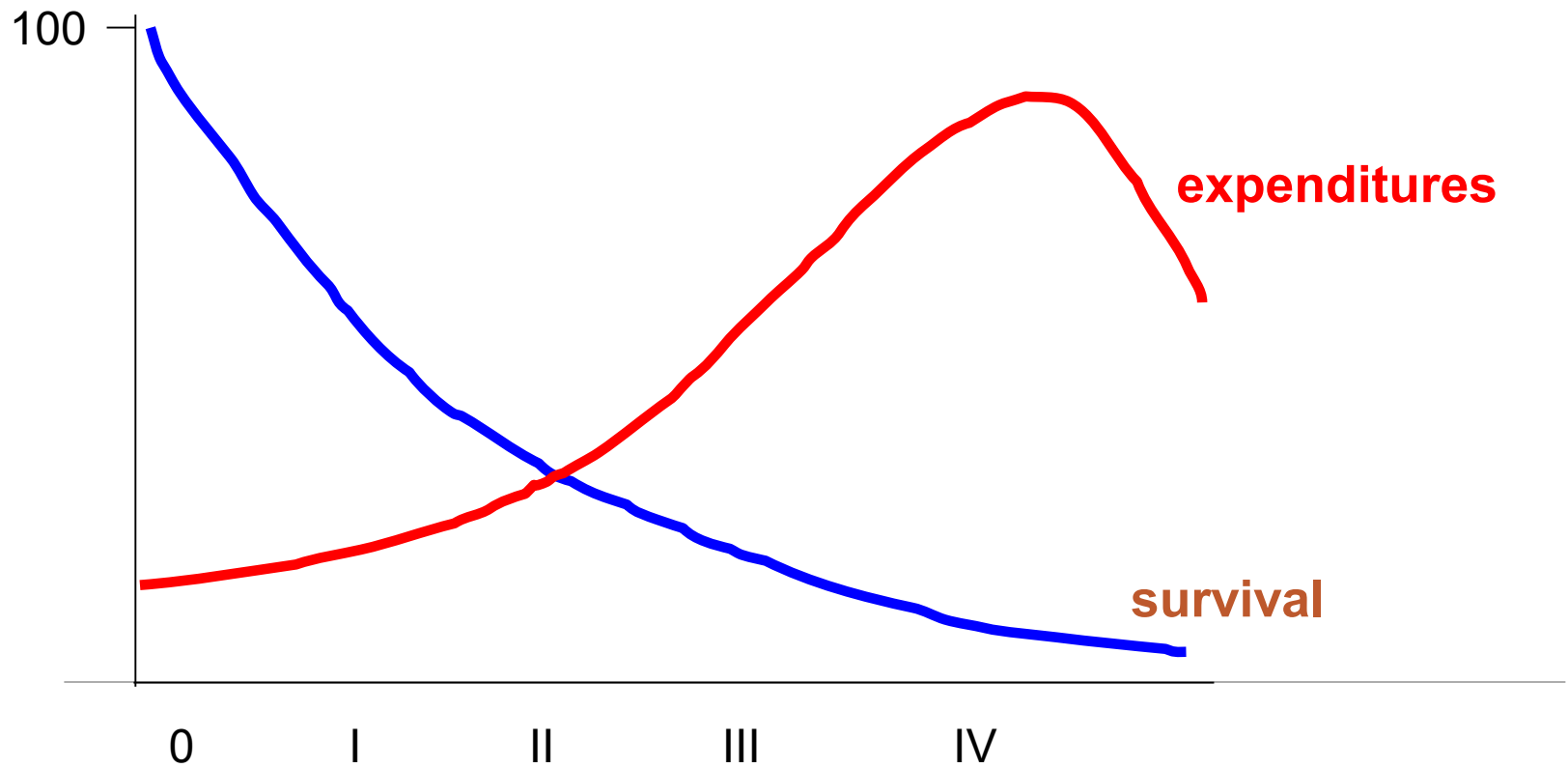
Screening in Czech Republic

Breast cancer screening – from 45 every second year mammography

Colorectal screening – from 50 either occult blood test every year or preventive colonoscopy once in ten years

Cervical screening – from 15 every year regular check at the gynecology with pap-smears

Lung cancer screening – from 60 to 74, heavy smokers and ex-smokers (20 cig. per day for 20 years or equivalent)



Onkologická paradox

How to find risk factors?

Which type of studies can be used?

OBSERVATIONAL

**/ descriptive / correlation
(ecological) studies**

Analytical

Case – control study

Cohort study

Retrospective

Prospective

How to get information (e.g. concerning the diet), if we need information:

- 10 – 20 YEARS OLD - BEFORE DISEASE OCCURRENCE
- INFORMATION CONCERNING THE QUALITY AND AMOUNT OF FOOD (ESP. IN MEN)
- ACCURACY OF ALL INFORMATION

Interventional studies

**CONTROLLED TRIALS DOUBLE-
BLINDED /TRIPLE-BLINDED**

CARET Study (*Beta-Carotene and Retinol Efficacy Trial*)

USA

14 254 SMOKERS/FORMER SMOKERS, MEN AND WOMEN

4 060 MEN EXPOSED TO ASBESTOS + SMOKERS

PLANNED 1988 – 2003

FINISHED 1996

HIGHER MORTALITY ON LUNG CANCER AND ALSO TOTAL MORTALITY IN SUPPLEMENTED GROUP

ATBC Study (Alpha-Tocopherol, Beta-Carotene Cancer Prevention Study)

FINLAND

29 133 MALE SMOKERS IN 4 GROUPS

ALPHA-TOCOPIEROL + BETA-CAROTENE

DOUBLE BLINDED TRIAL

5 TO 8 YEARS, MEDIAN 6,1 YEAR

IN BOTH SUPPLEMENTED GROUPS WAS
HIGHER MORTALITY NOT ONLY FROM
CANCER

HOPE-TOO STUDY

7000 diabetics + cardiovascular diseased people

Double-blinded, placebo controlled study

7 years daily vitamin E supplementation

In supplemented group increased risk of cardiac failure of 13%

Didn't decrease incidence of cancer

Cochrane Collaboration Expert Group

Vitamin supplementation, synthetic antioxidants, could lead to premature death.

„Beta caroten, vitamin A & E supplementation probably increase death rate.“

SELECT Study (Selenium and Vitamin E Cancer Prevention Trial)

Fred Hutchinson Cancer Research Center, Seattle,
Washington.

Over 35 000 males

Randomized placebo controlled, double-blinded trial

400 iu vitamin E & 200 μg of selenium/day

2001 – 2013, stopped 2008

SELECT Study (Selenium and Vitamin E Cancer Prevention Trial)cont.

Conclusions: supplementation by selenium & vitamin E could increase risk of prostate cancer in males

The worst result was found in men with adequate nutrition

THE RISK OF PROSTATE CANCER IN THIS GROUP INCREASED BY 91%

Is this one of possible explanation of prostate cancer increase in well-developer countries?

SELECT Study (Selenium and Vitamin E Cancer Prevention Trial) cont.

In supplemented group with vit.E incidence of prostate cancer was about 17% higher

In those with normal level of selenium at the beginning of the study, selenium supplementation increased twice risk of highly aggressive prostate cancer

In those, who could profit from selenium supplementation because of low level at the beginning of the study, supplementation by vitamin E again increased twice risk of highly aggressive prostate cancer

Women's Health Study

HARVARD SCHOOL OF MEDICINE

1992 - 2004

39 876 FEMALES OLDER 45 YEARS

ASPIRIN, VITAMIN E AND BETA-CAROTENE

SUPPLEMENTATION BY BETA-CAROTENE WAS
FINISHED

Because of results of ATBC and CARET studies

No significant difference in incidence of cancer or
cardiovascular dis. or total mortality

Prospective Study of Fruit and Vegetable Consumption and Risk of Lung Cancer Among Men and Women

71 910 FEMALES FROM NURSES' HEALTH STUDY

37 725 MALES FROM HEALTH PROFESSIONALS' FOLLOW-UP STUDY

HIGHER CONSUMPTION OF FRUIT & VEGETABLE HAS SMALL, NOT STATISTICALLY SIGNIFICANT, DECREASE OF CHRONIC DIS., MORE CARDIOVASCULAR THAN CANCER

Fruit and Vegetable Intake and Risk of Major Chronic Disease

71 910 FEMALES FROM NURSES' HEALTH STUDY

37 725 MALES FROM HEALTH PROFESSIONALS' FOLLOW-UP STUDY

ONLY LUNG CANCER

PROTECTIVE EFFECT IN NON-SMOKERS,
MALES & FEMALES

SMALL PROTECTIVE EFFECT IN FEMALES
(ALL)

NO EFFECT IN MALE SMOKERS

Indoor health risk factors (according to Joint Research Center)

Inorganic chemical compounds

- Combustion particles
- CO
- Radon
- NO₂

Biological factors

- Dampness, moulds, mites

Organic chemical compounds

- Benzene
- Formaldehyde
- (S)VOCs
- ETS



Late effects of xenobiotics

Teratogen

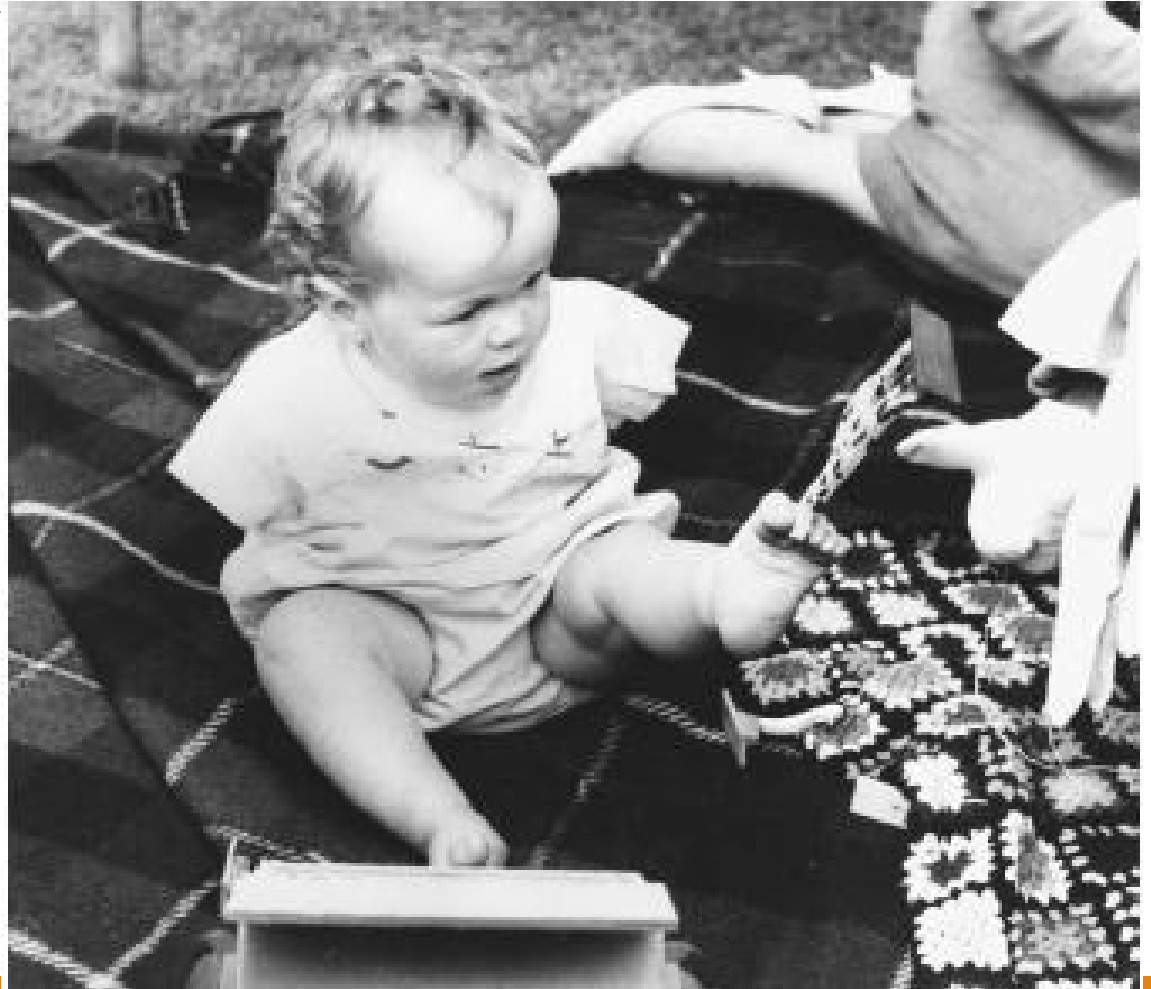
Mutagen

Carcinogen

Teratogenesis

IS THE FORMATION OF
CONGENITAL MALFORMATIONS
(MISLEADINGLY CALLED BIRTH
DEFECTS).

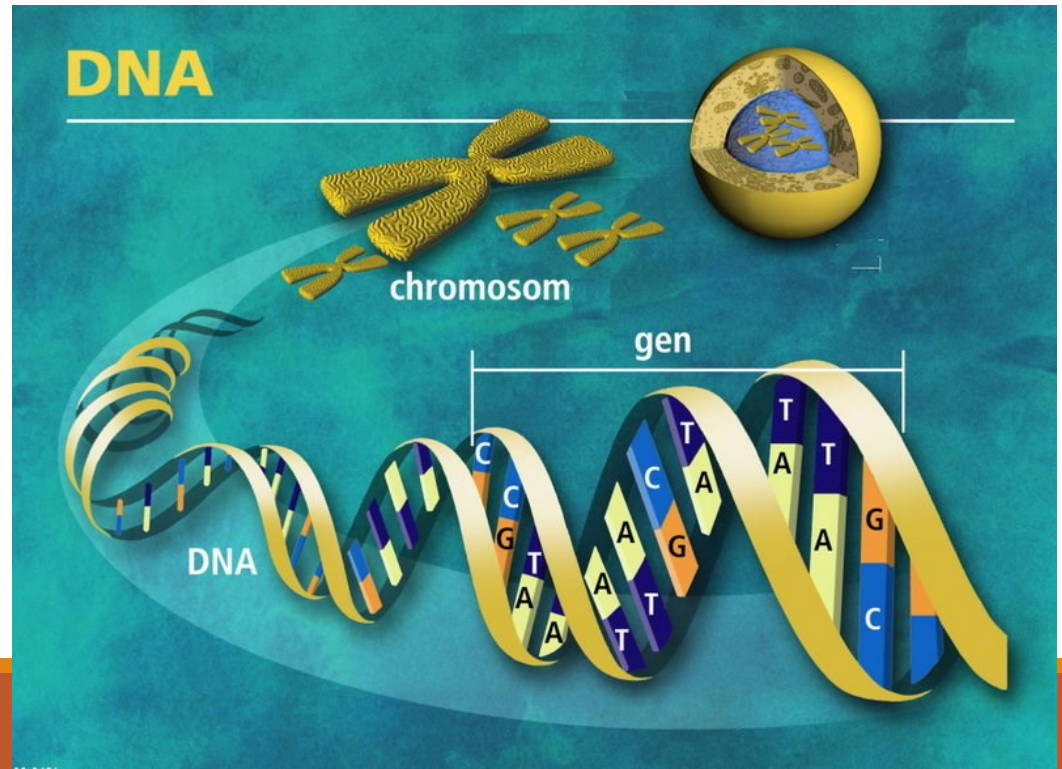
Teratogene



Effect of Contergan [thalidomid]

Mutagen is a physical or chemical agent that changes the genetic information (usually DNA) of an organism and thus increases the frequency of mutations above the natural background level. As many mutations cause cancer, mutagens are typically also carcinogens.

Not all mutations are caused by mutagens: So-called spontaneous mutations occur due to **errors in DNA replication, repair and recombination** of DNA sequences.



Carcinogens

may increase the risk of getting cancer by **altering cellular metabolism or damaging DNA** directly in cells, which interferes with biological processes, and induces the uncontrolled, malignant division ultimately leading to the formation of tumours.

Carcinogens cont.

Usually DNA damage, if too severe to repair, leads to **programmed cell death**, but if the programmed cell death pathway is damaged, then the cell cannot prevent itself from becoming a cancer cell.

Carcinogen vs mutagen

Mutagens or **genotoxic agents** cause mutations in **germ cells**

Mutations are transferable to new/next generation

Carcinogen cause mutations in **somatic cells**

Classifications

Group	Number ^a
1: Carcinogenic to humans	121
2A: Probably carcinogenic to humans	89
2B: Possibly carcinogenic to humans	319
3: Not classifiable as to carcinogenicity to humans	500
4: Probably not carcinogenic to humans	1
Total evaluated	1003

^aNumber of agents/exposures classified in IARC Monographs Vols **1 – 120**

Group 1: *The agent (mixture) is carcinogenic to humans. The exposure circumstance entails exposures that are carcinogenic to humans.*

Group 2A: The agent (mixture) is probably carcinogenic to humans. The exposure circumstance entails exposures that are probably carcinogenic to humans.

Group 2B: The agent (mixture) is possibly carcinogenic to humans. The exposure circumstance entails exposures that are possibly carcinogenic to humans.

Group 3: *The agent (mixture, or exposure circumstance) is not classifiable as to carcinogenicity in humans.*

Overall Evaluations of Carcinogenicity to Humans

Group 1: Carcinogenic to humans

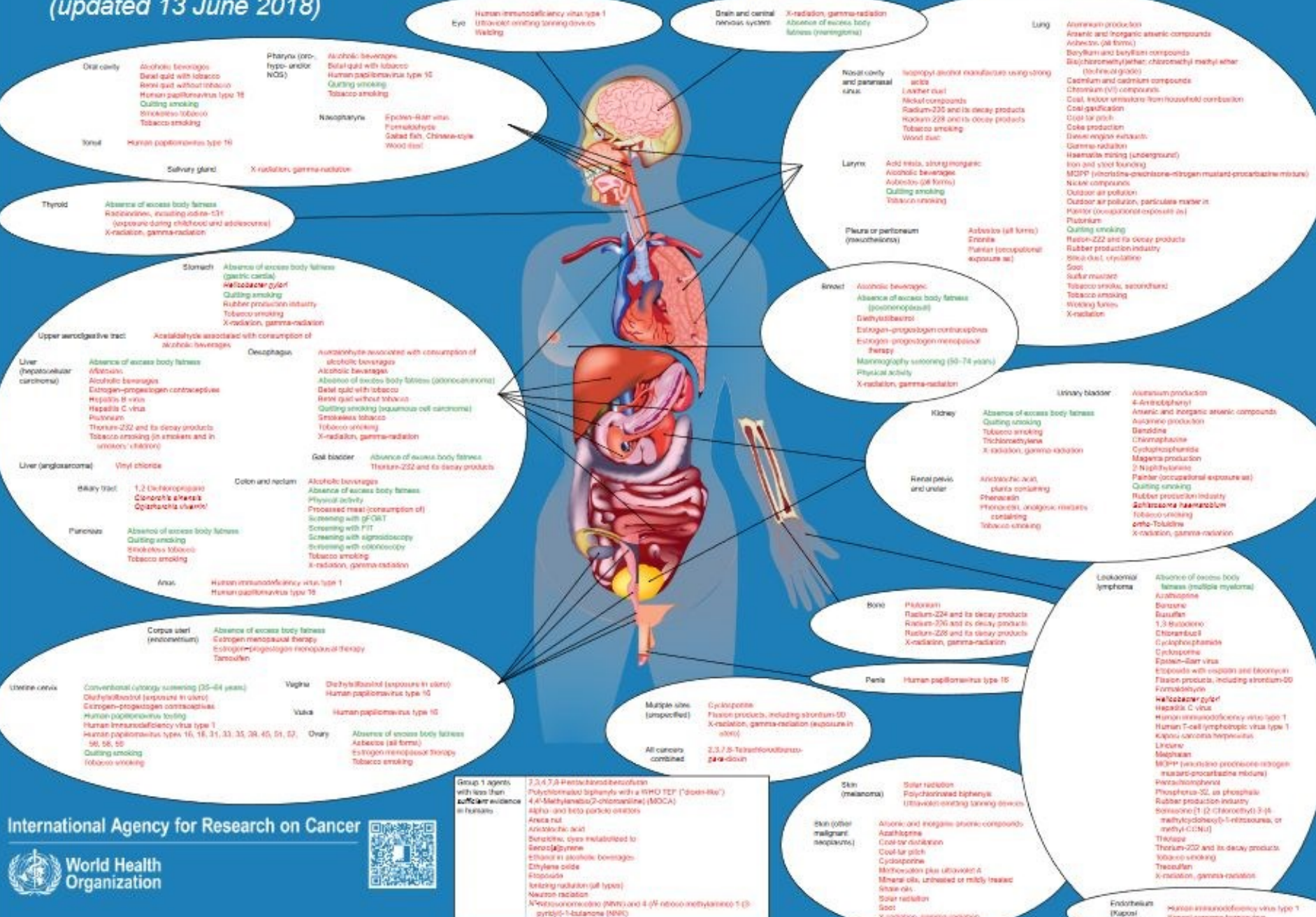
AS EVALUATED IN *IARC MONOGRAPHS* VOL. 1-120

THIS LIST CONTAINS ALL AGENTS, MIXTURES AND EXPOSURES EVALUATED AS BEING IN GROUP 1 TO DATE.

WHERE APPROPRIATE, CHEMICAL ABSTRACT NUMBERS ARE GIVEN [IN SQUARE BRACKETS]. FOR DETAILS OF THE EVALUATION, THE RELEVANT MONOGRAPH SHOULD BE CONSULTED (VOLUME NUMBER GIVEN IN ROUND BRACKETS, FOLLOWED BY YEAR OF PUBLICATION OF LATEST EVALUATION).

IARC Monographs of Carcinogenic Hazards to Humans and Handbooks of Cancer Prevention

(updated 13 June 2018)



International Agency for Research on Cancer



Group 1 agents with less than sufficient evidence in humans

2,3,4,7,8-Pentachlorodibenzo-p-dioxin
Polychlorinated biphenyls with a PHO TEF ("dioxin-like")
4-(4-Methylphenyl)-2-chloroaniline (MOCA)
Alpha- and beta-particle emitters

Arcus nit
Aristolochic acid
Benzofuran, eyes irradiated to
Benzofuran
Ethanol in alcoholic beverages
Ethylenic acid
Fluorocarbon
Gamma radiation (all types)
Neutron radiation
N-Ethylmaleimide (penta) and 4-(p-toluenemethylamino)-1-(p-
pyridyl)-1-butanone (MBC)
Ultraviolet radiation

Group 1: Carcinogenic to humans (120)

Acetaldehyde associated with consumption of alcoholic beverages (*Vol. 100E, 2012*)

Acid mists, inorg. acids (*Vol. 54, 100F, 2012*)

Aflatoxins (*Vol. 56, 82, 100F, 2012*)

Alcoholic beverages (*Vol. 44, 96, 100E, 2012*)

Aluminium production (*Vol. 34, sup. 7, 99, 100F, 2012*)

4-Aminobiphenyl (*Vol. 1, Suppl. 7, 99, 100F, 2012*)

Areca nut (*Vol. 85, 100E, 2012*)

Aristolochic acid, plants containing

Aristolochic acid (*Vol. 82, Vol. 100A; 2012*)

(NB: Overall evaluation upgraded from 2A to 1 based on mechanistic and other relevant data)



Group 1: Carcinogenic to humans (120)

Arsenic and inorganic arsenic compounds (*Vol. 23, Suppl. 7; 1987; 100C, 2012*)

Asbestos all forms, including actinolite, amosite, anthophyllite, chrysotile, crocidolite, tremolite)
(*Vol. 14, Suppl. 7; 1987; 100C, 2012*)

Auramine production [anilin dye] (*Sup. 7, Vol. 99, 100F 2012*)

Azathioprine [Imuran] (*Vol. 26, Suppl. 7; 1987; 100A 2012*)

Benzene (*Vol. 29, Suppl. 7; 1987; 100F 2012*)

Benzidine (*Vol. 29, Suppl. 7; 1987; 99, 100F 2012*)

Benzidine, dyes metabolised to (*Vol. 99, 100F 2012*)

(NB: Overall evaluation upgraded from 2A to 1 based on mechanistic and other relevant data)

Beryllium and its compounds (*Vol. 58; 1993; 100C, 2012*)

Group 1: Carcinogenic to humans (120)

Benzo[a]pyrene (*Vol. 32, Suppl. 7, Vol. 92; 100F, 2012*)
(NB: Overall evaluation upgraded from 2B to 1 based on mechanistic and other relevant data)

Betel quid with tobacco (*Vol.85, 100E, 2012*)

Betel quid without tobacco (*Vol.85, 100E, 2012*)

Bis(chloromethyl)ether; chloromethyl methyl ether (technical-grade) (*Vol. 4, Suppl. 7; 100F, 2012*)

Busulfan (*Vol. 4, Suppl. 7; 1987; 100 A 2012*)

1,3-Butadiene (*Vol. 97, 100F 2012*)

Cadmium & cadmium comp. (*Vol. 58, 100C 2012*)

Chlorambucil (*Vol. 26, Suppl. 7, 1987; 100A 2012*)

Chlornaphazine (*Vol.4, Suppl. 7, 1987; 100A 2012*)

Group 1: Carcinogenic to humans (120)

Chromium [VI] compounds (*Vol. 49, 100C, 2012*)

Clonorchis sinensis infections with (*Vol. 61, 100B, 2012*)

Coal (indoor emissions, household combustion of) (*Vol. 95, 100E, 2012*)

Coal gasification (*Vol. 92, 100F, 2012*)

Coal-tar distillation (*Vol. 92, 100F 2012*)

Coal-tar pitch (*Vol. 35, Sup. 7, 100F 2012*)

Coke production (*Vol. 92, 100F, 2012*)

Ciclosporin (*Vol. 50, 1990; 100A 2012*)

Cyclophosphamide (*Vol. 26, Suppl. 7, 100A, 2012*)

Diethylstilboestrol (*Vol. 21, Suppl. 7, 100A, 2012*)

1,2-Dichloropropane (*Vol. 110, in prep.*)

Group 1: Carcinogenic to humans (120)

Engine exhaust, diesel (*Vol. 46, 105, 2013*)

Epstein-Barr Virus (*Vol. 70, 1997; 100B, 2012*)

Erionite (*Vol. 42, Suppl. 7, 1987; 100C, 2012*)

Estrogen therapy postmenopausal (*Vol. 72, Vol. 100A; 2012*)

Estrogen-progestogen menopausal therapy (combined) (*Vol. 72, Vol. 91, Vol. 100A; 2012*)

Estrogen-progestogen oral contraceptives (combined) (*Vol. 72, Vol. 91, Vol. 100A; 2012*)

(NB: There is also convincing evidence in humans that these agents confer a protective effect against cancer in the endometrium and ovary)

Ethanol in alcoholic beverages (*Vol. 96; 100 E 2012*)

Ethylene oxide (*Vol. 60, Vol. 97, 2008; 100F 2012*)

(NB: Overall evaluation upgraded from 2A to 1 based on mechanistic and other relevant data)

Group 1: Carcinogenic to humans (120)

Etoposide (léčba nádorů varlat a ca plic malobuněčného) (*Vol. 76, Vol. 100A; 2012*)

(NB: Overall evaluation upgraded from 2A to 1 based on mechanistic and other relevant data)

Etoposide in combination with cisplatin and bleomycin

(*Vol. 76; 100A, 2012*)

Fissions products including strontium 90 (*Vol. 100D, 2012*)

Formaldehyde (*Vol. 88, 2006; 100F 2012*)

Hematite mining_(undeground) (*Vol. 1, Suppl. 7, 100D, 2012*)

Helicobacter pylori (infections with) (*Vol. 61, 100B in prep.*)

Hepatitis B virus (chronic infection with) (*Vol. 59, 100B, 2012*)

Hepatitis C virus (chronic infection with) (*Vol. 59, 100B, 2012*)

Human immunodeficiency virus typ 1 (infection with)

(*Vol. 67, 1996; 100B, 2012*)

Group 1: Carcinogenic to humans (120)

Human papillomavirus typ 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59 (Vol. 64, Vol. 90, 100B, 2012)

(NB: The HPV types that have been classified as *carcinogenic to humans* can differ by an order of magnitude in risk for cervical cancer)

Human T-cell lymphotropic virus typ I (Vol. 67, 100B, 2012)

Ionizing radiation (*all types*) (Vol. 100D, 2012)

Iron and steel founding (occupational exposure during) (Vol. 34, sup.7, 100F, 2012)

Isopropyl alcohol manufacture using strong acid (Sup.7, 100F, 2012)

Kaposi sarcoma herpes virus (Vol. 70, 100B 2012)

Group 1: Carcinogenic to humans (120)

Leather dust (*Vol. 100C, 2012*)

Lindane (hexachlorocyclohexanes) (*Vol. 113, in prep.*)

Magenta production (*Vol. 57, 99, 100F, 2012*)

Melphalan (Alkeran) (*Vol. 9, Suppl. 7, 100A, 2012*)

Methoxsalen (8-Methoxypsoralen) + UVA (*Vol. 24, Suppl. 7, Vol. 100A; 2012*)

Methyl-CCNU (*Sup.7, Vol.100A,2012*)

4,4-Methylenebis(2-chloroaniline) (MOCA) (*Vol. 57, Vol. 99; 2012*)

Mineral oils, untreated or mildly treated (*Vol.33, sup.7; 100F, 2012*)

MOPP (Mustargen Oncovin Procarbazine Prednisone) and other comb. chemotherapy including alkylated agents (*Suppl. 7; Vol. 100A; 2012*)

Group 1: Carcinogenic to humans (120)

2-Naphthylamine (*Vol. 4, Suppl.7, 99, 100F, 2012*)

Neutron radiation (*Vol. 75, 2000; 100D 2012*) (NB: Overall evaluation upgraded to group 1 with supporting evidence from other relevant data)

Nickel compounds (*Vol. 49, 1990; 100C 2012*)

N'-Nitrosornicotine (NNN) & 4-(*N*-Nitrosomethylamino-1-(3-pyridyl)-1-butanone (NNK) (*Vol. 89, 2007; 100E 2012*) (NB: Overall evaluation upgraded to group 1 based on mechanistic and other relevant data)

Opisthorchis viverrini (motolice jaterní) (*Vol. 61, 100B, 2012*)

Outdoor air pollution (*Vol. 109, 2016*)

Outdoor air pollution, particulate matter in
(*Vol. 109, 2016*)

Group 1: Carcinogenic to humans (120)

Painter (occupational exposure as a) (*Vol. 47,98, Vol. 100A; 2011*)

Particulate matter in outdoor air pollution (see

Outdoor air pollution, particulate matter in)

Pentachlorophenol (Polychlorophenols) (*Vol. 117; in prep.*)

3,4,5,3',4'–Pentachlorobiphenyl (PCB 126) (*Vol. 100F; 2012*)

2,3,4,7,8–Pentachlorodibenzofuran (*Vol. 100F; 2012*)

Phenacetin (*Vol. 24, Suppl. 7, Vol. 100A; 2011*) (NB: Overall

evaluation upgraded from 2A to 1 with supporting evidence from other relevant data)

Phenacetin, analgesic mixtures containing (*Vol. 100A; 2011*)

Phosphorus-32, as phosphate (*Vol. 78; 2001*)

Plutonium-239 and its decay products (may contain **plutonium-240 and other isotopes**), as aerosols (*Vol. 78; 2001*)

Group 1: Carcinogenic to humans (120)

Polychlorinated biphenyls (*Vol. 18, supp.7, 107, in prep.*)

Polychlorinated biphenyls, dioxin-like, with a

Toxicity Equivalency Factor (TEF) according to WHO

(PCBs 77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169, 189)

(NB: Overall evaluation upgraded to Group 1 with strong supporting evidence from other relevant data) (*Vol. 107, 2016*)

Processed Meat (*Vol. 114, in prep.*)

Radioiodines, including iodine-131 (*Vol. 78, 100D, 2012*)

Radionuclides, α -particle-emitting, internally

deposited (*Vol. 78; 2001*) (NB: Specific radionuclides for which there is *sufficient* evidence for carcinogenicity to humans are also listed individually as Group 1 agents)

Group 1: Carcinogenic to humans (120)

Radionuclides, b-particle-emitting, internally

deposited (*Vol. 78; 2001*) (NB: Specific radionuclides for which there is *sufficient* evidence for carcinogenicity to humans are also listed individually as Group 1 agents)

Radium-224 and its decay products (*Vol. 78; 2001*)

Radium-226 and its decay products (*Vol. 78; 2001*)

Radium-228 and its decay products (*Vol. 78; 2001*)

Radon-222 and its decay products (*Vol. 78; 2001*)

Rubber manufacturing industry (*Vol. 28, Sup, 7, 100F, 2012*)

Salted fish, Chinese- style (*Vol. 56, 100E; in prep.*)

Schistosoma haematobium (infection with) (*Vol. 61; 1994*)

Group 1: Carcinogenic to humans (120)

Shale oils (*Sup. 7, 100E, 2012*)

Silica dust, crystalline (inhaled in the form of quartz or cristobalite from occup. sources) (*Vol. 68; 1997*)

Solar radiation (*Vol. 55, 100D; 2012*)

Soot (as found in occupational exposure of chimney sweeps) (*Sup. 7, 100F, 2012*)

Sulfur mustard (*Sup. 7, 100F, 2012*)

Tamoxifen (*Vol. 66; 1996*) (NB: There is also conclusive evidence that this agent (tamoxifen) reduces the risk of contralateral breast cancer)

2,3,7,8 - TCDD (Tetrachlorodibenzo-*para*-dioxin) (*Vol. 69; 1997, 100F, 2012*)

Viktor Juščenko



July 2004

December 2004

Group 1: Carcinogenic to humans (120)

Thiotepa (*Vol. 50; 1990*)

Thorium-232 and its decay products, administered intravenously as a colloidal dispersion of thorium-232 dioxide (*Vol. 78; 2001*)

Tobacco, smokeless (*89, 100E, 2012*)

Tobacco smoke, second hand (*83, 100E, 2012*)

Tobacco smoking (*83, 100E, 2012*)

ortho-Toluidine (*Vol. 77, 99, 100F, 2012*)

Treosulfan (*Vol. 26, sup.7, 100A; 2011*)

Trichlorethylene (*Vol. 63, 106, in prep.*)

Ultraviolet radiation (wavelengths 100 – 400nm encompassing UVA, UVB, UVC) (*100D, 2012*)

Group 1: Carcinogenic to humans (120)

Ultraviolet –emitting tanning devices (*100D, 2012*)

Vinyl chloride (*100F, 2012*)

Welding fumes (*118, in prep.*)

Wood dust (*100C, 2012*)

X- and Gamma -Radiation (*100D, 2012*)

Group 2A: Probably carcinogenic to humans (81)

Biomass fuel (primarily wood), indoor emissions from household combustion of (*Vol.95, 2010*)

Chloramphenicol (*Vol.50, 1990*)

Frying, emissions from high-temperature (*Vol.95, 2010*)

Human papillomavirus type 68 (*Vol.100B, 2012*)

Hairdresser or barber (occupational exposure as a) (*Vol.57, 99, 2010*)

Lead compounds, inorganic (*Vol.87, 2006*)

Malaria (*Plasmodium falciparum*) (*Vol.104, 2013*)

Shiftwork that involves circadian disruption (*Vol.98, 2010*)

Red meat (*Vol.114, in prep.*)

Very hot beverages at above 65°C (drinking) (*Vol.116, in prep.*)

**Group 2B: Possibly carcinogenic
to humans (299)**

**Group 3: Not classifiable as to
carcinogenicity to humans (502)**