



Socio-economic regional microscope series

Cancer burden indicators in Europe: insights from national and regional information

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European Commission
Joint Research Centre

Socio-economic regional microscope series

Cancer burden indicators in Europe: insights from national and regional information

In 2018, 3 million new cases of cancer (all types, excluding non-melanoma skin cancer) and over 1.4 million cancer-related deaths are estimated in EU-28. Population-based cancer registries represent the invaluable data source for providing unbiased information on cancer burden in a defined population over a certain calendar period. They are critical resources for the clinical and epidemiological investigation of cancer and for the planning and evaluation of cancer prevention and control programmes.

The European Cancer Information System, officially released in February 2018, disseminates cancer burden indicators at European level, namely on incidence, mortality and survival, derived from data submitted by about 150 European population-based cancer registries. It provides an added value by allowing regional/national comparison of cancer indicators and prompting key questions on the aetiology of certain types of cancer and on the comparison of best practices in prevention, diagnosis and treatment interventions.

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Table of contents

Preface

The Socio-economic regional microscope series 3

Introduction 4

Monitoring the breast cancer burden in Europe 6

Monitoring lung cancer burden at national and sub-national level 11

Monitoring stomach cancer burden 17

Conclusion 20

Acknowledgements 20

The Socio-economic regional microscope series

The current political and economic challenges faced by the European Union and its Member States call even more for evidence-informed policies. They also require tailor-made policies, developed using highly sophisticated analyses based not only on country-level data, but rather on regional and sub-regional knowledge.

National averages, in particular, bear the risk to present a misleading picture in countries with significant disparities between different regions and areas.

Looking only at national averages can also limit and delay understanding of the differences between regions and cities – identifying leaders and laggards –, as well as prevent the identification of emerging trends in certain socio-economic indicators. Only a detailed analysis of data at regional and local level can bring these insights.

The Joint Research Centre (JRC) of the European Commission has developed the *Socio-economic regional microscope*. It is a new series of short periodical publications which aims to open-up new areas of analysis, and present the stories which can only be told using regional socio-economic data.

Each report presents EU socio-economic indicators according to a data storytelling principle, using a combination of three key elements: data, visuals (maps), and narrative. Each indicator will therefore be represented through maps at regional level (NUTS2), and in some cases even at the NUTS3 and local level.

The *Socio-economic regional microscope* will also show the breadth of the JRC regional analysis in a wide range of research areas: culture, economics, education, energy, healthcare, research and innovation, tourism, etc.

The reports, data and maps are also available on the Territorial Dashboard website of the JRC Knowledge Centre for Territorial Policies, in the *Thematic Analyses* section: <http://urban.jrc.ec.europa.eu/t-board/indic.html>.

Introduction

With more than 3 million new cases and 1.4 million deaths estimated for 2018¹, cancer represents the second most important cause of death and morbidity in the EU-28, after circulatory diseases².

Population-based cancer registration represents the 'gold' standard for the provision of unbiased information on cancer burden in a defined population and how it is changing over time³.

Population-based cancer registries (PBCRs) collect, manage and analyse data on patients diagnosed with cancer within a defined geographical area over a certain calendar period. They are invaluable resources for the clinical and epidemiological investigation of cancer and have a unique role in supporting public health officials and agencies in the planning and evaluation of cancer prevention and control programmes.

The European Network of Cancer Registries (ENCR)⁴, in operation since 1990, was established within the framework of the *Europe Against Cancer Programme* of the European Commission. The ENCR promotes collaboration between cancer registries, defines data collection standards, and supports cancer registries as data providers for the supply of information necessary to quantify and monitor the burden of cancer in the European Union and Europe⁵.

The first 'modern' PBCR was established in Hamburg, Germany already in 1926. In the next decades, European cancer registration expanded its coverage, particularly after World War II. Today, there are approximately 200 active cancer registries (CRs) in Europe, with around 80 % of the population covered in the EU-28 plus the EFTA countries Norway, Switzerland and Iceland, according to the records of the ENCR, but a few European countries still show sparse geographical cancer registration (Figure 1).

European PBCRs are heterogeneous entities in terms of their organization, funding, and size. Some may cover just a metropolitan area or a province while others may be nation-wide organizations. They may record all cancers (all cancer sites and all ages) or be specialized in a certain cancer site or age group.

In June 2015, the ENCR and the European Commission's Joint Research Centre (JRC) launched a Call for Data addressed to all European PBCRs, with the aim of establishing a single European cancer-registry data repository for use by any European wide study on cancer incidence, mortality, survival and prevalence.

Historical data collected by PBCRs enable to uncover possible significant improvements in the fight against specific cancers that can be due to different types of interventions, either resulting from a reduced exposure to major risk factors, earlier diagnosis through the implementation of screening programs and/or better treatment schemes.

Examples are given below for some of the leading cancer sites for women and men in Europe, whose trends and geographical distribution are analysed for the EU-28/EFTA countries in the context of different types of interventions, as mentioned above. These include the i) analysis of changing trends in incidence and

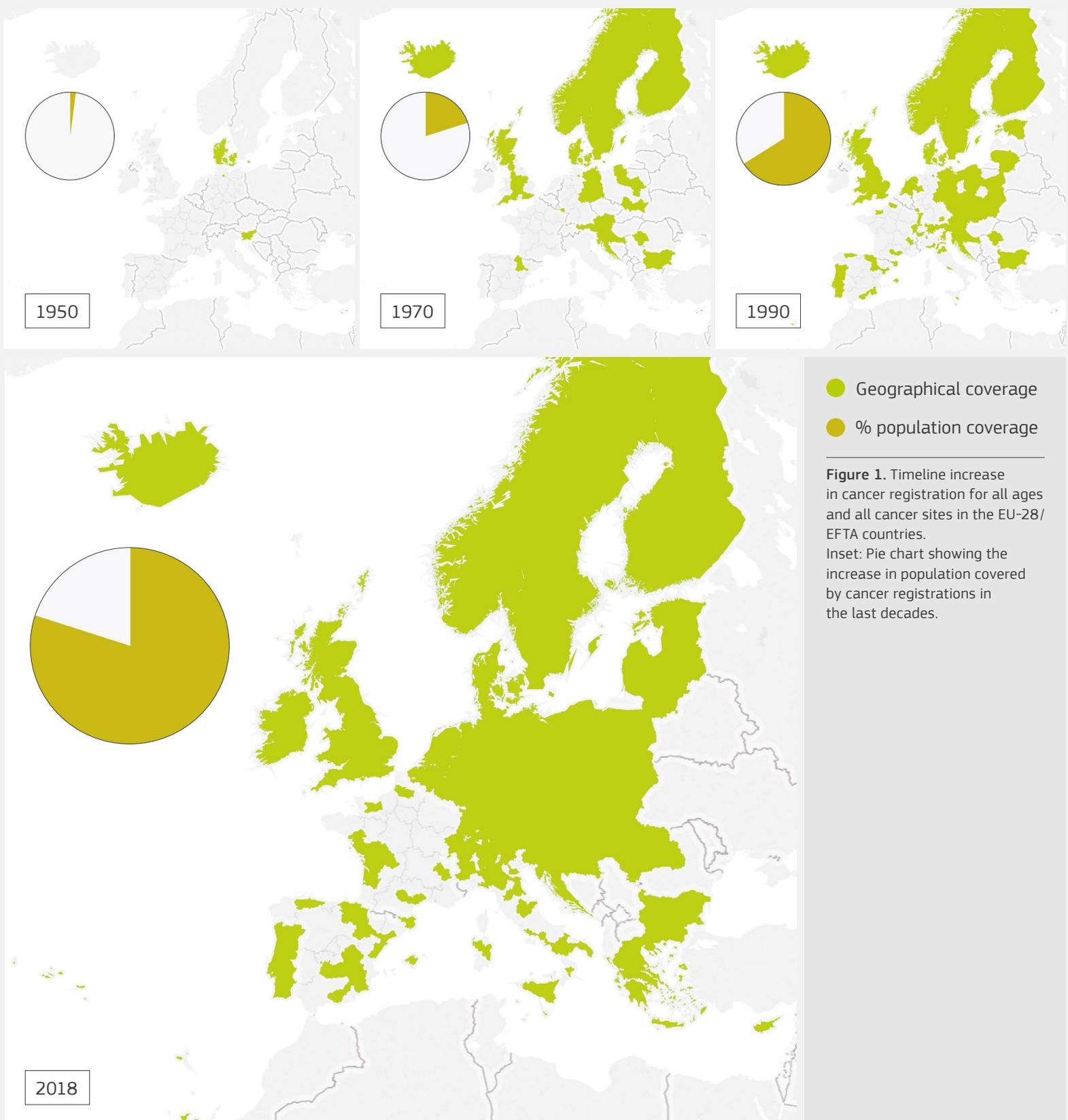
¹ ECIS – European Cancer Information System was released early 2018 by the European Commissions' Joint Research Centre (JRC) to promote awareness on cancer burden, monitor its magnitude and follow trends and changes over time, <https://ecis.jrc.ec.europa.eu>

² EUROSTAT – Causes of death statistics, http://ec.europa.eu/eurostat/statistics-explained/index.php?title=Causes_of_death_statistics

³ IARC Technical publications No.43, https://www.iarc.fr/en/publications/pdfs-online/treport-pub/treport-pub43/IARC_Technical_Report_No43.pdf

⁴ Since 2012, the JRC in close collaboration with the Directorate-General for Health and Food Safety (DG SANTE), is ensuring continued administrative functioning of the ENCR network, and is supporting further coordination and harmonisation of European Cancer data.

⁵ The ENCR includes registries operating in countries within the UN geographical definition of Europe: <http://unstats.un.org/unsd/methods/m49/m49regin.htm#europe>



mortality for breast cancer in women in light of several targeted interventions factors, such as the implementation of breast cancer screening programs across the EU, ii) analysis of lung cancer trends across Europe considering the changes in smoking prevalence (a major risk factor) by gender and geographic distribution, and iii) analysis of stomach cancer trends in incidence and mortality following improvements in primary prevention over the last decades. All cancer indicators are given as population-based rates (per 100,000 people), age-standardised using the new European standard population⁶.

The figures reported in the current publication consist of indicators computed from observed data (reported in the trend analysis) and estimates for incidence and mortality indicators for 2018.

It has to be noted that the variations in estimated indicators across European countries is influenced by a number of factors, including different levels of primary prevention and care, population-based screening, data registration coverage as well as the methods used for estimation. Thus the interpretation of the figures reported in this publication needs to take these factors into consideration.

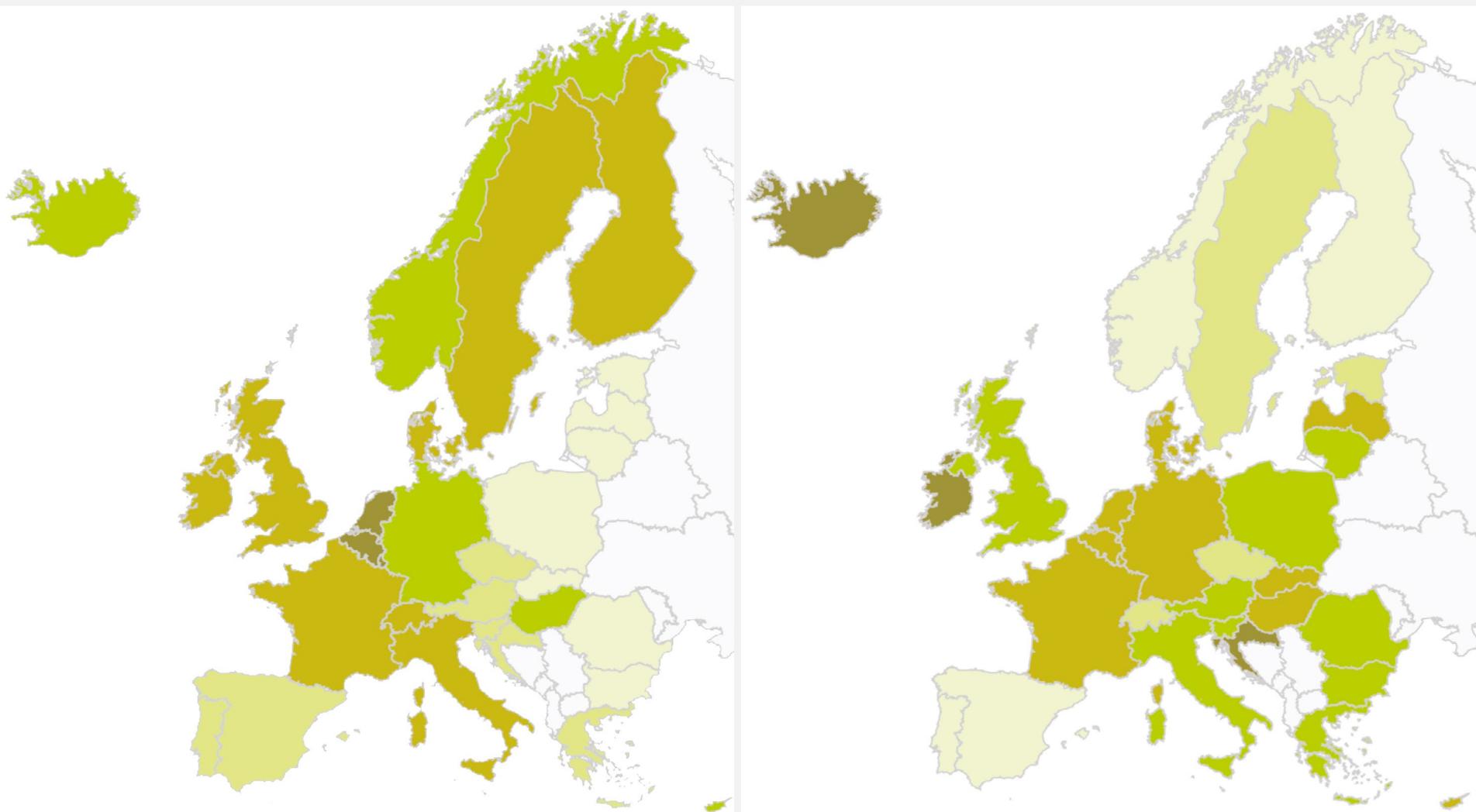
⁶ Revision of the European Standard Population. Report of Eurostat's task force (2013); ISSN 1977-0375

Monitoring the breast cancer burden in Europe

Breast cancer is the leading cancer site for incidence and the main cause of cancer death among women in Europe, according to estimates for 2018 (Figure 2). Known risk factors for breast cancer in women include: age, exposure to oestrogen, genetic predisposition, some breast conditions and lifestyle-related factors⁷.

Incidence, breast cancer, females

Mortality, breast cancer, females



Age standardised rate x 100,000

- 90.0 - 112.0
- 112.0 - 133.9
- 133.9 - 155.9
- 155.9 - 177.8
- 177.8 - 199.8

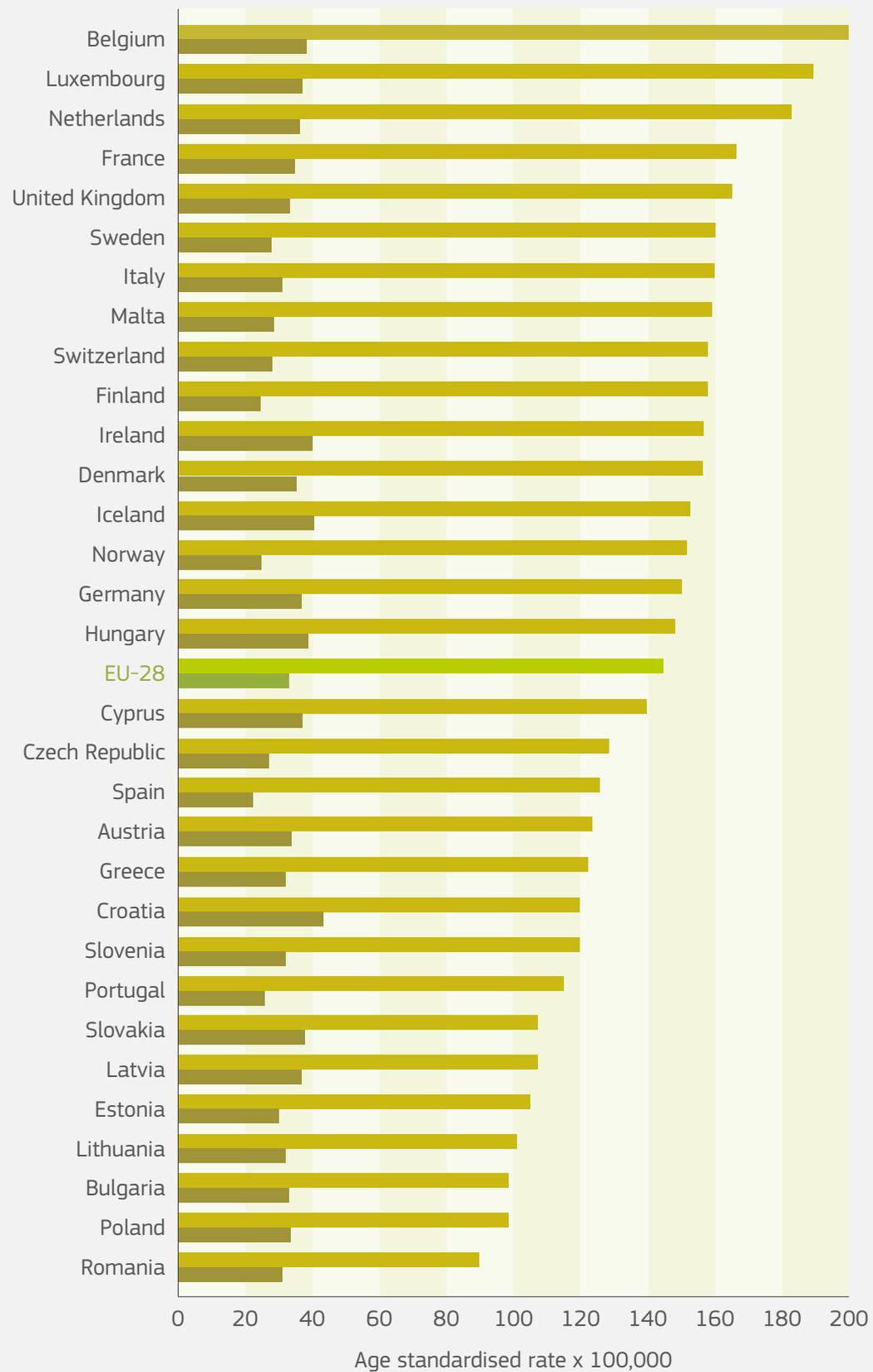
Age standardised rate x 100,000

- 22.7 - 26.8
- 26.8 - 30.9
- 30.9 - 35.0
- 35.0 - 39.1
- 39.1 - 43.2

Figure 2a. Estimated age-standardised rates (according to the European new standard population), per 100,000 people, for female breast cancer incidence (left) and mortality (right) for 2018. The countries are colored within a range from the minimum to the maximum estimated rates.

⁷ ENCR Breast cancer Factsheet (2014), https://encr.eu/sites/default/files/factsheets/ENCR_Factsheet_Breast_2014.pdf

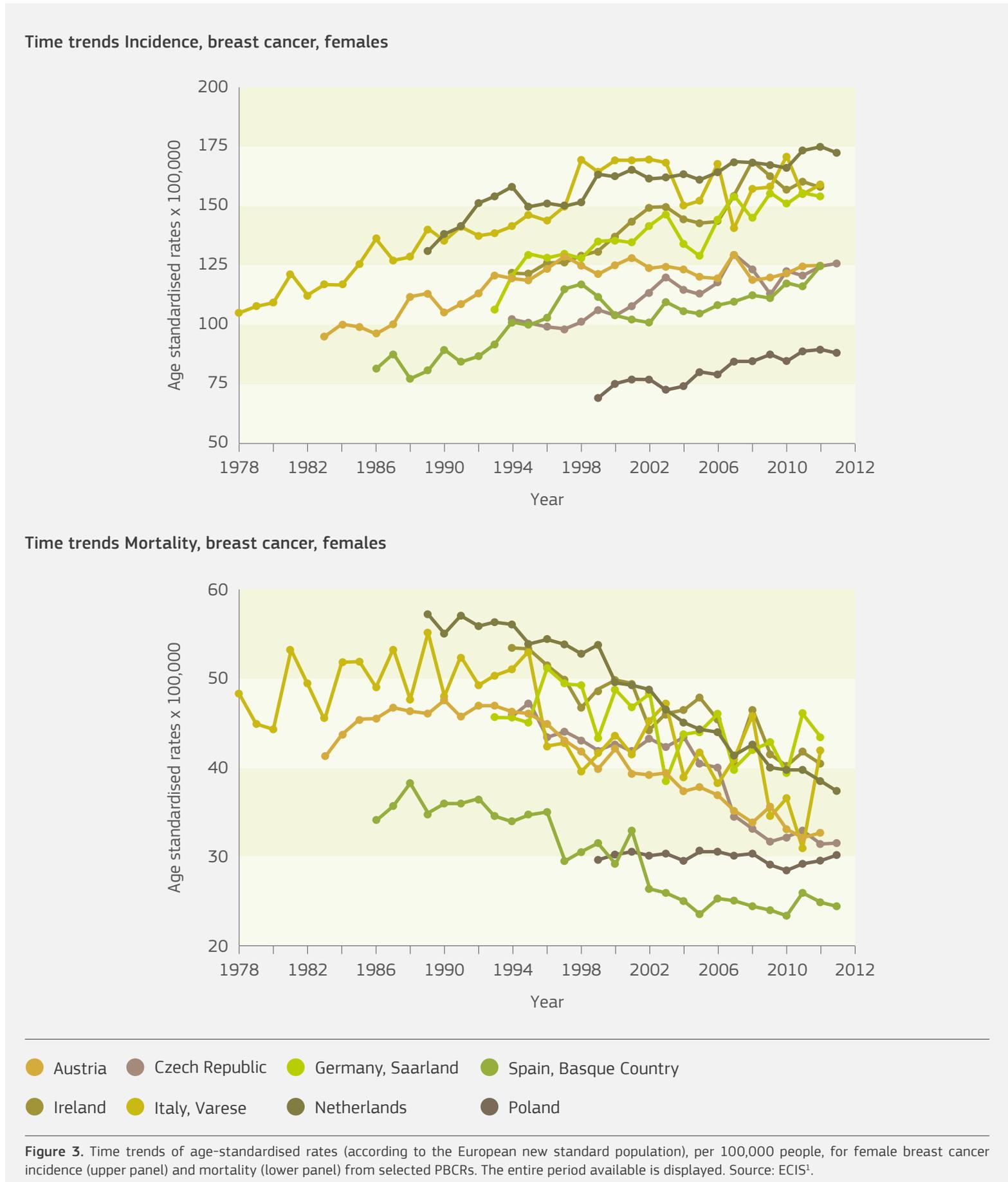
Incidence and mortality, breast cancer, females



● Incidence ● Mortality

Figure 2b. Comparison of female incidence and mortality estimates for breast cancer by country and EU-28. Source: ECIS¹.

The incidence of breast cancer varies widely across the EU-28/EFTA countries, however there has been an overall rising trend in most countries¹. On the contrary, breast cancer mortality rates have fallen in many countries since the mid-1990s (Figure 3).



Several factors could be responsible for the observed trends in breast cancer incidence and mortality, but a rise in risk factors and changes in early diagnostic factors and treatment are likely contributors.

Mammographic screening has been widely accepted as a main tool for early detection of breast cancer. Population coverage by breast cancer screening programmes has increased in the last decades (Table 1) and different levels of maturation of the screening programmes exist currently across the EU-28, ranging from 3 to 20 years from implementation (Figure 4). The Council Recommendations of 2003 on cancer screening recommends that Member States implement mammographic screening programs in women aged 50-69⁸. However, it is up to each Member State to extend or shorten the screening age, depending on national policies (Table 1). Currently, the European Initiative on Breast Cancer⁹ (ECIBC) is developing evidence-based recommendations for mammographic screening which aim to harmonise the practice in the EU.

Member States	Breast cancer screening programme in the EU	
	Year of programme initiation	Target age (years)
Austria	2014	45-69
Belgium	2001*	50-69
Bulgaria	NA	50-69
Croatia	2006	50-69
Cyprus	2003	50-69
Czech Republic	2002	45+
Denmark	2008	50-69
Estonia	2003	50-64
Finland	1987	50-69
France	2004	50-74
Germany	2005	50-69
Greece	NA	40+
Hungary	2001	45-64
Ireland	2000	50-69
Italy	1990	45-74*
Latvia	2009	50-69
Lithuania	2005	50-69
Luxembourg	1992	50-69
Malta	2009	50-69
Netherlands	1989	50-75
Poland	2006	50-69
Portugal	1990	45-74*
Romania	2015	50-69
Slovakia	NA	-
Slovenia	2008	50-69
Spain	1990	50-69*
Sweden	1986	40-74
United Kingdom	1988*	50-70

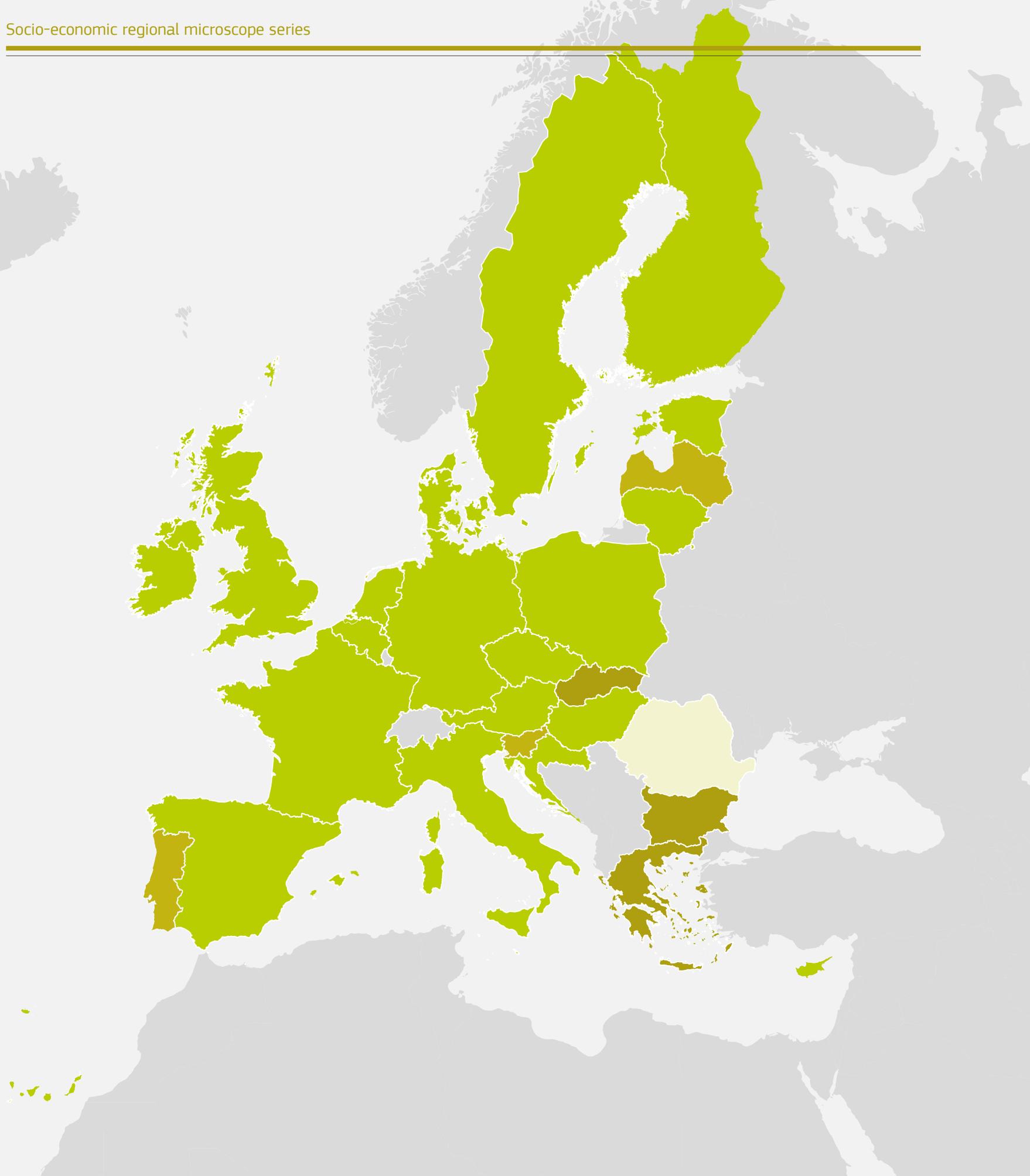
* countries with regional differences in the date of implementation or the target age group

Table 1. Breast cancer screening programmes in the EU, year of programme initiation and target age. Modified from IARC (2017)¹⁰.

⁸ COUNCIL RECOMMENDATION of 2 December 2003 on cancer screening (2003/878/EC)

⁹ ECIBC: <http://ecibc.jrc.ec.europa.eu>

¹⁰ IARC (2017) *Cancer Screening in the EU. Report on the implementation of the Council Recommendation on cancer screening.*



Breast cancer screening programmes in the EU

- Rollout complete
- Rollout ongoing
- Piloting
- Non-population-based programme

Figure 4. Status of implementation of breast cancer screening programmes. Modified from IARC (2017)¹⁰.

Continuous surveillance carried out by cancer registries is an important tool for monitoring the evolution of the breast cancer epidemic in Europe. Indeed, PBCRs data may be exploited for measuring the impact of control measures such as screening programs for breast cancer on the incidence, mortality and survival indicators.

Monitoring lung cancer burden at national and sub-national level

Lung cancer is estimated as the third most frequent cancer in the EU-28/ EFTA countries for 2018, and the most common cause of cancer death in men and women (Figure 5). Smoking, especially cigarettes, is the main risk factor, accounting for more than 80% of the total number of lung cancers^{11, 12, 13}.

Incidence, lung cancer, both sexes

Mortality, lung cancer, both sexes

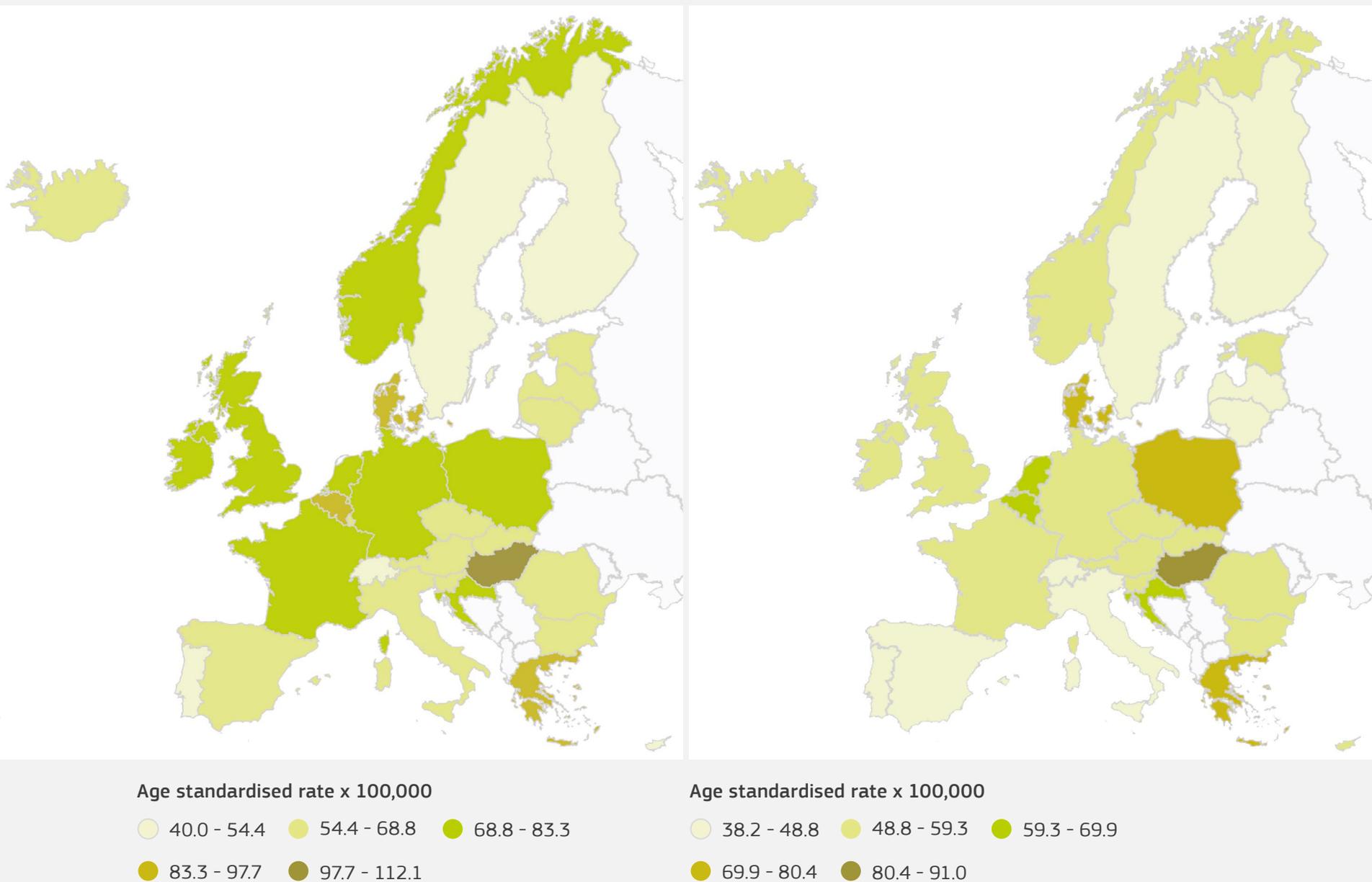


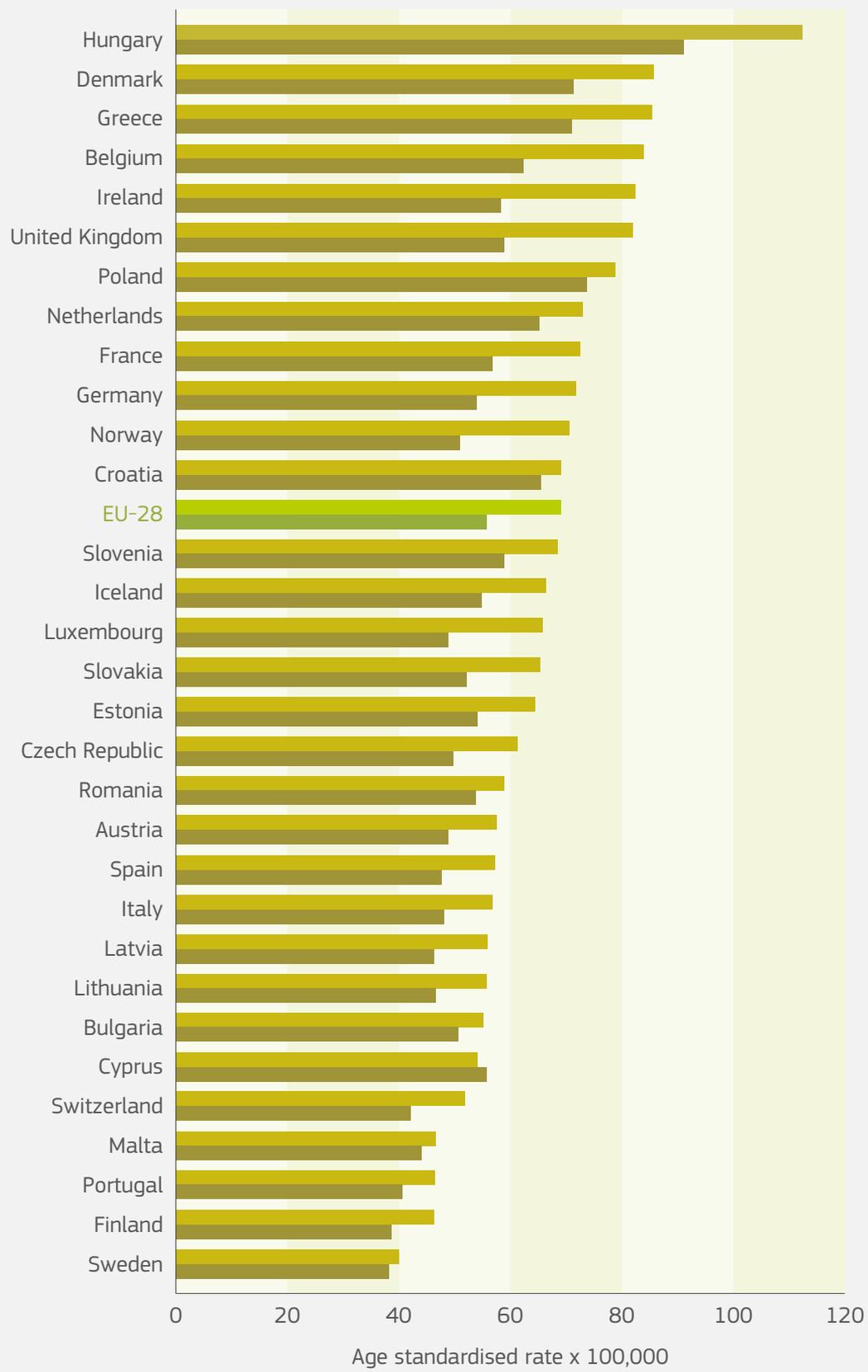
Figure 5a. Estimated age-standardised rates (according to the European new standard population), per 100,000 people, for lung cancer incidence (left) and mortality (right) for both sexes, for 2018. The countries are colored within a range from the minimum to the maximum estimated rates.

¹¹ Horn L, et all editors (2012) Principles of Internal Medicine. McGraw-Hill.

¹² Biesalski et al (1998) CA Cancer J Clin, 48(3), 167-76.

¹³ ENCR Lung cancer factsheet (2014), https://encr.eu/sites/default/files/factsheets/ENCR_Factsheet_Lung_2014.pdf.

Incidence and mortality, lung cancer, both sexes

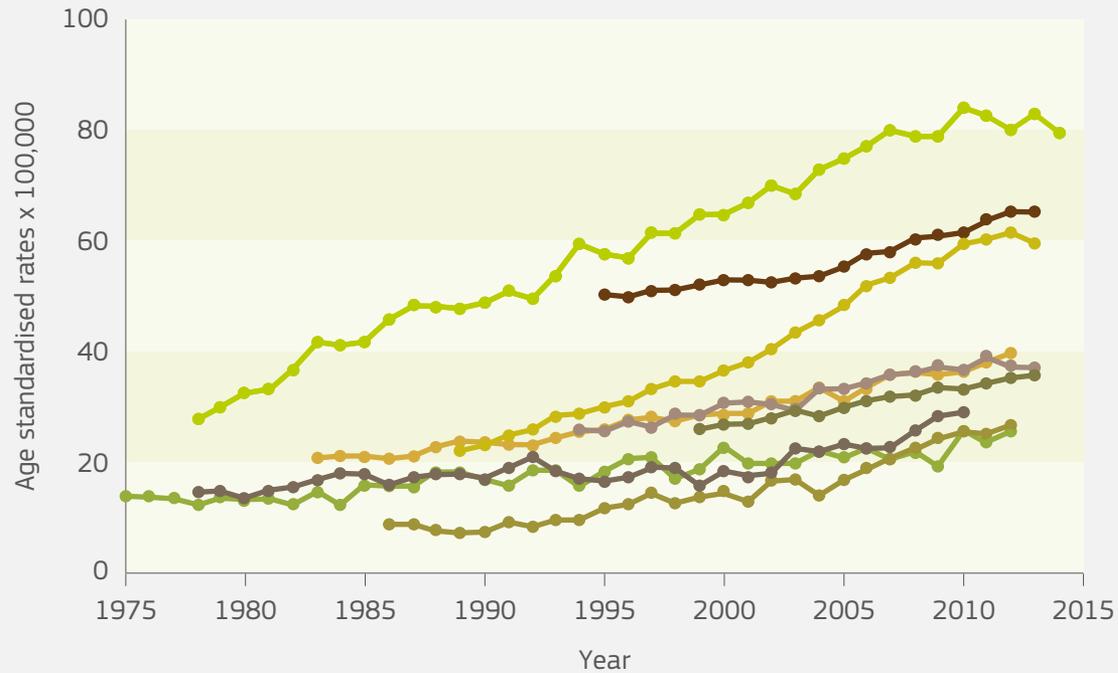


● Incidence ● Mortality

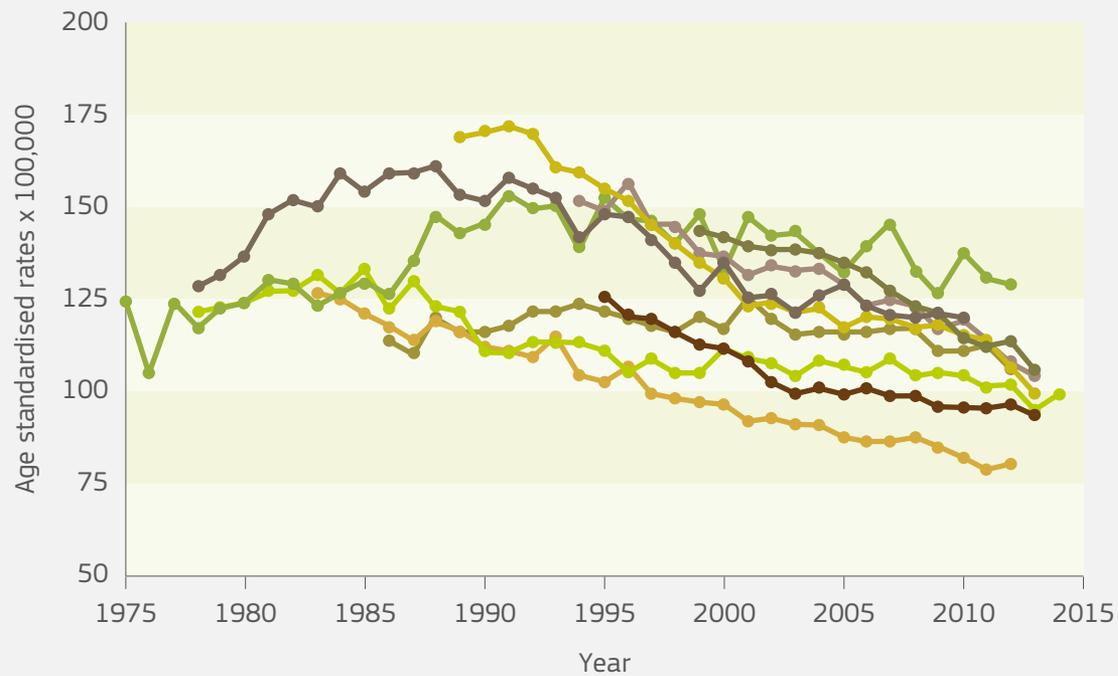
Figure 5b. Comparison of lung cancer incidence and mortality estimates by country and EU-28. Source: ECIS¹.

Interestingly, the characteristics of lung cancer incidence trends in Europe differ by gender (Figure 6). While the incidence in men has been decreasing in most European countries during the last two decades, the patterns in women have seen an increase, particularly in the West and Northern Europe, reflecting the difference in the smoking habits, which for women started later than for men.

Time trends Incidence, lung cancer, females



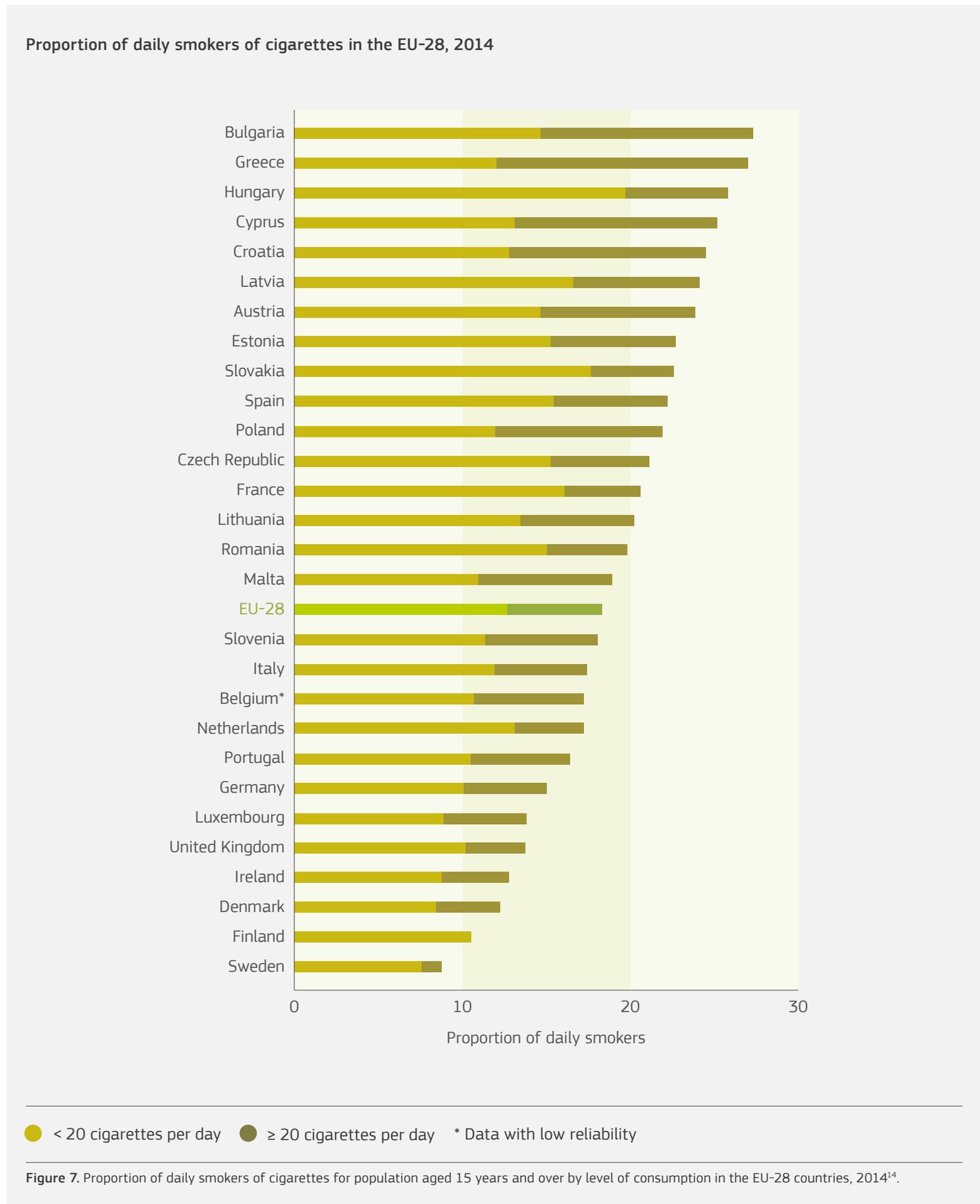
Time trends Incidence, lung cancer, males



- Austria ● Czech Republic ● Denmark ● Estonia ● Spain
- Netherlands ● Poland ● Slovakia ● United Kingdom, England

Figure 6. Time trends of age-standardised rates (according to the European new standard population), per 100,000 people, for incidence of lung cancer in females (upper panel) and males (lower panel) from selected PBCRs. The entire period available is displayed. Source: ECIS¹

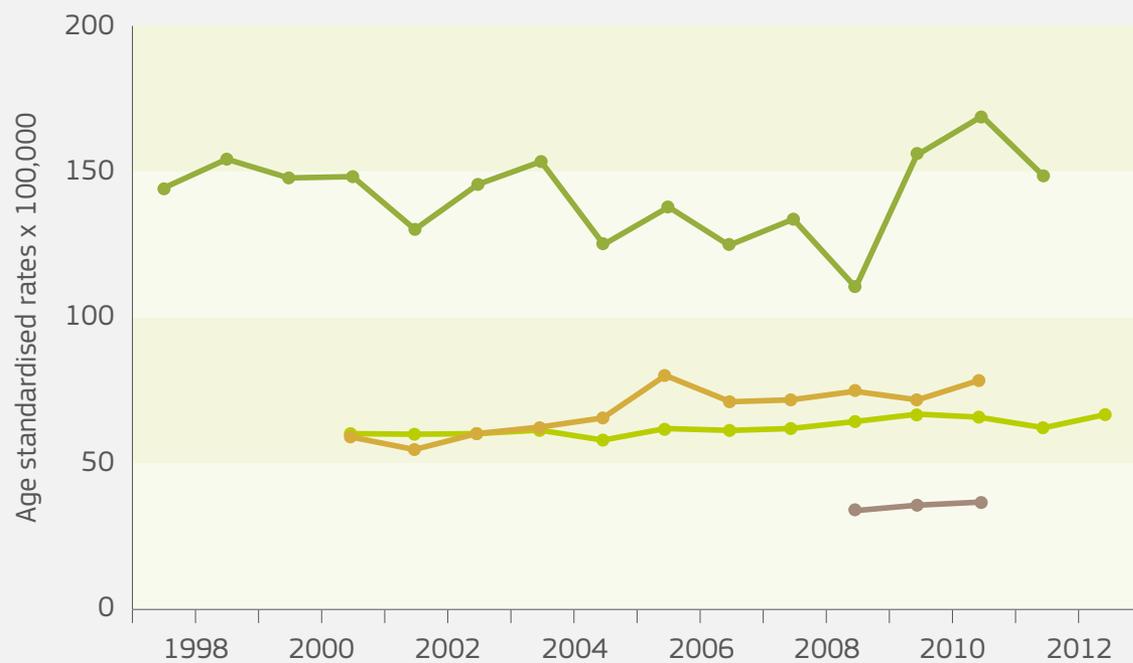
National differences in lung cancer incidence and mortality usually reflect the level of the smoking epidemic in the different EU countries (Figure 7).



¹⁴ EUROSTAT - Tobacco consumption statistics: http://ec.europa.eu/eurostat/statistics-explained/index.php/Tobacco_consumption_statistics

The analysis of cancer incidence rates and risk factors pooled at national level, however, tend to dilute regional variability. As an example, Portugal is one of the EU-28 countries with the lowest estimated incidence and mortality rates for lung cancer (Figure 5). However, when data are analysed at regional level, a considerable geographical heterogeneity is apparent, with the population in the Azorean archipelago presenting a significantly higher risk of developing some malignant diseases including lung cancer than the mainland Portuguese population¹⁵. Some major risk factors in the Azorean population, including tobacco smoking in men, have been suggested to account for geographical discrepancies, and interestingly the lung cancer incidence pattern (Figure 8) follows the regional differences in smoking prevalence (Figure 9), with a higher proportion of smokers identified in the Azores¹⁶.

Time trends Incidence, lung cancer, males, Portugal

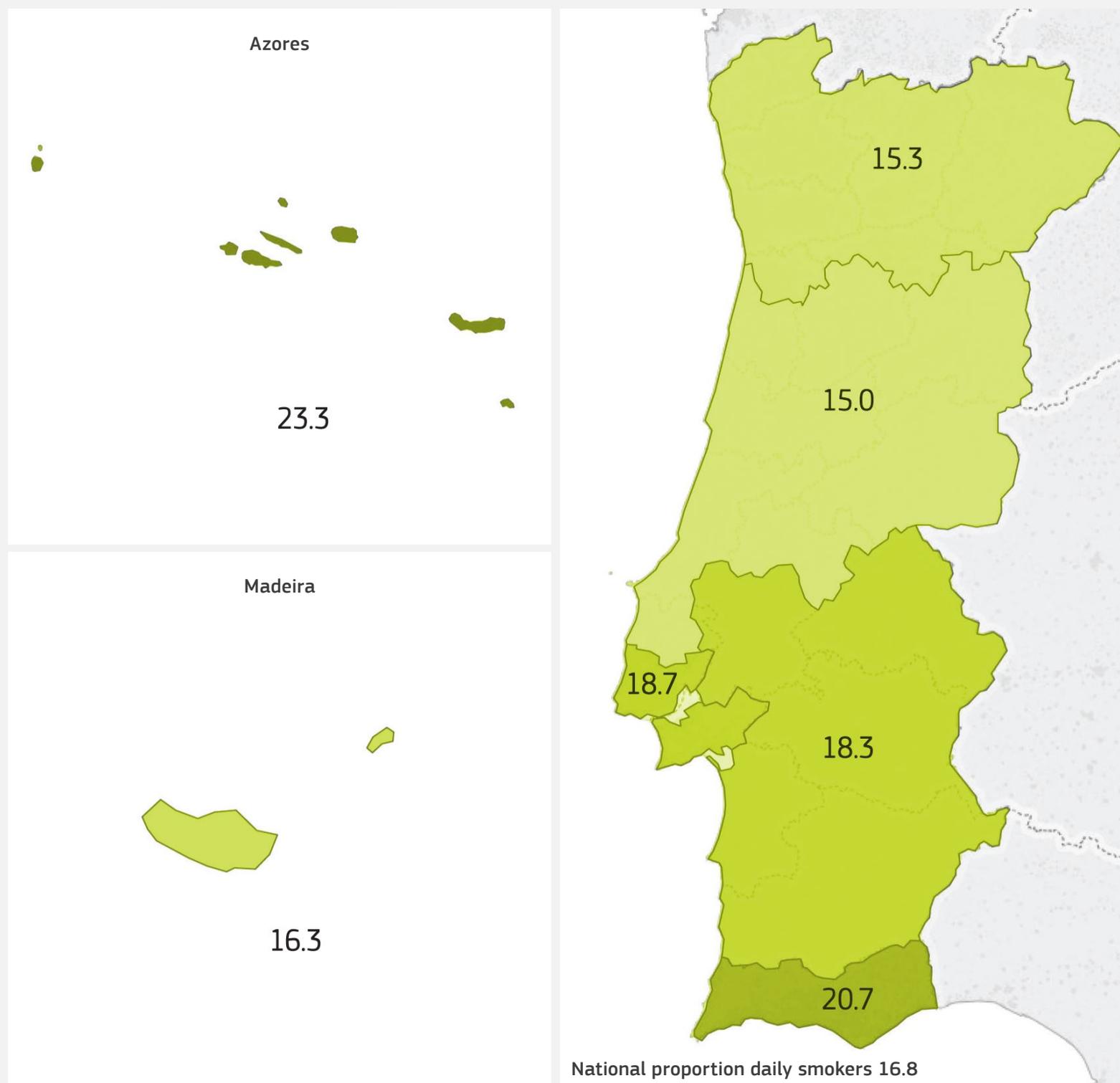


● PT, North Region ● PT, Central Region ● PT, South Region ● PT, Azores

Figure 8. Time trends of age-standardised rates (according to the European new standard population) per 100,000 people for incidence of lung cancer in different regions in Portugal. The entire period available is displayed. Source: ECIS¹

¹⁵ Lacerda GF, Pinheiro PS, Cabral JM Camara JG, Rodrigues VL (2012) Rev. Bras. Epidemiol. vol.15 no.2, <http://dx.doi.org/10.1590/S1415-790X2012000200006>

¹⁶ Statistics Portugal. Regional Statistical Yearbooks - Regional and municipal statistical data - 2015, https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_destaques&DESTAQUESdest_boui=250508919&DESTAQUESmodo=2



Daily smokers in Portugal

15,000 23,300

Figure 9. Proportion of the population aged 15 years and over that smokes every day, Portugal and NUTS 2 regions, 2014¹⁶.

Similar situations of regional heterogeneity can be observed in other countries and for other cancer sites, indicating that country-level information may not be sufficient to depict exhaustively cancer trends and drive health policies.

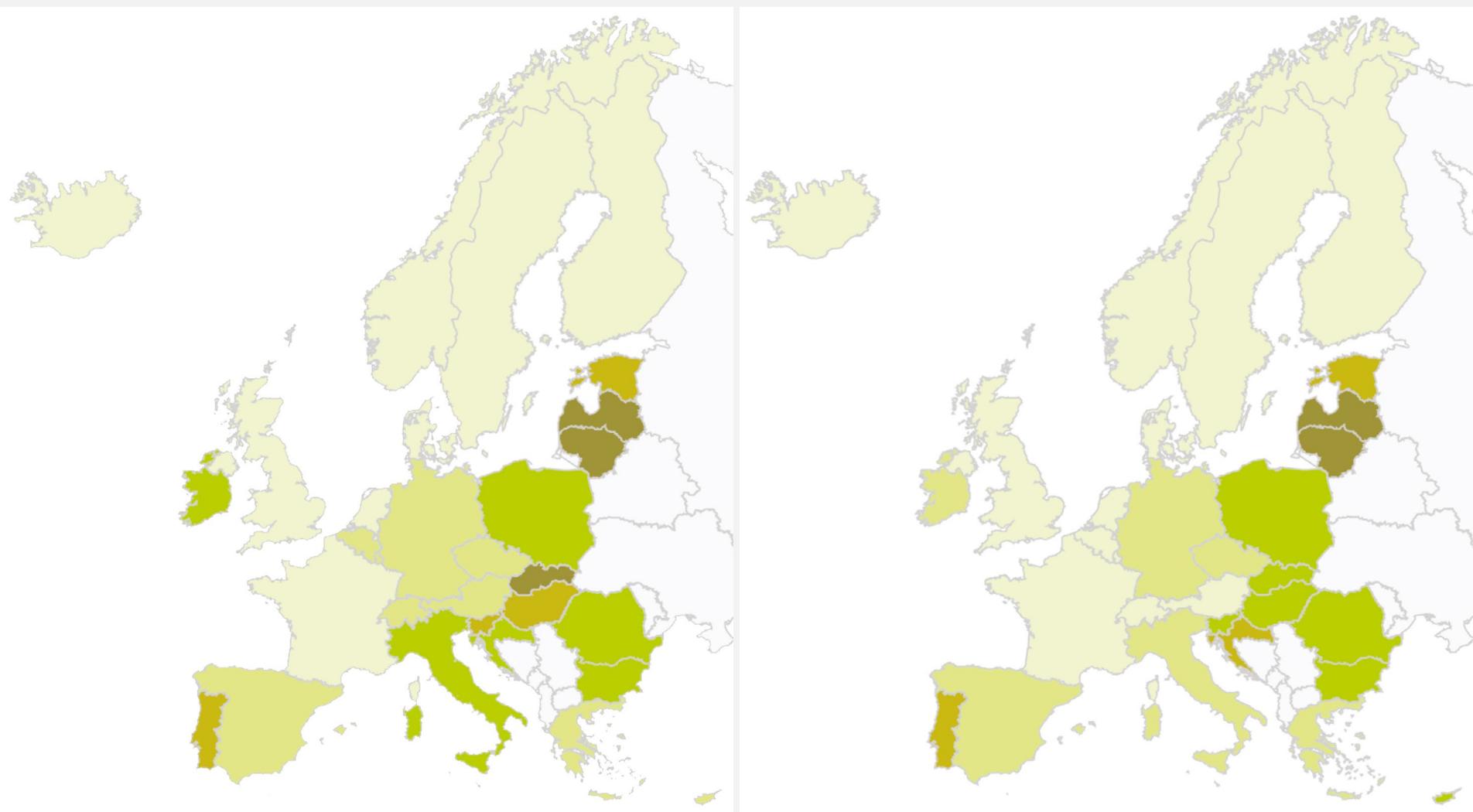
Higher geographical detail allows greater resolution in identifying populations at risk, which otherwise would be overlooked if important indicators on cancer and risk factors exposure were averaged at national level.

Monitoring stomach cancer burden

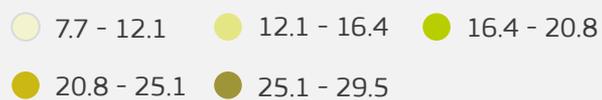
Incidence and mortality rates of stomach cancer vary widely across Europe, with the highest rates observed in Eastern Europe (Figure 10).

Incidence, stomach cancer, both sexes

Mortality, stomach cancer, both sexes



Age standardised rate x 100,000



Age standardised rate x 100,000

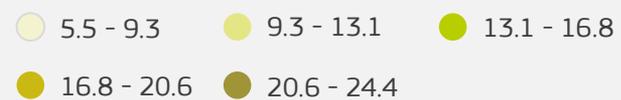
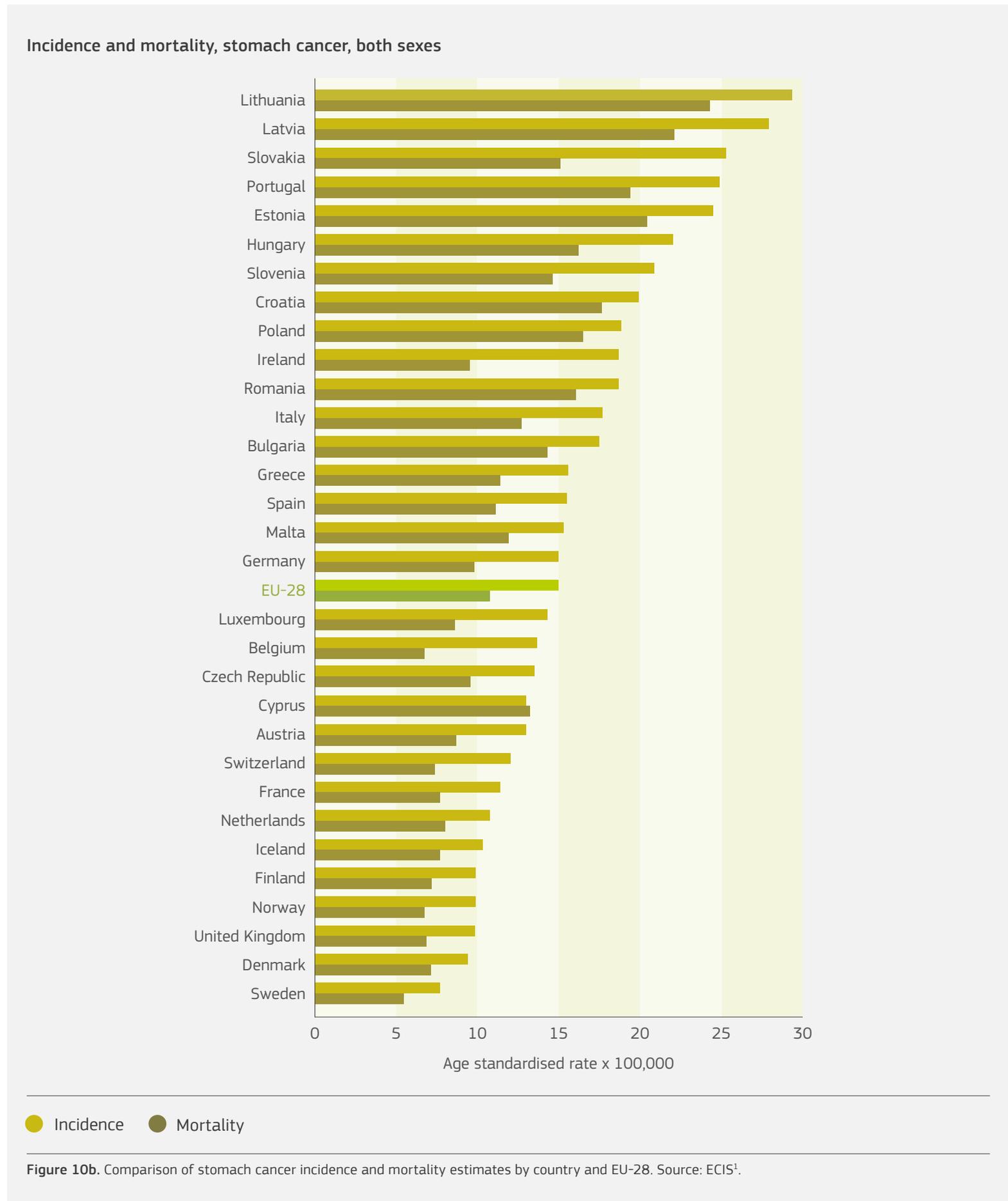
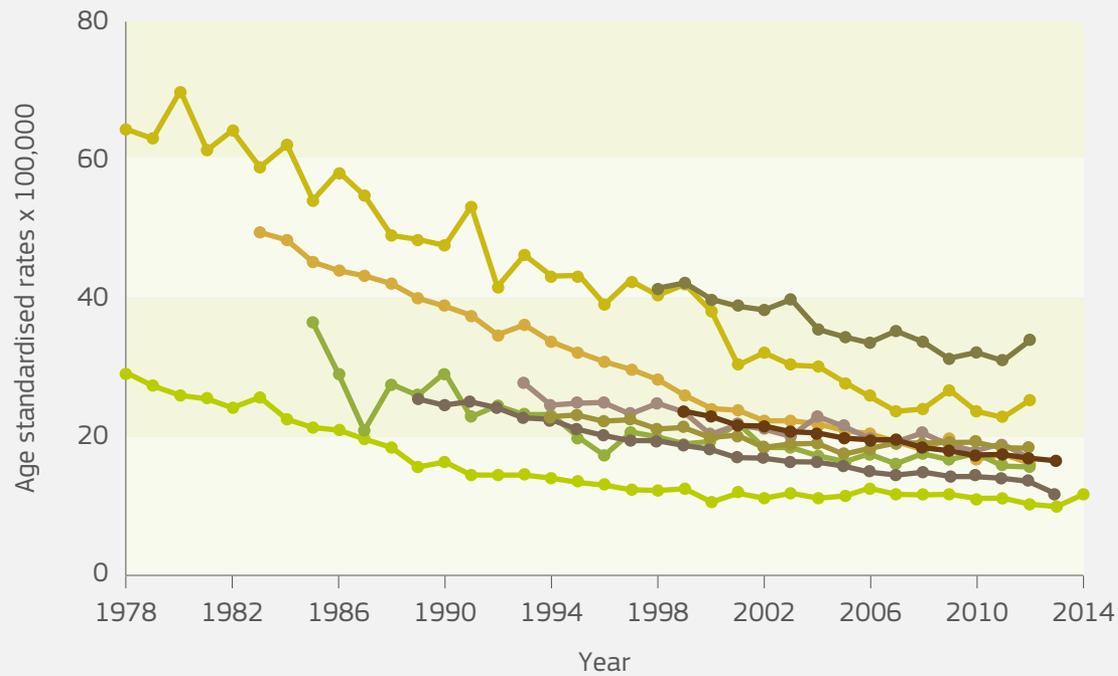


Figure 10a. Estimated age-standardised rates (according to the European new standard population), per 100,000 people, for stomach cancer incidence (left) and mortality (right) for both sexes, for 2018. The countries are colored within a range from the minimum to the maximum estimated rates.

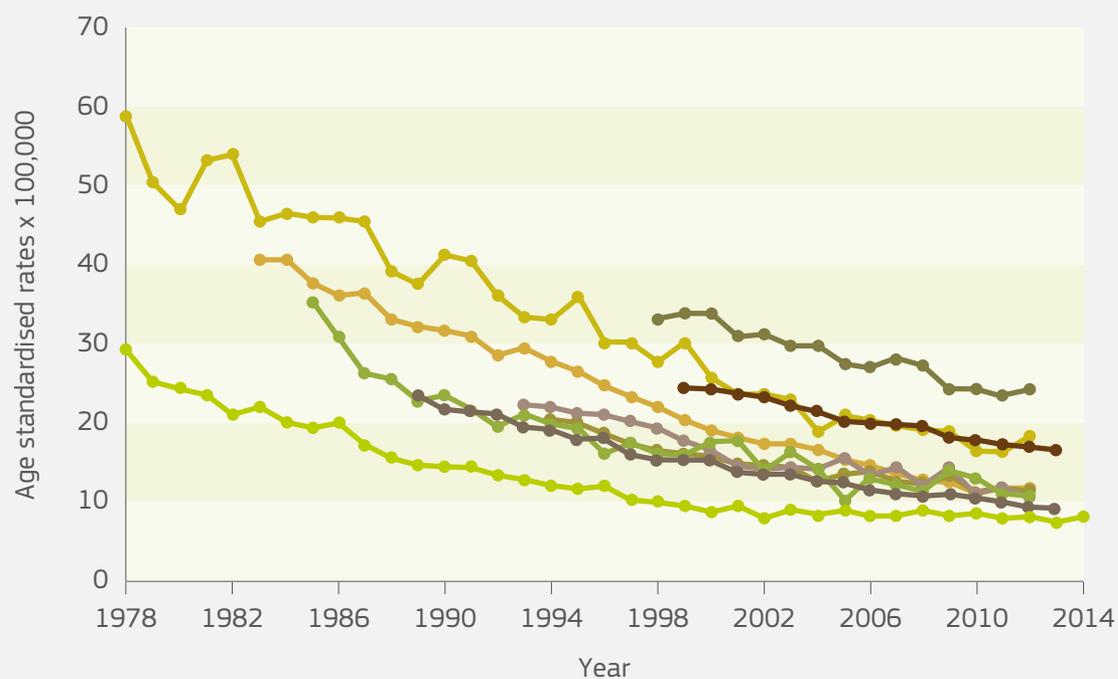


Recent estimates predict that around 80,000 new cases of stomach cancer will be diagnosed in 2018 in the EU-28/EFTA countries, placing stomach cancer as the 13th most commonly diagnosed cancer and the 7th most frequent cause of cancer deaths, in both sexes¹. This contrasts with the last 2012 estimates when stomach cancer was placed as the 7th most diagnosed cancer and the 5th most frequent cause of cancer death.

Time trends Incidence, stomach cancer, both sexes



Time trends Mortality, stomach cancer, both sexes



- Austria ● Germany, Saarland ● Denmark ● Spain ● Ireland
- Italy ● Lithuania ● Netherlands ● Poland

Figure 11. Time trends of age-standardised rates (according to the European new standard population), per 100,000 people, for stomach cancer incidence (upper panel) and mortality (lower panel) from selected PBCRs. The entire period available is displayed. Source: ECIS¹.

A remarkable decline in the incidence rates of stomach cancer has been recorded by PBCRs in almost all countries, which is reflected in a similar decline in mortality (Figure 11).

Reasons for this decrease are probably due to improvements in dietary patterns and standards of living and control of *Helicobacter pylori* infection.

Conclusion

The Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on Action Against Cancer; European Partnership (COM/2009/0291)³ acknowledges that:

‘European comparisons have brought to light considerable differences in cancer survival in the EU between countries with similar levels of wealth and health care provision. As a result, a number of Member States, which reported relatively high cancer mortality in the early 1990s have reviewed and subsequently reformed their national cancer policies, and are today reporting improved cancer survival. By developing a European benchmark for best practice, there is in other words considerable scope for addressing health inequalities. Thus, sharing relevant information for statistical purposes is essential for developing effective public health interventions and the European benchmarking process.’

Population-based cancer registries undertake a crucial task on a daily basis of recording new cancer cases or updating existing ones with new clinical information, to build comprehensive data repositories that can inform regional or national health authorities on important cancer indicators such as incidence, prevalence, survival and mortality. The European Cancer Information System provides an added value of leveraging cancer indicators at European level. Regions in different countries sharing similar socio-economic characteristics may be identified and cancer indicators compared, thus prompting key questions on the aetiology of certain types of cancer or allowing comparison of best practices in prevention, diagnosis or treatment interventions.

Acknowledgements

We would like to acknowledge all the ENCR Population-based Cancer Registries who provided the data to the ENCR-JRC project on Incidence and Mortality in Europe. A comprehensive list of the PBCRs and the time period of their data submitted to the project can be found in the ECIS https://ecis.jrc.ec.europa.eu/info/registries_encr.php.

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