

Tobacco smoking in countries of the European Union

Witold Zatoński¹, Krzysztof Przewoźniak¹, Urszula Sulkowska¹, Robert West², Andrzej Wojtyła³

¹ Cancer Center and Institute of Oncology, Cancer Epidemiology and Prevention Division, Warsaw, Poland

² University College London, Department of Epidemiology and Public Health; Cancer Research UK Health Behaviour Unit, Tobacco Studies, London, UK

³ Department of Health Promotion, Food and Nutrition, Institute of Rural Health, Lublin, Poland

Zatoński W, Przewoźniak K, Sulkowska U, West R, Wojtyła A. Tobacco smoking in countries of the European Union. *Ann Agric Environ Med.* 2012; 19(2): 181-192.

Abstract

Background: Existing smoking prevalence comparisons between the 'old' and 'new' members of the European Union (EU) give a misleading picture because of differences in methodology. A major EU project designed to find ways of closing the health gap between the member states, included the first ever comparison of smoking prevalence between these countries using a methodology that minimises potential biases.

Methods: A detailed analysis of methods and data from the most recent nationwide studies was conducted in the adult population of 27 countries of the European Union and Russia as an external comparator. To maximise comparability, daily smoking in the age range 20-64 was used. Prevalence of current daily smoking, former smoking and never smoking were age-standardised and calculated separately for males and females.

Findings: The European map of smoking prevalence shows that male smoking prevalence is much higher in the new than the old members of the EU, whereas in females the reverse is true, but there are also very large differences in smoking rates between particular countries within the same region. Sweden clearly has the lowest prevalence, and the prevalence in the United Kingdom (UK) at the time of the surveys emerges as near the average for old-Europe but higher than, for example, Ireland.

Interpretation: Restricting the analysis to daily smokers aged 20-64 produces a map of Europe in which variation in prevalence between individual countries within regions is as important as variation across regions. Survey methods need to be harmonised across countries to enable comparisons involving all ages and non-daily as well as daily smokers.

Key words

tobacco smoking, European Union

INTRODUCTION

The tobacco epidemic is one of the major public health challenges in Europe. In the WHO European region, smoking is responsible for 1.6 million premature deaths [1]. In the enlarged European Union (EU25), smoking kills more than 650,000 people every year [2] and 13 million Europeans currently suffer from tobacco-related chronic diseases. The annual economic cost of smoking in EU25 countries is somewhere between 97.7-130.3 billion Euros [3].

The 'tobacco epidemic' is at a different stage in the 'old' members of the European Union (EU15) than in 'new' EU countries (EU10), mainly from Central and Eastern Europe [4]. Although the absolute number of premature deaths caused by smoking is still much higher in Western Europe, smoking-attributable deaths as a proportion of all premature deaths is larger in the EU10 countries, especially among the male population (37% in EU10 vs. 29% in EU15) [2]. It is important to obtain accurate information about smoking prevalence in European countries in order to determine the extent of the problem, track changes over time, and assess

how far national tobacco control activities are associated with lower prevalence. Unfortunately, the current available figures [1, 4] can be misleading because they are based on simple comparisons between surveys that have adopted very different methodologies over different age ranges, and using different ways of defining what is a smoker. The presented study sought to address problems of comparability by, as far as is possible, using data from existing surveys, and present a more accurate picture of smoking prevalence across Europe.

Data on *per capita* consumption show that the tobacco epidemic occurred first in Western Europe after World War I, reaching a peak in the 1960s [3, 4, 5]. In Eastern Europe, the epidemic began one generation later (after World War II), and the highest *per capita* consumption of cigarettes occurred in the 1980s [5, 6]. A major European project called 'Closing the Gap' (www.hem.waw.pl) sought to describe differences between the EU15 and EU10 countries in terms of morbidity and mortality, and to examine what can be done to reduce the morbidity and mortality gap, with particular reference to modifiable lifestyle factors, of which smoking is clearly one of the most important [7]. The data reported here were analysed as part of this project. The aims were: 1) to obtain detailed information on the methodologies used in national surveys, and 2) to provide prevalence estimates using data that offered the greatest comparability.

Address for correspondence: Witold Zatoński, Cancer Center and Institute of Oncology, Cancer Epidemiology and Prevention Division, 5 Roentgena Street, 02-781 Warsaw, Poland.
E-mail: canepid@coi.waw.pl

Received: 10 May 2012; accepted: 10 June 2012

MATERIAL AND METHOD

Study aim and approach. The research aimed to quantify differences in smoking prevalence between the new European Union members (EU10) from Central and Eastern Europe (CEE), old members of the European Union (EU15) and two Mediterranean countries (Cyprus and Malta) that became EU members in 2004. The EU10 countries are: Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. The EU15 countries are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, the United Kingdom. For comparison, data on smoking prevalence in Russia, were added to the database.

In each country, the most recent studies were identified that could be considered as providing data representative of the whole country (see references in Tab. 1). Studies based on nationwide representative samples of the adult population were the focus. Because some countries only collected data on daily cigarette smoking and excluded non-daily smokers, the presented study was restricted to this parameter. Smoking prevalence was calculated, stratified by gender and age group.

Comparison of study methodologies. Table 1 presents methodological details of the surveys conducted in each country.

Study years. For most countries, the data come from 2002 or nearest years (2001 and 2003). However, in some cases,

more recent data were available and in others the data dated back to the 1990s. For Belgium, data were aggregated from the 2001 and 2004 study databases.

Populations. The surveys involved representative samples of the adult population; however, different age ranges were used (12-74, 13+, 15+, 15-84, 16+, 16-64, 18+, 20-64, 25+). To facilitate comparison, we included data only for age ranges that were present in all surveys.

Data source. Except for Portugal, where a community sample (city of Porto) was drawn from the telephone numbers database (Tab. 1), in most of the countries samples were taken from national population registers or postcode addresses and inhabitants registers. In three countries, surveys used data from electoral polls. For seven countries, the data were based on census studies. Information on source of study data was not available for three countries.

Sampling method and size. Sampling involved some form of random selection in all analysed studies. However, detailed information on the precise method of sampling and social strata was only available for 11 countries. In these countries, survey samples were selected in proportion to the general adult population by gender, age, education, and location. Sample sizes differed considerably. It was the largest in the microcensus studies in Germany (60,165 respondents) and Austria (44,193) and the smallest in Slovakia (847) and Slovenia (1,093).

Interviewing method. In most of the surveys, respondents were interviewed by face-to-face structured questionnaire. In the Baltic States, Finland and Ireland, studies were conducted as postal surveys with reminders after one month.

Table 1. Methodological status of analysed surveys on smoking in Europe

Country	Study name and year	Population age	Data source	Nation-wide/local	Study type	Gross sample size	Net sample size (response ratio)	Sampling method	Publication
Austria	Microcensus 1997	15+	Census	Nation-wide	Face-to-face survey	48947	44193 (90.3%)	Random stratified by NUTS 2 region	Domestic research report
Belgium	Health Interview Survey 2001, 2004	15+	National Population Register in 2001 and in 2004	Nation-wide	Face-to-face / self-completed questionnaires	2001: 12050 2004: 12600	2001: 9327 (77.4%) 2004: 9105 (72.3%)	Stratified clustered multi-stage sampling design, with a replacement scheme for non-participating households	Bayingana K, et al. Enquête de Santé par Interview, Belgique, 2004 - Synthèse Institut Scientifique de Santé Publique, Janvier 2006
Bulgaria	Health survey of Bulgarian Population 2001	15+	Postcode Address and Inhabitants Register	Nation-wide	Face-to-face survey	10122	9396 (92.8%)	Two-stage proportionate stratified random sample; first stage – random selection of clusters, second stage – random selection of respondents	Census of Population, Housing and Farm Lands. Volume 6. Representative surveys. Book 4. Health Survey of Population. National Statistical Institute, Sofia, Bulgaria 2002
Cyprus	Health Interview Survey 2003	15+	Population Census 2001	Nation-wide	Computer-assisted personal interview	6179	5617 (90.9%)	Two-stage simple systematic random sample stratified by place of living (urban/rural) and socio-economic class	Alpert HR et al. Strategic Plan for Tobacco Control in Cyprus. Cyprus International Institute for Environment and Public Health 2006
Czech Rep.	Health Interview Survey 2002	15+	Central population registry	Nation-wide	Face-to-face survey	3500	2475 (70.7%)	Proportional, random sample stratified by geographic area	HIS CR 2002 Sample Survey of the Health Status of the Czech Population 2002, Institute of Health Information and Statistics of Czech Republic, Prague 2004
Denmark	Annual survey on smoking habits in Denmark, 2002	13+	Population Register	Nation-wide	Telephone interview	4200	2985 (71.1%)	Random sample stratified by gender, age and geographical area, proportional sampling	Research report on the web www.sst.dk/Forebyggelse/Alkohol_narkotika_og_tobak/Tobak

Table 1 (Continuation). Methodological status of analysed surveys on smoking in Europe

Country	Study name and year	Population age	Data source	Nation-wide/local	Study type	Gross sample size	Net sample size (response ratio)	Sampling method	Publication
Estonia	Health Behaviour Study among Estonian Population 2004	16-64	National population register	Nation-wide	Mail survey	5000	2904 (58.1%)	Simple random sample, not stratified	Helasoja V, et al. Determinants of daily smoking in Estonia, Latvia, Lithuania, and Finland in 1994-2002. Scand J Public Health 2006;34(4):353-62; National Institute for Health Development. Health Behaviour Among Estonian Adult Population in 2004, Tallinn 2005
Finland	Health Behavior and Health among Finnish Adult Population 2003; Health Behaviour among the Finnish Elderly 2003	15-64	National population register	Nation-wide	Mail survey	5000	2747 (54.9%)	Random	Helasoja V, et al. Determinants of daily smoking in Estonia, Latvia, Lithuania, and Finland in 1994-2002. Scand J Public Health 2006;34(4):353-62; Helakorpi S, Patja K, Prättälä R, Aro AR, Uutela A. Health Behaviour and Health Among Finnish Adult Population, Spring 2002. National Public Health Institute. Publications B 12/2002, Helsinki 2002
France	"Barometre sante" 2004/2005	12-75	Census 1999	Nation-wide	Telephone survey	30000	28640 (95.5%)	Random sample (no data on sample stratification and methods)	A chapter of the INPES published : Barometre santé 2005, 1st results (March 2006)
Germany	Microcensus 2003	15+	Census data (micro)	Nation-wide	Face-to-face survey	70363	60165 (85.5%)	Random sample of households	Thamm, M. Tabak - Zahlen und Fakten zum Konsum. In: Deutsche Hauptstelle für Suchtfragen (ED.). Jahrbuch Sucht 2005. pp. 29-51
Greece	European Prospective Investigation into Cancer and nutrition (EPIC) 1994-1999	25+	General population	Nation-wide	Interviewer-administered questionnaires	28000	27869 (99.5%)	No data	Riboli E, Hunt KJ, Slimani N, Ferrari P, Norat T, Fahey M, et al. European Prospective Investigation into Cancer and Nutrition (EPIC): study populations and data collection. Public Health Nutr 2002; 5(6B): 1113-24
Hungary	National Health Interview Survey 2003	18+	Election registry of the Central Data Processing	Nation-wide	Face-to-face survey	7000	5012 (71.6%)	Two-stage, weighted random sampling stratified by counties; poststratification by gender, age and settlement size	Boros J, et al.(2004) National Health Interview Survey 2003 – Hungary. National Center for Epidemiology, Budapest
Ireland	The Irish National Survey on Lifestyles, Attitudes and Nutrition 2002	18+	Electoral Register	Nation-wide	Self-completed questionnaires	11212	5992 (53.4%)	Multistage sample, draw by district electoral division and stratified by locality and gender	The National Health and Lifestyle Survey 2003: Regional Summary Report and Regional Results of SLAN & HBSC 2003
Italy	Annual survey on smoking in Italy 2005	15+	Electoral rolls	Nation-wide	Computer assisted personal in-house interview	No data	3114	Random sample stratified by gender and geographic areas	Gallus S, et al., A tax to prevent the epidemic of lung cancer. Lancet 2005;366:288
Latvia	Health Behaviour Study among Latvian Population 2002	15-64	National population register	Nation-wide	Mail survey	3000	2029 (67.6%)	Random sample stratified by age and place of living	Helasoja V, et al. Determinants of daily smoking in Estonia, Latvia, Lithuania, and Finland in 1994-2002. Scand J Public Health 2006;34(4):353-62; Pudule et al. Health Behaviour Among Latvian Adult Population, 2004. National Public Health Institute, Helsinki 2005
Lithuania	Health Behaviour Study among Lithuanian Population 2002	20-64	National population register	Nation-wide	Mail survey	3000	1883 (62.8%)	Random sample (no data on sample stratification and methods)	Helasoja V, et al. Determinants of daily smoking in Estonia, Latvia, Lithuania, and Finland in 1994-2002. Scand J Public Health 2006;34(4):353-62; Grabauskas V, et al. Health Behavior Among Lithuanian Adult Population 2002. National Public Health Institute, Helsinki 2003

Table 1 (Continuation). Methodological status of analysed surveys on smoking in Europe

Country	Study name and year	Population age	Data source	Nation-wide/local	Study type	Gross sample size	Net sample size (response ratio)	Sampling method	Publication
Luxembourg	Le tabagisme au Luxembourg Bilan 2002	15+	No data	Nation-wide	Face-to-face survey	No data	3884	Random sample stratified by nationality (no data on sampling method)	Le tabagisme au Luxembourg Bilan 2002. Fondation luxembourgeoise Contre le Cancer, 2002
Malta	Health Interview Survey 2001/2002	15+	National ID Card Register	Nation-wide	Face-to-face survey	5500	4249 (77.3%)	Weight stratified sample, based on age, gender, locality of address	Report on the web www.sahha.gov.mt
Netherlands	The Continuous Survey of Smoking Habits (CSSH) 2002	15+	Omnibus Internet survey	Nation-wide	Omnibus internet survey	No data	18212	Two-stage random sample; first stage – selection of households, second stage - selection of respondents (two per household); no data on sampling stratification	No data
Poland	Public opinion surveys conducted in 2002	15+	Postcode address and inhabitants register	Nation-wide	Face-to-face survey	2003	2003	Random-route sample of households stratified by place of living, see footnote * in the text	Zatoński W. Tobacco smoking in Central European countries: Poland. In: Boyle P., Gray N., Henningfield J., Sefrin J., Zatoński W.: Tobacco and Public Health: Science and Policy. Oxford University Press 2004, 235-252; Zatoński et al. Tobacco smoking in male and female population, Poland 1974-2004. Zeszyty Naukowe Ochrony Zdrowia. Zdrowie Publiczne i Zarządzanie 2009;7(2):4-11 (in Polish)
Portugal	Health and Nutrition Survey	18+	Telephone numbers database	Local (Porto)	Face-to-face survey	2414	1690 (70.0%)	Two-stage random sample; first stage - random digit dialling for recruitment of households, second stage - random selection of adult respondents	Santos A.C., Barros H., Smoking patterns in a community sample of Portuguese adults, 1999-2000, Preventive Medicine 2004;38:114-119
Romania	Health Status of population in Romania 2001	15+	Census of population and dwellings 1992	Nation-wide	Face-to-face survey	9824	9018 (91.8%)	Two-stage random sample stratified by geographical area	Health Status of population in Romania, National Institute of Statistics, Bucharest 2001
Slovakia	Health Monitor Survey 2002	15+	No data	Nation-wide	Face-to-face survey	No data	847	Random	No data
Slovenia	Slovenian Public Opinion Survey 2001	15+	Central Population Register of Slovenia	Nation-wide	Face-to-face survey	1100	1093 (99.4%)	Two-level sampling- on the first level areas stratified per 12 statistical regions and 6 types	Toš N, et al. Vrednote v prehodu III: Slovensko javno mnenje 1999-2003. IDV-CJMMK, Ljubljana, 2004
Spain	National Health Interview Surveys (NHIS) 2003	16+	Census data 2002	Nation-wide	Face-to-face survey	22000	21655 (98.4%)	Multistage and stratified sampling (first stage with 7 strata according to municipality size)	Raport available in web www.ine.es
Sweden	Living conditions survey (ULF) 2004	15+	No data	Nation-wide	Face-to-face survey	No data	5575	Random	No data
UK	General Household Survey 2002	15+	Postcode Address Register	Nation-wide	Face-to-face survey	20149	14789 (73.4%)	Probability, stratified two-stage sample design of (1) postcode sectors and (2) household addresses within those sectors;	Office for National Statistics. Social Survey Division, General Household Survey, 2002-2003 4th Edition. Colchester, UK Data Archive 2006
Russia	Living conditions, Lifestyles & Health 2001	18+	Census	Nation-wide	Face-to-face survey	5488	4006 (73.0%)	Multi-stage random sampling with stratification by region and area (rural/urban settlement types)	Gilmore A, et al. Prevalence of smoking in 8 countries of the former Soviet Union: results from the living conditions, lifestyles and health study. Am J Public Health 2004;94(12):2177-87

In Denmark and France, telephone interviews were used. In Greece, both self-administered questionnaires and telephone interviews were administered.

Response rate. In face-to-face interview surveys, response rates varied between 71% in Czech Republic and 93% in Bulgaria. In telephone interview surveys, response rates were similar to the lowest response rates in a face-to-face interview survey (71% in Denmark). The lowest response rates were found for mail surveys and varied from 55% in Finland to 68% in Latvia. In Poland, random-route¹ sampling was used in the face-to-face interview survey.

Analytical methods. Smoking categories. Following WHO recommendations, three smoking categories (current, former and never smokers) were used [8]. As already noted, consideration of current smokers to daily smokers had to be restricted. Former smokers were those who had previously smoked daily for at least six months. Never smokers consisted of people who had never smoked in the past or smoked occasionally. Current occasional smokers were included in the 'never smoking' category. In most of the countries where information was available, they were a very small proportion of the population, usually less than 5%.

Statistical analysis. Analysis of smoking status was limited to respondents between the ages of 20-64 because this

was the common age range for all the studies. In addition, the prevalences of current, former and never smoking were age-adjusted using the world standard population [9]. The analyses were undertaken separately for males and females.

RESULTS

Current smoking. Males aged 20-64 years (Fig. 1). In the European Union (EU25) more than one third of men are current smokers (37.0%). This rate is substantially higher in EU10 (42.7%) than in EU15 countries (35.5%). The external reference country, Russia, had the highest current smoking rate (66.2%) which was around 10 percent points above the EU country on the list with the highest prevalence (Latvia), and four times higher than for the lowest smoking rate in Europe (Sweden). However, there was considerable variation in prevalence within regions with countries in EU15 (Greece, Portugal) having higher rates than the average for EU10, and conversely, countries in EU10 having lower prevalence than the average for EU15 (Slovenia).

Females aged 20-64 years (Fig. 1). In EU25 the average prevalence of current smoking among the female population was 26.9%. This rate was slightly higher in EU15 countries (27.4%) than EU10 countries (24.8%). In contrast to the pattern of smoking in the male population, differences in current smoking in women between EU10 and EU15 countries were small. Variability within a region was much greater than across regions. In Russia, the prevalence of smoking was one of the lowest in Europe: comparable with that observed in Finland and Sweden.

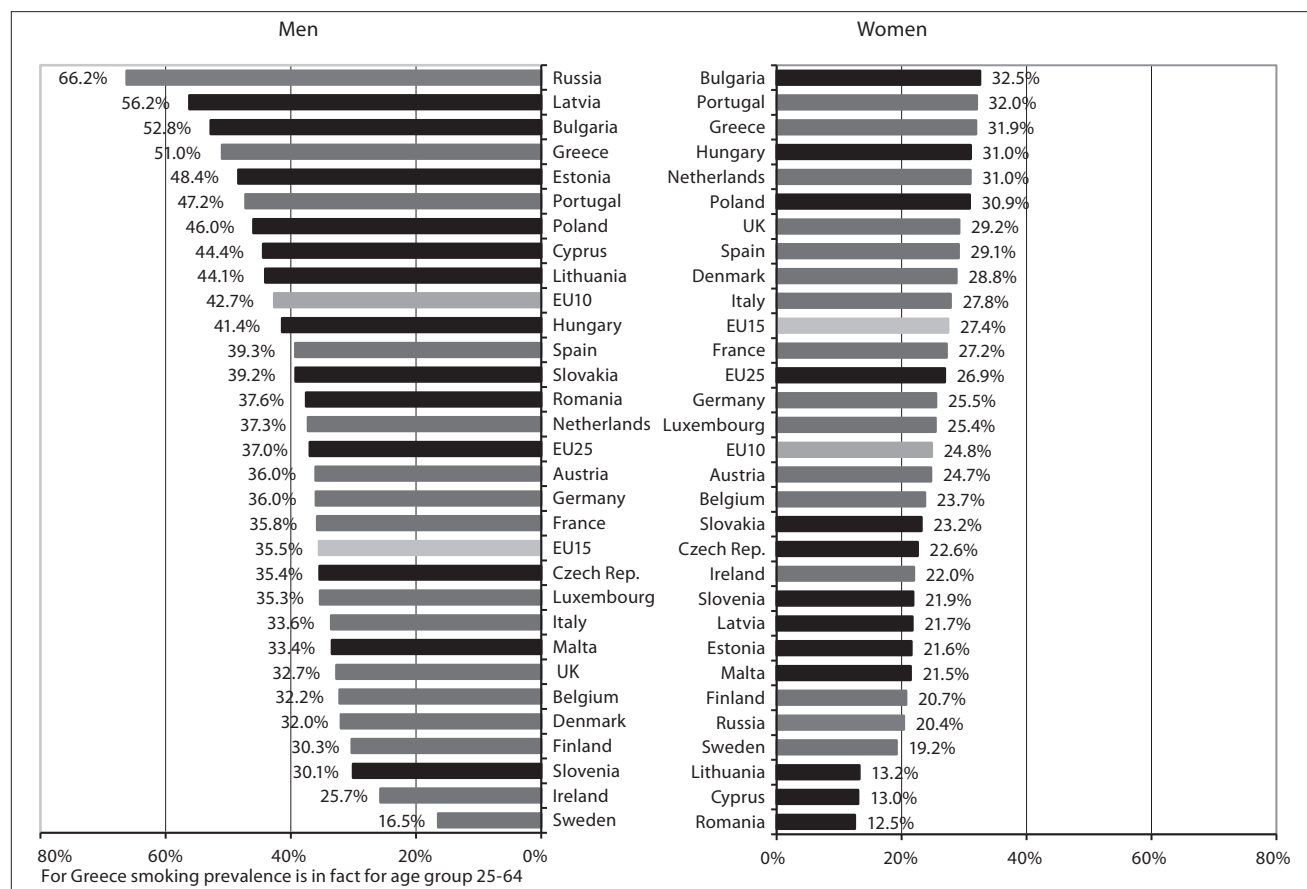


Figure 1. Smoking prevalence in Europe (weighted by world standard population), current smokers aged 20-64

Males aged 20-44 years (Fig. 2). In the European Union (EU25) almost 40% of men are current smokers (39.5%). This rate is substantially higher in EU10 (43.6%) than in EU15 countries (38.4%). Russia had the highest current smoking rate (69.4%), which was around 13 percent points above the EU country on the list with the highest prevalence (Latvia), and more than five times higher than for the lowest smoking rate in Europe (Sweden).

Females aged 20-44 years (Fig. 2). In EU25 the average prevalence of current smoking among the female population was 30.1%. This rate was higher in EU15 countries (31.2%) than EU10 countries (26.3%). The lowest prevalence of smoking was observed in Romania (13.4%), Cyprus (14.5%) and Lithuania (15.8%), comparable with that observed in Sweden (17.2%).

Males aged 45-64 years (Fig. 3). In the European Union (EU25) about one third of males are current smokers (32.7%). This rate is substantially higher in EU10 (41.0%) than in EU15 countries (30.5%). Russia had the highest current smoking rate (60.6%), which was almost three times higher than for the lowest smoking rate in Europe (Ireland).

Females aged 45-64 years (Fig. 3). In EU25 the average prevalence of current smoking among the female population was 21.3%. This rate was at similar level in EU10 (22.0%) and EU15 countries (21.0%). The lowest prevalence of smoking was observed in Lithuania (8.6%), Russia (9.4%) and Cyprus (10.4%).

Former smoking. Males aged 20-64 years (Fig. 4). In the European Union (EU25) more than one fifth of males are former smokers (20.9%). This rate is substantially lower in EU10 (17.8%) than in EU15 countries (21.7%). The highest

former smoking rate in males was found in Slovakia (30.2%). Luxembourg had the lowest rate (8.0%).

Females aged 20-64 years (Fig. 4). In EU25 the average prevalence of former smoking among the female population was 15.6%. This rate was substantially higher in EU15 countries (16.8%) than EU10 countries (11.2%). The highest former smoking rate in females was found in France (27.2%). In Cyprus, the prevalence of former smoking was extremely low, only 3.2%.

Males aged 20-44 years (Fig. 5). In the male population, the prevalence of former smoking in the EU25 was 13.8%. This rate is lower in EU10 (12.5%) than in EU15 countries (14.1%). The highest former smoking rate in males was found in Slovakia (22.6%). Luxembourg had the lowest rate (5.2%).

Females aged 20-44 years (Fig. 5). In the female population, the prevalence of former smoking in the EU25 was 13.5%. This rate was substantially higher in EU15 countries (14.5%) than EU10 countries (9.6%). The highest former smoking rate in females was found in France (22.9%). In Cyprus, the prevalence of former smoking was extremely low, only 3.3%.

Males aged 45-64 years (Fig. 6). In the male population, the prevalence of former smoking in the EU25 was 33.5%. This rate is substantially lower in EU10 (27.2%) than in EU15 countries (35.2%). The highest former smoking rate in males was found in France (46.2%). Luxembourg had the lowest rate (13.0%).

Females aged 45-64 years (Fig. 6). In the female population, the prevalence of former smoking in the EU25 was 19.5%. This rate was substantially higher in EU15 countries (21.1%) than EU10 countries (14.1%). The highest former smoking rate in females was found in the Netherlands (38.0%). In Cyprus, the prevalence of former smoking was extremely low, only 3.1%.

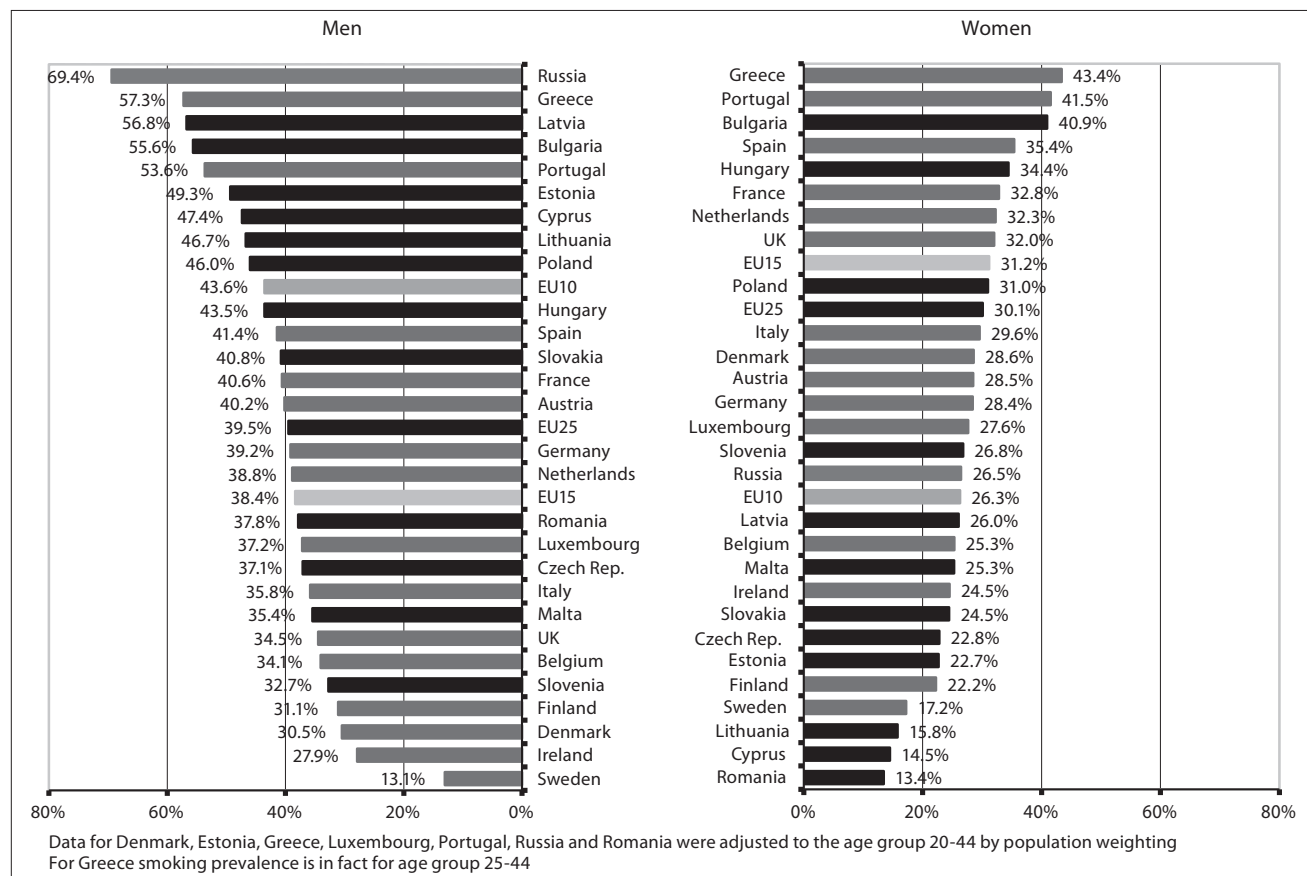


Figure 2. Smoking prevalence in Europe (weighted by world standard population), current smokers aged 20-44

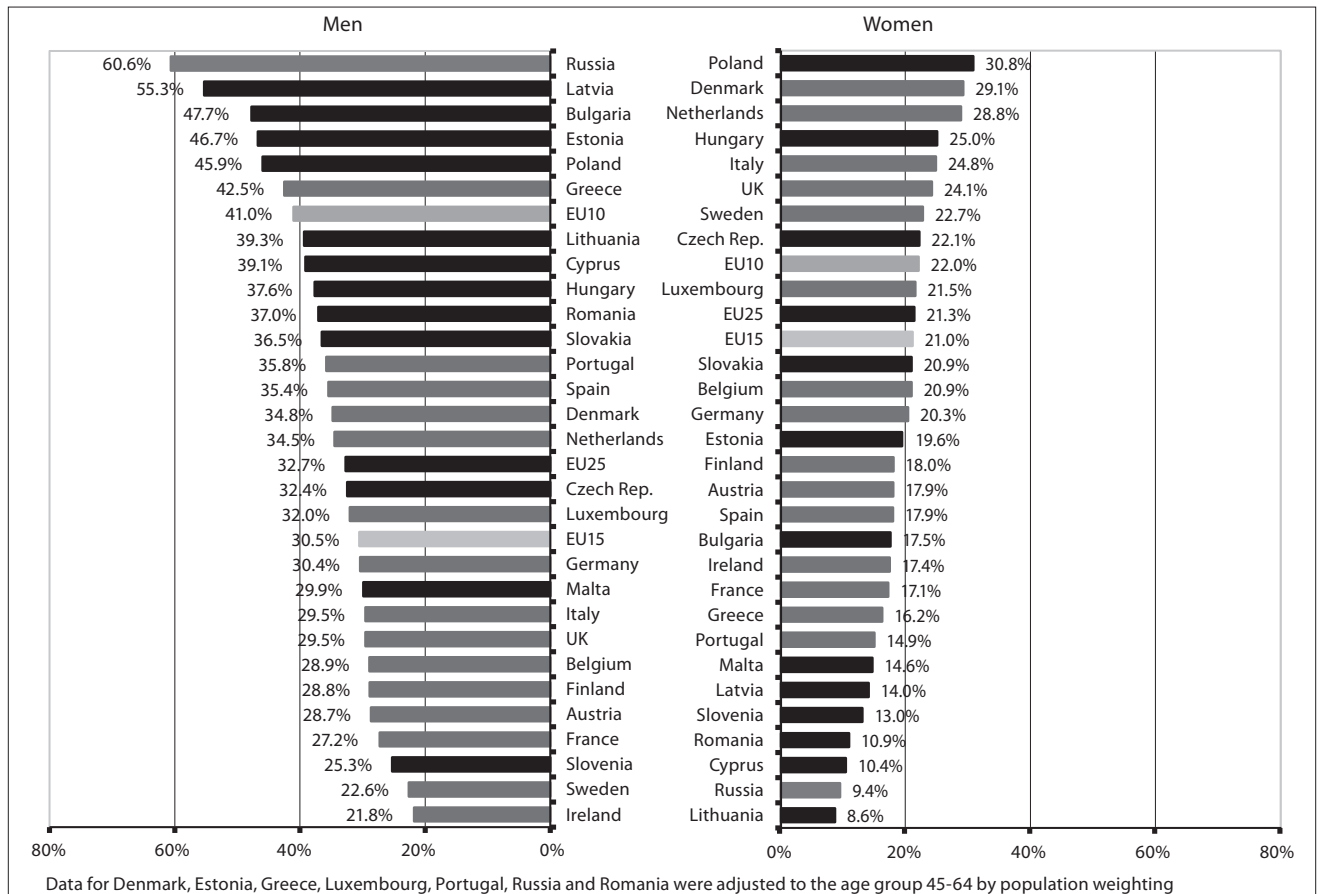


Figure 3. Smoking prevalence in Europe (weighted by world standard population), current smokers aged 45-64

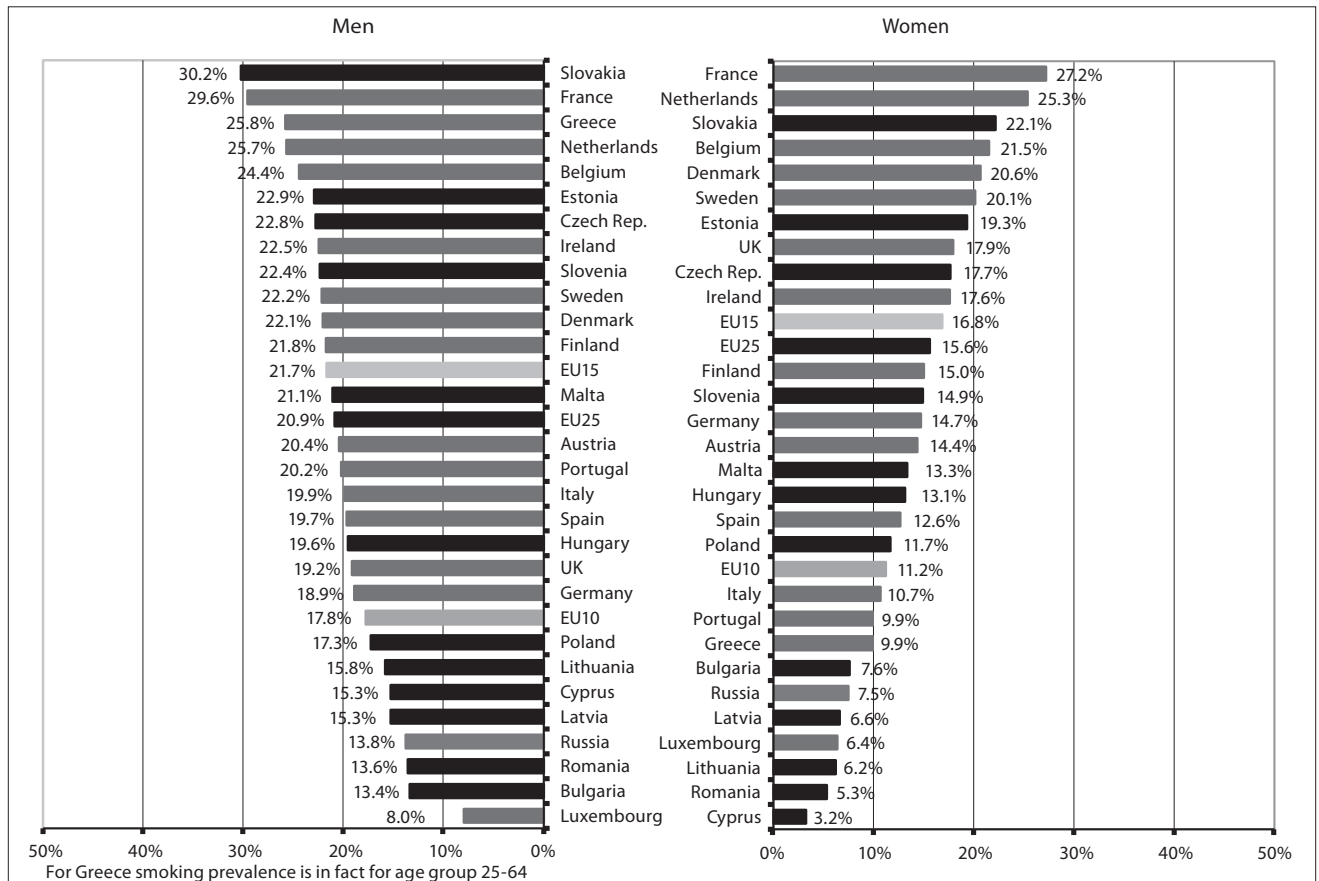


Figure 4. Smoking prevalence in Europe (weighted by world standard population), former smokers aged 20-64

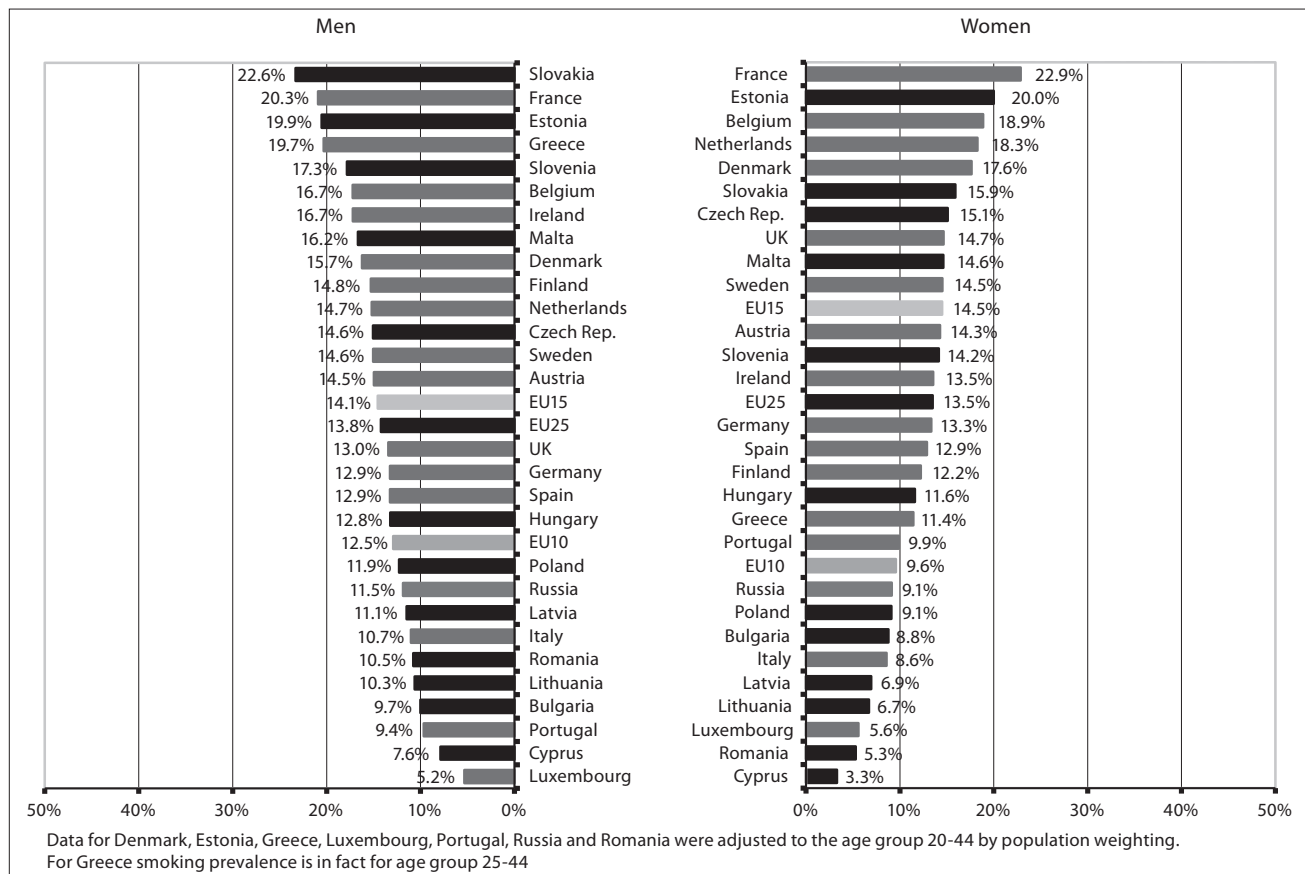


Figure 5. Smoking prevalence in Europe (weighted by world standard population), former smokers aged 20-44

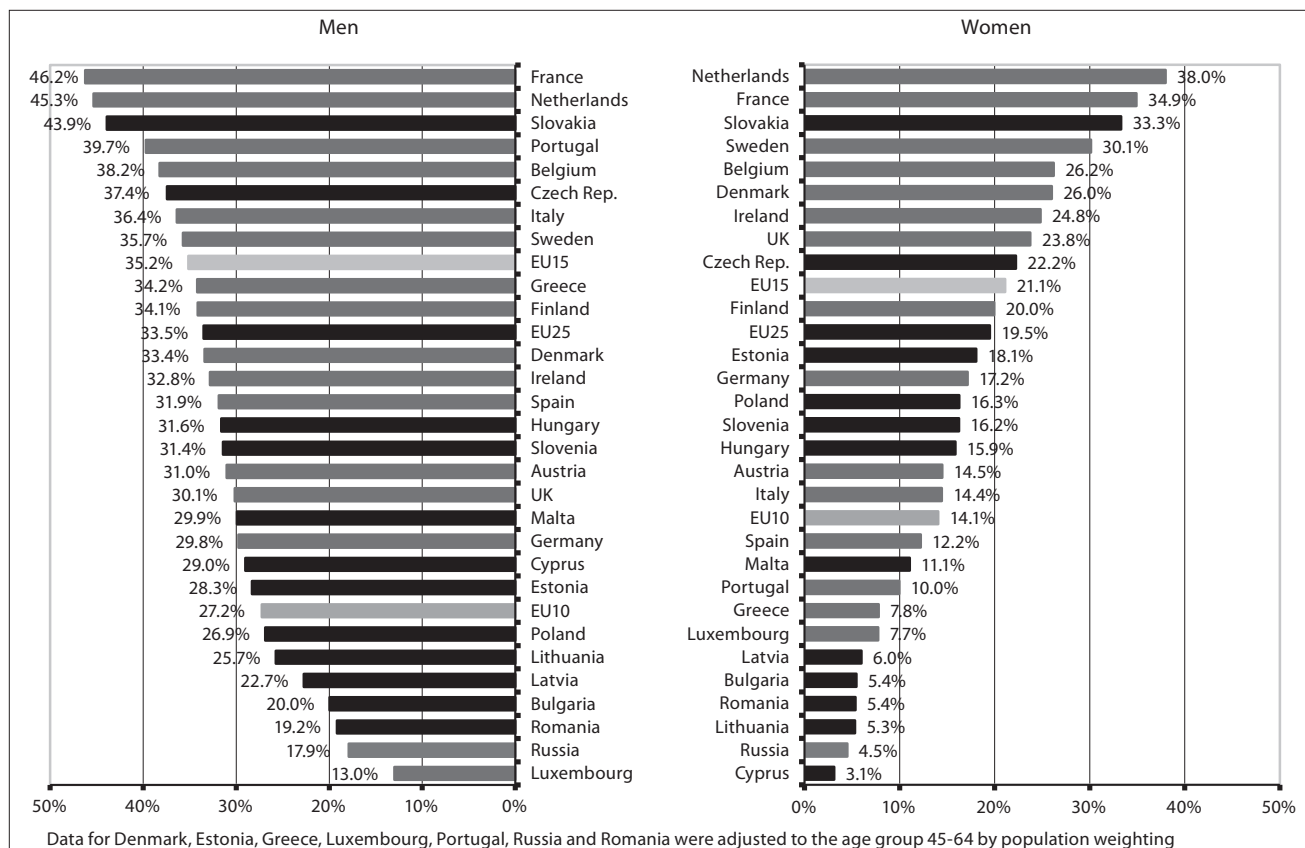


Figure 6. Smoking prevalence in Europe (weighted by world standard population), former smokers aged 45-64

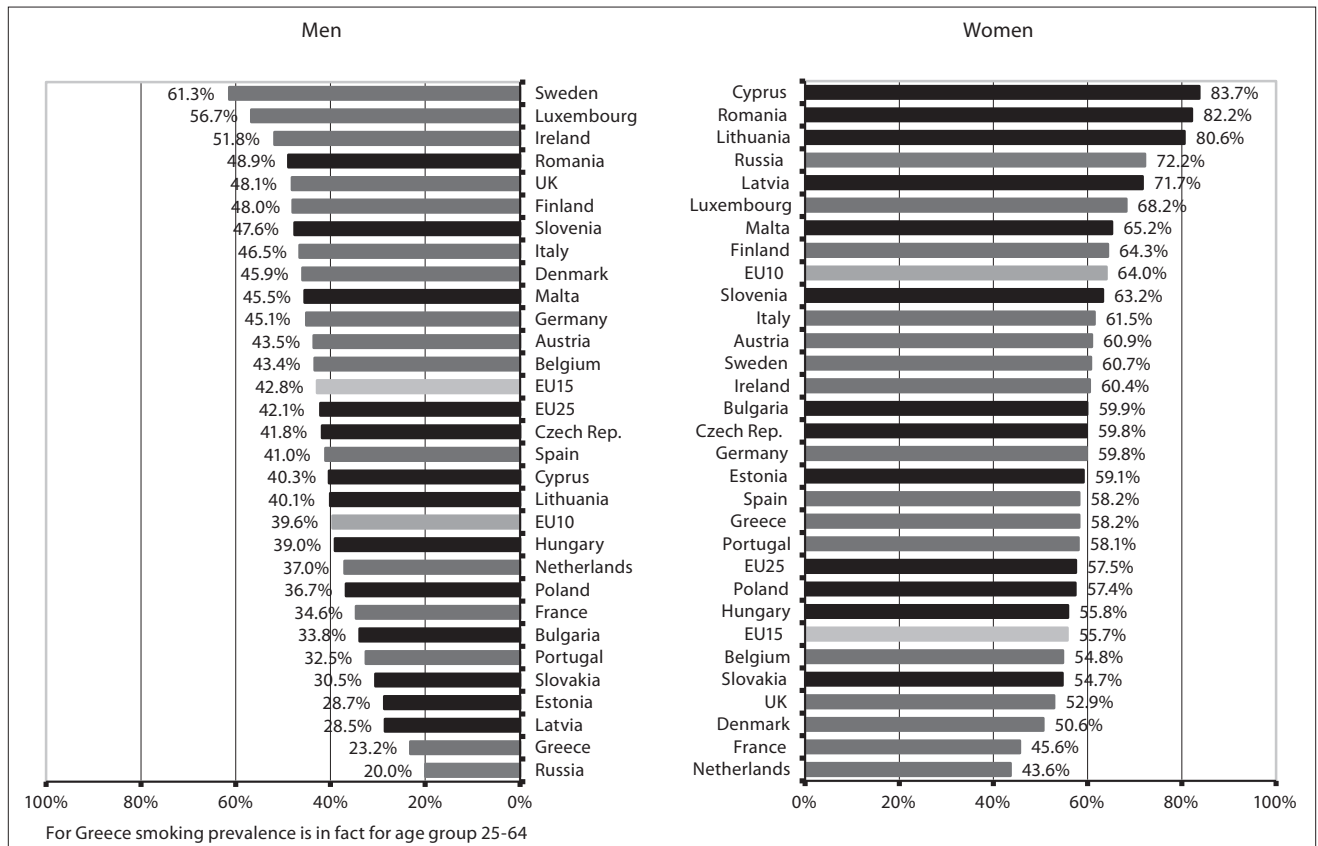


Figure 7. Smoking prevalence in Europe (weighted by world standard population), never smokers aged 20-64

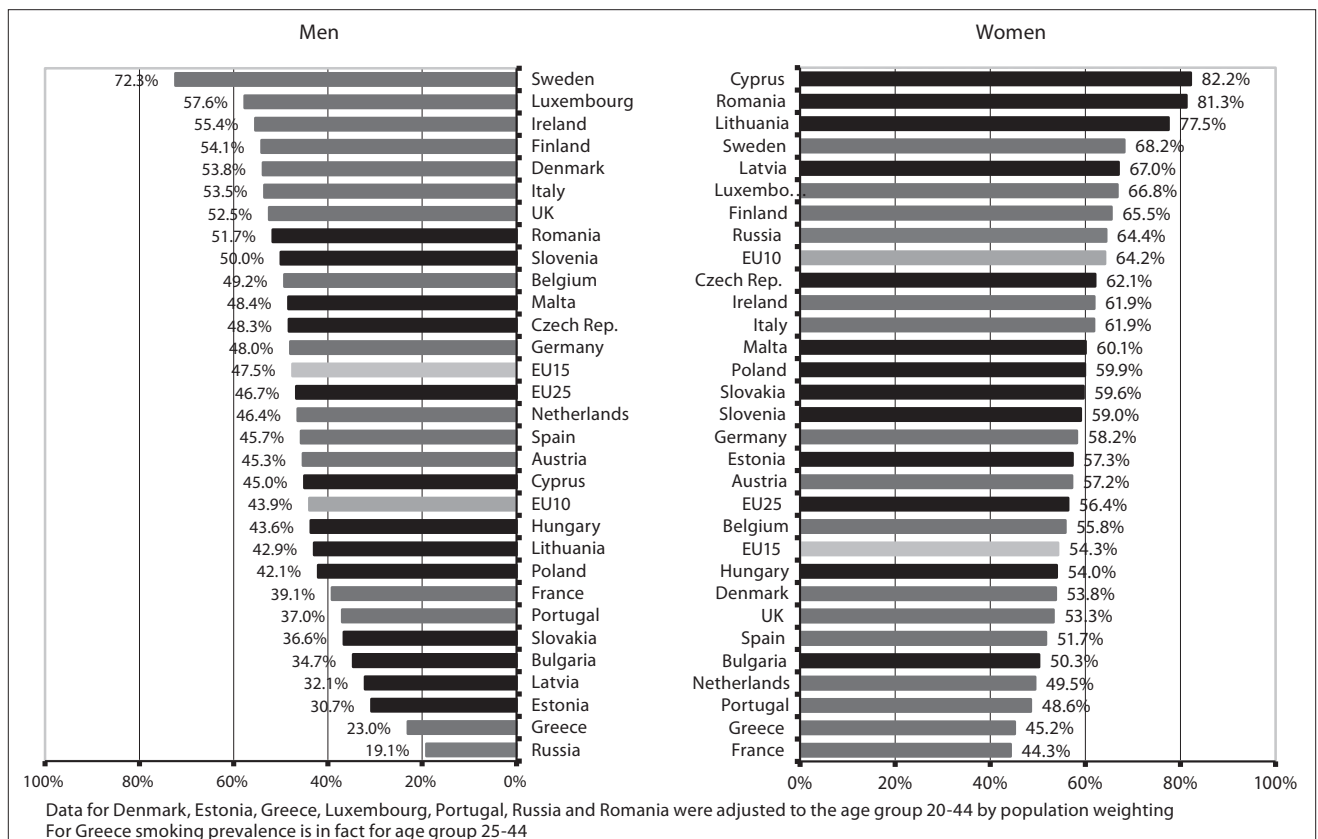


Figure 8. Smoking prevalence in Europe (weighted by world standard population), never smokers aged 20-44

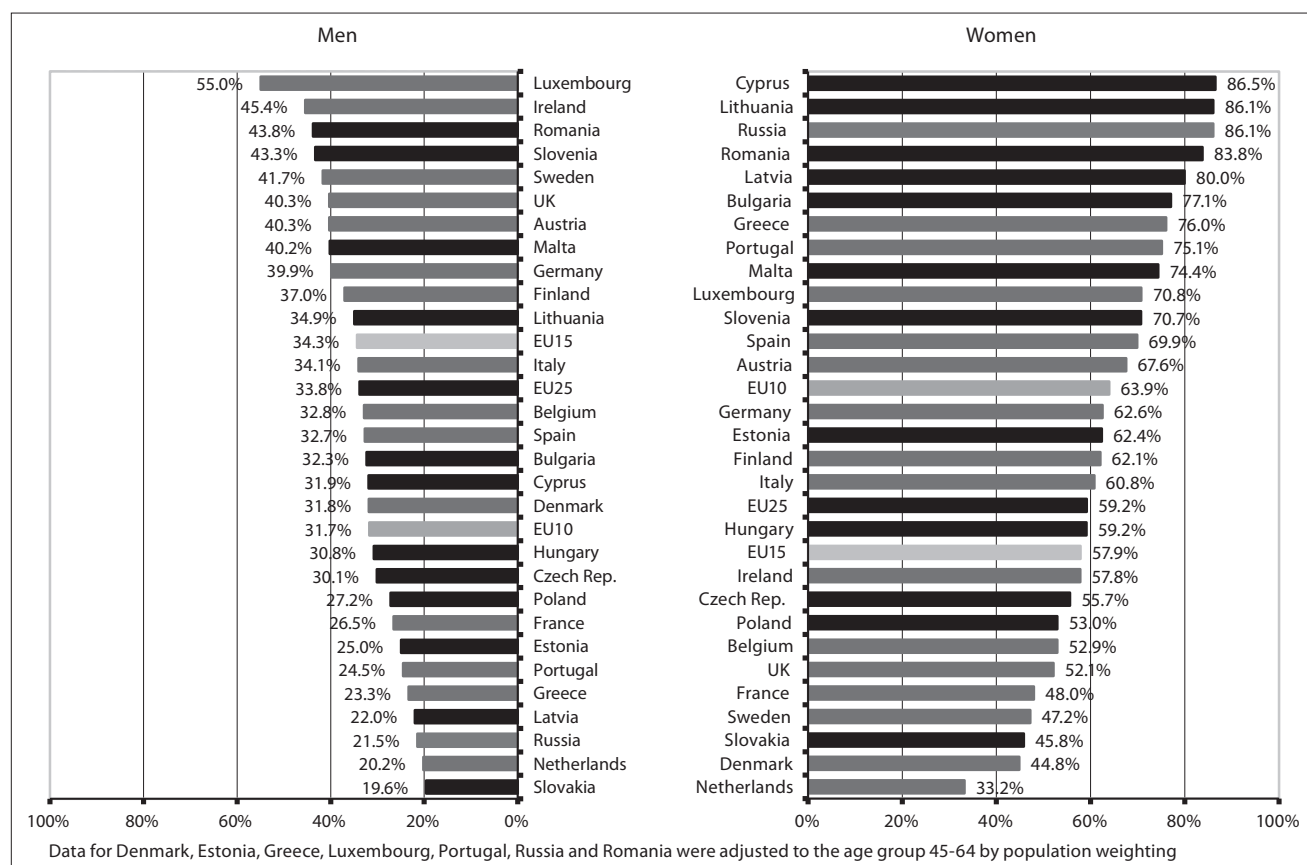


Figure 9. Smoking prevalence in Europe (weighted by world standard population), never smokers aged 45-64

Never smoking. Males aged 20-64 years (Fig. 7). In the male population, the prevalence of never smoking in the EU25 was 42.1%. There was little difference between the average prevalence of never smoking in EU15 (42.8%) and EU10 (39.6%). The highest never smoking rate in males was found in Sweden, where the rate is almost 1.5 times higher than the EU25 average. Russia had the lowest rate. In Greece, the rate is one of the lowest in Europe, more than 2.5 times lower than observed in Sweden, and very similar to the rate in Russian.

Females aged 20-64 years (Fig. 7). There are significant differences in female never smoking rates between old and new European Union states. In EU10 countries the average rate (64.0%) is almost 10 percent points higher than in EU15 countries (55.7%). The highest percentage of never smokers was in Cyprus, Romania and Lithuania. The Netherlands has the lowest female never smoking rate.

Males aged 20-44 years (Fig. 8). In the male population, the prevalence of never smoking in the EU25 was 46.7%. There was little difference between the average prevalence of never smoking in EU15 (47.5%) and EU10 (43.9%). The highest never smoking rate in males was found in Sweden (72.3%). Russia had the lowest rate (19.1%). In Greece, the rate is one of the lowest in Europe, more than three times lower than that observed in Sweden, and very similar to the Russian rate.

Females aged 20-44 years (Fig. 8). There are significant differences in female never smoking rates between old and new European Union states. In EU10 countries the average rate (64.2%) is 10 percent points higher than in EU15 countries (54.3%). The highest percentage of never smokers was in Cyprus, Romania and Lithuania. France has the lowest female never smoking rate.

Males aged 45-64 years (Fig. 9). In the male population, the prevalence of never smoking in the EU25 was 33.8%. There was little difference between the average prevalence of never smoking in EU15 (34.3%) and EU10 (31.7%). The highest never smoking rate in men was found in Luxembourg (55.0%). Slovakia had the lowest rate (19.6%). In the Netherlands, the rate is one of the lowest in Europe, almost three times lower than that observed in Luxembourg, and very similar to the Russian rate.

Females aged 45-64 years (Fig. 9). There are quite significant differences in female never smoking rates between old and new European Union states. In EU10 countries the average rate (63.9%) is six percent points higher than in EU15 countries (57.9%). The highest percentage of never smokers was in Cyprus, Lithuania and Russia. The Netherlands has the lowest female never smoking rate.

DISCUSSION

This study revealed several key findings:

- 1) the methods and samples used to assess smoking across the EU are very variable and raw comparisons of prevalence rates can be misleading;
- 2) when comparing like-with-like, as far as possible by limiting consideration to daily smoking and standardising on age distribution, some surprising results emerge, e.g. with Ireland being better than the UK in terms of both overall prevalence and smoking cessation rates;
- 3) for males, smoking prevalence is much higher in EU10 than EU15 countries, whereas for females there is little difference, but EU15 countries tend to have a higher prevalence;

4) there are very large differences within EU groupings, and Sweden clearly leads the way in terms of low smoking prevalence and cessation rates for both males and females.

The variability in survey methods is clearly a matter of concern and it must be an urgent priority to harmonise the data gathering procedures. This would not necessarily mean always using household surveys, but should involve bringing the standard of questioning, similar sampling methods and the age range sampled up to the level of the best. Non-daily smoking is rare, but it should still be covered in all surveys; all people aged 16 and above should be included and the same question should be asked. A further potential problem with all the surveys is the absence of biochemical verification of smoking status. West et al. [10] recently showed significant under-reporting in both the UK and to a greater extent in Poland, in national surveys when self-report was compared with an assessment based on the nicotine metabolite, cotinine [see also methodology used in the PONS study; 11].

The much higher rate of prevalence and generally lower rate of cessation among males in EU10 countries and the lower rate among females must arise from cultural differences rather than specific tobacco control strategies [see 12]. Overcoming the cultural norms about smoking in males and preventing females from EU10 countries from adopting the norms from Western Europe is probably the major challenge facing tobacco control in Europe. Westernization of smoking patterns in the female population of Central and Eastern European countries is illustrated by rapid changes in smoking prevalence among girls in Poland. In the 1990s, smoking prevalence among 15-year-old girls rose almost twofold: from 16% in 1990 to 28% in 1998 [13]. A similar phenomenon seems to be observed in other countries of Central and Eastern Europe [14]. This phenomenon is followed by rapid increase in smoking by young adult females [15-17].

However, it is also clear that tobacco control activities in countries can make a substantial difference. The clearest example is Sweden which has low smoking rates and high cessation rates in both males and females. The low smoking rates in Sweden have often been ascribed to the use of the smokeless tobacco product, snus, which some think of as a substitute for cigarettes. However, this cannot be the whole explanation because snus use in females is very low, and shows a similar pattern to males [18]. In the former Soviet block, it can be demonstrated by differences in smoking and lung cancer mortality trends between countries of Central and Eastern Europe [19]. In Poland in the 1980s and 1990s, where comprehensive tobacco control legislation, policy and programme was enforced earlier [20], a decline in the prevalence of current smoking and lung cancer mortality in males has been observed earlier than in Hungary where a tobacco control policy was brought into force later [21-23].

The prevalence figures for some countries, such as the UK, are higher than the headline figures given in official publications. The reason is that these data are standardised to the EU average age distribution. This adjustment makes it apparent that the UK has not been as successful in combating smoking relative to other European countries as has been supposed. Indeed, the UK has achieved less than Ireland – and this was before the introduction of the Irish indoor smoking ban.

Apart from working hard to harmonise data gathering on smoking in Europe (and indeed the world as far as possible), there are some important subsequent steps to be taken when it

comes to assessing how best to combat smoking in this region. One of these is to start documenting in a systematic way both the smoking surveillance and tobacco control activities of the different countries annually to start to provide a basis for cross-country and within-country associations between smoking parameters. The presented study is one of the first steps in collecting recent comparable and reliable survey data on smoking in adult population in European countries. A small start in this process has been also made with the development of a tobacco control index [24]. However, this kind of methodology would have to be considerably refined and expanded in order to provide the kind of lessons one is looking for [see such attempt in ECAP study; 25]. Thus, tobacco control policies may change over time and take many years to create an effect, therefore a snapshot at one time would be inadequate. Moreover, the concept of an index makes a lot of questionable assumptions about the comparability of the same category of policy across countries and lack of interactions between policies and, indeed, that the effects of policies described in this way summate. The key to success in this important project will be establishing an appropriate methodology and that markers of the success of tobacco control policies, such as prevalence, ever-smoking and cessation rates, are measured in a comparable way [7].

CONCLUSIONS

This is the first study that has attempted to make cross national comparisons in Europe using best available data and minimising bias due to methodological and sociodemographic differences. It has revealed considerable variability across countries in survey methods and urgent work is needed to develop more consistent methodologies. Despite this, the study has been able to show marked differences across individual countries within the region that reveal that country-specific cultural and political climate over a period of years can have a marked impact on tobacco use. What is needed now is the development of a sophisticated methodology for characterising the factors within countries that best explain the variation in rates of smoking and smoking cessation and uptake.

Acknowledgements

Data collection, analysis and study report have been prepared within the HEM Project 'Closing the Gap. Reducing Premature Mortality. Baseline for Monitoring Health Evolution Following Enlargement', funded by the European Commission Public Health Programme (Agreement No. 2003121) and the Ministry of Science and Higher Education in Warsaw, Poland.

We wish to express our thanks Gabriela Böhm (Austria), Lydia Gisle (Belgium), Plamen Dimitrov (Bulgaria), Jana Brozova and Rudolf Poledne (Czech Republic), Hans Storm (Denmark), Raul Kiivet (Estonia), Tiina Laatikainen (Finland), Jean Louis Wilquin (France), René Thyrian (Germany), Antonia Trichopoulos (Greece), Csilla Kaposvari (Hungary), Cecily Kelleher (Ireland), Silvano Gallus (Italy), Iveta Pudule (Latvia), Jurate Klumbiene (Lithuania), Marie-Paule Prost-Heinisch (Luxembourg), Tarquinia Zeegers (the Netherlands), Florin Mihaltan (Romania), Hana Vrbanova (Slovakia), Tit Albrecht (Slovenia), Esteve Fernandez (Spain), Margaretha Haglund (Sweden), Anna Gilmore and Martin Jarvis (UK) who kindly provided country data on tobacco smoking.

REFERENCES

1. WHO Regional Office for Europe. The European Tobacco Control Report 2007. Copenhagen: World Health Organization; 2007.
2. Peto R, Lopez AD, Boreham J, Thun M. Mortality from smoking in developed countries 1950-2000. 2nd ed. Oxford: Oxford University Press; 2003.
3. The ASPECT Consortium. Tobacco or health in the European Union - past, present and future. Luxembourg: Office for Official Publications of the European Communities; 2004.
4. Shafey O, Dolwick S, Guindin GE, editors. Tobacco Control Country Profiles. 2nd ed. Atlanta (GA): American Cancer Society, Inc.; 2008.
5. Forey B, Hamling J, Lee P, Wald N, editors. International Smoking Statistics. A collection of historical data from 30 economically developed countries. 2nd ed. New York: Oxford University Press; 2002.
6. Zatoński W. Tobacco smoking in central European countries: Poland. In: Boyle P, Gray N, Henningfield J, Seffrin J, Zatoński W, (ed.). Tobacco and Public Health: Science and Policy. Oxford: Oxford University Press; 2004. p. 235-252.
7. Zatoński W, (ed.). Closing the health gap in European Union. Warsaw: Cancer Epidemiology and Prevention Division, the Maria Skłodowska-Curie Memorial Cancer Center and Institute of Oncology; 2008. Available from: <http://www.hem.waw.pl/index.php?idm=>
8. World Health Organization. Guidelines for controlling and monitoring the tobacco epidemic. Geneva: World Health Organization; 1998.
9. World Health Statistics. <http://www.who.int/whosis/en/> 2007.
10. West R, Zatoński W, Przewoźniak K, Jarvis MJ. Can we trust national smoking prevalence figures? Discrepancies between biochemically assessed and self-reported smoking rates in three countries. *Cancer Epidemiol Biomarkers Prev.* 2007; 16(4): 820-822.
11. Przewoźniak K, Łobaszewski J, Cedzyńska M, Wojtyła A, Paprzycki P, Mańczuk M, Zatoński W. Cigarette smoking among a sample of PONS study subjects: preliminary assessment. *Ann Agric Environ Med* 2011; 18(2): 215-220.
12. Panasiuk L, Mierzecki A, Wdowiak L, Paprzycki P, Lukas W, Godycki-Cwirko M. Prevalence of cigarette smoking among adult population in eastern Poland. *Ann Agric Environ Med* 2010; 17(1): 133-138.
13. Woynarowska B, Mazur J. Health Behaviours, Health and Perception of School by Youth in Poland in 2002. A Technical Research Report. Warsaw: Warsaw University and Institute of Mother and Child; 2002.
14. Global Youth Tobacco Survey Collaborating Group. Differences in worldwide tobacco use by gender: findings from the Global Youth Tobacco Survey. *J Sch Health.* 2003; 73(6): 207-215.
15. Zatoński W, Przewoźniak K, Sulkowska U, Mańczuk M, Gumkowski J. Tobacco smoking in male and female population, Poland 1974-2004. *Zeszyty Naukowe Ochrony Zdrowia. Zdrowie Publiczne i Zarządzanie* 2009;7(2):4-11 (in Polish)
16. Balabanova D, Bobak M, McKee M. Patterns of smoking in Bulgaria. *Tob Control.* 1998; 7(4): 383-385.
17. Gilmore A, Pomerleau J, McKee M, Rose R, Haerpfner CW, Rotman D et al. Prevalence of smoking in 8 countries of the former Soviet Union: results from the living conditions, lifestyles and health study. *Am J Public Health.* 2004; 94(12): 2177-2187.
18. Zatoński W. Lung Cancer Trends in Selected European Countries: What we can learn from the Swedish Experience with oral tobacco (snuff). ENSP Status Report on Oral Tobacco. Brussels: European Network for Smoking Prevention; 2003. p. 37-54.
19. Zatoński W, Mańczuk M, Sulkowska U, Przewoźniak K. Tobacco smoking and smoking-attributable mortality in Central and Eastern Europe. *Zeszyty Naukowe Ochrony Zdrowia. Zdrowie Publiczne i Zarządzanie* 2009; 7(2): 58-77 (in Polish).
20. Zatoński W. Decreasing Smoking in Poland: The Importance of a Comprehensive Governmental Policy. *J Clin Psychiatry Monograph.* 2003; 18(1): 74-82.
21. Didkowska J, Mańczuk M, McNeill A, Powles J, Zatoński W. Lung cancer mortality at ages 35-54 in the European Union: ecological study of evolving tobacco epidemics. *BMJ* 2005; 331(7510): 189-191.
22. Zatoński W. Democracy and Health: Tobacco Control in Poland. In: de Beyer J, Waverly Brigden L, (ed.). Tobacco Control Policy: Strategies, Successes and Setbacks. Washington: World Bank/Research for International Tobacco Control; 2003. p. 97-120.
23. Zatoński WA, Mańczuk M, Powles J, Negri E. Convergence of male and female lung cancer mortality at younger ages in the European Union and Russia. *Eur J Public Health.* 2007; 17(5): 450-454.
24. Joossens L, Raw M. The Tobacco Control Scale: a new scale to measure country activity. *Tob Control.* 2006; 15(3): 247-253.
25. Stankiewicz-Choroszuca BL, Wawrzyniak ZM, Lipiec A, Piekarska B, Kapalczyński WJ, Samoliński BK. Consequences of smoke inhalation in the 'Epidemiology of Allergic Diseases in Poland' project (ECAP). *Ann Agric Environ Med* 2011; 18(2): 420-428.