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Burden of disease from second-hand tobacco smoke exposure at home among adults from European Union countries in 2017: an analysis using a review of recent meta-analyses

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ABSTRACT

Smoke-free legislation reduced second-hand smoke (SHS) exposure in public places, and indirectly promoted private smoke-free settings. Nevertheless, a large proportion of adults is still exposed to SHS at home. The aim of this paper is to quantify the burden of disease due to home SHS exposure among adults in the 28-European Union (EU) countries for year 2017.

The burdens by gender from lung cancer, chronic obstructive pulmonary disease (COPD), breast cancer, ischemic heart disease (IHD), stroke, asthma, and diabetes were estimated in an original research analysis using the comparative risk assessment method. Relative risks of death/diseases by gender for adults exposed to SHS at home compared to not exposed ones were estimated updating existing meta-analyses. Prevalence of home SHS exposure by gender was estimated using a multiple imputation procedure based on Eurobarometer surveys. Data on mortality and disability adjusted life years (DALYs) were obtained from the Global Burden of Disease, Injuries and Risk Factors Study.

In 2017, 526,000 DALYs (0.36% of total DALYs) and 24,000 deaths (0.46% of total deaths) were attributable to home SHS exposure in the 28-EU countries, mainly from COPD and IHD. South-Eastern EU countries showed the highest burden, with proportion of DALYs/deaths attributable to SHS exposure on total higher than 0.50%/0.70%, whereas northern EU-countries showed the lowest burden, with proportions of DALYs/deaths lower than 0.25%/0.34%.

The burden from SHS exposure is still significant in EU countries. More could be done to raise awareness of the health risks associated with SHS exposure at home.

1. Introduction

Exposure to second-hand smoke (SHS) from burning tobacco products can cause several diseases (US Department of Health and Human Services, 2014; International Agency for Research on Cancer (IARC), 2007; Öberg et al., 2011).

In the last decades laws that prohibit smoking in public settings, such as workplaces and restaurants, were widely implemented worldwide as

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a consequence of the implementation of Article 8 of the World Health Organization (WHO) Framework Convention on Tobacco Control (FCTC) (World Health Organization, 2003). Decreases in SHS exposure after smoke-free policies implementation have been documented in several studies with reductions up to 80–90% in workplaces and public places in several European countries (Gorini et al., 2008; IARC, 2008; López et al., 2013; Martínez-Sánchez et al., 2012).

Several studies indicated that smoke-free legislation had the positive effects in promoting private smoke-free settings (Monson and Arsenault, 2017). In Europe, for example, smoke-free homes increased from 72% in 2008 to 78% in 2012 in Italy, after 8 years from the smoke-free law implementation (Minardi et al., 2014; Gallus et al., 2016), from 16% in 1998 to almost 50% in 2008 in smokers' houses in England (Jarvis et al., 2012), and from 71% in 2006 to 87% in 2011 in Spanish homes (Fernández et al., 2017).

Nevertheless, a large proportion of persons is still exposed to SHS, especially at home. As an example, in Portugal in 2016 14% of children were exposed to SHS at home (Precioso et al., 2019). Thus, the burden of disease due to SHS exposure is still considerable. In adults, in 2017 SHS exposure caused in European Union (EU) countries 67,000 deaths and 1.5 million DALYs in all adults (Global Burden of Disease Study 2017, 2018).

A full understanding of exposure to SHS at home and the consequent burden of diseases for the whole EU population in recent years is lacking. The aim of this study, conducted within the TackSHS project (Fernández et al., 2020), is to quantify the burden of disease due to SHS exposure at home by gender among adults aged 15 years old or more in the 28-EU countries for year 2017.

2. Methods

A review and update of recent meta-analyses and an original study by estimating the number of deaths and DALYs attributable to SHS exposure at home among adults in the 28-EU countries by gender and by country was performed using the comparative risk assessment (CRA) methodology (Öberg et al., 2010). The first step of the CRA consists in selecting the diseases for which there is evidence of a causal relationship with SHS exposure and for which there is sufficient quantitative information. Based on a previous systematic review, the burden of disease due to SHS exposure in adults was studied for lung cancer (LC), chronic obstructive pulmonary disease (COPD), breast cancer (BC), ischemic heart disease (IHD), stroke (STR), asthma (AS), and diabetes (DIAB) (Carreras et al., 2019).

2.1. Statistical analysis

In accord with the CRA, mortality and morbidity attributable to SHS exposure were then obtained estimating, for each country, gender and disease, the population attributable fraction (PAF) and multiplying it by the corresponding number of deaths or DALYs (Öberg et al., 2010).

The PAF is a weighted sum of age-specific attributable fractions with the proportion of cases in each stratum as weight, where the attributable fractions are computed with the standard Levin's formula which depends on the prevalence of exposure to SHS and on the relative risks (RR) of death/disease for exposed in comparison to non-exposed (Levin, 1953).

Depending on the disease under study a lag of 10 (cancers, COPD and DIAB) and 5 (IHD, STR and AS) years was assumed between SHS exposure and development or death from the disease by using the prevalence of SHS exposure estimated respectively for years 2006 and 2012 among people 10 and 5 years younger (Öberg et al., 2010). For each country, disease and gender, the number of deaths and DALYs attributable to SHS exposure was computed by multiplying the number of deaths or DALYs by the corresponding PAF to SHS exposure. For each estimate of deaths and DALYs attributable to SHS exposure, an uncertainty interval (UI) was obtained with a Monte Carlo procedure (Öberg et al., 2010).

In a further analysis, smokers were excluded from the estimation of the burden of disease from SHS exposure, not because smokers are not considered to be susceptible to the health effects of SHS exposure, but because the much greater impact of smoking could mask the effects of SHS (Öberg et al., 2010). In order to estimate the burden in non-smokers, the burden of disease in smokers was estimated using the same approach as for SHS exposure, with the difference that the Smoking Impact Ratio (SIR), instead of the lagged smoking prevalence, was used in the computation of the attributable fraction for those disease with a longer latency, i.e. cancers, COPD and DIAB. The SIR represents the accumulated risk from smoking using LC mortality in excess as a biological marker for accumulated hazards of smoking and it depends on the country-specific LC death rates in the overall population and in never smokers only, and on LC death rates in smokers and never smokers from a reference population (Peto, 1986).

The burden in non-smokers was then obtained by subtracting the burden due to smoking from the total burden, and, for each country, disease and gender, the number of deaths and DALYs attributable to SHS exposure was finally computed by multiplying the number of deaths or DALYs in non-smokers by the corresponding PAF to SHS exposure.

2.2. Data

The RRs of death or disease due to SHS exposure at home were estimated reviewing and updating the most recent meta-analyses selecting only studies on household SHS exposure. When the updated meta-analytical results showed heterogeneity (I^2 index above 60%), case-control studies were excluded, and only prospective studies were considered (Table 1).

The country and age-specific prevalence of home SHS exposure for 2006 and 2012 were obtained using a multiple imputation procedure on data from the Eurobarometer surveys 2006, 2010, 2012, 2014, 2017 (Carreras et al., 2020a; European Commission. Eurobarometer Special Surveys, 2014). Non-smokers were defined to be exposed to SHS if they declared to be ever exposed to tobacco smoke at home on a daily basis at the time of the interview, i.e. they answered "less than one hour a day", "1-5 hours a day" or "more than 5 hours a day" to the question "How long are you exposed to tobacco smoke at home, on a daily basis?" (for which there was also the possible answer "never or almost never").

The age-specific RR of death or disease for smokers compared to non-smokers used in the analyses were selected from the most recent meta-analyses (appendix table A1). The country, age and gender-specific prevalence of smoking used to compute the burden from smoke were extracted from the Eurobarometer surveys (European Commission. Eurobarometer Special Surveys, 2014).

Estimates of disease, gender and country-specific mortality and DALYs, as well as the 2017 LC death rates used for the SIR estimation, were extracted from the Global Health Data Exchange (GHDx) of the Global Burden of Disease (GBD) study. The GBD is an international project that annually quantifies and compares globally the health loss due to diseases, accidents and risk factors by age, gender and geographical area (Global Burden of Disease Study 2017, 2018).

Since the Eurobarometer surveys cover people aged 15 years old and over and SHS exposure for some diseases has an impact starting from 15 years of age (e.g. lung cancer), the analyses were performed on persons older than 15 years of age.

3. Results

A total of 144 million DALYs lost (UI 125,449,929-165,347,437) and 5 million deaths (UI 4,851,282- 5,527,996) in persons older than 15 years were estimated in the 28-EU countries in 2017, out of which respectively 525,549 DALYs (UI: 352,328-783,855) and 23,657 deaths (UI:13,027-44,974) were attributable to SHS exposure at home.

The proportion of both DALYs and deaths attributable to SHS

exposure on the overall DALYs and deaths was higher in males (0.45%, UI:0.35%–0.57% DALYs and 0.57%, UI:0.37%–0.91% deaths) in comparison to females (0.27%, UI:0.20%–0.38% DALYs and 0.35%, UI:0.17%–0.72% deaths).

The geographical distribution showed a higher proportion of both DALYs and deaths in the South-Eastern EU countries, and a lower proportion in the Northern ones (Fig. 1). Bulgaria, Romania, Poland, Greece, Croatia, Hungary and Cyprus showed proportion of DALYs and deaths attributable to SHS exposure on the overall DALYs and deaths higher than 0.50% and 0.70%, respectively. Luxembourg, Finland, Germany, Sweden, United Kingdom, France and Denmark showed proportions of DALYs and deaths lower than 0.25% and 0.34%, respectively.

In women, COPD was the disease with the highest proportion of DALYs lost due to SHS exposure in most EU countries with an average proportion of 0.09% (63,157, UI: 44,070–92,162 DALYs lost from SHS exposure globally), whereas IHD dominated in some Eastern countries (Bulgaria, Czech Republic, Estonia, Finland, Croatia, Lithuania, Latvia, Malta, Slovakia) with an average proportion of 0.06% (38,857, UI: 22,196–70,531 DALYs lost globally). In men, COPD, with an average proportion of 0.12% on total DALYs (92,419, UI:69,563–123,084 DALYs lost from SHS in EU), was the disease with the highest burden mostly in South-Western EU countries, whereas IHD was the highest in Northern EU countries (Fig. 2).

For all countries in both women and men, the disease with the lowest burden was AS (2689 DALYs lost in women, UI: 1397–4422 and 3012 DALYs in men, UI: 1720-4683), followed by DIAB in men. In women, AS was followed by BC in all countries except Germany, France, United Kingdom, and the Netherlands, where DIAB showed a lower impact than BC, and Cyprus and Malta where LC was the second disease (Fig. 3).

Table 1
Relative risks of death or disease for exposed to second-hand smoke at home in comparison to not exposed individuals with referring disease, age, gender and reference. CI: confidence interval.

Disease	Age	Gender	Relative Risk (95% CI)	References
Lung Cancer	≥15 years	Both	1.21 (1.13–1.30)[§]	(US Department of Health and Human Services, 2006)
Ischemic heart disease	≥15 years	Females	1.14 (1.10–1.19)	(US Department of Health and Human Services, 2006; Khoramdad et al., 2020; Fischer and Kraemer, 2015; Eisner et al., 2007; Attard et al., 2017; He et al., 1994; He et al., 2012; Helsing et al., 1988; Rosenlund et al., 2001; Wen et al., 2006)
		Males	1.14 (1.08–1.20)	
Stroke	≥35 years	Females	1.16 (1.03–1.29)[*]	(Fischer and Kraemer, 2015; Oono et al., 2011)
		Males	1.24 (0.95–1.53)[*]	
Asthma onset	≥20 years	Females	1.07 (0.97–1.16)	(Thorn et al., 2001; Gupta et al., 2006; Lee et al., 2006; Jaakkola et al., 2003; Larsson et al., 2003; Radon et al., 2002; Janson et al., 2001; Iribarren et al., 2001; Flodin et al., 1995)
		Males	1.08 (0.98–1.18)	
Breast cancer	≥35 years	Females	1.08 (1.00–1.16)	(Macacu et al., 2015)
Diabetes mellitus	≥40 years	Both	1.12 (1.00–1.24)[*]	(Pan et al., 2015; Zhu et al., 2014)
Chronic Obstructive Pulmonary Disease	≥35 years	Females	1.56 (1.30–1.83)[*]	(Fischer and Kraemer, 2015; Eisner et al., 2007; Attard et al., 2017; He et al., 1994; He et al., 2012; Helsing et al., 1988; Rosenlund et al., 2001; Wen et al., 2006; Oono et al., 2011; Thorn et al., 2001; Gupta et al., 2006; Lee et al., 2006; Jaakkola et al., 2003; Larsson et al., 2003; Radon et al., 2002; Janson et al., 2001; Iribarren et al., 2001; Flodin et al., 1995; Macacu et al., 2015; Pan et al., 2015; Zhu et al., 2014; Jindal et al., 2006)
		Males	1.57 (1.30–1.83)[*]	

[§] spouse exposure.
[*] only prospective studies.

4. Discussion

In 2017, approximately 526,000 DALYs and 24,000 lives were lost due to SHS exposure at home in the 28-EU countries, mainly from COPD and IHD, especially in South-Eastern EU countries and with a higher burden in males in comparison to females. In women, COPD was the disease with the higher proportion of DALYs lost due to SHS exposure in most EU countries, confirming the recent increase in COPD prevalence in females with mortality increasing more rapidly than in males (Ntritsos et al., 2018).

In few countries for some diseases the burden from SHS exposure was higher in females than in males, such as COPD in Germany, asthma in Spain, Finland, France, Greece and Hungary, and diabetes in Bulgaria, Germany and Slovakia. Globally, the burden in males was higher in comparison to females, suggesting a past higher exposure to SHS in males since RR are similar by gender (except stroke for which males exposed to SHS have a higher risk than females).

The geographical distribution of the burden from SHS exposure showed a higher proportion of both DALYs and deaths in the South-Eastern EU countries, such as Bulgaria, Romania, Poland, Greece, Croatia, Hungary and Cyprus, and a lower proportion in the Northern ones, such as Luxembourg, Finland, Germany, Sweden, United Kingdom, France and Denmark. This trend can hardly be explained by a different implementation of anti-smoking policies, since there are no marked differences in the implementation in 2006 and 2012, i.e., the years of SHS exposure used assuming the time lag (see Table A2, Smoke free Partnership, 2020). The geographical differences are probably due to higher smoking prevalence of active smoking and to different habits in smoking at home (see Fig. A1).

The burden in non-smokers was also estimated in order to isolate the effect of SHS exposure not masked by the effect of active smoking which has a greater impact then SHS exposure in all the selected diseases (see Table A1 and Fig. A2). However smokers are at least equally if not more exposed to SHS from other smokers nearby, and it is important to consider them when estimating the burden from SHS exposure (Lam et al., 2005). The number of DALYs and deaths due to SHS exposure in non-smoking adults were respectively 173,477 (UI:99,779- 284,130) and 6251 (UI:3132-11,998), about 0.12% of the total number of DALYs and deaths, with the same distribution by gender and countries as in all the population.

Since in most EU countries laws that prohibit smoking in workplaces and public places have already been implemented in the last 15 years (see Table A2), in this study we evaluated the impact of SHS exposure at

home, that is the one of the private setting where exposure still persists, and is more difficult to control. In fact, no specific interventions or policies designed to reduce exposure in private settings, such as homes and private vehicles, are reported in the WHO-FCTC (World Health Organization, 2003). However, in the last decade in EU countries smoke-free interventions at the local, regional or even national level were implemented in settings that were not indicated in the WHO-FCTC, such as outdoor areas of hospitality venues and healthcare buildings, children playgrounds, and even in private cars, a setting as private as home (Ntritsos et al., 2018). In UK, laws prohibiting smoking in cars with children and pregnant women was introduced on October 2015 (Gov UK, 2015). In Italy, the transposition of the New Tobacco Product Directive 2014/40/UE - the law n.6/2016 - entered into force in February 2016, and introduced a similar smoke-free law in cars with children and pregnant women (Italian Ministry of Health, 2016). When in 2016 this smoke-free cars legislation was introduced in Italy, there was a strong public support for this measure (Lugo et al., 2017). Other EU countries (Greece, Cyprus, Austria, Ireland, Finland, the Netherlands) are planning or already introduced similar laws for private vehicles. Thus, public acceptance of smoke-free legislation in settings that were not even imaginable when WHO-FCTC was developed in 2003, has been increasing in EU countries (Fu et al., 2018). However, more could be done to raise awareness of the health risks to both adults and children associated with SHS exposure at home.

It should be considered that in multi-unit housing with a smoking unit, the choice of a smoke-free home is hard to be applied since even though individuals may make their individual unit smoke-free, if smoking is allowed in other units within a house, smoke can infiltrate the home where smoking is not allowed. A recent study on an air quality feedback to promote smoke-free homes on multi-unit housing consisting of both smokers and non-smokers, carried within the TackSHS project, showed reductions in SHS in homes but not totally smoke-free homes (Dobson et al., 2020).

To our knowledge, this is the first study on the health burden due to exposure to SHS in EU countries that exclusively considered exposure at home, whereas other studies considered exposure to SHS in all settings, including homes. As an example, the GBD study estimated the burden form SHS exposure at home, workplaces and public venues (Global Burden of Disease Study 2017, 2018). In 2017 the GBD study quantified this burden in EU countries as about 1.5 million DALYs and 67,000 deaths in the overall population of adults older than 15 years of age (Global Burden of Disease Study 2017, 2018).

Considering exclusively home SHS exposure allowed us to obtain more precise estimates of the burden of SHS exposure. In most surveys on SHS exposure, e.g., the Eurobarometer surveys, SHS exposure in public places is evaluated by asking if respondents saw people smoking. This might produce biased estimates of the true SHS exposure in these settings.

Moreover, in this study a direct estimate of SHS exposure was used by estimating it from the Eurobarometer surveys that directly ask to non-smokers if they are exposed to SHS in their home. In some studies, such as the 2017 GBD study, SHS exposure in home is indirectly estimated using surveys on both household composition and tobacco habits through a joint probability of being a non-smoker and living with a

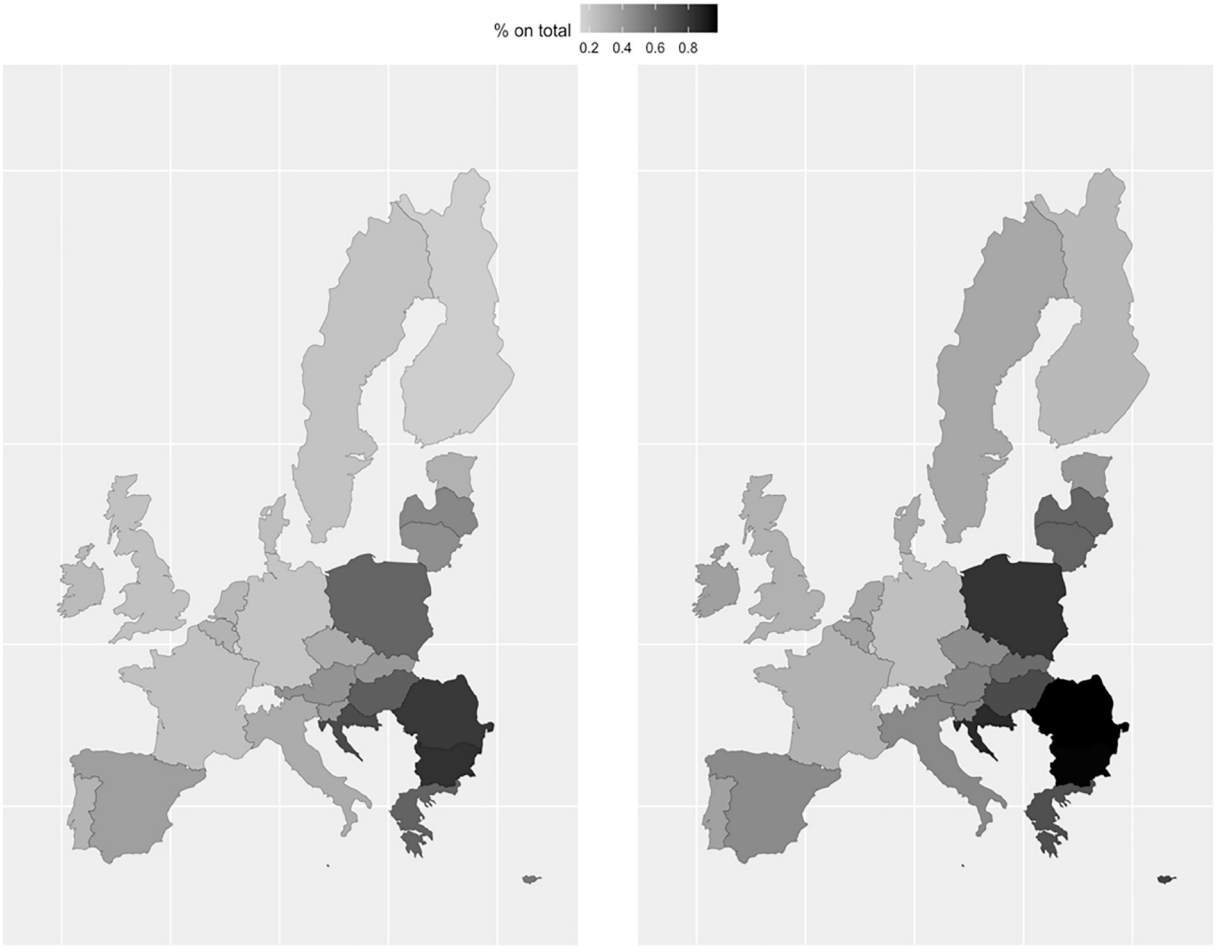

Fig. 1. Proportion of DALYs (left) and deaths (right) attributable to second-hand smoke exposure at home respectively on total DALYs and deaths in 2017 (males + females).

smoker (Global Burden of Disease Study 2017, 2018).

Another strength of this study is the homogeneous use of household SHS exposure for estimates of both exposure and RRs. In fact, SHS exposure from Eurobarometer surveys was estimated considering only respondents with SHS exposure at home. Similarly, for each disease, we updated existing meta-analyses by selecting RRs from exclusively household SHS exposure. Instead, in most studies on the burden of SHS exposure, there is not a homogeneous correspondence between exposure setting (for example, household SHS exposure) and RRs from meta-analyses that included studies with RRs from that specific setting only (Carreras et al., 2019). In a recent study, carried out within the TackSHS project, we estimated the burden from breast cancer due to smoking and SHS exposure. We refined such analyses in this paper by considering only RRs related to SHS exposure at home (Carreras et al., 2020b).

This study has however some limitations. In the SIR approach used to estimate the burden due to active smoking from cancers, DIAB and COPD, we used the LC mortality as an indicator of smoking exposure history. However, the relationship of active smoking to most diseases may depend also from other measures, such as smoking intensity or years of smoking (International Agency for Research on Cancer (IARC), 2007). Moreover, in the SIR estimation, a US pooled estimate in never smokers of European descent was used as LC death rates in non-smokers, since no specific rates were available for each EU country (Thun et al., 2008).

Another limitation of this study is that we assumed the same RR for SHS exposure for all ages since there were no robust meta-analytical RR estimates by age in the literature, even if there is evidence that for some diseases the risk varies with age, such as for BC where pre-menopausal and post-menopausal cancer risks for SHS exposure may differ (Hanaoka et al., 2005).

A final methodological limitation is that, in the imputation procedure used to estimate SHS exposure, systematically missing data were treated by forcing the survey year to be a predictor, instead of using a hierarchical multiple imputation taking into account for the multilevel structure of the data, that is given by the four independent surveys used in the imputation procedure. However, valid inferences form hierarchal multiple imputation methods can be obtained if the dataset gathers a large number of clusters. In this study, four clusters only were available (Audigier et al., 2018).

5. Conclusions

In the EU, in 2017 about 526,000 DALYs and 24,000 deaths were attributable to SHS exposure at home, mainly from COPD and IHD, especially in South-Eastern EU countries. More could be done to raise awareness on the health risks of both adults and children associated with

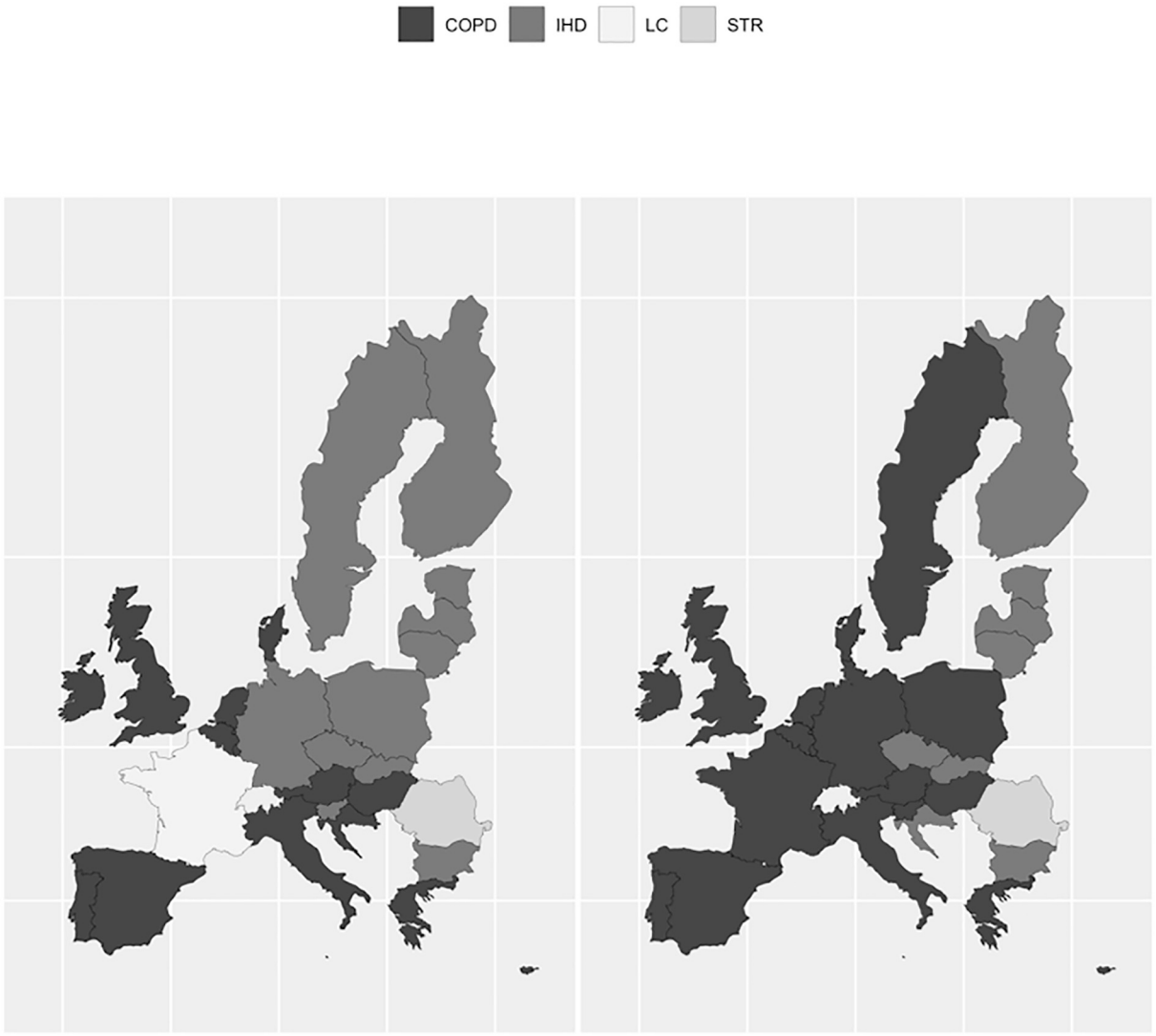

Fig. 2. Diseases with the highest proportion of DALYs attributable to second-hand exposure by country in men (left) and women (right). COPD: chronic obstructive pulmonary disease, IHD: ischemic heart disease, LC: lung cancer, STR: stroke.

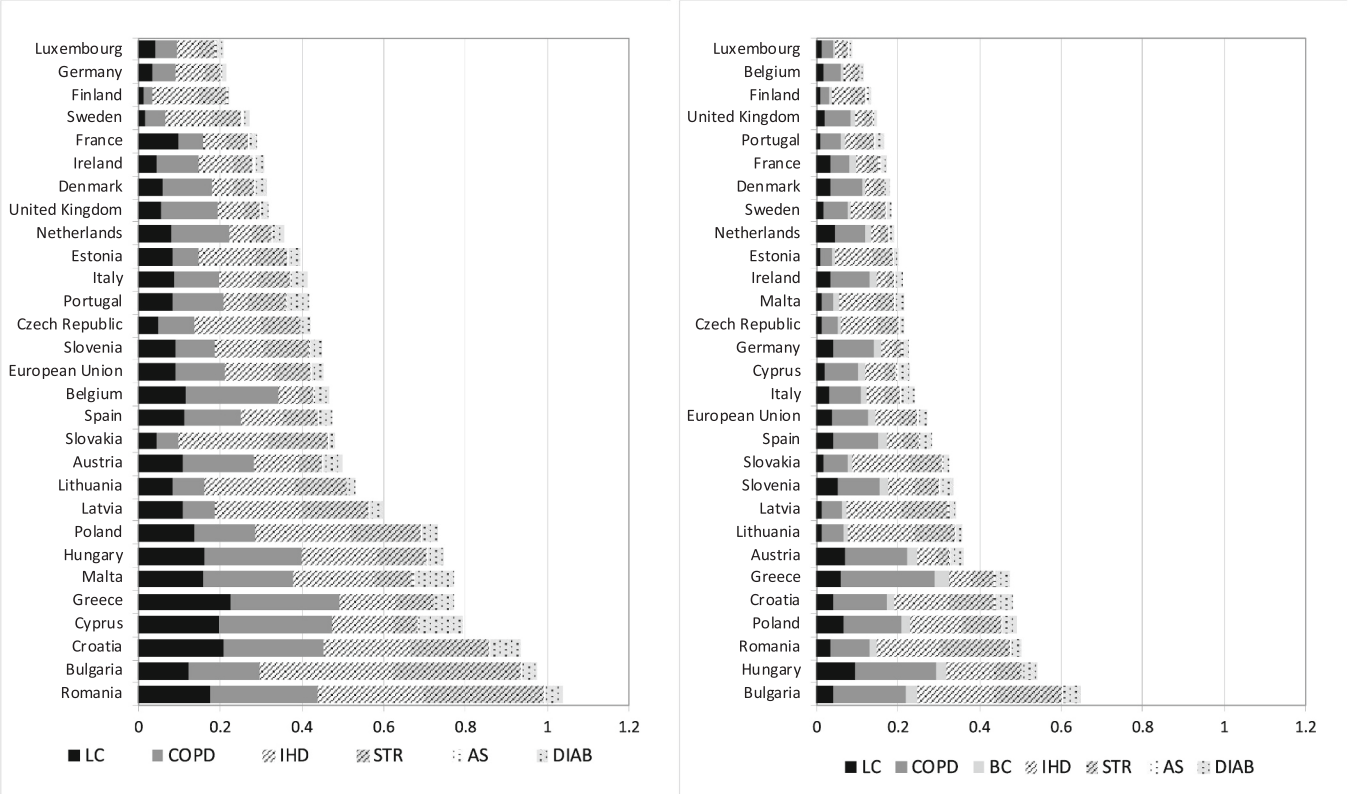

Fig. 3. Proportion of DALYs attributable to SHS exposure at home on total DALYs by country and disease in men (left) and women (right). AS: asthma, BC: breast cancer, COPD: chronic obstructive pulmonary disease, DIAB: diabetes, IHD: ischemic heart disease, LC: lung cancer, STR: stroke.

SHS exposure at home. Health authorities should promote individuals to prohibit smoking in their own homes through evidence-based multilevel interventions for promoting smoke-free homes and smoking cessation.

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Disclaimer

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Declaration of Competing Interest

None declared.

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Appendix

Table A1
Relative risks of death or disease for smokers in comparison to not smokers with referring age, gender and reference. CI: confidence interval.

Disease	Gender	Age	Relative Risk (95% CI)	Reference
Lung Cancer	Females	35–39	5.5 (2.9–11.15)	Thun et al., 2013
		40–44	9.9 (4.8–21.3)	
		45–49	14.4 (6.7–31.4)	
		50–54	18.8 (8.6–41.6)	
		55–59	23.3 (10.5–51.7)	
		60–64	22.9 (15.8–33.0)	
		65–69	26.8 (20.9–34.3)	
		70–74	28.1 (23.0–34.2)	
		75–79	24.9 (20.6–30.0)	
		80+	23.59 (18.1–30.8)	
	Males	35–39	4.6 (2.6–8.8)	

(continued on next page)

Table A1 (*continued*)

Disease	Gender	Age	Relative Risk (95% CI)	Reference
		40–44	8.2 (4.2–16.6)	
		45–49	11.8 (5.8–24.4)	
		50–54	15.4 (7.4–32.2)	
		55–59	19.0 (9.0–40.0)	
		60–64	25.1 (16.7–37.9)	
		65–69	42.8 (31.2–58.6)	
		70–74	28.2 (22.8–34.9)	
		75–79	25.1 (20.0–31.5)	
		80+	20.9 (14.9–29.5)	
Ischemic heart disease	Females	35–39	1.5 (1.2–2.0)	Thun et al., 2013; Mahonen et al., 2004
		40–44	1.9 (1.4–3.0)	
		45–49	2.4 (1.5–3.9)	
		50–54	2.8 (1.7–4.9)	
		55–59	3.3 (1.9–5.9)	
		60–64	3.8 (2.9–5.0)	
		65–69	3.8 (3.2–4.6)	
		70–74	3.6 (3.1–4.1)	
		75–79	2.4 (2.1–2.8)	
		80+	1.8 (1.5–2.2)	
	Males	35–39	1.4 (1.2–1.8)	
		40–44	1.9 (1.4–2.6)	
		45–49	2.3 (1.7–3.4)	
		50–54	2.8 (1.9–4.2)	
		55–59	3.2 (2.1–5.0)	
		60–64	3.9 (3.2–4.8)	
		65–69	3.4 (2.9–3.9)	
		70–74	3.1 (2.7–3.5)	
		75–79	2.3 (2.0–2.6)	
		80+	1.6 (1.3–2.0)	
Stroke	Females	35–39	1.3 (1.0–2.0)	Thun et al., 2013
		40–44	1.5 (1.0–3.0)	
		45–49	1.8 (0.9–4.0)	
		50–54	2.0 (0.9–5.0)	
		55–59	2.3 (0.9–6.0)	
		60–64	3.8 (2.3–6.3)	
		65–69	2.6 (1.9–3.6)	
		70–74	2.3 (1.9–2.9)	
		75–79	1.8 (1.4–2.2)	
		80+	1.6 (1.2–2.0)	
	Males	35–39	1.2 (0.9–2.2)	
		40–44	1.4 (0.8–3.4)	
		45–49	1.6 (0.8–4.6)	
		50–54	1.8 (0.7–5.8)	
		55–59	2.0 (0.6–7.0)	
		60–64	2.5 (1.5–4.3)	
		65–69	2.8 (2.0–4.0)	
		70–74	2.3 (1.8–3.0)	
		75–79	1.7 (1.2–2.3)	
		80+	1.2 (0.7–1.9)	
Asthma onset	Females	≥ 20	1.3 (1.0–1.8)	Piipari et al., 2004
	Males	≥ 20	2.1 (1.8–2.5)	
Breast cancer	Females	≥ 35	1.1 (1.1-1.2)	Calle et al., 1994; (Macacu et al., 2015)
Diabetes mellitus	Both	≥40	1.5 (1.3-1.6)	(Pan et al., 2015)
COPD	Females	35–39	4.1 (2.6–6.9)	Thun et al., 2013; Forey et al., 2011
		40–44	7.1 (4.1–12.7)	
		45–49	10.2 (5.7–18.6)	
		50–54	13.2 (7.2–24.5)	
		55–59	16.3 (8.8–30.3)	
		60–64	19.3 (10.3–36.2)	
		65–69	39.4 (25.2–61.7)	
		70–74	37.2 (27.0–51.2)	
		75–79	20.7 (16.4–26.1)	
		80+	16.7 (12.7–21.9)	
	Males	35–39	17.1 (4.8–67.5)	
		40–44	33.2 (8.6–134.0)	
		45–49	49.3 (12.4–200.5)	
		50–54	65.3 (16.2–266.9)	
		55–59	81.4 (20.0–333.4)	
		60–64	97.5 (23.8–399.9)	
		65–69	28.6 (18.0–45.4)	
		70–74	35.3 (25.3–49.4)	
		75–79	26.5 (19.7–35.7)	
		80+	21.5 (14.8–31.2)	

Table A2
Year of implementation of smoke-free policies in workplaces and in hospitality venues (partial, with a separate smoking room; and complete, with 100% smoke-free hospitality venues) by country.

Country	Workplace	Hospitality veues, partial	Hospitality venues, 100%
Austria	2010	2010	
Belgium	2006	2007	2011
Bulgaria	2012		2012
Croatia	2008	2010	
Cyprus	2010	2010	
Czech Republic	2017		2017
Denmark	2007	2007	
Estonia	2005	2007	
Finland	2007		2007
France	2008	2008	
Germany			
Greece	2010	2010	
Hungary	2012		2012
Ireland	2004		2004
Italy	2005	2005	
Latvia	2010		2010
Lithuania	2007	2007	
Luxembourg	2006	2014	
Malta	2004	2004	
Netherlands	2004	2008	2018
Poland	2011	2011	
Portugal	2008	2008	
Romania	2016	2011	2016
Slovakia	2004		
Slovenia	2007	2007	
Spain	2006	2006	2011
Sweden	2005	2005	
United Kingdom	2007		2007

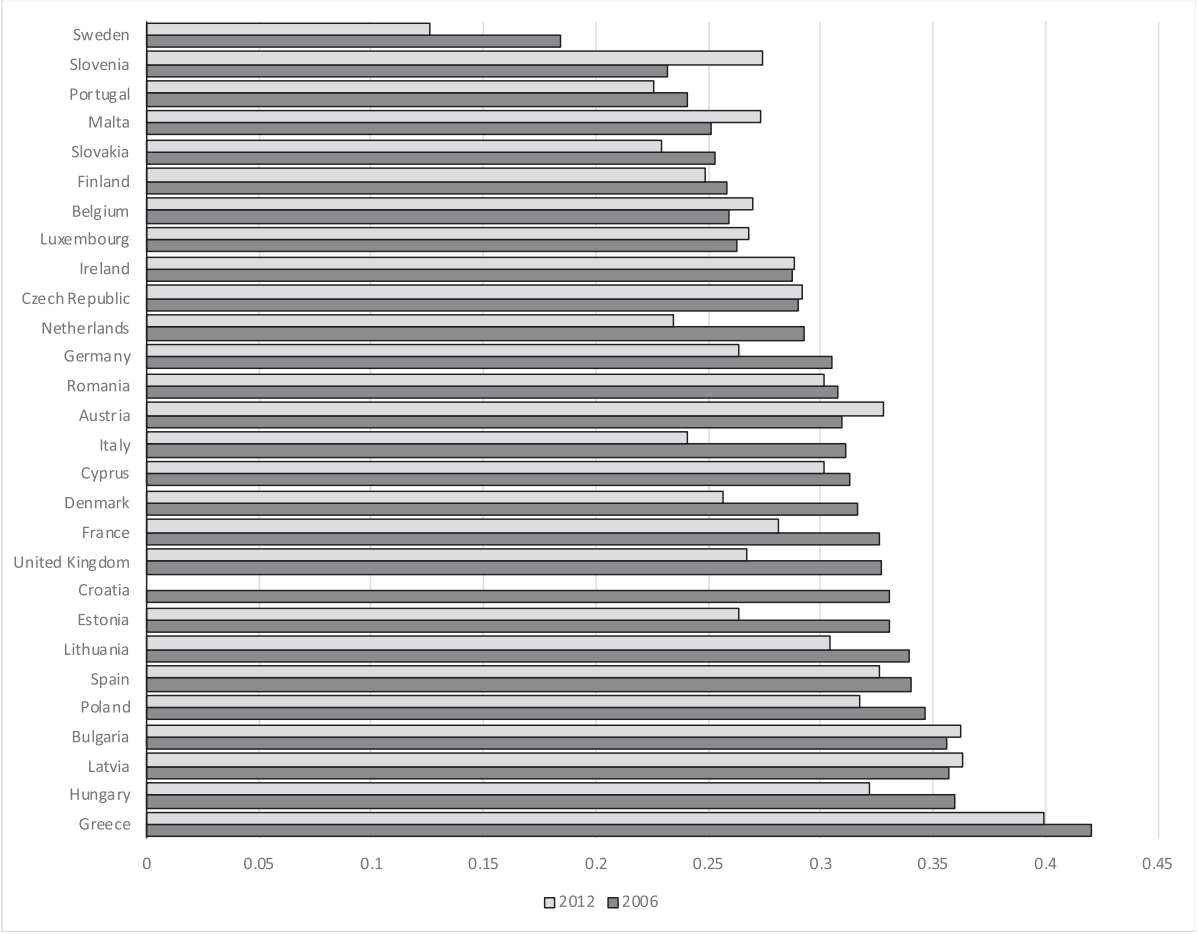

Fig. A1. Prevalence of active smoking by country in years 2006 and 2012 (source: Eurobarometer).

Fig. A2. Proportion of DALYs (left) and deaths (right) attributable to active smoking from the diseases causally linked to SHS exposure respectively on total DALYs and deaths in 2017 (males + females).

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