Environmental and occupational cancers: understanding the factors shown to influence cancer risk

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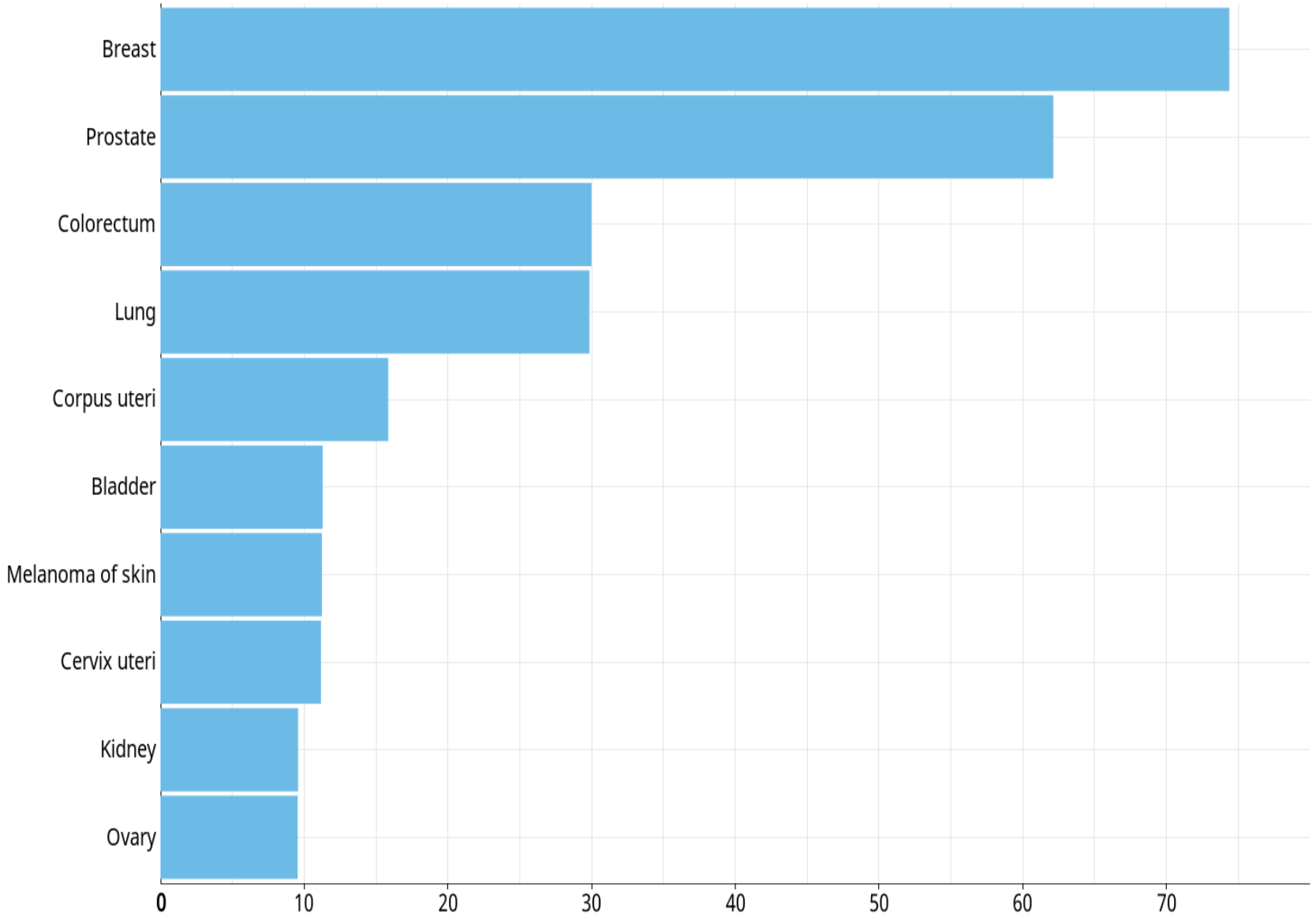
Oviedo - España

Lung cancer

1. Lung cancer is a very important health problem in Europe

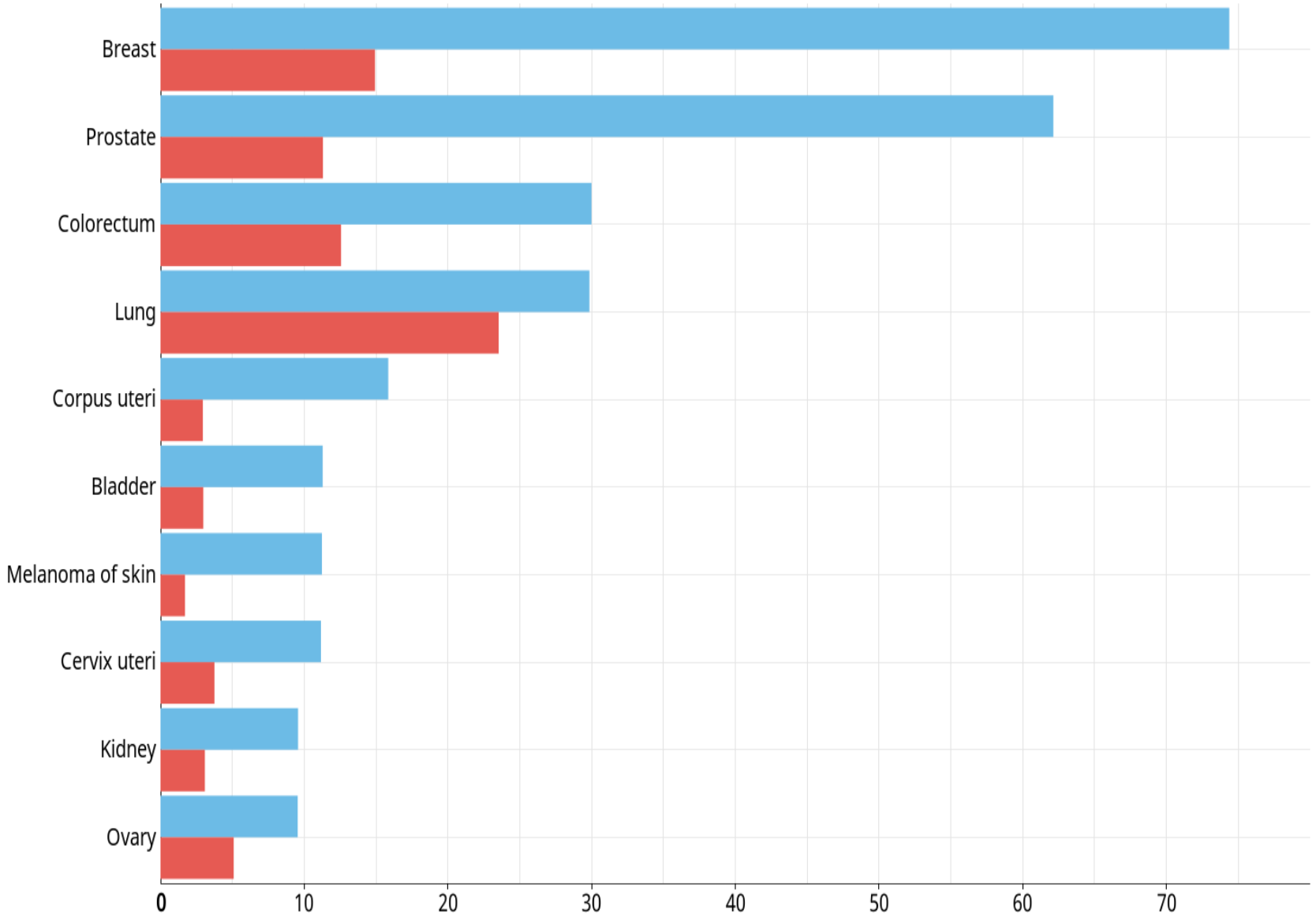
Estimated age-standardized incidence rates (World) in 2018, Europe, both sexes, all ages



Data source: Globocan 2018
Graph production: Global Cancer Observatory (http://gco.iarc.fr)

International Agency for Research on Cancer
World Health Organization

Estimated age-standardized incidence and mortality rates (World) in 2018, Europe, both sexes, all ages



Data source: Globocan 2018
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International Agency for Research on Cancer
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Lung cancer

1. Lung cancer is a very important health problem in Europe

2. The best approach to the problem is early diagnosis and prevention

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EUnetHTA Joint Action 3 WP4

**Rapid assessment of other technologies using the HTA Core Model®
for Rapid Relative Effectiveness Assessment**

LUNG CANCER SCREENING IN RISK GROUPS

Project ID: OTCA28

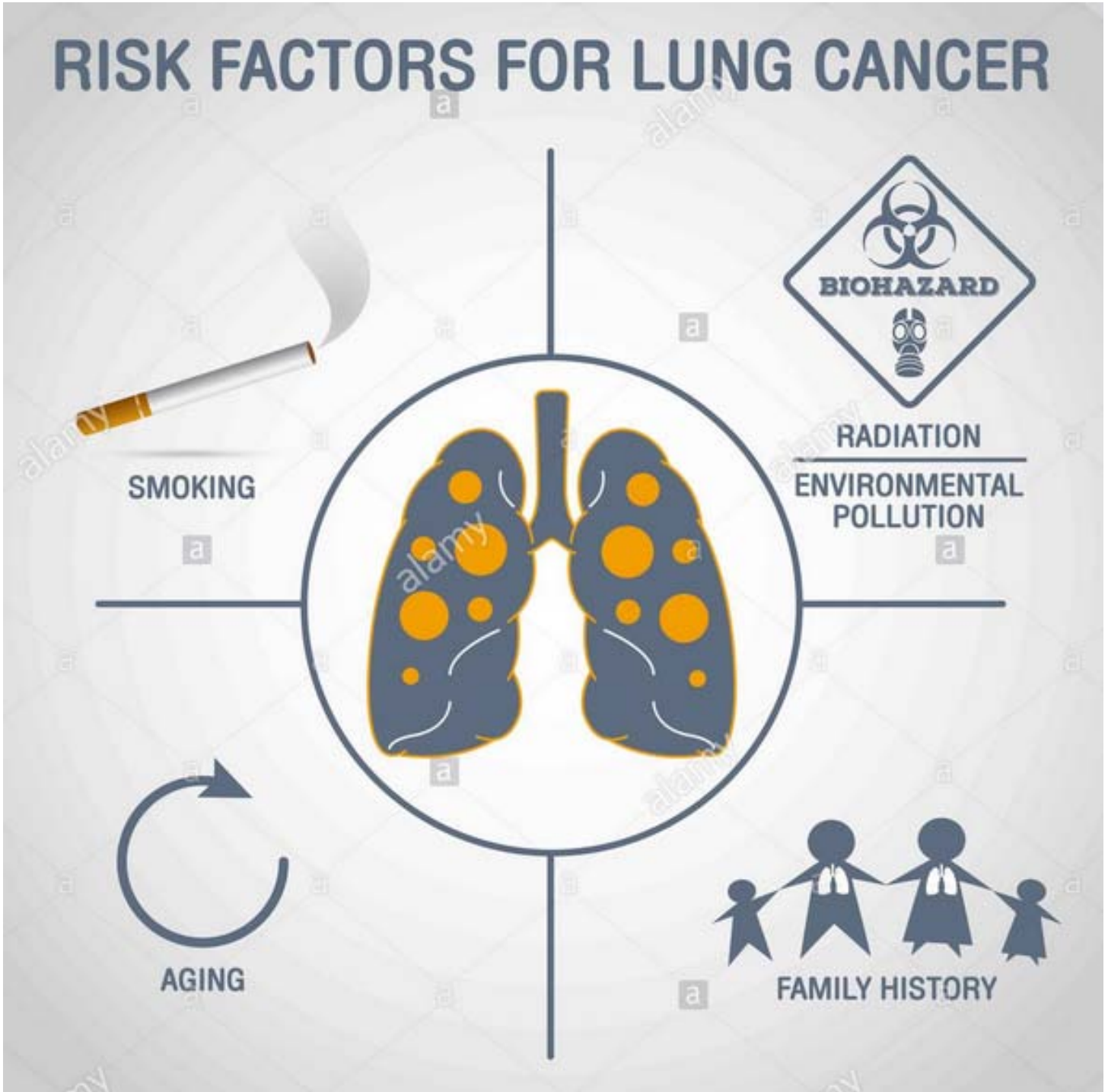
Version 1.5, 25.11.2020

Lung cancer

1. Lung cancer is a very important health problem in Europe

2. The best approach to the problem is early diagnosis and prevention

3.Prevention should target known risk factors


RISK FACTORS FOR LUNG CANCER
SMOKING
BIOHAZARD
RADIATION
ENVIRONMENTAL POLLUTION
AGING
FAMILY HISTORY

smoking


SURGEON GENERAL'S WARNING:
Smoking Causes Lung Cancer,
Heart Disease, Emphysema, And
May Complicate Pregnancy.

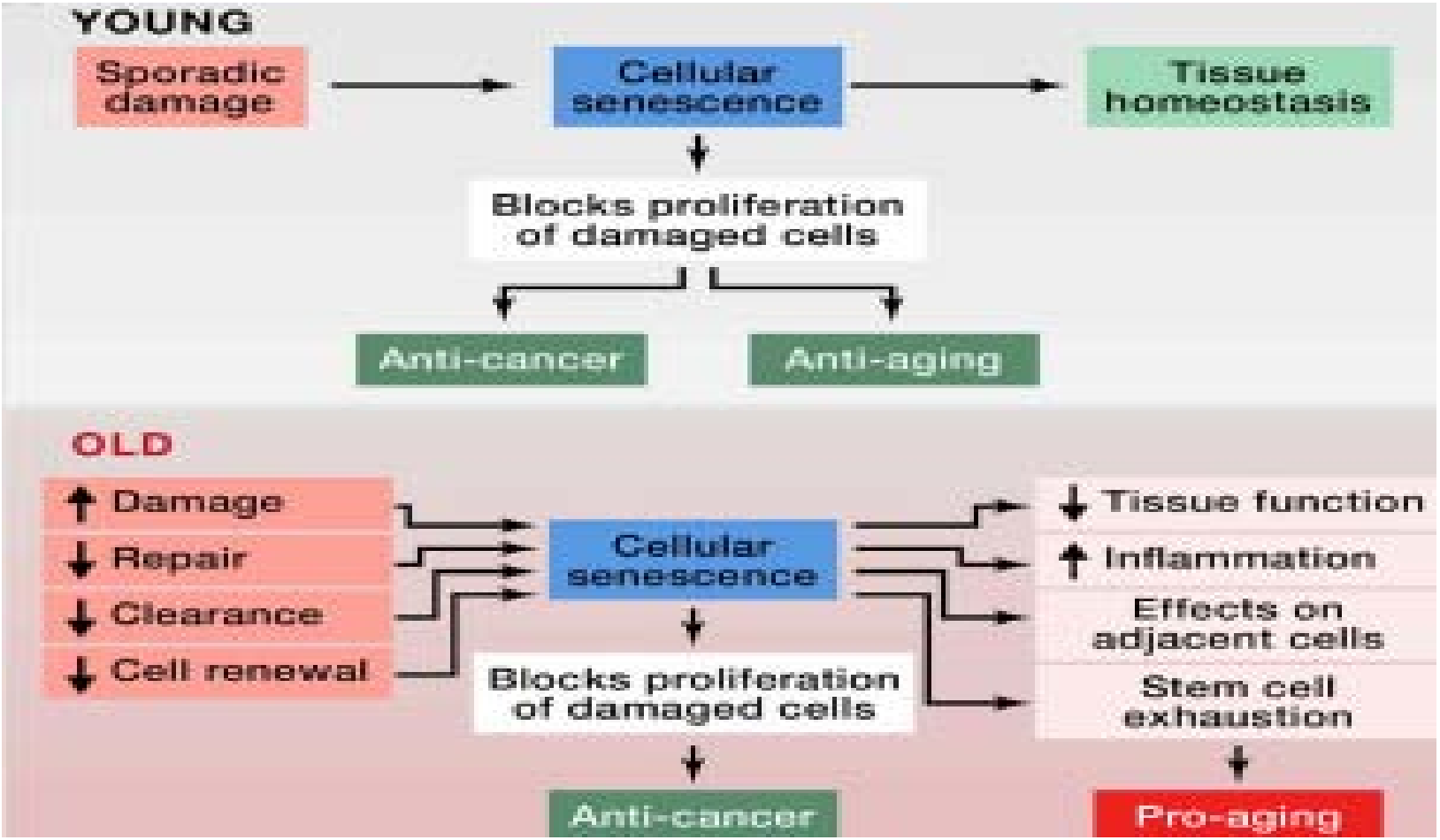
Passive Smoke

People who are exposed to passive smoke during adulthood are 1.41 times more likely to develop lung cancer compared to never-smokers unexposed to passive smoke

relative risk ratio 1.41, (95%CI: 1.21–1.65)

European Lung Foundation. SMOKEHAZ. A scientific review of the health hazards of smoking – Lung cancer; Passive smoking. 2013; Available from: https://www.europeanlung.org/en/projects-and-research/projects/smokehaz/lungconditions/home/adults/lung-cancer/ [cited 15.07.2020]

aging



López-Otín C. et al. The Hallmarks of Aging. http://dx.doi.org/10.1016/j.cell.2013.05.039

family history

The risk of lung cancer was more than five-fold higher among individuals who had a family history of lung cancer and two copies of the high-risk alleles rs8034191 and rs1051730

Liu P, Vikis HG, Wang D, Lu Y, Wang Y, Schwartz AG, Pinney SM, Yang P, de Andrade M, Petersen GM, et al: Familial aggregation of common sequence variants on 15q24-25.1 in lung cancer. J Natl Cancer Inst 2008;100:1326-30

Approximately 25% of lung cancer cases world wide are not attributable to smoking

Sun, S., Schiller, J. & Gazdar, A. Lung cancer in never smokers — a different disease.
***Nat Rev Cancer* 2007;7:778–90**

Radon

- **Radon was classified as a human Group I carcinogen by the International Agency for Research on Cancer in 1988**

- **The US Environmental Protection Agency recognised indoor exposure to radon as the second leading risk factor for lung cancer after smoking, and the first risk factor for nonsmokers**

Small cell lung cancer in never-smokers

María Torres-Durán[1], Alberto Ruano-Ravina[2,3,4], Karl T. Kelsey[4], Isaura Parente-Lamelas[5], Mariano Provencio[6], Virginia Leiro-Fernández[1], José Abal-Arca[5], Carmen Montero-Martínez[7], Iria Vidal-Garcia[7], Carolina Pena[8], Olalla Castro-Añón[9], Antonio Golpe-Gómez[10], Cristina Martínez[11], Rosirys Guzmán-Taveras[11], María José Mejuto-Martí[12], Alberto Fernández-Villar[1] and Juan Miguel Barros-Dios[2,3,13]

Affiliations: [1]Service of Pneumology, University Hospital Complex of Vigo, Vigo, Spain. [2]Dept of Preventive Medicine and Public Health, University of Santiago de Compostela, Santiago de Compostela, Spain. [3]CIBER de Epidemiología y Salud Pública (CIBERESP), Spain. [4]Dept of Epidemiology, Brown School of Public Health, Brown University, Providence, Rhode Island, USA. [5]Service of Pneumology, Ourense Hospital Complex, Ourense, Spain. [6]Service of Oncology, Puerta de Hierro University Hospital, Madrid, Spain. [7]Service of Pneumology, University Hospital Complex of A Coruna, A Coruna, Spain. [8]Service of Oncology, Oncologic Center of A Coruna, A Coruna, Spain. [9]Service of Pneumology, Hospital Lucus Augusti, Lugo, Spain. [10]Service of Pneumology, Santiago de Compostela University Clinic Hospital, Santiago de Compostela, Spain. [11]National Institute of Silicosis, University Hospital of Asturias, Oviedo, Spain. [12]Service of Pneumology, Arquitecto Marcide Hospital, Ferrol, Spain. [13]Service of Preventive Medicine, University Hospital Complex of Santiago de Compostela, Santiago de Compostela, Spain.

Residential radon exposure is higher than the action levels recommended by the World Health Organization.

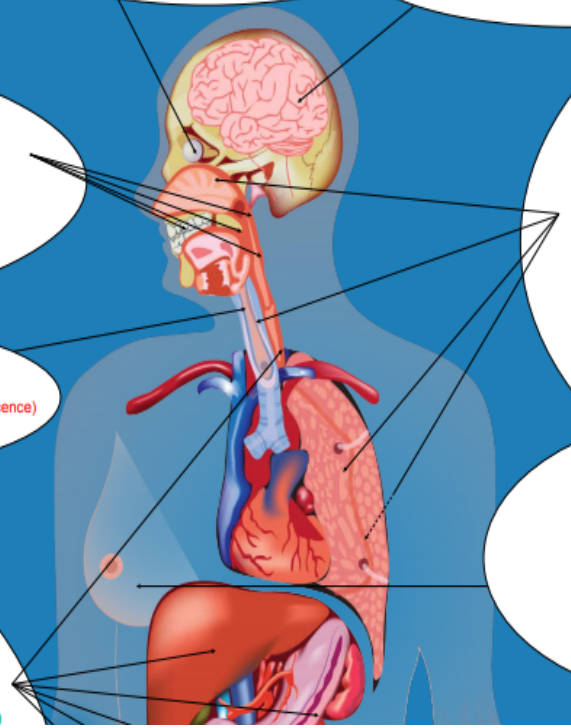
ERJ 2016;47:947-953

Dr. Alberto Ruano-Ravina

Human Cancer: Known Causes and Prevention by Organ Site

IARC Monographs on the Identification of Carcinogenic Hazards to Humans and Handbooks of Cancer Prevention

s 1-17, updated 27 November 2020
to humans (Group 1) (in red)
nce of a cancer-preventive effect (in green)



Eye
Human immunodeficiency virus type 1
Ultraviolet emissions from welding
Ultraviolet-emitting tanning devices

Brain and central nervous system
X-radiation, gamma-radiation
Absence of excess body fatness (meningioma)

Pharynx (oro-, hypo- and/or NOS)
Alcoholic beverages
Betel quid with tobacco
Human papillomavirus type 16
Quitting smoking
Tobacco smoking

Nasopharynx
Epstein–Barr virus
Formaldehyde
Salted fish, Chinese-style
Wood dust

X-radiation, gamma-radiation

Thyroid
Absence of excess body fatness
Radioiodines, including iodine-131 (exposure during childhood and adolescence)
X-radiation, gamma-radiation

…sence of excess body fatness
…astric cardia)
…*licobacter pylori*
…uitting smoking
…ubber manufacturing industry
…bacco smoking
…radiation, gamma-radiation
…ed with consumption of

Oesophagus
Acetaldehyde associated with consumption of alcoholic beverages
Alcoholic beverages
Absence of excess body fatness (adenocarcinoma)

Lung
Acheson process (occupational exposure)
Aluminium production
Arsenic and inorganic arsenic compounds
Asbestos (all forms)
Beryllium and beryllium compounds
Bis(chloromethyl)ether; chloromethyl methyl ether (technical grade)
Cadmium and cadmium compounds
Chromium (VI) compounds
Coal, indoor emissions from household combustion
Coal gasification
Coal-tar pitch
Coke production
Diesel engine exhausts
Gamma-radiation
Haematite mining (underground)
Iron and steel founding
MOPP (vincristine-prednisone-nitrogen mustard-procarbazine mixt…
Nickel compounds
Opium (consumption of)
Outdoor air pollution
Outdoor air pollution, particulate matter in
Painter (occupational exposure as)
Plutonium
Quitting smoking
Radon-222 and its decay products
Rubber manufacturing industry
Silica dust, crystalline
Soot
Sulfur mustard
Tobacco smoke, secondhand
Tobacco smoking
Welding fumes
X-radiation

Nasal cavity and paranasal sinus
Isopropyl alcohol manufacture using strong acids
Leather dust
Nickel compounds
Radium-226 and its decay products
Radium-228 and its decay products
Tobacco smoking
Wood dust

Larynx
Acid mists, strong inorganic
Alcoholic beverages
Asbestos (all forms)
Opium (consumption of)
Quitting smoking
Tobacco smoking

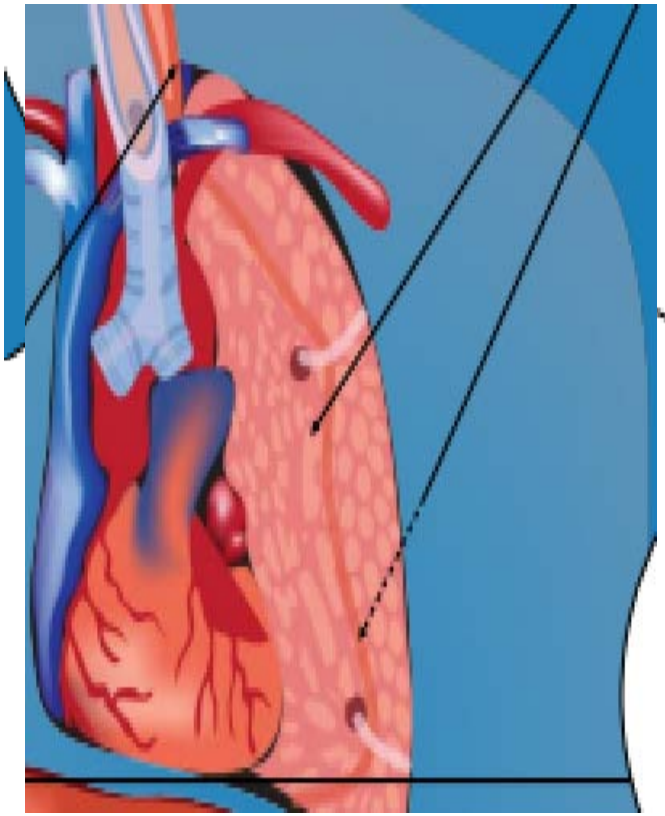
Pleura or peritoneum (mesothelioma)
Asbestos (all forms)
Erionite
Fluoro-edenite fibrous amphibole
Painter (occupational exposure as)

Breast
Alcoholic beverages
Absence of excess body fatness (postmenopausal)
Diethylstilbestrol
Estrogen–progestogen contraceptives
Estrogen–progestogen menopausal therapy
Mammography screening (50–74 years)
Regular physical activity
X-radiation, gamma-radiation

Urinary bladder
Aluminium production
4-Aminobiphenyl
Arsenic and inorganic arsenic compounds

Kidney
Absence of excess body fatness

Monographs 1-128, Handbooks 1-17, updated 27 November 2020
Agents classified as carcinogenic to humans (Group 1) (in red)
Interventions with sufficient evidence of a cancer-preventive effect (in green)



Asbestos (all forms)
Erionite
Fluoro-edenite fibrous amphibole
Painter (occupational exposure as)

Outdoor air pollution, particulate matter in
Painter (occupational exposure as)
Plutonium
Quitting smoking
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Rubber manufacturing industry
Silica dust, crystalline
Soot
Sulfur mustard
Tobacco smoke, secondhand
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X-radiation

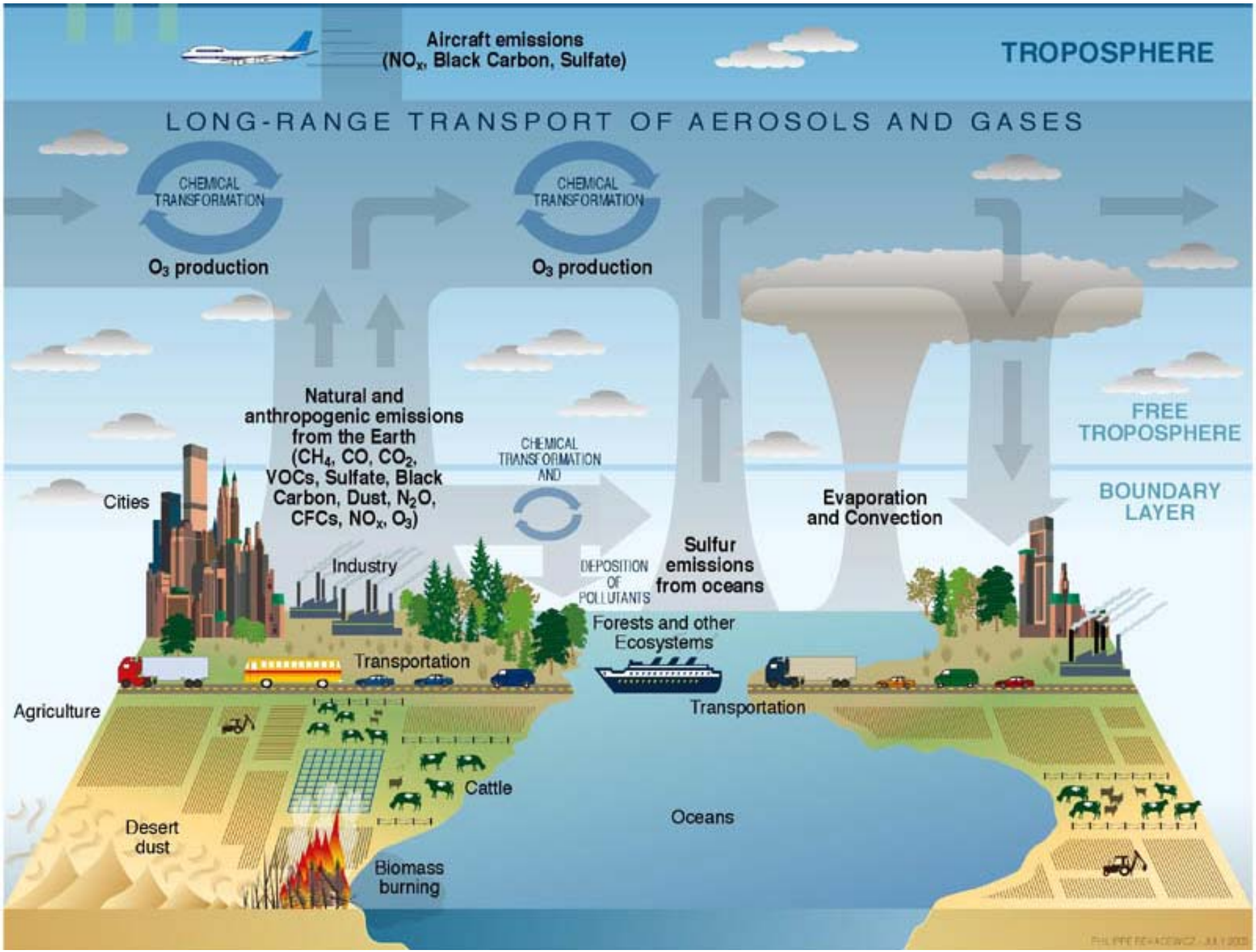
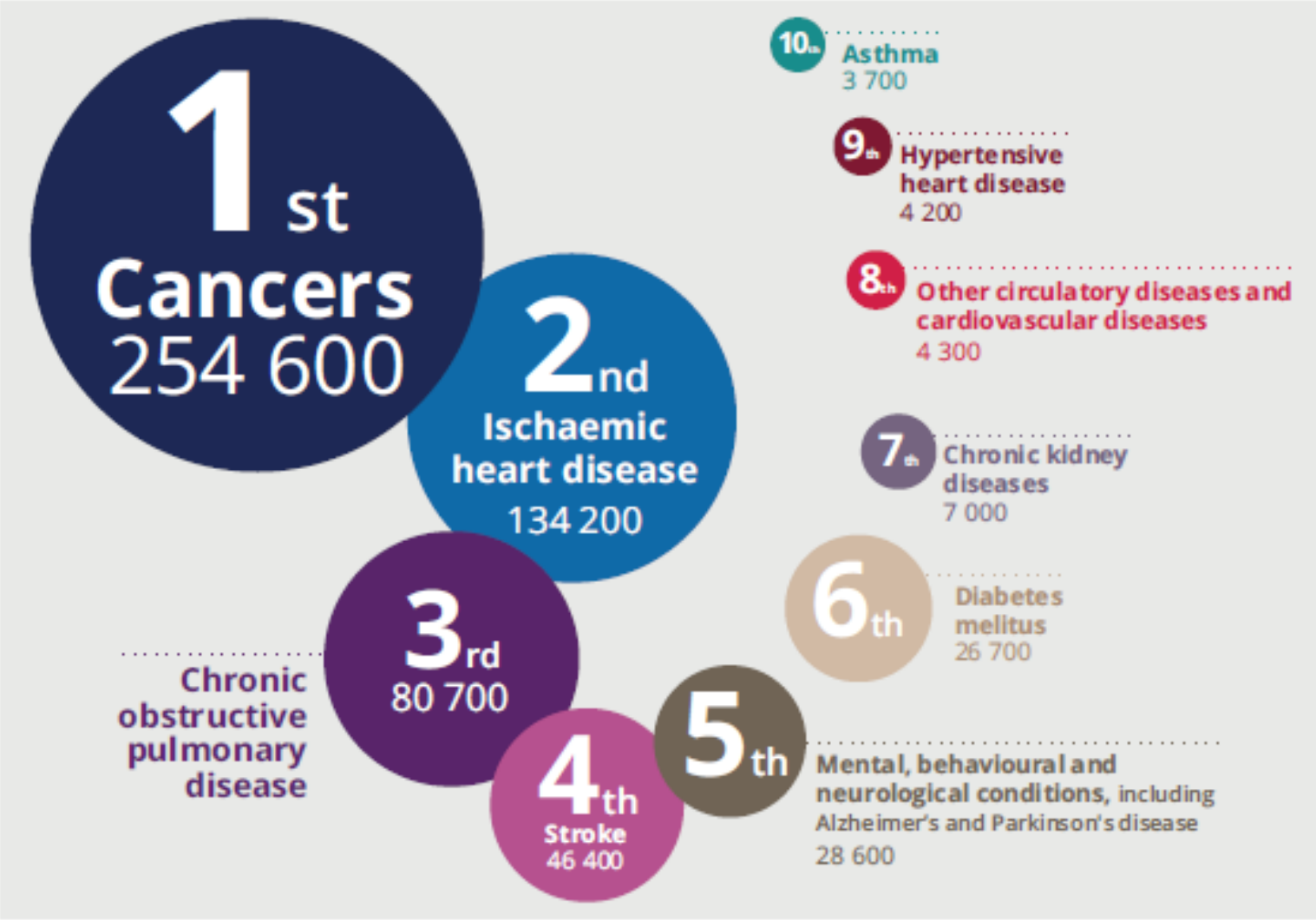

Aircraft emissions
(NO_x, Black Carbon, Sulfate)
TROPOSPHERE
LONG-RANGE TRANSPORT OF AEROSOLS AND GASES
CHEMICAL TRANSFORMATION
O_3 production
CHEMICAL TRANSFORMATION
O_3 production
Natural and anthropogenic emissions from the Earth (CH_4, CO, CO_2, VOCs, Sulfate, Black Carbon, Dust, N_2O, CFCs, NO_x, O_3)
CHEMICAL TRANSFORMATION AND
FREE TROPOSPHERE
BOUNDARY LAYER
Evaporation and Convection
Cities
Industry
DEPOSITION OF POLLUTANTS
Sulfur emissions from oceans
Forests and other Ecosystems
Transportation
Transportation
Agriculture
Cattle
Oceans
Desert dust
Biomass burning

Figure 2.2 **Top 10 non-communicable diseases causing deaths attributable to the environment in the high income European countries, 2012**



Note: The high-income countries in Europe include Andorra, Austria, Belgium, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Latvia, Lithuania, Luxembourg, Malta, Monaco, the Netherlands, Norway, Poland, Portugal, San Marino, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Source: WHO (2016b).

Air pollution and lung cancer incidence in 17 European cohorts: prospective analyses from the European Study of Cohorts for Air Pollution Effects (ESCAPE)

Ole Raaschou-Nielsen, Zorana J Andersen, Rob Beelen, Evangelia Samoli, Massimo Stafoggia, Gudrun Weinmayr, Barbara Hoffmann, Paul Fischer, Mark J Nieuwenhuijsen, Bert Brunekreef, Wei W Xun, Klea Katsouyanni, Konstantina Dimakopoulou, Johan Sommar, Bertil Forsberg, Lars Modig, Anna Oudin, Bente Oftedal, Per E Schwarze, Per Nafstad, Ulf De Faire, Nancy L Pedersen, Claes-Göran Östenson, Laura Fratiglioni, Johanna Penell, Michal Korek, Göran Pershagen, Kirsten T Eriksen, Mette Sørensen, Anne Tjønneland, Thomas Ellermann, Marloes Eeftens, Petra H Peeters, Kees Meliefste, Meng Wang, Bas Bueno-de-Mesquita, Timothy J Key, Kees de Hoogh, Hans Concin, Gabriele Nagel, Alice Vilier, Sara Grioni, Vittorio Krogh, Ming-Yi Tsai, Fulvio Ricceri, Carlotta Sacerdote, Claudia Galassi, Enrica Migliore, Andrea Ranzi, Giulia Cesaroni, Chiara Badaloni, Francesco Forastiere, Ibon Tamayo, Pilar Amiano, Miren Dorronsoro, Antonia Trichopoulou, Christina Bamia, Paolo Vineis, Gerard Hoek**

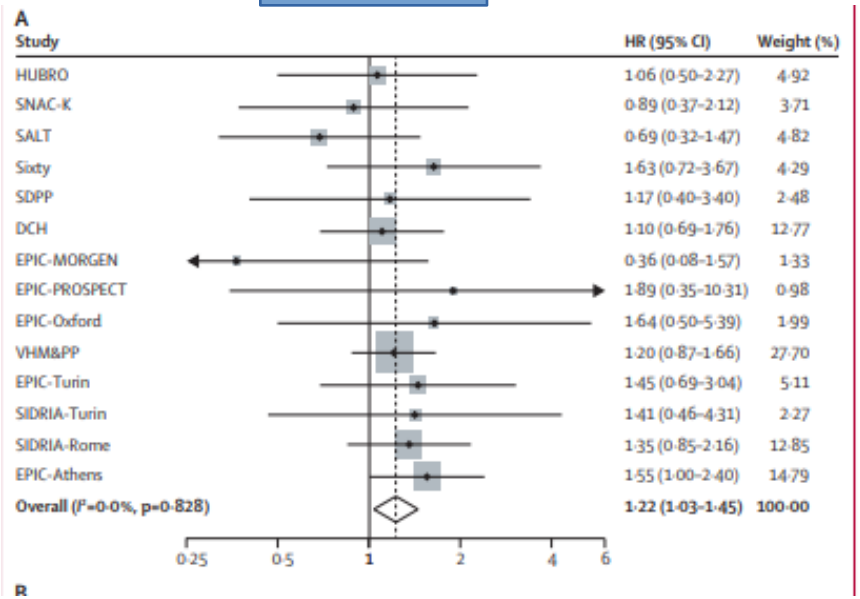
Summary

Background Ambient air pollution is suspected to cause lung cancer. We aimed to assess the association between long-term exposure to ambient air pollution and lung cancer incidence in European populations.

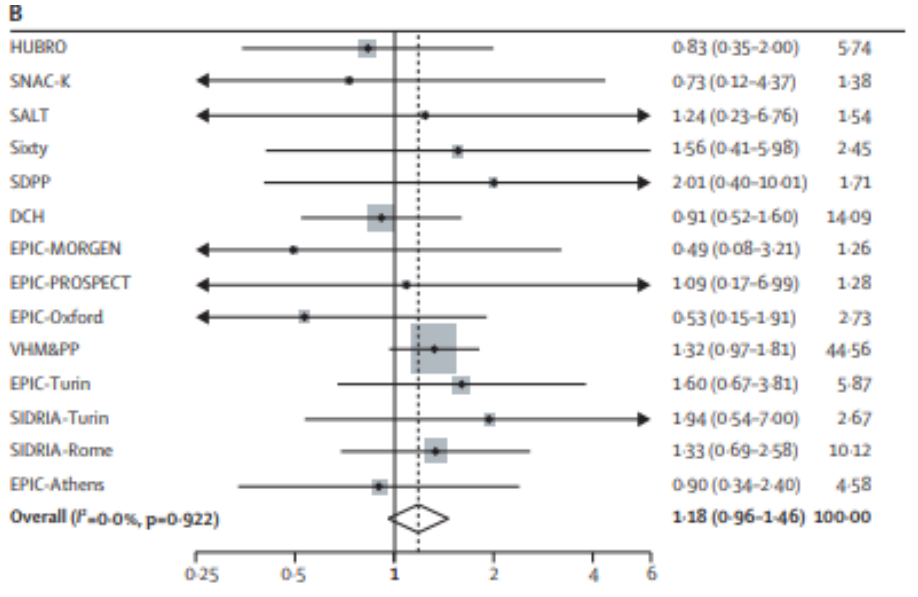
Lancet Oncol 2013; 14: 813–22

Published Online

PM10



PM2,5



Environ Health Perspect. 2014 Sep; 122(9): 906–911.
Published online 2014 Jun 6. doi: 10.1289/ehp/1408092
Review

PMCID: PMC4154221
PMID: 24911630

Outdoor Particulate Matter Exposure and Lung Cancer: A Systematic Review and Meta-Analysis

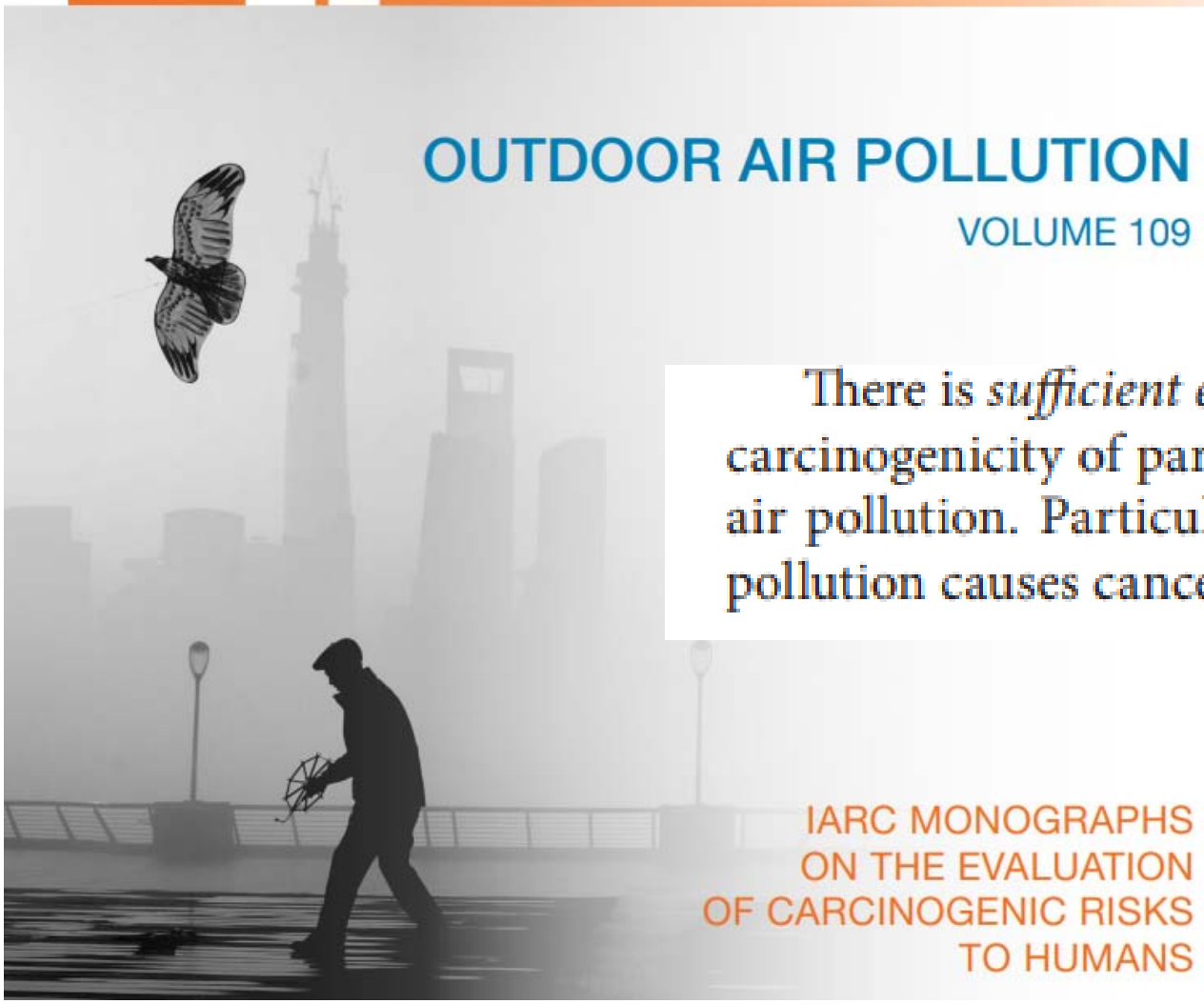
Ghassan B. Hamra,[✉1] Neela Guha,[1] Aaron Cohen,[2] Francine Laden,[3,4,5] Ole Raaschou-Nielsen,[6] Jonathan M. Samet,[7] Paolo Vineis,[8] Francesco Forastiere,[9] Paulo Saldiva,[10] Takashi Yorifuji,[11] and Dana Loomis[1]

Estimates for the relationship between a 10-$\mu g/m^3$ change in $PM_{2.5}$ and PM_{10} and histological cancer subtypes.

Exposure and outcome	RR (95% CI)	*n*	Studies included (by ID)[a]
$PM_{2.5}$			
Adenocarcinoma	1.40 (1.07, 1.83)	2,339	9, 10, 15
Squamous cell carcinoma	1.11 (0.72, 1.72)	1,523	9, 15
PM_{10}			
Adenocarcinoma	1.29 (1.02, 1.63)	965	10, 15
Squamous cell carcinoma	—	—	—

RR, meta-relative risk. Estimates are the result of random-effects meta-analysis. [a]Studies included in the analysis according to ID numbers listed in Table 1.

IARC MONOGR



OUTDOOR AIR POLLUTION

VOLUME 109

There is *sufficient evidence* in humans for the carcinogenicity of particulate matter in outdoor air pollution. Particulate matter in outdoor air pollution causes cancer of the lung.

IARC MONOGRAPHS
ON THE EVALUATION
OF CARCINOGENIC RISKS
TO HUMANS

Chronic Effects of High Fine Particulate Matter Exposure on Lung Cancer in China

Jianxin Li [1,2], Xiangfeng Lu [1,2], Fangchao Liu [1], Fengchao Liang [1], Keyong Huang [1], Xueli Yang [1], Qingyang Xiao [3], Jichun Chen [1], Xiaoqing Liu [4], Jie Cao [1], Shufeng Chen [1], Show All...

https://doi.org/10.1164/rccm.202001-0002OC PubMed: 32614242
Originally Published in Press as DOI: 10.1164/rccm.202001-0002OC on July 2, 2020

Measurements and Main Results: A total of 844 incident lung cancer cases were identified during 915,053 person-years of follow-up. Among them, 701 lung cancer deaths occurred later. The exposure-response curves for lung cancer associated with $PM_{2.5}$ exposure were nonlinear, with steeper slopes at the higher concentrations. Adjusted for age, sex, geographical region, urbanization, education level, smoking status, alcohol consumption, work-related physical activity, and body mass index, participants exposed to the second-fifth quintiles of $PM_{2.5}$ had higher risk for lung cancer incidence than those exposed to the first quintile, with hazard ratios of 1.44 (95% confidence interval [CI], 1.10–1.88), 1.49 (95% CI, 1.12–1.99), 2.08 (95% CI, 1.42–3.04), and 2.45 (95% CI, 1.83–3.29), respectively. The corresponding hazard ratios for lung cancer mortality were 1.83 (95% CI, 1.33–2.50), 1.80 (95% CI, 1.29–2.53), 2.50 (95% CI, 1.62–3.86), and 2.95 (95% CI, 2.09–4.17), respectively.

Conclusions: We provide strong evidence that high $PM_{2.5}$ exposure leads to an elevated risk of lung cancer incidence and mortality, highlighting that remarkable public health benefits could be obtained from the improvement of air quality in highly polluted regions.

Conclusion

Healthy environment, healthy lives