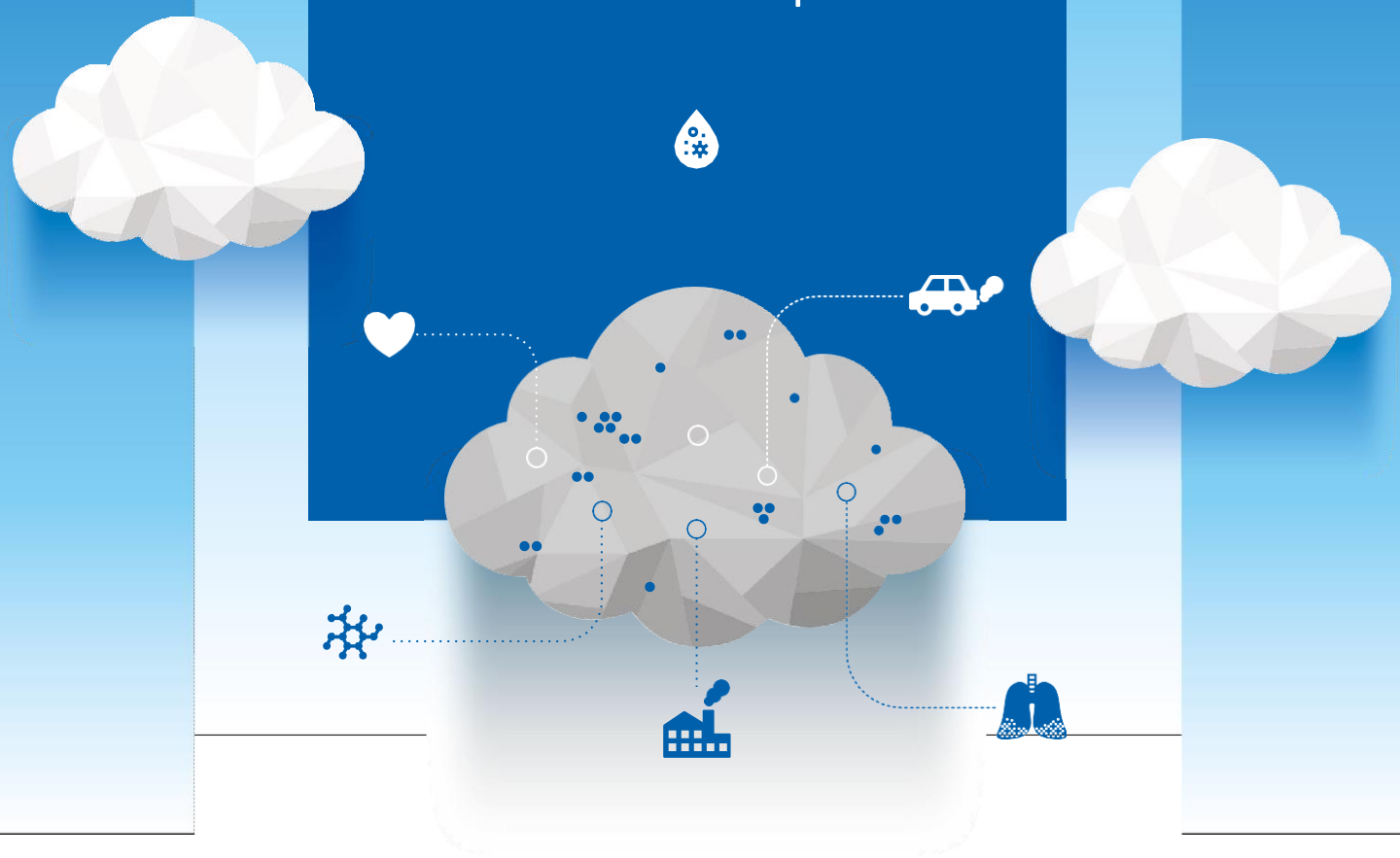
University of Deusto

Environmental pollution and its impact on human health

Situation in Spain



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Abstract

Nowadays environmental pollution is the first environmental risk factor for public health, being traffic emissions one of the main contributors to it. The impact on the inhabitants' health and costs to society increase year after year. Pollution is one of the most relevant risk factors for cardiovascular and respiratory diseases worldwide.

Environmental pollution is one of the main risk factors for human health worldwide. It causes around 11.2% of deaths and 163 million of Disability Adjusted Life Years (DALYs) globally, ranking even ahead of well-recognized risk factors such as sedentary life or alcohol consumption [1-2]. If no action is taken, the estimates predict a doubling of the number of deaths by the year 2050 [3].

According to data published by the World Health Organization (WHO), 9 out of 10 people in the world breathe polluted air, which directly affects people's respiratory and cardiovascular systems [4]. In Europe, air pollution is the greatest individual environmental risk to health, leading the ranking of causes of premature mortality [5]. According to data from the European Environment Agency, in 2014 the high levels of air pollution from the combustion of fossil fuels caused more than half a million deaths in 41 European countries. Despite the high impact still caused today by exposure to polluted air in Europe, there has been an average decrease of 60% in premature mortality from exposure to PM2.5 between 1990 and 2015 [6].

Moreover, although the values remain high, a decreasing trend is documented since the beginning of the century in Europe with respect to the levels of exposure to polluted air. In 2016 approximately 74% of the EU 28 population was exposed to the levels of airborne particles (PM2, 5) exceeding OMS recommended values. For nitrogen dioxide (NO2) levels, about 12% of measuring stations reported concentrations above OMS recommended standards; in 88% of cases these exceedances were observed near traffic stations [6].

In Spain in 2015 it is estimated that a total of 38,600 premature deaths occurred due to the effects of exposure to high levels of PM2.5, NO2 and Ozone (O3), being 27,900 (72%), 8,900 (23%) and 1,800 (5%) of those deaths caused by high exposure to PM 2.5 particles, NO2 and O3 [6] respectively.

This impact on human health has been well studied and continues to be of great importance today. Recent publications estimate that the total number of deaths in 2016 from heart disease, stroke, lung cancer, respiratory tract infections and chronic obstructive pulmonary disease worldwide, 22.6%, 21.4%, 23.5%, 45.1% and 44.7% respectively, were attributable to air pollution [1]. Spanish studies confirm the impact on mortality as well as on other effects in the medium and long term for cardiovascular and respiratory reasons, such as cardiovascular and respiratory consultations and hospitalizations [7-10].

The health impact of airborne particulate pollutants has been evidenced through epidemiological, toxicological and clinical studies [11-12]. In general, studies show the aggravation of symptoms and diseases related to environmental pollution and particles, despite the difficulty of isolating the effect of a single pollutant on the incidence of a certain pathology. Likewise, the effect on health may also be conditioned by other factors such as exposure time, particle concentration, as well as the sensitivity of certain groups of people such as children, pregnant women and people with chronic diseases.

To address this challenge, it is required social awareness of the problem and political action to take measures to reduce air pollution levels. Below is a diagram showing the current situation in Spain.

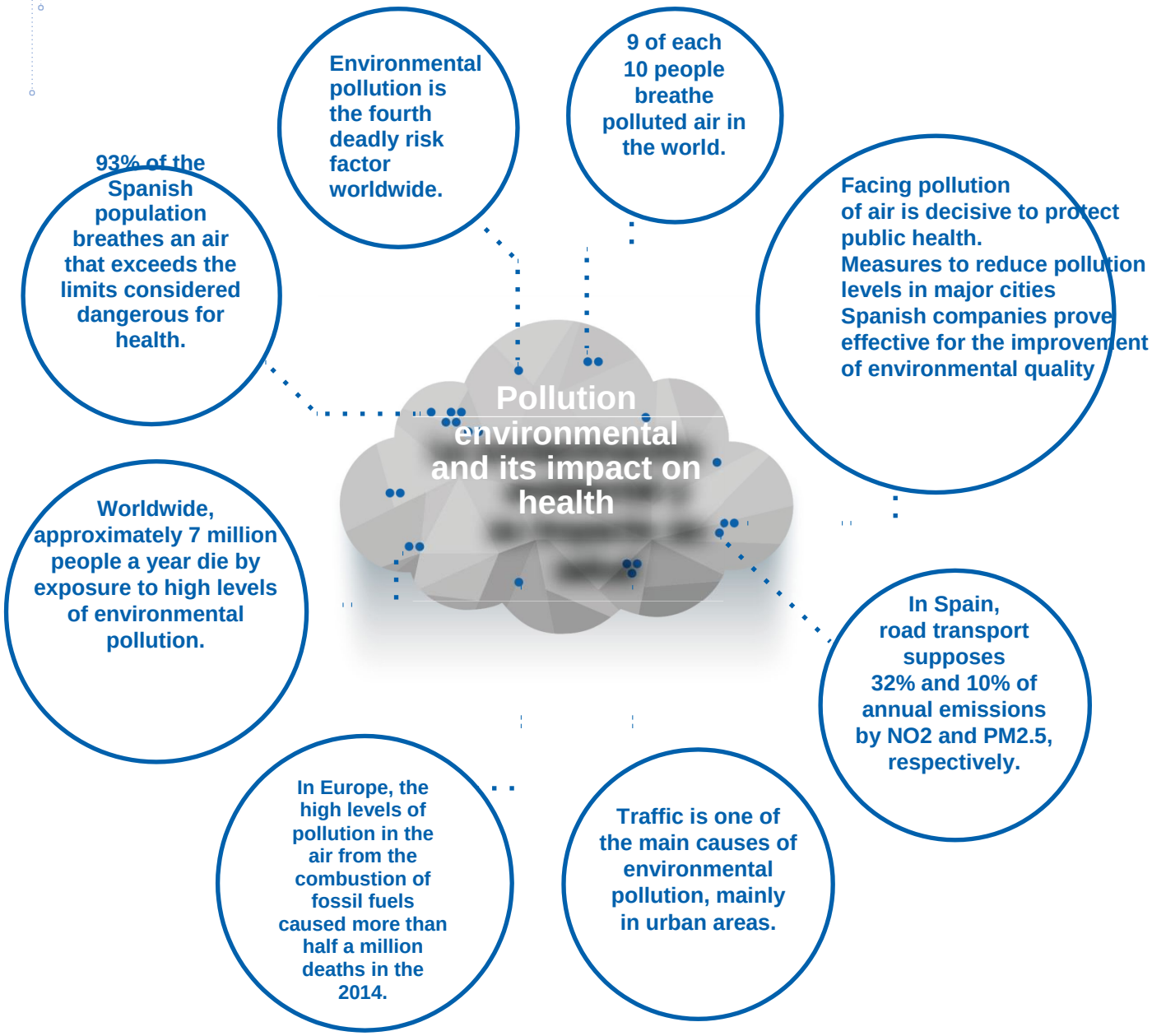
Even though the main sources of pollution are located around industrial areas, thermoelectric plants and urban areas, the problem of atmospheric pollution is practically widespread throughout the State, as many of the pollutants can travel hundreds of kilometres. Therefore, it is estimated that 93% of the Spanish population breathes air that exceeds the limits considered dangerous for health according to the OMS for polluting substances. If the legal limits established in the European Union are considered, almost 40% of the population is exposed to concentrations of contaminating gases considered harmful to health [22]. At present, it has been shown that the main causes of pollution in cities come from human activity; and that transport, agriculture, industry and residential heating systems are responsible for most of these high levels of air pollution [17], with transport being the main responsible for the deterioration of air quality in cities [23]. A

global systematic review study estimated that traffic contributed to 25% of PM2.5 air pollution in urban areas [24]. Spanish studies estimate that road traffic is the main cause of pollution in the country, with a contribution between 70% and 80% in pollution by PM 2.5 [10].

Data from the National Inventory of Air Pollutants published in March 2018 corroborate the impact and contribution of road traffic to the increase of PM2.5 and NO2 in the air, among other environmental pollutants [25]. Specifically, for the city of Madrid, road transport accounted for 81.3%, 74.9%, 77% of annual emissions of PM2.5, PM10 and NOx, respectively [23].
Since 1990, there has been a decrease in the main environmental pollutants with an impact on health. The volume of emissions from road transport experienced a reduction in 2016 with respect to the previous year, representing 32% of the global NOx emissions in 2016. However, emissions from these sources were reduced by 4.0%, a consequence of the technological improvement of the automobile fleet [25]. The emissions of PM2, 5 in 2016 also decreased by 1.3%, mainly due to the displacement of conventional power generation plants, despite the fact that the main sources of these emissions (residential combustion (41%) and waste (27 %)) increased their emissions slightly [25].

Since 1990 a decrease has been experienced in the main environmental pollutants with an impact on human health. The volume of emissions from road transport experienced a reduction in 2016 compared to the previous year, accounting for 32% of global NOx emissions in 2016. However, emissions from these sources were reduced by 4.0%, as a result of the technological improvement in the car fleet [25]. PM2, 5 emissions in 2016 also decreased by 1.3%, mainly due to the displacement of conventional power generation plants, even though the main sources of these emissions (residential combustion (41%) and waste (27%)) slightly increased their emissions [25].

Current situation



Addressing this challenge requires social awareness of the problem and political action to take measures to reduce air pollution levels. A scheme showing the current situation in Spain is presented below

Although the main sources of pollution are located around industrial areas, thermoelectric power plants and urban areas, the problem of air pollution is widespread in practically the entire State, since many of the pollutants can travel hundreds of years. Kilometers therefore, it is estimated that 93% of the Spanish population breathes air that exceeds the limits considered hazardous to health according to the WHO for polluting substances. If the legal limits established in the European Union are taken into account, almost 40% of the population is exposed to concentrations of polluting gases considered harmful to health [22]. At present, it has been shown that the main causes of pollution in cities come from human activity; and that transport, agriculture, industry and residential heating systems are responsible for most of these high levels of air pollution [17], with transportation being the main cause of the deterioration of air quality in cities [2. 3]. A systematic review study worldwide estimated that traffic contributed 25% of environmental pollution by PM2.5 in urban areas [24]. Spanish studies estimate that road traffic is the main cause of pollution in the country, with a contribution between 70% and 80% in PM 2.5 pollution [10].

Despite the fact that the main sources of pollution are located around industrial areas, thermoelectric plants and urban areas, the problem of atmospheric pollution is practically widespread throughout the State, as many of the pollutants can travel hundreds of kilometres. Therefore, it is estimated that 93% of the Spanish population breathes air that exceeds the limits considered dangerous for health according to the WHO for polluting substances. If the legal limits established in the European Union are taken into account, almost 40% of the population is exposed to concentrations of contaminating gases considered harmful to health [22]. At present, it has been shown that the main causes of pollution in cities come from human activity; and that transport, agriculture, industry and residential heating systems are responsible for most of these high levels of air pollution [17], with transport being the main responsible for the deterioration of air quality in cities [23]. A global systematic review study estimated that traffic contributed to 25% of PM2.5 air pollution in urban areas [24]. Spanish studies estimate that road traffic is the main cause of pollution in the country, with a contribution between 70% and 80% in pollution by PM 2.5 [10].

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References

[1] Health Effects Institute. State of Global Air 2018. Special Report. Boston, MA:Health Effects Institute 2018.

[2] Hadley M B, Baumgartner J, Vedanthan J. Developing a Clinical Approach to Air Pollution and Cardiovascular Health. Circulation. 2018; 137:725–742. DOI: 10.1161/CIRCULATIONAHA.117.030377.

[3] The Lancet Neurology. Air pollution and brain health: an emerging issue. The Lancet Neurology 2018 Feb 1,;17(2):103.

[4] Nueve de cada diez personas de todo el mundo respiran aire contaminado. Sin embargo, cada vez hay más países que toman medidas. 2018. [Consultado el 14/05/2018]. Disponible en: http://www.who.int/es/news-room/detail/02-05-2018-9-out-of-10-people-worldwide-breathe-polluted-air-but-more-countries-are-taking-action

[5] Ecologistas en Accion. Medidas fiscales para mejorar la calidad del aire. Mejor sin diésel. GreenBudgetEurope.

[6] European Environment Agency. Air quality in Europe — 2018 report. EEA Report No 12/2018. doi: 10.2800/777411.

[7] Guillén Pérez J, Cirera L, García-Marcos Álvarez L, Jiménez Torres E, Barber X, José Martínez García M, et al. The short-term impact of air pollution on the mortality. Results of the EMECAM project in Cartagena. Revista Española de Salud Pública 1999 March 1; 73:215-224.

[8] Martín Martín R, Sánchez Bayle M. Impacto de la contaminación ambiental en las consultas pediátricas de Atención Primaria: estudio ecológico. An Pediatr (Barc). 2017. http://dx.doi.org/10.1016/j.anpedi.2017.06.013

[9] Alonso Fustel E., Martínez Rueda T., Cambra Contín K., Lopez Carrasco L., Boldo Pascua E., Zorrilla Torras B., et al. Evaluación en cinco ciudades españolas del impacto en salud de la contaminación atmosférica por partículas: Proyecto europeo APHEIS. Rev. Esp. Salud Publica 79 (2): 297-308. Abril 2005. [Consultado el 18/05/2018]. Disponible en: http://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S1135-57272005000200015&lng=es

[10] Linares C., Julio D. Efecto de las partículas de diámetro inferior a 2,5 micras (PM 2,5) sobre los ingresos hospitalarios en niños menores de 10 años en Madrid. Gac Sanit 2009; 23:192-7 - Vol. 23 Núm.3 DOI: 10.1016/j.gaceta.2008.04.006.

[11] Royal College of Physicians. Every breath we take: the lifelong impact of air pollution. Report of a working party. London: RCP, 2016.

[12] Rumana HS, Sharma RC, Beniwal V, Sharma AK. A retrospective approach to assess human health risks associated with growing air pollution in urbanized area of Thar Desert, Western Rajasthan, India. J Environ Health Sci Eng. 2014; 12:23.

[13] Cohen, Aaron J., et al. Estimates and 25-year trends of the global burden of disease attributable to ambient air pollution: an analysis of data from the Global Burden of Diseases Study 2015. The Lancet, Volume 389, Issue 10082, 1907 – 1918. DOI: https://doi.org/10.1016/S0140-6736(17)30505-6

[14] United States Environmental Protection Agency. Health and Environmental Effects of Particulate Matter (PM). [Consultado el 18/05/2018]. Disponible en: https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm

[15] WHO | Ambient air pollution: Health impacts. 2018. [Consultado el 14/05/2018]. Disponible en: http://www.who.int/airpollution/ambient/health-impacts/en/

[16] Álvarez, E., Menéndez, J. y Bravo, M. (2018), "Calidad del aire. Situación en España y escenarios a futuro para la CAPV, Madrid y Barcelona", Orkestra.

[17] Mapping the sources and level of air pollution in Europe: Commission publishes new Air Quality Index and Atlas. Premium Official News 2017 Nov 16.

[18] Ecologistas en Acción. Informe La calidad del aire en el Estado español durante 2016. Madrid 27 de junio 2017. [Consultado el 15/11/2018]. Disponible en: https://www.ecologistasenaccion.org/IMG/pdf/informe-calidad-aire-2016.pdf

[19] Ecologistas en Acción, Calidad del aire en la ciudad de Madrid, año 2017. Madrid 16 de enero 2018. [Consultado el 15/11/2018]. Disponible en: https://www.ecologistasenaccion.org/IMG/pdf/info-calidad-aire-madrid-2017.pdf

[20] Pope,C.A.I., Burnett,R.T., Thun,M.J., Calle,E.E., Krewski,D., Ito,K., Thurston, G.D. Lung cancer, cardiopulmonary mortality, and long term exposure to fine particulate air pollution. JAMA, 2002; 287: 1132-1141.

[21] WHO Global Urban Ambient Air Pollution Database (update 2018). [Consultado el 15/11/2018]. Disponible en: http://www.who.int/phe/health_topics/outdoorair/databases/cities/en/

[22] Blázquez Sanchez, N. Mejor sin diésel. Medidas fiscales para mejorar la calidad del aire. Ecologistas en Acción. Marzo 2018. [Consultado el 15/11/2018]. Disponible en: https://www.ecologistasenaccion.org/?p=35894

[23] Observatorio DKV de salud y medioambiente en España 2010. Contaminación atmosférica y salud. Octubre 2010.

[24] Karagulian F, Belis CA, Dora CFC, Prüss-Ustün AM, Bonjour S, Adair-Rohani H, et al. Contributions to cities' ambient particulate matter (PM): A systematic review of local source contributions at global level. Atmospheric Environment 2015 November 1; 120:475-483.

[25] Inventario Nacional de emisiones de Contaminantes atmosféricos: Informe Resumen Edición 1990-2016. [Consultado el 17/11/2018]. Disponible en: https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/documentoresumeninventariocontaminantes_tcm30-444542.pdf

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