EU Regional Development Funds - Interreg Central Europe AWAIR

Strategies and operational tools to support adaptation actions
in vulnerable population groups during the Severe Air Pollution Episodes (SAPEs)

Parma - APE Parma Museo, via Farini 32a, November 6th, 2019

Environment, Obesity and Diabetes - a red thread

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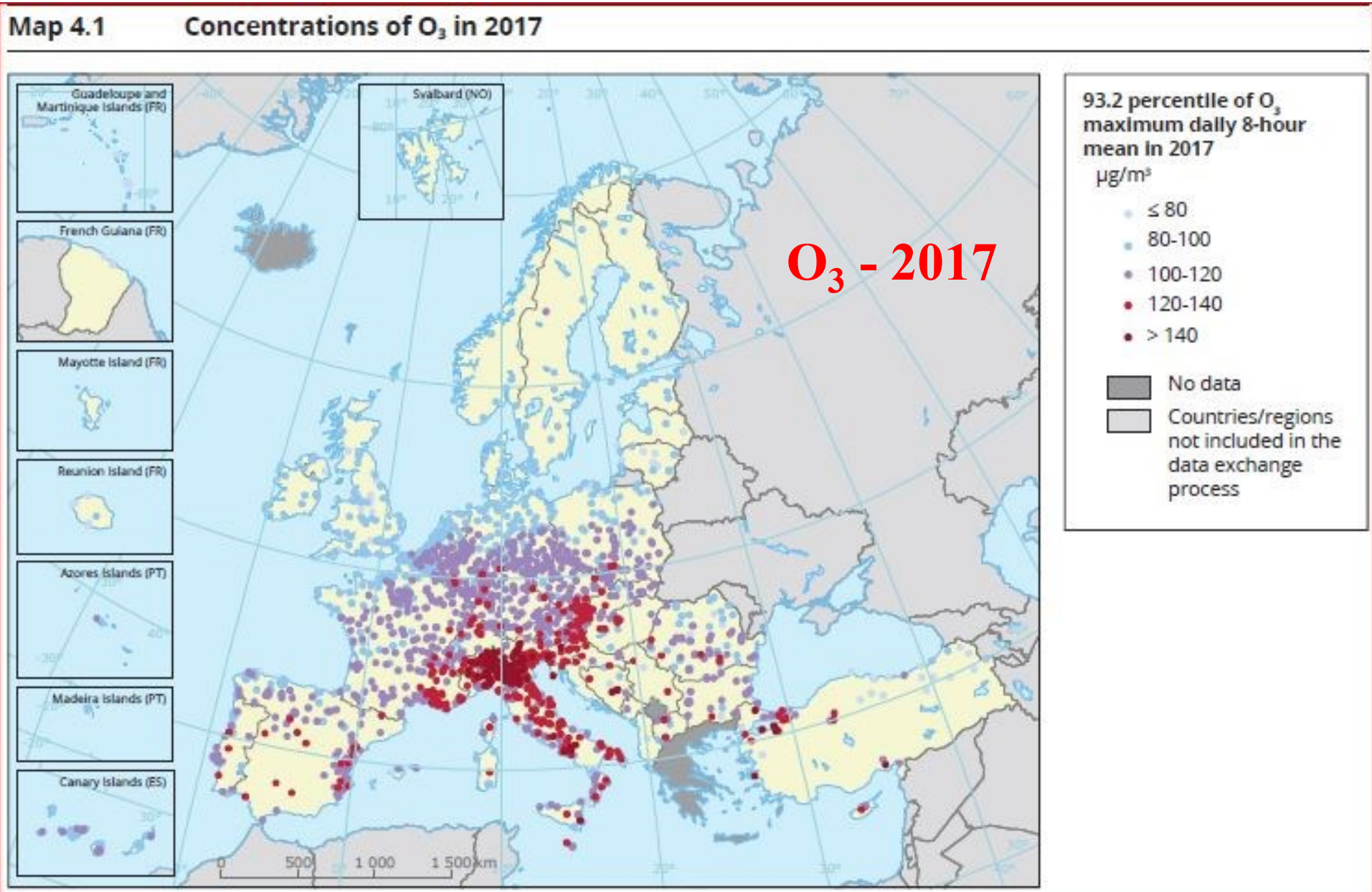
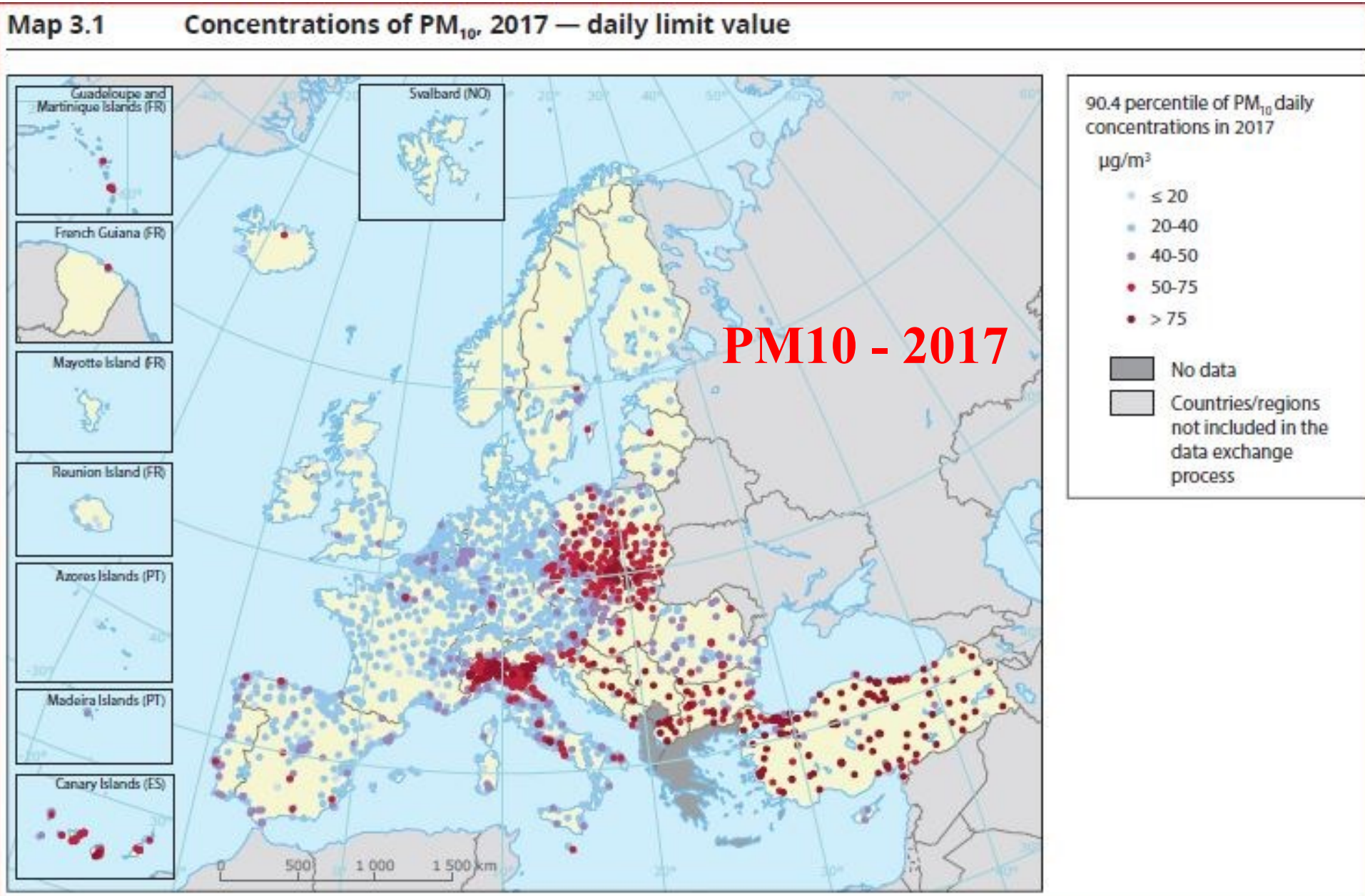
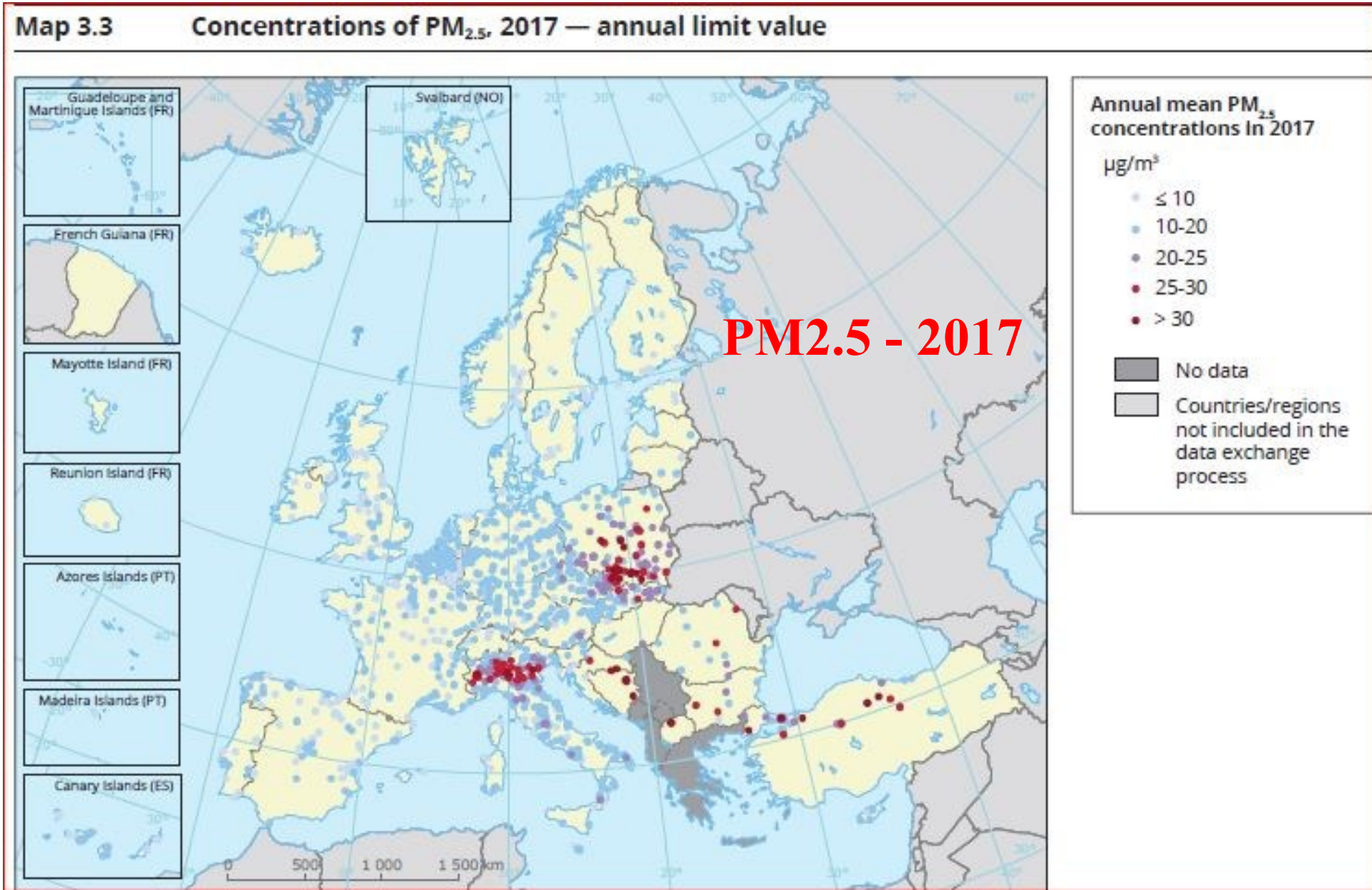
November 2017 AEA



November 2017 AEA



November 2017 AEA



Pollutants, obesity, Type 2 myotonic dystrophy - 1

Environ Health Perspect. 2010 Sep;118(9):1235-42. Epub 2010 May 5.

Low dose of some persistent organic pollutants predicts type 2 diabetes: a nested case-control study.

Lee DH, Steffes MW, Sjödin A, Jones RS, Needham LL, Jacobs DR Jr.

Diabetes Care. 2006 Jul;29(7):1638-44.

A strong dose-response relation between serum concentrations of persistent organic pollutants and diabetes: results from the National Health and Examination Survey 1999-2002.

Lee DH, Lee IK, Song K, Steffes M, Toscano W, Baker BA, Jacobs DR Jr.

Diabetes Care. 2007 Mar;30(3):622-8.

Association between serum concentrations of persistent organic pollutants and insulin resistance among nondiabetic adults: results from the National Health and Nutrition Examination Survey 1999-2002.

Lee DH, Lee IK, Jin SH, Steffes M, Jacobs DR Jr.

Persistent Organic Pollutants & Diabetes

Pollutants, Obesity, Type 2 myotonic dystrophy - 2

Epidemiology. 1997 May;8(3):252-8.

Serum dioxin and diabetes mellitus in veterans of Operation Ranch Hand.

Henriksen GL, Ketchum NS, Michalek JE, Swaby JA.

Diabetologia. 2010 May;53(5):899-906. Epub 2010 Feb 25.

High prevalence of prediabetes and diabetes in a population exposed to high levels of an organochlorine cocktail.

Ukropec J, Radikova Z, Huckova M, Koska J, Kocan A, Sebokova E, Drobna B, Trnovec T, Susienkova K, Labudova V, Gasperikova D, Langer P, Klimes I.

Diabetes Care. 2008 Sep;31(9):1802-7. Epub 2008 Jun 16.

Association of brominated flame retardants with diabetes and metabolic syndrome in the U.S. population, 2003-2004.

Lim JS, Lee DH, Jacobs DR Jr.

Environ Health Perspect. 2007 Jun;115(6):876-82. Epub 2007 Mar 14.

Concentrations of urinary phthalate metabolites are associated with increased waist circumference and insulin resistance in adult U.S. males.

Stahlhut RW, van Wijngaarden E, Dye TD, Cook S, Swan SH.

Serum dioxin
Organochlorine
Bromide
Phthalates
&
Diabetes

Pollutants, Obesity, Type 2 myotonic dystrophy - 3

Int J Androl. 2012 Jun;35(3):437-48. doi: 10.1111/j.1365-2605.2012.01247.x. Epub 2012 Feb 28.

Obesogens, stem cells and the developmental programming of obesity.

Janesick A, Blumberg B.

J Altern Complement Med. 2002 Apr;8(2):185-92.

Chemical toxins: a hypothesis to explain the global obesity epidemic.

Baillie-Hamilton PF.

Obesogens
Toxins
&
Obesity

Pollutants and carbohydrate metabolism

Ambient air pollutants adversely affects glucose tolerance, insulin sensitivity and blood lipid concentrations

Ambient Air Pollutants Have Adverse Effects on Insulin and Glucose Homeostasis in Mexican Americans.

Chen Z, Salam MT, Toledo-Corral C et al.

Diabetes Care 2016;39:547-554

Pollution and insulin resistance

The concentrations of NO_2, typically considered a marker of *vehicular traffic*, are independently associated with *Insulin Resistance*

In models combining both air pollution and urban greenness NO_2 remained significantly associated with Insulin Resistance whereas effect estimates for all other exposures (e.g. PM10) attenuated

Associations of Residential Long-Term Air Pollution Exposures and Satellite-Derived Greenness with Insulin Resistance in German Adolescents

Elisabeth Thiering, Iana Markevych, Irene Brüske et al.

Environ Health Perspect 2016, 124, 1291-1298

Pollution, obesity and DM

Exposure in infancy to perfluorooctanesulfonic acid (PFOS) and perfluoroctanoic acid (PFOA) predicts *adiposity at 15 and 21 years* of age and the altered function of *beta-cells at 15 years* of age, respectively

Longitudinal Associations of Exposure to Perfluoroalkylated Substances in Childhood and Adolescence and Indicators of Adiposity and Glucose Metabolism 6 and 12 Years Later: The European Youth Heart Study

Domazet SL, Grøntved A, Timmermann AG, Nielsen F and Jensen TK

Diabetes Care 2016 Oct; 39(10): 1745-1751.

Bisphenol A (BPA) and DM2

BPA affects *resistin and adiponectin* production in adipose tissue cultures and thus it may be responsible for the development of *insulin resistance in childhood obesity*

Bisphenol A is associated with insulin resistance and modulates adiponectin and resistin gene expression in obese children.

Menale C, Grandone A, Nicolucci C, (…), Miraglia Del Giudice E. Pediatr Obes. 2017 Oct;12(5):380-387. doi: 10.1111/ijpo.

Endocrine disruptors and DM

There is a *direct relationship* between the *risk of diabetes*, especially among women, and *polychlorinated biphenyls (PCBs), organo-chlorinated pesticides (OCPs), bisphenol A (BPA) and phthalates*. Major serum levels are found among African Americans

The incidence of diabetes and the dose-response relationship are greater in African-Americans, Hispanics and low-income ones versus non-Hispanic whites

Disparities in Environmental Exposures to Endocrine-Disrupting Chemicals and Diabetes Risk in Vulnerable Populations.

Ruiz D, Becerra M, Jagai JS, Ard K, Sargis RM.

Diabetes Care. 2018 Jan;41(1):193-205.

Traffic noise and obesity

A statistical study of 3,796 adults who had completed at least two follow-up visits between 2001 and 2011 revealed that a rise in the average of *10 dB noise level* is associated with an increased risk of *obesity* by 17%

Long-term exposure to transportation noise and its association with adiposity markers and development of obesity

MariaForaster, Ikenna C.Eze, DanielleVienneau, (…),NicoleProbst-Hensch

Environment International Volume 121, Part 1, December 2018, Pages 879-889

PM2.5 and diabetes

Nearly 150,000 adults recruited between 2001 and 2014 and subjected to at least 2 *blood glucose and PM2.5* concentration measurements in their neighborhood

In participants exposed to the *second, third and fourth quartile of environmental PM2.5*, especially if occasional or regular drinkers, or with a low BMI, the risk of *diabetes was significantly higher* compared to participants exposed in the first quartile

Long-term exposure to ambient fine particulate matter ($PM_{2.5}$) and incident type 2 diabetes: a longitudinal cohort study.
Lao XQ, Guo C, Chang LY, (…), Chan TC.
Diabetologia. 2019 May;62(5):759-769.

PM2.5 and diabetes

Out of a sample of 1.7 million non-diabetic American veterans, the risk of DM2 and PM 2.5 levels were compared

A *10 point increase in PM2.5 concentration was associated with an increase 15% risk of diabetes and an 8% increase in mortality risk*

The risk increased when pollution levels exceeded *2.4 mcg/m^3*, well below the current standard set by the WHO of 10 mcg/m^3

Considering the PM2.5 levels in the world, one can estimate an increase of *3.2 million new cases of diabetes, of 8.2 million years of life lost* due to disability and *over 200,000 deaths every year*, especially in low and middle-low income countries

Air pollution and diabetes: it's time to get active!
Gary O'Donovan, Carlos Cadena-Gaitán
Lancet Planetary Health Volume 2, No. 7, e287–e288, July 2018

Air quality in Europe is poor

Improvements in member States are negligible

400,000 premature deaths registered in 2016