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Use of E-PRTR Data in Health Studies

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Chronic diseases

- Noncommunicable diseases (NCDs), or chronic diseases, are not transmitted from person to person.
- Chronic diseases are the **new epidemics** in developed societies
- The four main types are:

  -Cardiovascular disease
  -Cancer
  -Chronic respiratory diseases
  -Diabetes.

- NCDs already disproportionately affect low- and middle-income countries, where almost 75% of NCD deaths are recorded, 28 million.
- In Spain, cancer, heart disease, cerebrovascular diseases, chronic diseases of the lower respiratory tract, Alzheimer's disease and diabetes mellitus **are the five leading causes of mortality.**

Chronic diseases

- They have shared and modifiable risk factors (tobacco, obesity, lack of physical exercise, **environmental factors**, etc.).

- Their **surveillance** (knowing their magnitude, their distribution and the interest in identifying the risk factors involved) is necessary.

- In Spain, there is not a national system in Spain for the surveillance of chronic diseases

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Public health surveillance

- Systematic collection, consolidation and analysis of data and **dissemination of information** to those who need to know so that action can be taken.

- It is the essential activity that makes it possible to guide actions (preventive and control interventions), as well as systematically evaluate the results of its implementation.

- **Communication for health (information for action).**

- **Surveillance of the health effects of environmental and genetic factors**

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Environment and Chronic Diseases

- **Scientific Consensus:** The environment (as lifestyle, habitat and setting, occupation and diet) is involved in the etiology of many types of chronic diseases (eg cancer).

- **”Environmental”**= “exposures that are present in the daily life of persons and defy individual control and correspond to **habitat and setting**—air (both indoor and outdoor), water and soil pollution—although occupational exposures could also be included”.

- **Industry as one of the sources of this contamination.**

- The industrial sector makes great efforts every year to **minimize its impact** on the environment and thus on health.

Refinería de Cepsa en San Roque (Cádiz). JULIÁN ROJAS

https://elpais.com/elpais/2014/11/26/ciencia/1417005093_700957.html

Petroquímica de Tarragona, polígono norte. JOSEP LLUIS SELLART

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1. Vista aérea de la rotura de embalse de de Aznalcóllar (Sevilla), el 12 de mayo de 1998.

4. Operarios de la Agencia de Medio Ambiente, protegidos con guantes y mascarillas, recogen peces muertos en un campo de cultivo próximo a Doñana, donde fueron arrastrados por la ola tóxica que provocó el vertido de Minas de Aznalcóllar, el 29 de abril de 1998.

https://elpais.com/elpais/2018/04/20/album/1524211696_728584.html#foto_gal_1

Incendio en el polígono de Fuente del Jarro, Paterna. FOTO: MÒNICA TORRES / VIDEO: EL PAÍS

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Welcome

The *European Pollutant Release and Transfer Register (E-PRTR)* is the Europe-wide register that provides easily accessible key environmental data from industrial facilities in European Union Member States and in Iceland, Liechtenstein, Norway, Serbia and Switzerland. It replaced and improved upon the previous European Pollutant Emission Register (EPER).
The new register contains data reported annually by more than *30,000 industrial facilities* covering 65 economic activities across Europe.
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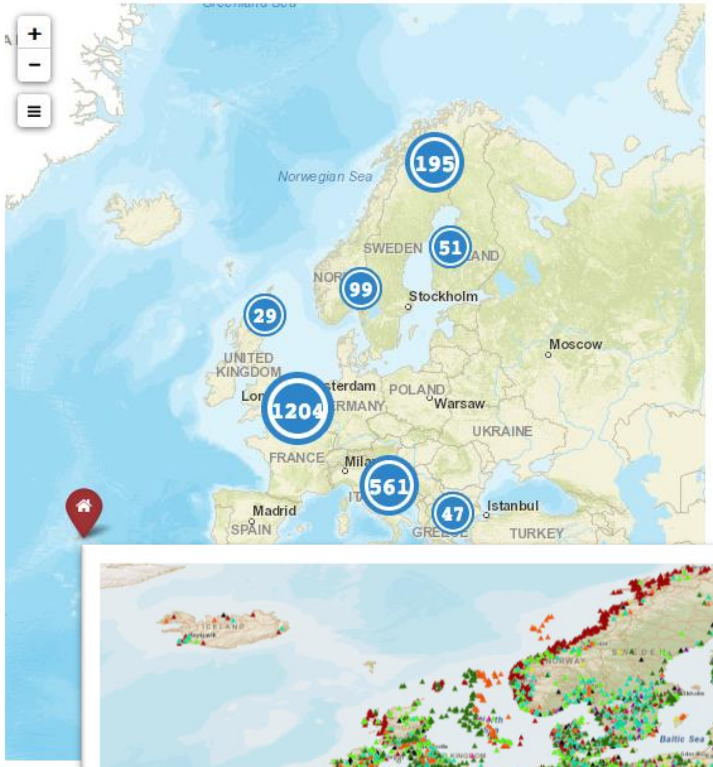
Pollutant Releases • Pollutant Transfers • Waste Transfers

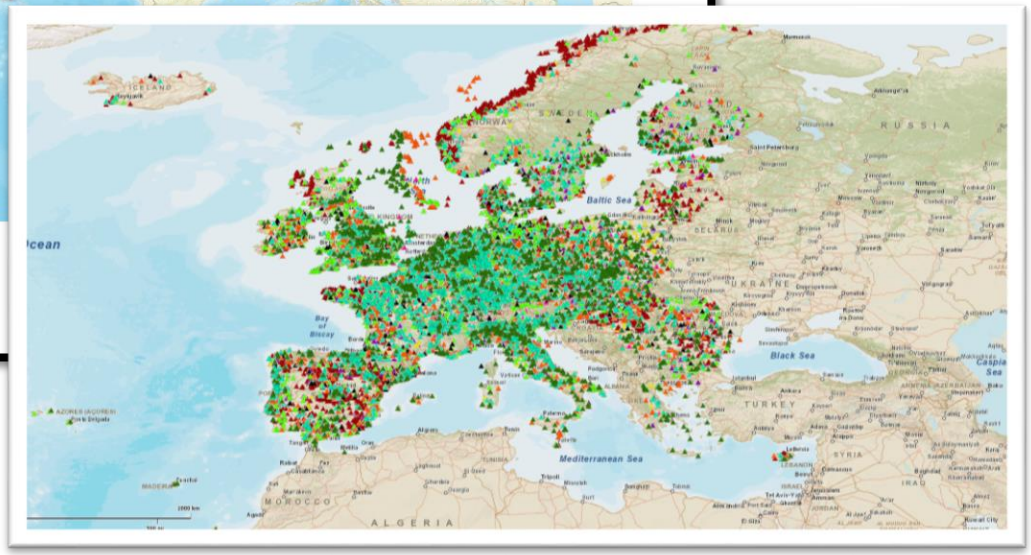
Diffuse emissions

Releases to air • Releases to water

Pollutant description | Frequent Questions | Contact & feedback

E-PRTR Facilities





http://prtr.ec.europa.eu/#/home

http://prtr.ec.europa.eu/MapSearch.aspx

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http://www.prtr-es.es/

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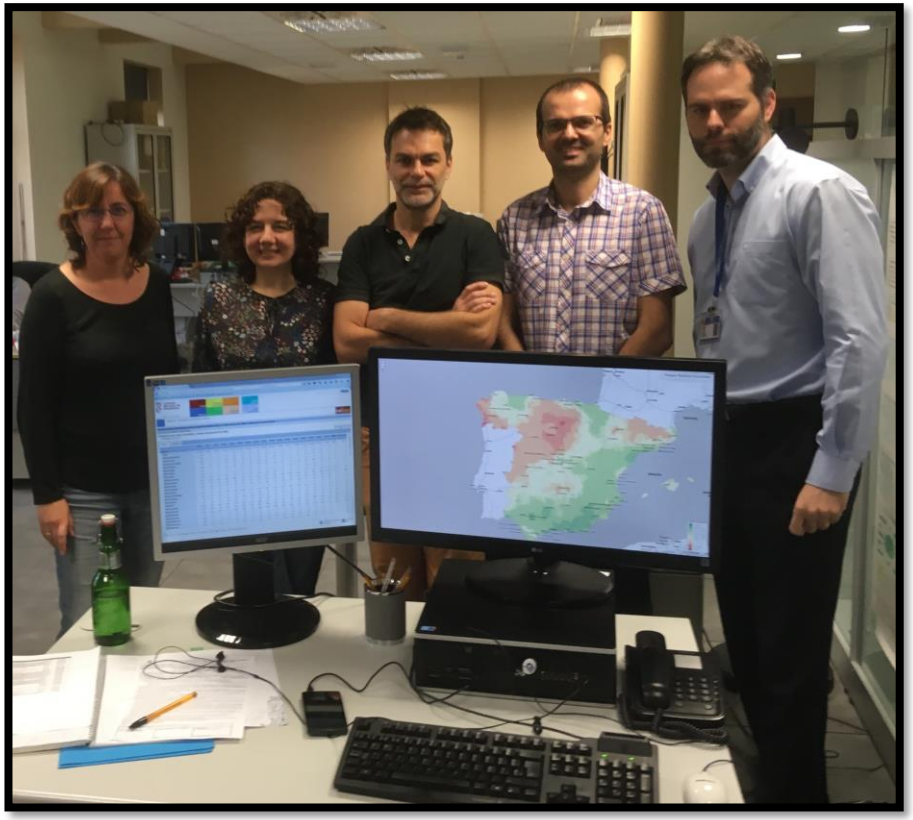

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1) Monitoring of cancer situation in Spain

2) **Environmental**, occupational epidemiology and lifestyle.

3) Cancer genetics epidemiology

4) Development of methods in studies design, data analysis, and bioinformatics.

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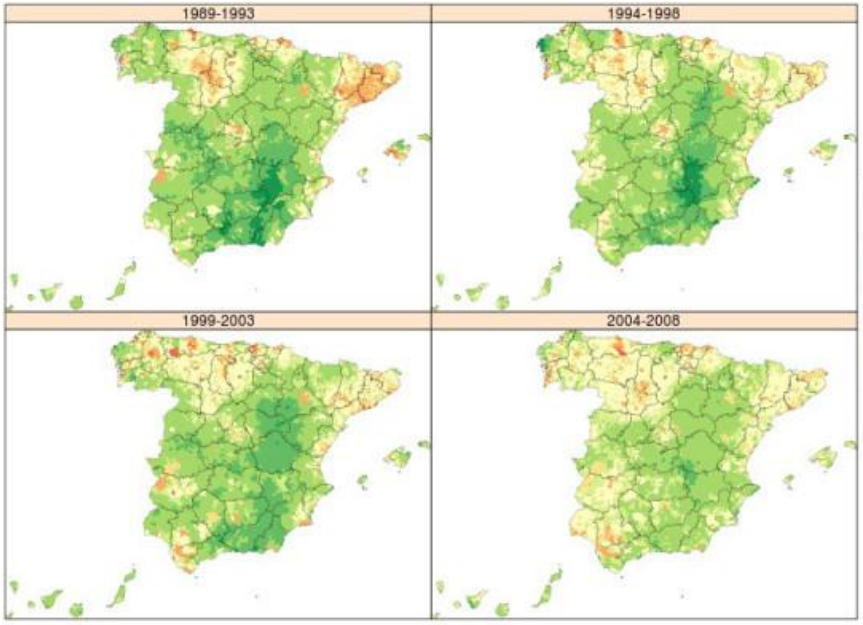
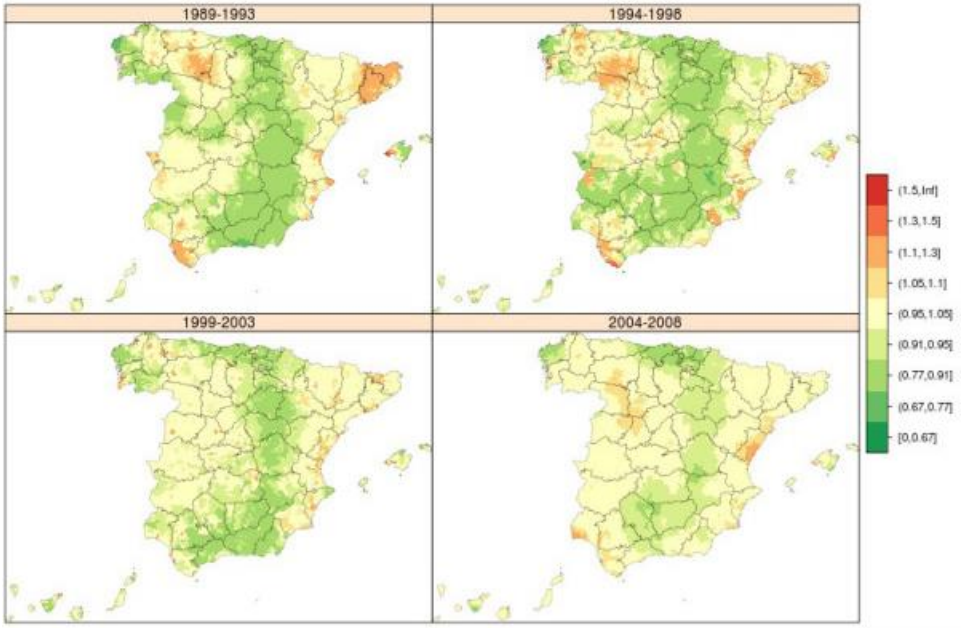
Men



Women



López-Abente G, Aragonés N, Pérez-Gómez B, Pollán M, García-Pérez J, Ramis R, Fernández-Navarro P. Time trends in municipal distribution patterns of cancer mortality in Spain. BMC Cancer. 2014 Jul 24;14:535. doi: 10.1186/1471-2407-14-535.

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Spanish reseach projects since 2004

(1)“Patrones de mortalidad municipal determinados por la proximidad de industrias contaminantes en España”. FIS PI04/041. IP: Gonzalo López Abente.

(2)“Contaminación industrial y cáncer en España”. FIS PI08/0662. IP: Gonzalo López Abente.

(3)“Nuevos enfoques en el estudio de la influencia de la contaminación emitida por las industrias en la **mortalidad por cáncer** NAPICAM”. FIS CP11/00112. IP: Pablo Fernández Navarro.

(4) “Influencia de la contaminación industrial en bio-marcadores de exposición a iones metálicos/dioxinas y efectos epigenéticos de la contaminación por mercurio (Proyecto CIBIO-EPIGEN)”. FIS PI14CIII/00065. IP: Pablo Fernández Navarro.

(5)“Contaminación industrial e **incidencia del cáncer** infantil en España”. FIS 12/01416, IP: Rebeca Ramis (Registro Español de Tumores Infantiles (RETI-SEHOP)).

(6)“Estudio de la **incidencia del cáncer** y su relación con la contaminación industrial”. Fundación Científica de la AECC. IP: Javier García Pérez (MCC-Spain)

HYPOTHESIS: Exposure to pollution emitted by industries may be associated with the development of cancer.

INITIAL CONSIDERATIONS:

(1) Pollution emitted by industries contains carcinogenic elements.

(2) The concentration levels of these pollutants are generally low.

(3) The greater proximity to an industrial complex may imply greater exposure to the pollution emitted by it.

(4) The emissions of industrial pollutants can be release to air, water or soil, so exposure can also happen in different ways.

(5) There are industrial activities that can make a certain compound bioavailable or in greater concentration in the environment (example: mining activities).

(6) Substance emissions can be assessed during the normal operation of an installation, or in the event of an accident.

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Geographic association between industrial pollution and municipal cancer mortality in Spain

-Data: -Mortality municipal (National Institute of Statistics, INE)
-Demographic sociodemographic data: 1991 Census, 2001
-Data of the municipal population (INE)
-Cartography (INE)

- Calculation of expected deaths

$$O_i \sim Poisson(\mu_i), \text{with} \mu_i = E_i \lambda_i$$

$$\log(\lambda_i) = \alpha Expos_i + \sum_j \beta_j Soc_{ij} + h_i + b_i \Rightarrow \log(\mu_i) = \log(E_i) + \alpha Expos_i + \sum_j \beta_j Soc_{ij} + h_i + b_i$$

- Spatial regression models:

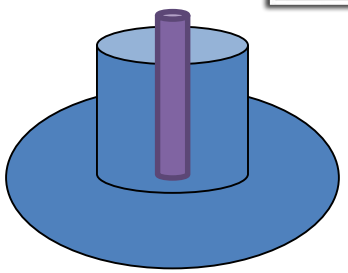
-Poisson mixed regression

$$Soc_{ij} = ps_i + ill_i + far_i + unem_i + pph_i + inc_i$$

-Autogressive Bayesians proposed by Besag, York and Mollié

-Bayesine estimation: - Markov Chain Monte Carlo (MCMC) (Winbugs)
-Laplace (INLA)

- Exposure to industrial pollution: Distance to the source (E-PRTR)



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Industrial pollution and cancer in Spain: An important public health issue

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ABSTRACT

Cancer can be caused by exposure to air pollution released by industrial facilities. The European Pollutant Release and Transfer Register (E-PRTR) has made it possible to study exposure to industrial pollution. This study seeks to describe the industrial emissions in the vicinity of Spanish towns and their temporal changes, and review our experience studying industrial pollution and cancer. Data on industrial pollutant sources (2007–2010) were obtained from the E-PRTR registries. Population exposure was estimated by the distance from towns to industrial facilities. We calculated the amount of carcinogens emitted into the air in the proximity (< 5 km) of towns and show them in municipal maps. We summarized the most relevant results and conclusions reported by ecological E-PRTR-based on studies of cancer mortality and industrial pollution in Spain and the limitations and result interpretations of these types of studies. There are high amounts of carcinogen emissions in the proximity of towns in the southwest, east and north of the country and the total amount of emitted carcinogens is considerable (e.g. 20 Mt of arsenic, 63 Mt of chromium and 9 Mt of cadmium). Although the emissions of some carcinogens in the proximity of certain towns were reduced during the study period, emissions of benzene, dioxins+furans and polychlorinated biphenyls rose. Moreover, the average population of towns lying within a 5 km radius from emission sources of carcinogens included in the International Agency for Research on Cancer list of carcinogens was 9 million persons. On the other hand, the results of the reviewed studies suggest that those Spanish regions exposed to the pollution released by certain types of industrial facilities have around 17% cancer excess mortality when compared with those unexposed. Moreover, excess mortality is focused on digestive and respiratory tract cancers, leukemias, prostate, breast and ovarian cancers. Despite their limitations, ecological studies are a useful tool in environmental epidemiology, not only for proposing etiological hypotheses about the risk of living close to industrial pollutant sources, but also for providing data to account for situations of higher mortality in specific areas. Nevertheless, the reduction of emissions should be a goal, with special relevance given to establishing limits for known carcinogens and other toxic substances in the environs of population centers, as well as industry-specific emission limits.

sed by the industrial facilities (2007–2010) in the proximity of towns in Spain (5 km). Data expressed in tonnes per year (except for dioxins and furanes which are expressed in Kg).

Pollutant Name	Type	2007	2008	2009	2010	Total tonnes	% change 2007–2010	Exposed population (at 5 km)	IARC Group[a]
Arsenic and compounds	Heavy metal	5.952	4.573	4.192	5.315	20.032	−10.71	14675255	1
Cadmium and compounds	Heavy metal	3.247	2.139	1.827	1.776	8.989	−45.30	15270017	1
Chromium and compounds	Heavy metal	20.680	12.529	10.029	20.566	63.804	−0.55	17983210	1
Nickel and compounds	Heavy metal	62.982	53.901	42.850	51.020	210.753	−18.99	17081634	1
Lead and compounds	Heavy metal	62.757	46.905	37.312	43.355	190.329	−30.92	15055352	2A
Cobalt and compounds	Heavy metal	0.140	0.600	0.573	0.141	1.454	0.13	3898074	2B
Polychlorinated biphenyls (PCBs)	POP[b]	0.026	0.013	0.014	0.466	0.519	1685.40	1941687	1
Polycyclic aromatic hydrocarbons (PAHs)	POP[b]	12.981	30.588	17.568	32.584	93.721	151.02	9609264	1
Lindane	POP[b]	0.00007	0.00005	0.00006	0.00008	0.00026	14.29	1216	1
Dioxins + furans[d]	POP[b]	0.047	0.052	0.052	0.685	0.836	1343.12	11292803	1
1,2,3,4,5,6-hexachlorocyclohexane (HCH)	POP[b]	0.00003	0.00001	0.00011	0.00003	0.00018	0	49408	2B
Hexachlorobenzene (HCB)	POP[b]	0.004	0.022	0.006	0.00016	0.032	−96.03	340388	2B
Benzene	VOC[c]	192.186	262.143	258.667	244.804	957.800	27.38	10394624	1
Trichloroethylene	VOC[c]	57.901	67.680	2.089	0.762	128.432	−98.68	2559663	1
Vinyl chloride	VOC[c]	62.606	46.509	46.065	37.546	192.726	−40.03	239139	1
Tetrachloroethylene (PERC)	VOC[c]	11.586	7.691	7.221	5.486	31.984	−52.65	1710289	2A
Dichloromethane (DCM)	VOC[c]	479.811	355.401	314.230	40.449	1.189.891	−91.57	2252521	2A
1,2-dichloroethane (EDC)	VOC[c]	2.630	1.128	9.894	6.450	20.102	145.23	1582347	2B
Naphthalene	VOC[c]	3.045	5.377	3.014	2.733	14.169	−10.25	3508082	2B
Trichloromethane (chloroform)	VOC[c]	12.541	0.417	91.863	49.311	154.132	293.19	877023	2B
Ethylene oxide	VOC[c]	14.937	19.401	18.186	3.265	55.789	−78.14	1680159	1
Particulate matter PM10	Other	33452.603	25374.829	14638.757	13111.462	86577.651	−60.81	22700796	1
Di-(2-ethyl hexyl) phthalate (DEHP)	Other	0.072	1.197	1.146	0.916	3.331	1180.01	888400	2B
Tetrachloromethane (TCM)	Other	0.050	0.101	0.033	0.025	0.209	−50.50	1288837	2B

[a] http://monographs.iarc.fr/ENG/Classification/latest_classif.php. Group 1 Carcinogenic to humans; Group 2A: Probably carcinogenic to humans; Group 2B: Possibly carcinogenic to humans.

[b] POP = Persistent organic pollutant.

[c] VOC = Volatile organic compound.

[d] Kg.

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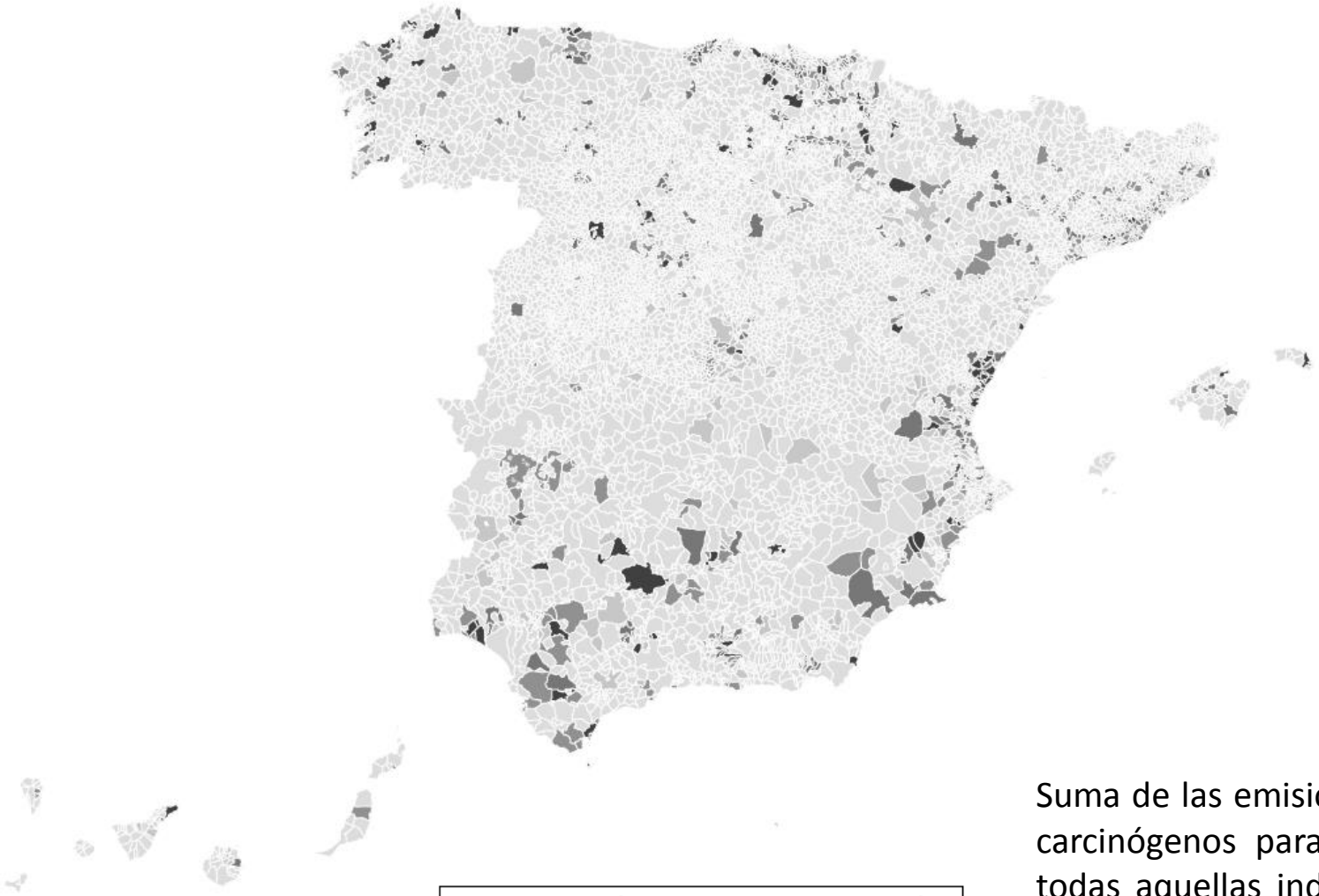
2010



Suma de las emisiones al aire de los carcinógenos para el año 2010 de todas aquellas industrias que estén a 5km de los núcleos poblacionales.

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Industrial sector	Tumor site	Total RR (95% CI/CrI)	Men RR (95% CI/CrI)	Women RR (95% CI/CrI)
Metallurgical[a] (García-Pérez et al., 2012, 2010b, 2010a)	Liver	1.11 (1.04–1.18)	1.10 (1.02–1.17)	1.14 (1.01–1.27)
	Colon-rectum	1.06 (1.03–1.09)	1.06 (1.02–1.09)	1.06 (1.02–1.11)
	Leukemia	1.09 (1.03–1.14)	1.09 (1.02–1.16)	1.06 (0.99–1.13)
Ferrous metals	Oesophagus	1.03 (0.85–1.24)	0.94 (0.77–1.16)	1.81 (1.16–2.84)
Surface treatment	Stomach	1.08 (0.98–1.18)	1.12 (1.00–1.26)	1.04 (0.90–1.21)
	Pancreas	1.14 (1.00–1.30)	1.15 (0.96–1.36)	1.11 (0.92–1.33)
	Bladder	1.26 (1.03–1.54)	1.38 (1.00–1.89)	1.26 (0.98–1.61)
Combustion installations[a] (García-Pérez et al., 2009)	Lung	1.12 (1.08–1.16)	1.14 (1.10–1.19)	0.93 (0.82–1.06)
	Larynx	–	1.12 (1.00–1.26)	–
Only coal	Bladder	1.18 (1.01–1.37)	1.22 (1.03–1.44)	0.97 (0.66–1.42)
Mining[b] (Fernández-Navarro et al., 2012)	Colon-rectum	1.10 (1.04–1.16)	1.10 (1.03–1.17)	1.09 (1.02–1.17)
	Lung	1.07 (1.01–1.13)	1.08 (1.02–1.14)	0.97 (0.86–1.09)
	Bladder	1.11 (1.02–1.20)	1.13 (1.03–1.24)	1.02 (0.86–1.22)
	Leukemia	1.09 (1.00–1.19)	1.12 (1.00–1.25)	1.12 (0.99–1.27)
Underground coal	Gallbladder	1.09 (0.79–1.52)	1.53 (1.00–2.35)	0.81 (0.52–1.26)
	Thyroid gland	1.77 (1.15–2.71)	2.05 (1.01–4.13)	1.70 (1.02–2.84)
Underground ornamental rocks	Myeloma	1.58 (0.97–2.58)	2.26 (1.26–4.04)	0.92 (0.38–2.23)
Open-pit coal	Liver	1.51 (0.99–2.30)	1.69 (1.09–2.63)	1.21 (0.29–2.52)
	Brain	1.37 (0.98–1.90)	1.75 (1.19–2.57)	0.86 (0.49–1.52)
Open-pit minerals	Stomach	1.51 (0.95–2.38)	1.28 (0.71–2.31)	1.97 (1.05–3.70)
Hazardous waste[b] (García-Pérez et al., 2013)	All cancers	1.06 (1.04–1.09)	1.08 (1.05–1.11)	1.03 (1.01–1.06)
	Stomach	1.18 (1.10–1.27)	1.18 (1.09–1.28)	1.16 (1.06–1.27)
	Colon-rectum	1.08 (1.03–1.13)	1.12 (1.06–1.18)	1.04 (0.98–1.10)
	Liver	1.18 (1.06–1.30)	1.17 (1.05–1.30)	1.20 (1.02–1.40)
	Gallbladder	1.10 (0.99–1.21)	1.26 (1.08–1.45)	1.02 (0.90–1.15)
	Lung	1.10 (1.05–1.15)	1.12 (1.06–1.18)	0.92 (0.84–1.00)
	Pleura	1.71 (1.34–2.14)	1.84 (1.39–2.40)	1.52 (1.04–2.14)
	Ovary	–	–	1.14 (1.05–1.23)
	Bladder	1.08 (1.01–1.16)	1.10 (1.02–1.18)	1.02 (0.91–1.15)
	Kidney	1.14 (1.04–1.23)	1.12 (1.02–1.24)	1.16 (1.02–1.31)
	Brain	1.04 (0.97–1.12)	1.00 (0.91–1.09)	1.11 (1.00–1.22)
	Leukemia	1.10 (1.03–1.17)	1.12 (1.04–1.21)	1.07 (0.98–1.17)
Scrap metal + end-of life vehicles	Kidney	1.36 (1.17–1.58)	1.39 (1.15–1.64)	1.33 (1.03–1.67)
	Thyroid gland	1.63 (1.16–2.20)	1.97 (1.17–3.00)	1.42 (0.91–2.06)
Oil + oily waste	Connective and soft tissue	1.48 (1.01–2.06)	1.32 (0.80–1.99)	1.47 (0.85–2.28)
	Skin	1.50 (0.95–2.22)	2.14 (1.31–3.22)	1.06 (0.50–1.88)
	Vulva and vagina	–	–	1.85 (1.28–2.56)
Solvents	Skin	2.34 (1.06–4.20)	3.30 (1.30–6.34)	1.49 (0.33–3.70)
Physico/chemical treatment	Kidney	2.25 (1.22–3.61)	2.43 (1.16–4.17)	2.15 (0.64–4.66)
	Hodgkin's lymphoma	3.39 (0.81–8.05)	5.64 (1.34–13.43)	0 (0-inf)
Industrial waste	Vulva and vagina	–	–	1.55 (1.02–2.24)
Cement, lime and plaster[b] (García-Pérez et al., 2015b)	All cancers	1.03 (1.00–1.06)	1.04 (1.01–1.07)	1.03 (1.00–1.06)
	Stomach	1.07 (0.99–1.16)	1.09 (1.00–1.18)	1.04 (0.94–1.15)
	Colon-rectum	1.08 (1.03–1.13)	1.07 (1.01–1.14)	1.10 (1.03–1.16)
	Gallbladder	1.09 (0.98–1.22)	1.21 (1.02–1.42)	1.04 (0.91–1.19)
	Peritoneum	1.22 (0.96–1.53)	1.62 (1.15–2.20)	0.94 (0.69–1.26)
	Pleura	1.50 (1.15–1.91)	1.71 (1.24–2.28)	1.22 (0.80–1.77)
	Bladder	1.07 (1.00–1.16)	1.11 (1.03–1.20)	0.96 (0.83–1.10)
Lime	Vulva and vagina	–	–	1.65 (1.08–2.36)
	Kidney	1.33 (1.08–1.61)	1.26 (0.97–1.58)	1.54 (1.10–2.06)
	Brain	1.25 (1.03–1.48)	1.16 (0.90–1.45)	1.37 (1.05–1.74)
Plaster	Melanoma	2.11 (1.19–3.31)	2.34 (1.12–4.04)	1.81 (0.66–3.59)

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Table 3
Mortality relative risks (RR) and credibility intervals (95% CrI) from pleural, colorectal, prostate, breast and ovarian cancers comparing mortality in towns situated at a distance of less than 2 km from installations of different industrial sectors with mortality in more remote municipalities without industries. Only RRs with CrIs not including 1 in either men, women, or both are shown here.

Tumor	Industrial sector	Total RR (95% CrI)	Men RR (95% CrI)	Women RR (95% CrI)
Pleura (López-Abente et al., 2012a)	Combustion installations	1.40 (0.99–1.98)	1.51 (1.01–2.26)	1.25 (0.68–2.31)
	Refineries and coke ovens	1.27 (0.58–2.83)	0.90 (0.32–2.54)	2.83 (1.11–7.22)
	Galvanization	1.64 (1.14–2.35)	1.78 (1.16–2.72)	1.75 (0.97–3.15)
	Glass and mineral fibers	1.67 (1.04–2.67)	1.77 (1.03–3.05)	1.52 (0.70–3.32)
	Organic chemical industry	1.39 (1.08–1.78)	1.43 (1.07–1.92)	1.79 (1.23–2.59)
	Biocides	2.60 (1.46–4.62)	2.88 (1.47–5.69)	3.18 (1.26–8.04)
	Non-hazardous waste	1.74 (1.08–2.80)	2.18 (1.28–3.72)	0.76 (0.27–2.12)
	Food and beverage sector	1.26 (1.01–1.56)	1.40 (1.08–1.80)	1.06 (0.72–1.56)
	Ship building	2.32 (1.38–3.92)	2.92 (1.61–5.33)	0.77 (0.38–1.56)
Colon-rectum (López-Abente et al., 2012b)	Production and processing of metals	1.07 (1.01–1.12)	1.06 (1.00–1.13)	1.03 (0.97–1.10)
	Surface treatment of metals and plastic	1.04 (1.00–1.08)	1.05 (1.00–1.10)	0.98 (0.94–1.03)
	Mining industry	1.26 (1.08–1.46)	1.26 (0.98–1.43)	1.18 (0.98–1.43)
	Ceramic	1.05 (1.00–1.10)	1.01 (0.96–1.07)	1.09 (1.02–1.15)
	Urban waste-water treatment plants	1.06 (0.99–1.13)	1.01 (0.93–1.09)	1.08 (1.00–1.17)
	Paper and wood production	1.07 (1.01–1.14)	1.09 (1.01–1.17)	1.03 (0.92–1.12)
	Food and beverage sector	1.07 (1.03–1.11)	1.05 (1.00–1.10)	1.07 (1.02–1.12)
	Surface treatment using organic solvents	1.06 (0.99–1.13)	1.08 (1.00–1.16)	1.00 (0.92–1.09)
Ovarian (García-Pérez et al., 2015a)	Fertilizers	–	–	1.22 (1.00–1.46)
Prostate (García-Pérez et al., 2016b)	Aquaculture	–	2.42 (1.53–3.63)	–
Non-Hodgkin's lymphoma (Ramis et al., 2009)	Paper and wood production	1.21 (1.01–1.45)	–	–

Fernández-Navarro P, García-Pérez J, Ramis R, Boldo E, López-Abente G. Industrial pollution and cancer in Spain: An important public health issue. Environ Res. 2017 Nov;159:555-563.

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General conclusions

(1) According to the PRTR + IPPC registry, there are **many municipalities exposed to carcinogens** distributed throughout the Spanish territory.

(2) **Excess risk** of dying due to some cancers is observed in municipalities in the vicinity of which there are certain industrial complexes.

(3) The **limitations** of the studies carried out, make the results should be taken with great caution and **never be interpreted in terms of causality**.

(4) Studies that **generate hypotheses** about the possible associations between the pollution emitted by industries and the development of cancer.

Surveillance of the health effects of environmental and genetic factors

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General conclusions

(5) The hypothesis: some of the pollutants emitted by industries are causal factors of some types of cancer, but **in no case is it a study on causal effects**, so **the statistical significance** of the findings in **no case marks a causal relationship.**

(6) The ecological associations that have to be more deeply analyzed in order to arrive at an understanding of the causal relationship that may be operating in the association found.

(7) Independientemente de los hallazgos encontrados, dada la cantidad de sustancias contaminantes (muchas de ellas carcinógenas) que emiten este tipo de instalaciones, desde el punto de vista de la salud pública, cualquier medida preventiva en relación con la NO/baja exposición a estas es fundamental y necesaria.

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Industrial emissions and exposed population

- The municipalities in whose vicinity (less than 5km) there is a greater **amount of emissions** of carcinogens (declared by industries to the PRTR registry) are located in the **southwest, east and north of Spain.**

- According to the definition of exposure to carcinogens emitted by industries that has been developed in the article Fernández-Navarro P, et al. Environ Res. 2017 (definition with many limitations) there is an average of 9 million people living less than 5km from industrial complexes or industries that emit some type of carcinogen.

- The air emissions of most of the carcinogens in the vicinity of the population centers have been reduced between 2007 and 2010 except for: benzene, polycyclic aromatic hydrocarbons (PAHs), dioxins + furans and polychlorinated biphenyls (PCBs).

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Mortality from cancer

- There is an excess of municipal average mortality of **17%** before an industrial environmental exposure (Average value of the RR in those significant associations in both men and women).

Industrial sector	Tumor site	Total RR (95% CI/CrI)	Men RR (95% CI/CrI)	Women RR (95% CI/CrI)
Metallurgical[a] (García-Pérez et al., 2012, 2010b, 2010a)	Liver	1.11 (1.04–1.18)	1.10 (1.02–1.17)	1.14 (1.01–1.27)
	Colon-rectum	1.06 (1.03–1.09)	1.06 (1.02–1.09)	1.06 (1.02–1.11)
	Leukemia	1.09 (1.03–1.14)	1.09 (1.02–1.16)	1.06 (0.99–1.13)
Ferrous metals	Oesophagus	1.03 (0.85–1.24)	0.94 (0.77–1.16)	1.81 (1.16–2.84)
Surface treatment	Stomach	1.08 (0.98–1.18)	1.12 (1.00–1.26)	1.04 (0.90–1.21)
	Pancreas	1.14 (1.00–1.30)	1.15 (0.96–1.36)	1.11 (0.92–1.33)
	Bladder	1.26 (1.03–1.54)	1.38 (1.00–1.89)	1.26 (0.98–1.61)
Combustion installations[a] (García-Pérez et al., 2009)	Lung	1.12 (1.08–1.16)	1.14 (1.10–1.19)	0.93 (0.82–1.06)
	Larynx	–	1.12 (1.00–1.26)	–
Only coal	Bladder	1.18 (1.01–1.37)	1.22 (1.03–1.44)	0.97 (0.66–1.42)
Mining[b] (Fernández-Navarro et al., 2012)	Colon-rectum	1.10 (1.04–1.16)	1.10 (1.03–1.17)	1.09 (1.02–1.17)
	Lung	1.07 (1.01–1.13)	1.08 (1.02–1.14)	0.97 (0.86–1.09)
	Bladder	1.11 (1.02–1.20)	1.13 (1.03–1.24)	1.02 (0.86–1.22)
	Leukemia	1.09 (1.00–1.19)	1.12 (1.00–1.25)	1.12 (0.99–1.27)
Underground coal	Gallbladder	1.09 (0.79–1.52)	1.53 (1.00–2.35)	0.81 (0.52–1.26)
	Thyroid gland	1.77 (1.15–2.71)	2.05 (1.01–4.13)	1.70 (1.02–2.84)
Underground ornamental rocks	Myeloma	1.58 (0.97–2.58)	2.26 (1.26–4.04)	0.92 (0.38–2.23)
Open-pit coal	Liver	1.51 (0.99–2.30)	1.69 (1.09–2.63)	1.21 (0.29–2.52)
	Brain	1.37 (0.98–1.90)	1.75 (1.19–2.57)	0.86 (0.49–1.52)
Open-pit minerals	Stomach	1.51 (0.95–2.38)	1.28 (0.71–2.31)	1.97 (1.05–3.70)
Hazardous waste[b] (García-Pérez et al., 2013)	All cancers	1.06 (1.04–1.09)	1.08 (1.05–1.11)	1.03 (1.01–1.06)
	Stomach	1.18 (1.10–1.27)	1.18 (1.09–1.28)	1.16 (1.06–1.27)
	Colon-rectum	1.08 (1.03–1.13)	1.12 (1.06–1.18)	1.04 (0.98–1.10)
	Liver	1.18 (1.06–1.30)	1.17 (1.05–1.30)	1.20 (1.02–1.40)
	Gallbladder	1.10 (0.99–1.21)	1.26 (1.08–1.45)	1.02 (0.90–1.15)
	Lung	1.10 (1.05–1.15)	1.12 (1.06–1.18)	0.92 (0.84–1.00)
	Pleura	1.71 (1.34–2.14)	1.84 (1.39–2.40)	1.52 (1.04–2.14)
	Ovary	–	–	1.14 (1.05–1.23)
	Bladder	1.08 (1.01–1.16)	1.10 (1.02–1.18)	1.02 (0.91–1.15)
	Kidney	1.14 (1.04–1.23)	1.12 (1.02–1.24)	1.16 (1.02–1.31)
	Brain	1.04 (0.97–1.12)	1.00 (0.91–1.09)	1.11 (1.00–1.22)
	Leukemia	1.10 (1.03–1.17)	1.12 (1.04–1.21)	1.07 (0.98–1.17)
Scrap metal + end-of life vehicles	Kidney	1.36 (1.17–1.58)	1.39 (1.15–1.64)	1.33 (1.03–1.67)
	Thyroid gland	1.63 (1.16–2.20)	1.97 (1.17–3.00)	1.42 (0.91–2.06)
Oil + oily waste	Connective and soft tissue	1.48 (1.01–2.06)	1.32 (0.80–1.99)	1.47 (0.85–2.28)
	Skin	1.50 (0.95–2.22)	2.14 (1.31–3.22)	1.06 (0.50–1.88)
	Vulva and vagina	–	–	1.85 (1.28–2.56)
Solvents	Skin	2.34 (1.06–4.20)	3.30 (1.30–6.34)	1.49 (0.33–3.70)
Physico/chemical treatment	Kidney	2.25 (1.22–3.61)	2.43 (1.16–4.17)	2.15 (0.64–4.66)
	Hodgkin's lymphoma	3.39 (0.81–8.05)	5.64 (1.34–13.43)	0 (0-inf)
Industrial waste	Vulva and vagina	–	–	1.55 (1.02–2.24)
Cement, lime and plaster[b] (García-Pérez et al., 2015b)	All cancers	1.03 (1.00–1.06)	1.04 (1.01–1.07)	1.03 (1.00–1.06)
	Stomach	1.07 (0.99–1.16)	1.09 (1.00–1.18)	1.04 (0.94–1.15)
	Colon-rectum	1.08 (1.03–1.13)	1.07 (1.01–1.14)	1.10 (1.03–1.16)
	Gallbladder	1.09 (0.98–1.22)	1.21 (1.02–1.42)	1.04 (0.91–1.19)
	Peritoneum	1.22 (0.96–1.53)	1.62 (1.15–2.20)	0.94 (0.69–1.26)
	Pleura	1.50 (1.15–1.91)	1.71 (1.24–2.28)	1.22 (0.80–1.77)
	Bladder	1.07 (1.00–1.16)	1.11 (1.03–1.20)	0.96 (0.83–1.10)
Lime	Vulva and vagina	–	–	1.65 (1.08–2.36)
	Kidney	1.33 (1.08–1.61)	1.26 (0.97–1.58)	1.54 (1.10–2.06)
	Brain	1.25 (1.03–1.48)	1.16 (0.90–1.45)	1.37 (1.05–1.74)
Plaster	Melanoma	2.11 (1.19–3.31)	2.34 (1.12–4.04)	1.81 (0.66–3.59)

Table 3
Mortality relative risks (RR) and credibility intervals (95% CrI) from pleural, colorectal, prostate, breast and ovarian cancers comparing mortality in towns situated at a distance of less than 2 km from installations of different industrial sectors with mortality in more remote municipalities without industries. Only RRs with CrIs not including 1 in either men, women, or both are shown here.

Tumor	Industrial sector	Total RR (95% CrI)	Men RR (95% CrI)	Women RR (95% CrI)
Pleura (López-Abente et al., 2012a)	Combustion installations	1.40 (0.99–1.98)	1.51 (1.01–2.26)	1.25 (0.68–2.31)
	Refineries and coke ovens	1.27 (0.58–2.83)	0.90 (0.32–2.54)	2.83 (1.11–7.22)
	Galvanization	1.64 (1.14–2.35)	1.78 (1.16–2.72)	1.75 (0.97–3.15)
	Glass and mineral fibers	1.67 (1.04–2.67)	1.77 (1.03–3.05)	1.52 (0.70–3.32)
	Organic chemical industry	1.39 (1.08–1.78)	1.43 (1.07–1.92)	1.79 (1.23–2.59)
	Biocides	2.60 (1.46–4.62)	2.88 (1.47–5.69)	3.18 (1.26–8.04)
	Non-hazardous waste	1.74 (1.08–2.80)	2.18 (1.28–3.72)	0.76 (0.27–2.12)
	Food and beverage sector	1.26 (1.01–1.56)	1.40 (1.08–1.80)	1.06 (0.72–1.56)
	Ship building	2.32 (1.38–3.92)	2.92 (1.61–5.33)	0.77 (0.38–1.56)
Colon-rectum (López-Abente et al., 2012b)	Production and processing of metals	1.07 (1.01–1.12)	1.06 (1.00–1.13)	1.03 (0.97–1.10)
	Surface treatment of metals and plastic	1.04 (1.00–1.08)	1.05 (1.00–1.10)	0.98 (0.94–1.03)
	Mining industry	1.26 (1.08–1.46)	1.26 (0.98–1.43)	1.18 (0.98–1.43)
	Ceramic	1.05 (1.00–1.10)	1.01 (0.96–1.07)	1.09 (1.02–1.15)
	Urban waste-water treatment plants	1.06 (0.99–1.13)	1.01 (0.93–1.09)	1.08 (1.00–1.17)
	Paper and wood production	1.07 (1.01–1.14)	1.09 (1.01–1.17)	1.03 (0.92–1.12)
	Food and beverage sector	1.07 (1.03–1.11)	1.05 (1.00–1.10)	1.07 (1.02–1.12)
	Surface treatment using organic solvents	1.06 (0.99–1.13)	1.08 (1.00–1.16)	1.00 (0.92–1.09)
Ovarian (García-Pérez et al., 2015a)	Fertilizers	–	–	1.22 (1.00–1.46)
Prostate (García-Pérez et al., 2016b)	Aquaculture	–	2.42 (1.53–3.63)	–
Non-Hodgkin's lymphoma (Ramis et al., 2009)	Paper and wood production	1.21 (1.01–1.45)	–	–

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Other condiderations

- Statistical significance
- Magnitude of the observed effect
- Facilities evaluated and results generated
- Exposure time
- Dose of the exposure factor
- Multiple comparisons
- Ecological fallacy
- Confusion
- Mortality
- Emission / Inmission

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Validation of distance as an exposure approximation

Environmental HEALTH 2013
Science and Policy to Protect Future Generations
3-6 March 2013 Boston, USA

20th IEA World Congress of Epidemiology
17-21 AUGUST 2014
ANCHORAGE, ALASKA USA
GLOBAL EPIDEMIOLOGY IN A CHANGING ENVIRONMENT: THE CIRCUMPOLAR PERSPECTIVE

Instituto de Salud Carlos III | Environmental HEALTH 2013 | ciberesp

Association between blood mercury levels and proximity to industrial facilities.

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Association between blood lead levels and proximity to industrial facilities

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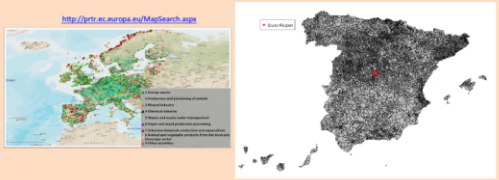
INTRODUCTION AND OBJECTIVES

- Lead is released into the environment as a by-product of numerous industrial processes. This pollutant was measured in the **Bio-Madrid Project**, a bio-monitoring study to assess environmental exposures among pregnant women and their couples in Madrid (Spain).
- The objective was to investigate the association between **blood lead levels (B-Ld)** and residential proximity to industrial facilities included in the European Pollutant Release and Transfer Register **(E-PRTR)** (http://prtr.ec.europa.eu).



METHODS

- **Bio-Madrid Project** is a cross-sectional study in which 145 pregnant women and their couples donated peripheral blood samples and answered an epidemiological questionnaire*. **E-PRTR** data were used to identify facilities releasing lead in the vicinity of participant's residence. Google Earth was used to geocode home addresses and to validate the geographic coordinates of the E-PRTR facilities.
- Population **exposure** to industrial lead emissions was estimated on the basis of **"distance"** from the participant's residence to pollutant sources. The distance used to detect differences in mean B-Ld was estimated using the sum of squared errors (SSE) of prediction of a model including only **"exposure"** (Un-adjusted model).

Un-adjusted model: $\log(\text{B-Ld}) \sim \textbf{exposure}_D$

exposure_D=[0: not exposed to a facility releasing lead into the air at a distance D; 1: exposed to a facility releasing lead into the air at a distance D]

- Linear models were used to assess the association between B-Ld and distance to the nearest industry, adjusting for sex, age, tobacco, traffic, alcohol and health district (Adjusted Model). All analyses were also stratified by sex.

Adjusted model: $\log(\text{B-Ld}) \sim \textbf{exposure}_D + \text{sex} + \text{age} + \text{tobacco} + \text{traffic} + \text{alcohol} + \text{health-district}$

tobacco=non smoker/smoker; traffic=traffic density in the environment (low, medium and high); alcohol=ingestion of alcohol (gr); health district=Health Area 1/ Health Area 10

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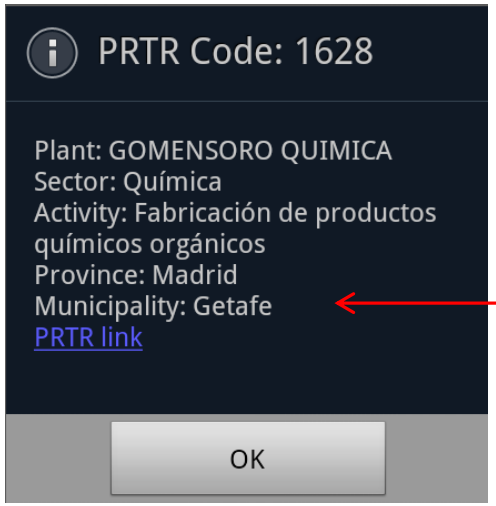
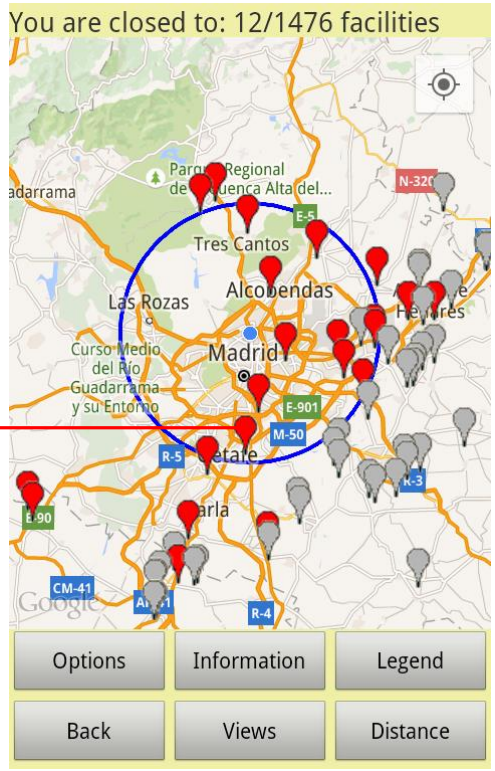
Mobile application for Information on Industrial Pollution / and Cancer Mortality





BIODAMA
Bioinformatics and Data Management

NAPICAM

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And now …

- Results of our articles in the press (information for the action).
- **Continuous monitoring of the effects:** mortality, incidence, the industry itself ... change over time.
- Studies of **new sectors, new methodological approaches**, morbidity ...
  - Study on the chemical industry (methodological approx.) (Ana Ayuso)
  - Study of stomach cancer controlling smoking (José Matías Triviño)
  - Study of Leukemias controlling natural radiation (Unai Larrinaga)
  - Incorporate emissions to studies, ...
- Projects by Rebeca Ramis and Javier García Pérez with the incidence of cancer.
- New studies with greater validity of inference
- New AMICIC
- International projects (Joint Action Health Information)