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Efectos del ruido de tráfico sobre la salud.

14 de mayo 2024.



Definición de contaminación atmosférica.

Según la Ley 34/2007, de 15 de noviembre, de calidad del aire y protección de la atmósfera (BOE, 2007), la contaminación atmosférica se define como: “La presencia en la atmósfera de materias, sustancias o formas de energía que impliquen molestia grave, riesgo o daño para la seguridad o la salud de las personas, el medio ambiente y demás bienes de cualquier naturaleza”.

Fuentes de contaminación sónica

- Instituto del Ruido Londres para una gran ciudad:
- 80 % Tráfico rodado
- 4% Ferrocarril
- 10 % Industria
- 6% Varios



Efectos del ruido sobre la salud

- **Efectos auditivos del Ruido:**
- Desplazamiento del umbral audición
- Trastornos de audición
- Efecto Máscara
- Acúfenos
- Fatiga Auditiva



Efectos del ruido sobre la salud

- Los estudios sobre contaminación acústica se ha dirigido generalmente a población adulta y principalmente a efectos en el **entorno laboral**.
- Regla de la energía constante :
INTENSIDAD X TIEMPO
Ruidos de alta intensidad puntuales tienen efectos similares en salud que ruidos de intensidad media prolongada





ELSEVIER

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journal homepage: www.elsevier.com/locate/envres



Review article

Road traffic noise effects on cardiovascular, respiratory, and metabolic health: An integrative model of biological mechanisms



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Noise = Stressor



↑ Adrenalin
↑ Noradrenaline

SAM
Sympathetic
-adrenal-
medullar axis

Adrenal
Medulla

Adrenal
Cortex

↑ Cortisol

HPA
Hypothalamic-
pituitary-
adrenocortical
axis

CNS: Auditory cortex

CNS: Locus coeruleus

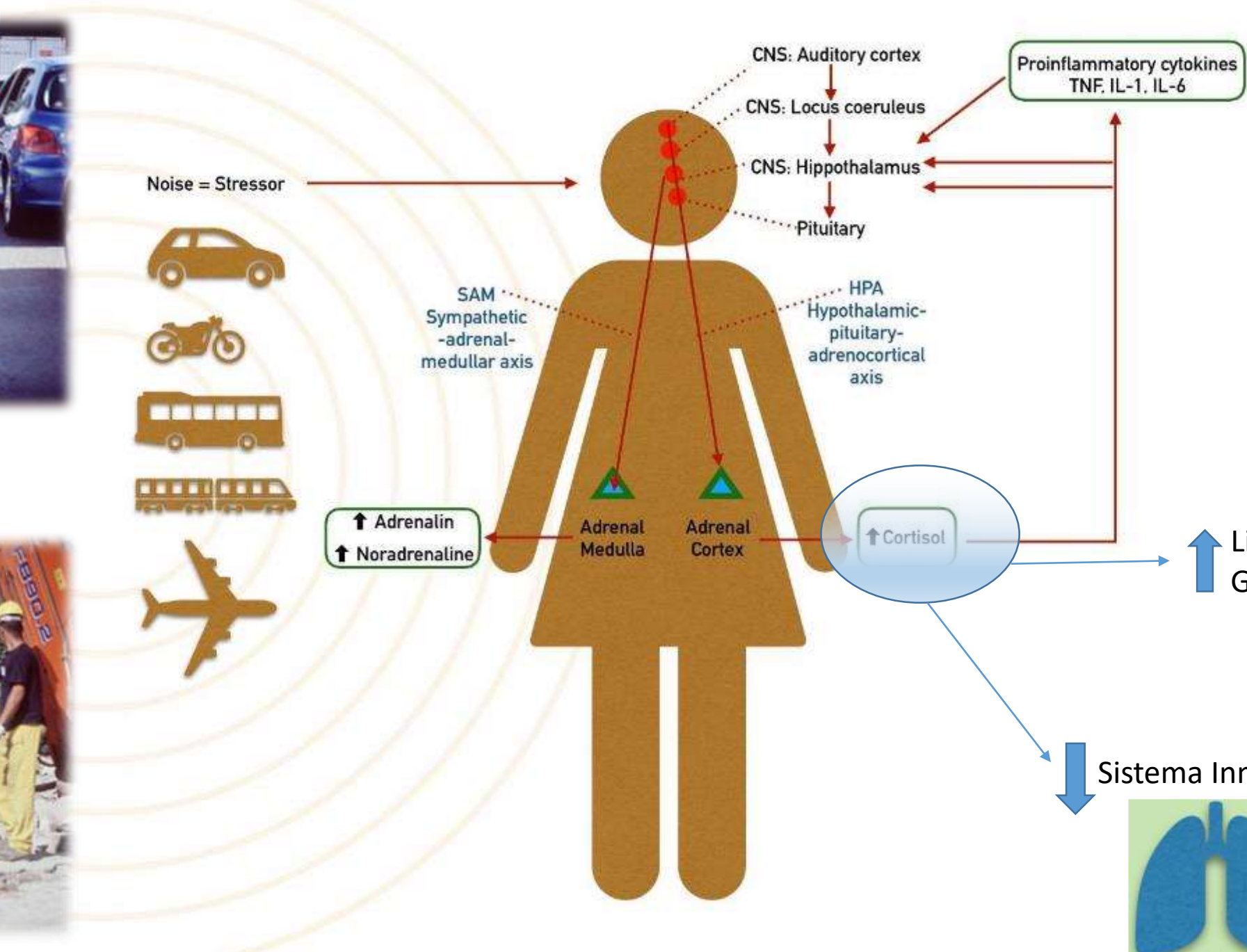
CNS: Hypothalamus

Pituitary

Proinflammatory cytokines
TNF, IL-1, IL-6

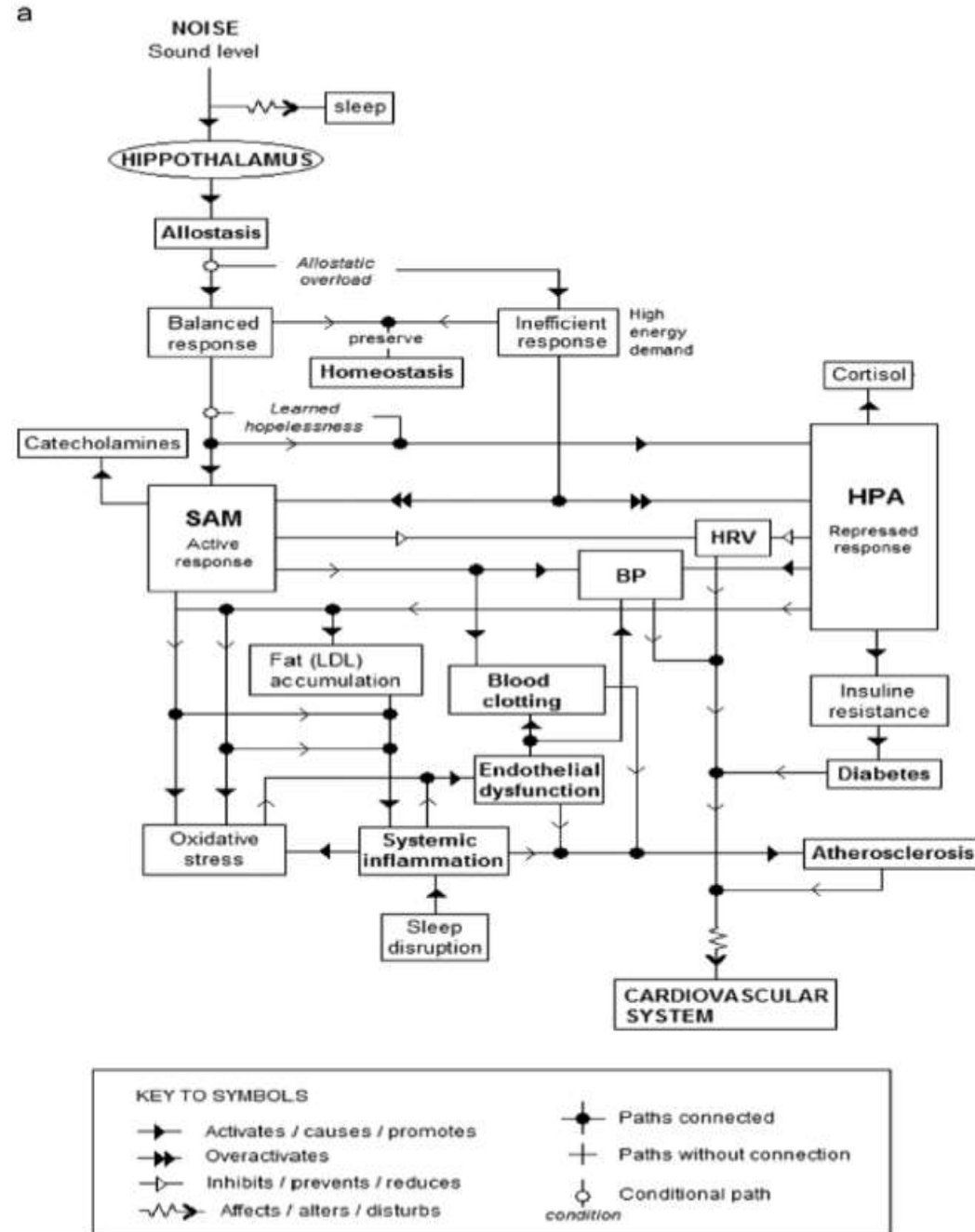
↑ Lipolisis
Glucosa

↓ Sistema Inmunitario



HPA:
Hipotalámico Pituitario Adrenocortical.

SAM:
Simpático Adrenal Medular



Efectos en salud ruido tráfico

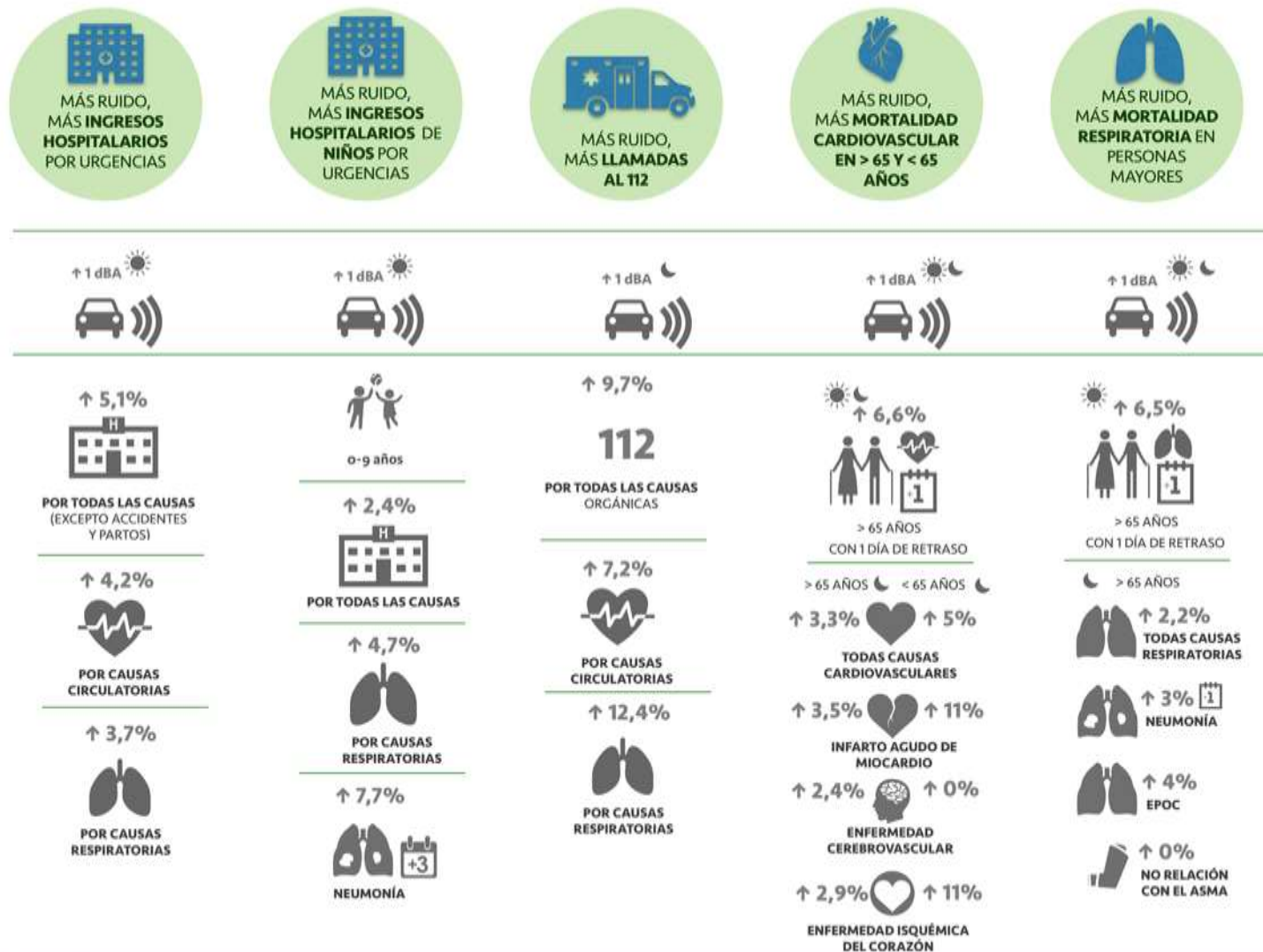
Studies 1975-1999	Time of day	Source (situation)	Test persons	Glucose	Cholesterol	Triglycerides	Fibrinogen	Adrenaline	Noradrenaline	Cortisol
Brown (14)	day	work-noise	51	=	-					
Manninen (28)	day	work-noise	292	-	+			-	+	
Ising (25)	day	work-noise	46					=	+	
Belli (8)	day	work-noise	940	+	+	+				
Idzior (24)	day	work-noise	784		+	+				
Polano (38)	day	work-noise	80				+			
Cavatorta (18)	day	work-noise	130					+	+	=
Altena (1)	day	street/flight	863		=					
Babisch (3)	day	street-noise	2512	+	+	=	(+)			
Babisch (3)	day	street-noise	2030	+	(+)	+	=			
Babisch (3)	day	work /street	255	=	+	(+)	(+)			
Maschke (29)	night	flight (lab)	40					+	+	
Maschke (30)	night	flight (field)	28	=	=	=		+	=	+
Carter (16)	night	lorry (lab)	9					=	=	
Meiam (35,36)	day	work-noise	2145		+	+				+
Sudo (42)	day	work-noise	75					+	+	+
Braun (12)	night	street (field)	25					=	+	+
Harder (20)	night	flight (field)	16	=	=	=	(+)	(+)	=	(+) (-)
No relevant difference =				Signif. higher +		Signif. lower -		Relevant, not significant ()		

Semi-quantitative representation of laboratory findings in comparison with control situations (adults)

Source: Maschke, C. et al. The Influence of stressors on biochemical reactions - a review of present scientific findings with noise. In: *Int. J. Hyg. Environ. Health*, 2000.



Asociación entre ruido ambiental de tráfico y distintos efectos en la salud en la ciudad de Madrid (1/2)





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Health impact assessment of traffic noise in Madrid (Spain)



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ABSTRACT

The relationship between environmental noise and health has been examined in depth. In view of the sheer number of persons exposed, attention should be focused on road traffic noise. The city of Madrid (Spain) is a densely populated metropolitan area in which 80% of all environmental noise exposure is attributed to traffic. The aim of this study was to quantify avoidable deaths resulting from reducing the impact of equivalent diurnal noise levels (LeqD) on daily cardiovascular and respiratory mortality among people aged ≥ 65 years in Madrid. A health impact assessment of (average 24 h) LeqD and PM_{2.5} levels was conducted by using previously reported risk estimates of mortality rates for the period 2003–2005: For cardiovascular causes: LeqD 1.048 (1.005, 1.092) and PM_{2.5} 1.041(1.020, 1.062) and for respiratory causes: LeqD 1.060 (1.000, 1.123) and PM_{2.5} 1.030 (1.000, 1.062). The association found between LeqD exposure and mortality for both causes suggests an important health effect. A reduction of 1 dB(A) in LeqD implies an avoidable annual mortality of 284 (31, 523) cardiovascular- and 184 (0, 190) respiratory-related deaths in the study population. The magnitude of the health impact is similar to reducing average PM_{2.5} levels by 10 $\mu\text{g}/\text{m}^3$. Regardless of air pollution, exposure to traffic noise should be considered an important environmental factor having a significant impact on health.

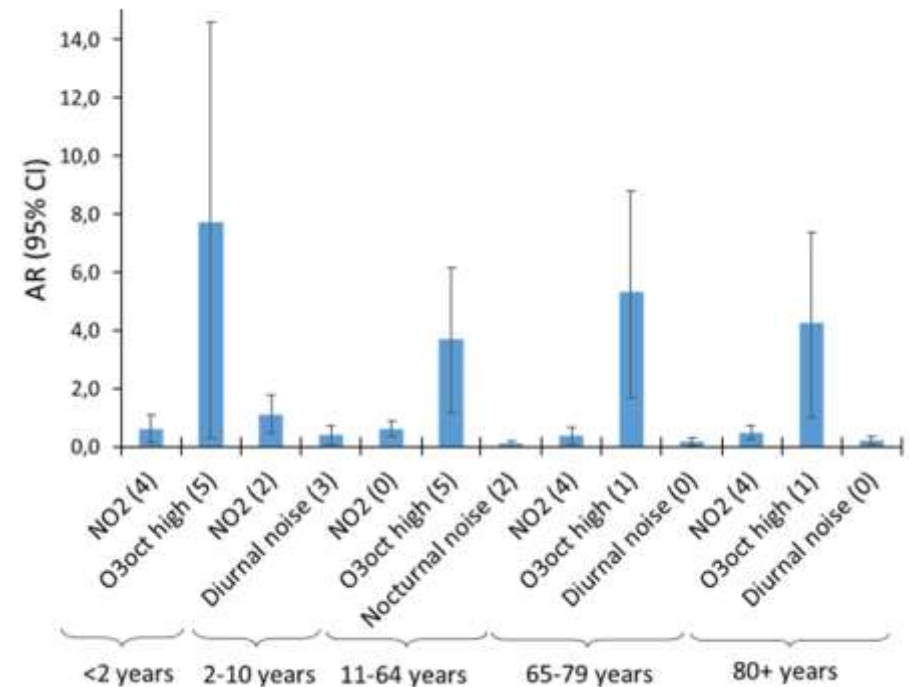
Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

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Short-term effects of air pollution and noise on emergency hospital admissions in Madrid and economic assessment

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Admissions per year attributable to pollutant.

	Mean annual attributable admissions (95% CI)	Mean annual admissions on WHO threshold being exceeded (95% CI)	% attributable admissions
Natural-cause admissions:			
NO ₂ (lag 0)	5191 (2966–7412)	1503 (859–2146)	1.49%
NO ₂ (lag 4)	3055 (1614–4493)	885 (467–1301)	0.88%
O ₃ oct high (lag 1)	31 (11–51)	31 (11–51)	0.01%
O ₃ oct high (lag 7)	24 (4–44)	24 (4–44)	0.01%
Diurnal noise (lag 0)	5685 (2533–8835)	–	1.63%
Respiratory-cause admissions:			
NO ₂ (lag 0)	1427 (529–2321)	451 (167–734)	2.10%
NO ₂ (lag 5)	1301 (702–1898)	411 (222–600)	1.92%
Diurnal noise (lag 0)	1987 (594–3378)	–	2.93%
Circulatory-cause admissions:			
O ₃ oct high (lag 4)	13 (6–19)	13 (6–19)	0.02%
Diurnal noise (lag 0)	2432 (1257–3605)	–	4.47%

Mean annual admissions on WHO threshold being exceeded, was obtained by calculating the mean number of daily admissions that occurred on days on which the daily threshold value recommended by the WHO was exceeded (O₃: 100 µg/m³, NO₂: 25 µg/m³).

Table 5
Economic estimate per year.

	Total annual cost (€)	95% CI
Natural-cause admissions:		
NO ₂ (lag 0)	€75 million	€43–108 million
NO ₂ (lag 4)	€44 million	€23–65 million
O ₃ oct high (lag 1)	€ 451,000	€160,000–741,000
O ₃ oct high (lag 7)	€ 349,000	€58,100–640,000
Diurnal noise (lag 0)	€83 million	€37–128 million
Respiratory-cause admissions:		
NO ₂ (lag 0)	€20 million	€8–33 million
NO ₂ (lag 5)	€19 million	€10–27 million
Diurnal noise (lag 0)	€28 million	€9–48 million
Circulatory-cause admissions:		
O ₃ oct high (lag 4)	186,000 €	€86,000–273,000
Diurnal noise (lag 0)	€35 million	€18–52 million

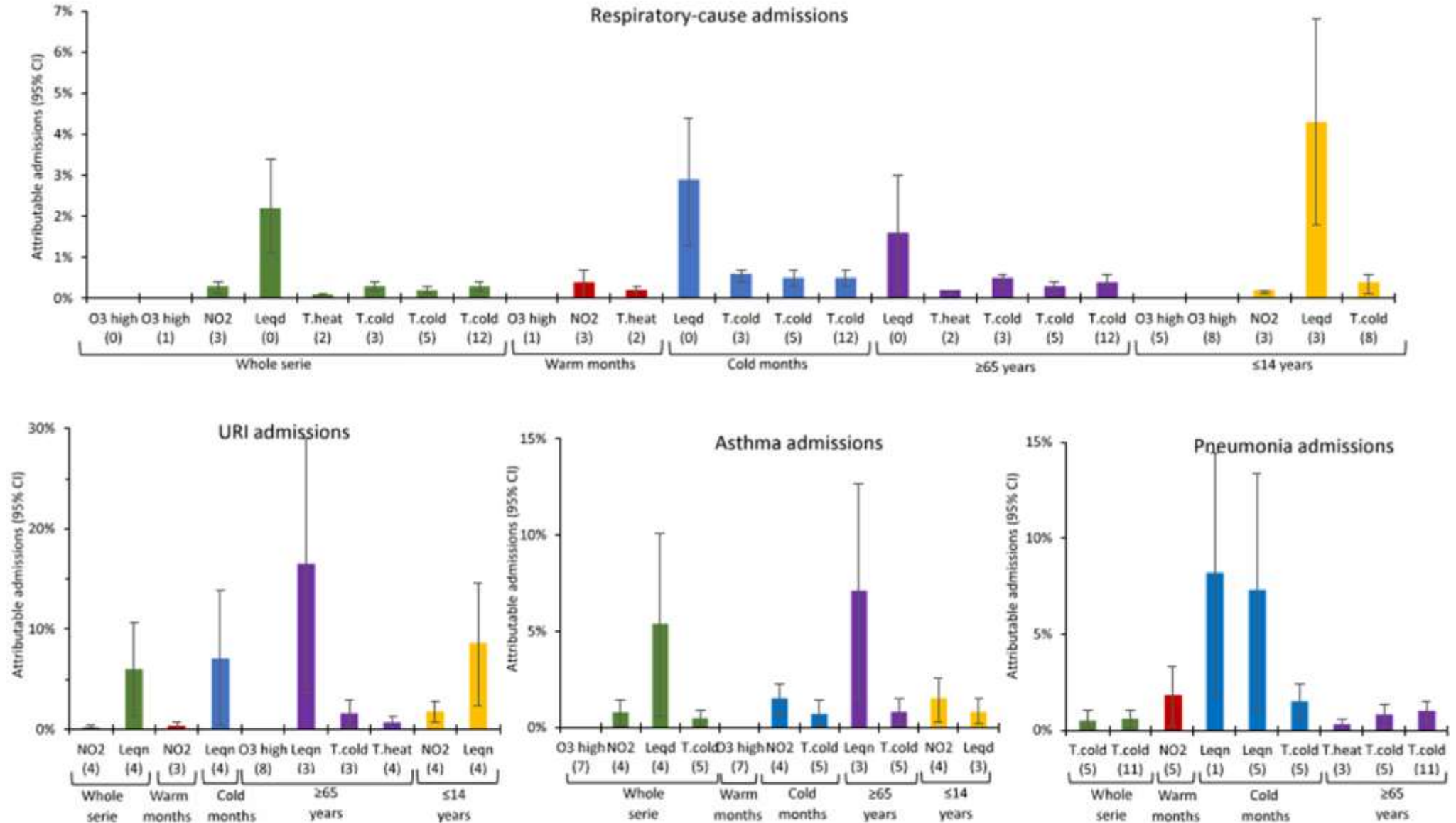


Figure 1. Percentage of attributable admissions with their respective 95% CIs for the significant independent variables in respiratory-cause admissions. Increases for every 10 $\mu\text{g}/\text{m}^3$ above the 8-h ozone threshold of 107.5 $\mu\text{g}/\text{m}^3$. Lags shown in brackets. Leqd: $L_{Aeq,7-23h}$, Leqn: $L_{Aeq,23-7h}$, Leq24: $L_{Aeq,24h}$. URTIs: Acute upper respiratory tract infections.

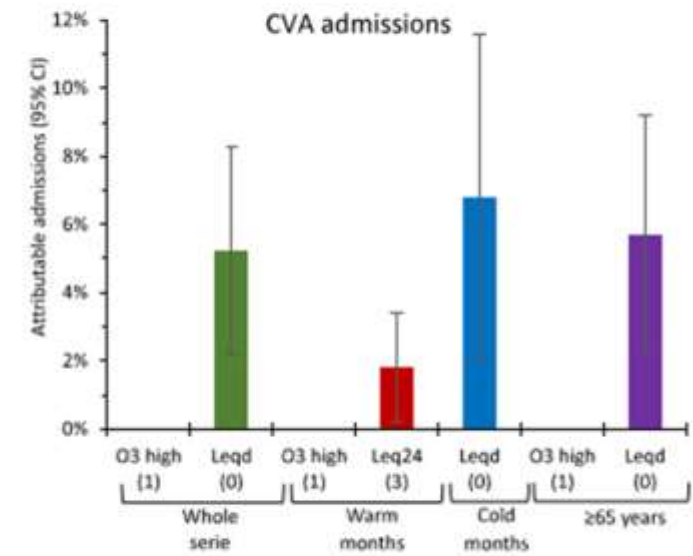
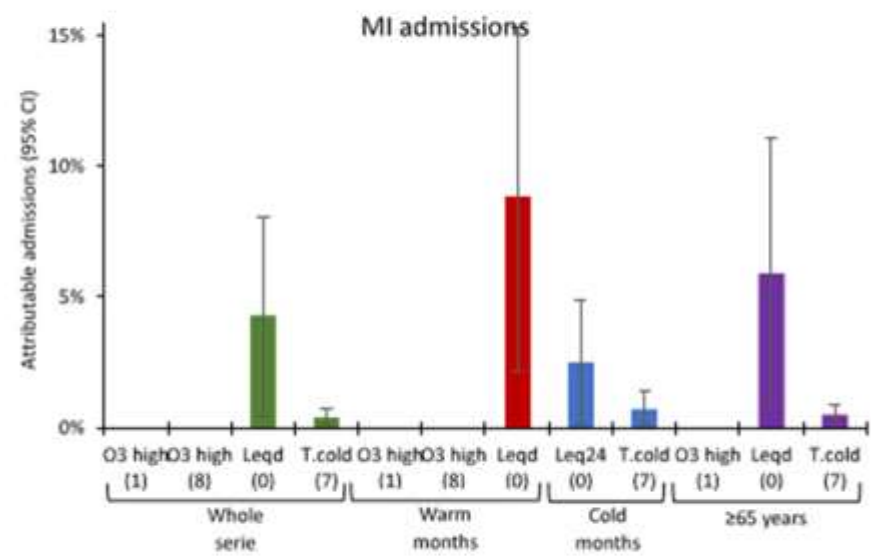
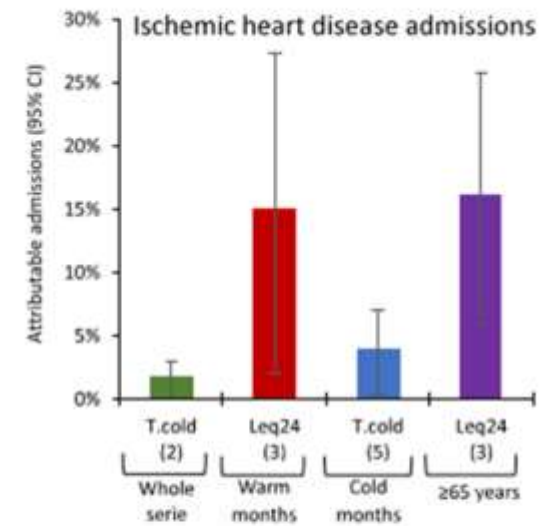
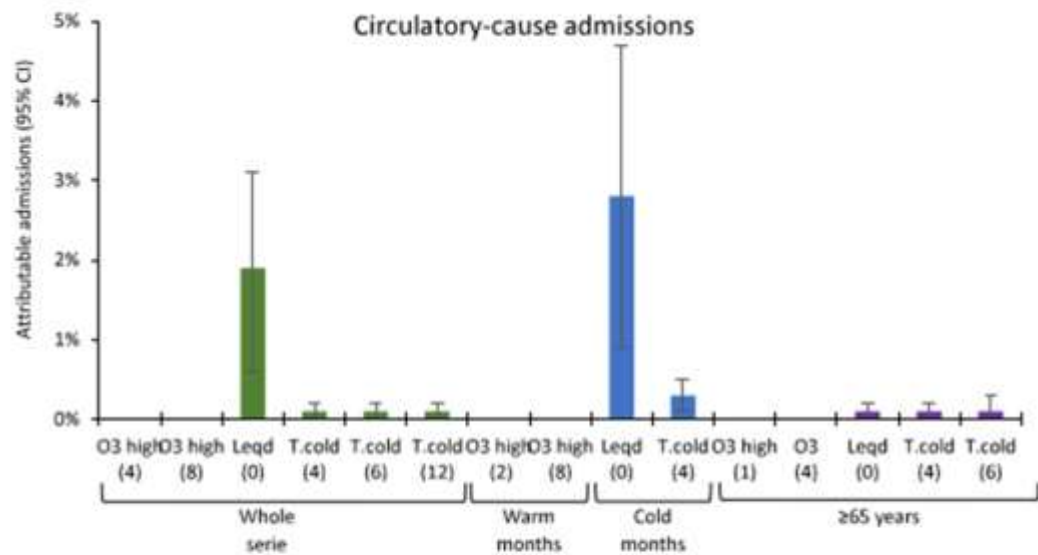


Figure 2. Percentage of attributable admissions with their respective 95% CIs for the significant independent variables in circulatory-cause admissions. Increases for every 10 $\mu\text{g}/\text{m}^3$ above the 8-h ozone threshold of 107.5 $\mu\text{g}/\text{m}^3$. Lags shown in brackets. Leqd: $L_{A_{O_3,7-23h}}$, Leqn: $L_{A_{O_3,23-7h}}$, Leq24: $L_{A_{O_3,24h}}$. MI: Acute myocardial infarction. ACVA: Acute cerebrovascular accident.



Asociación entre ruido ambiental de tráfico y distintos efectos en la salud en la ciudad de Madrid (2/2)



Ruido diurno



Ruido nocturno

Notas:

El estudio hace referencia a efectos no auditivos de la contaminación acústica en la salud.

Algunos aspectos de los estudios se han simplificado o reducido para mostrarse en esta ilustración.

Los riesgos por dB que aparecen en esta infografía no son comparables entre las diversas patologías por ser diferentes los valores medios de cada una de ellas.

Fuente: @ensgismau

Recio A, Carmona R, Linares C, Ortíz C, Banegas JR, Díaz J. Efectos del ruido urbano sobre la salud: estudios de análisis de series temporales realizados en Madrid. Instituto de Salud Carlos III, Escuela Nacional de Sanidad: Madrid, 2016.

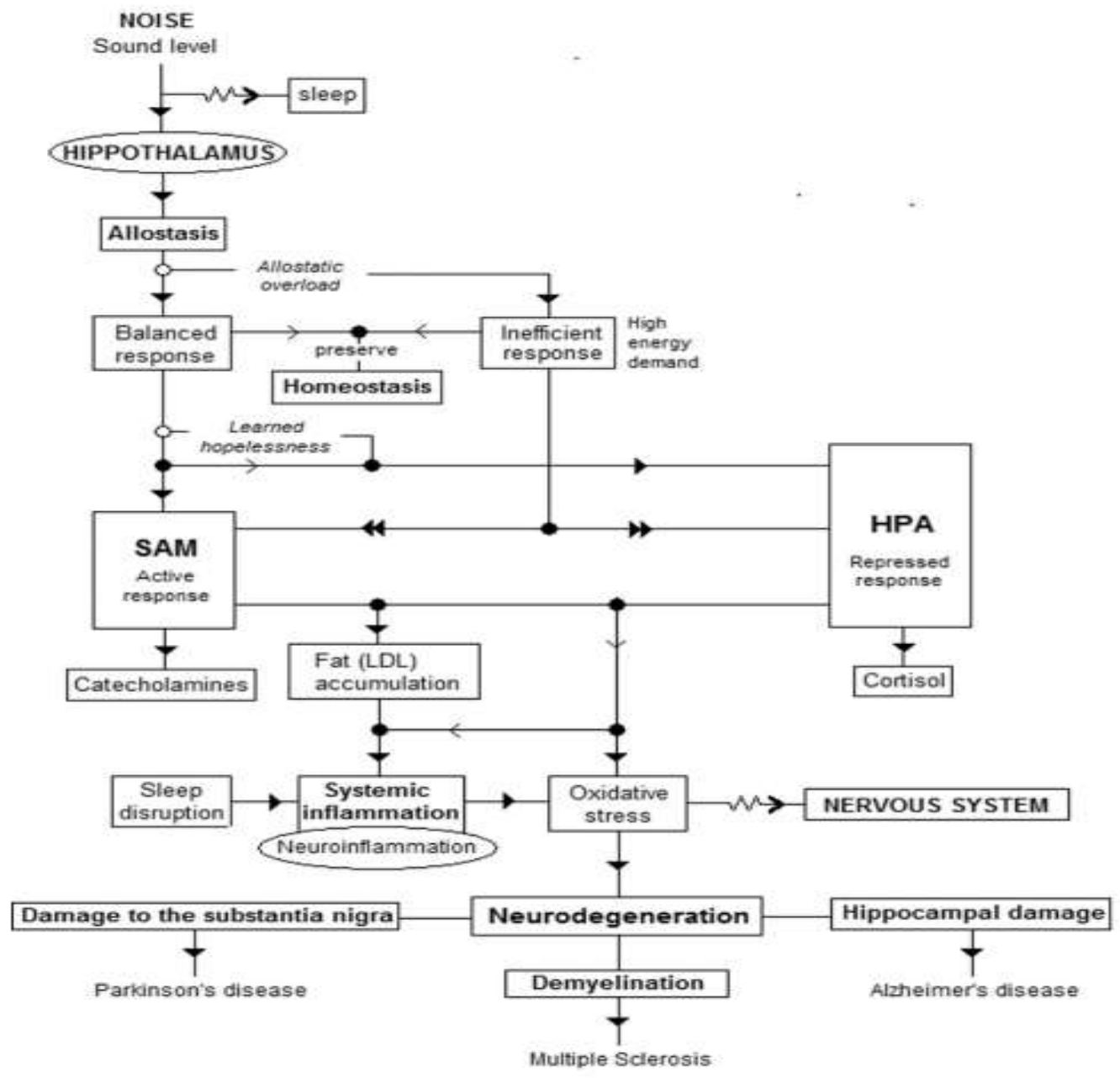
Díaz J, Linares C et al. Short-term effects of traffic noise on suicides and emergency hospital admissions due to anxiety and depression in Madrid (Spain). Science of The Total Environment. Volume 710, 25 March 2020.

Infografía: @jesusdelaosa 2020

TABLE. Percentage Increase in Risk (%IR) of Adverse Birth Outcomes Associated with an Increase of 1 db(A) of Diurnal Noise in Madrid, Spain

	Preterm Birth %IR (95% CI)	Low-birthweight Infants %IR (95% CI)	Newborn Deaths %IR (95% CI)
Diurnal noise at lag 0	3.20 (1.92, 4.45)	6.36 (4.82, 7.84)	6.00 (2.13, 9.56)
Diurnal noise at lag 0 + temperature + PM _{2.5} + O ₃	5.03 (3.48, 6.54)	5.78 (3.87, 7.63)	12.03 (7.16, 16.41)

95% CI indicates 95% confidence interval.



Original article

Short-term association between road traffic noise and healthcare demand generated by Parkinson's disease in Madrid, Spain



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Table 2

Relative risks for an increment of 1dB(A) in daily diurnal noise levels and daily nocturnal noise levels with attributable risks. For Tcal, relative risk and attributable risk for every increment of 1 °C in cases where the daily maximum temperature surpassed the threshold of 34 °C.

Variables	RR (95%CI)	AR (95%CI)
PD-hospital admissions	Tcal ^a (lags 1,5): 1.13 (1.03-1.23)	11.4% (3.3-18.9)
	Leqd (lag 0): 1.07 (1.04-1.09)	6.2% (4.1-8.3)
PD-ambulatory visits	Leqd (lag 0): 1.28 (1.12-1.45)	21.6% (10.8-31.0)
PD-medical calls	Leqn (lags 0,1): 1.46 (1.06-2.01)	31.4% (5.6-50.2)
PD-mortality	Tcal (lag 3): 1.14 (1.01-1.28)	12.1% (0.9-22.0)

AR: attributable risk; 95%CI: confidence interval of 95%; Leqd: equivalent diurnal noise level (from 8 to 22 h); Leqn: equivalent nocturnal noise level (from 22 to 8 h); PD: Parkinson's disease; RR: relative risk.

^a Variable that determines the existence of the effect of a heat wave on PD-related morbidity and mortality.



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Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv



Emergency multiple sclerosis hospital admissions attributable to chemical and acoustic pollution: Madrid (Spain), 2001–2009



Rocío Carmona ^a, Cristina Linares ^a, Alberto Recio ^b, Cristina Ortiz ^a, Julio Díaz ^{a,*}

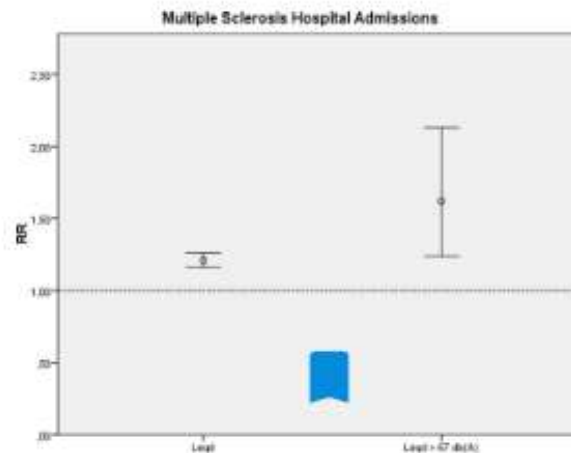
^a National School of Public Health, Carlos III Institute of Health, Madrid, Spain

^b Department of Preventive Medicine and Public Health, Universidad Autónoma de Madrid, Madrid, Spain

HIGHLIGHTS

- Multiple sclerosis (MS) is the most prevalent neurological disease among young adults in Spain.
- No has been detected association between chemical pollutants caused by traffic and MS admissions.
- The relationship is linear and without threshold. The effect is more pronounced above 67 dB (A).
- The results indicate that traffic noise can exacerbate MS symptoms, leading to hospital admissions due to this cause

GRAPHICAL ABSTRACT





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Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv



Short-term effects of traffic noise on suicides and emergency hospital admissions due to anxiety and depression in Madrid (Spain)



J. Díaz ^{a,*}, J.A. López-Bueno ^a, J.J. López-Ossorio ^b, J.L. González ^b, F. Sánchez ^b, C. Linares ^a

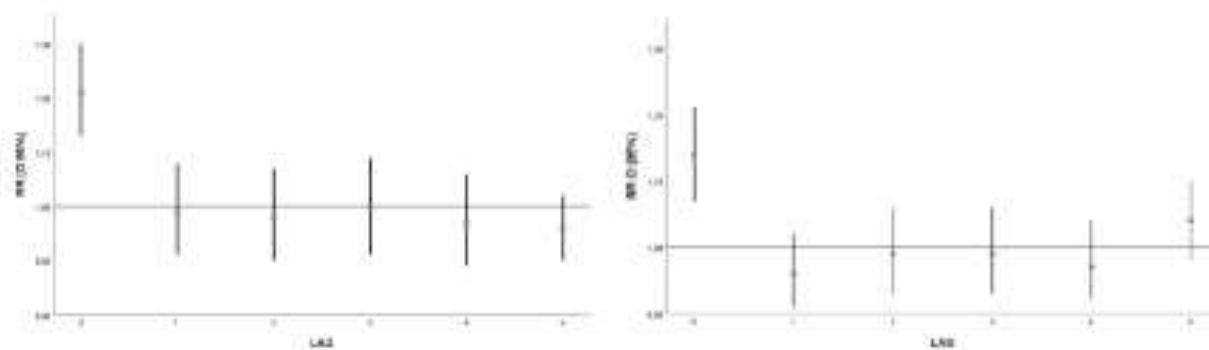
^a National School of Public Health Carlos III Institute of Health Madrid, Spain

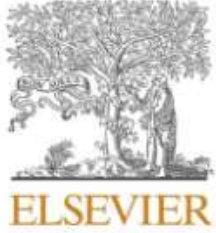
^b State Secretariat for Security Ministry of Interior Madrid, Spain

HIGHLIGHTS

- The results show no association between chemical pollutants and the dependent variables.
- Leq_{day} are associated in lag 0 for the cases of anxiety and depression.
- Leq_{day} are associated in lag 1 for suicides.
- An association was also found between T_{cold} and admissions for anxiety in lag 9.

GRAPHICAL ABSTRACT





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Short-term impact of noise, other air pollutants and meteorological factors on emergency hospital mental health admissions in the Madrid region

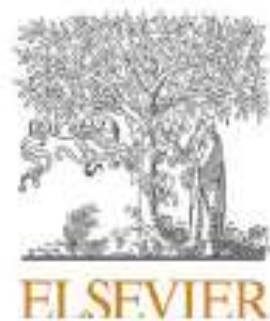
L. Gómez González^a, C. Linares^a, J. Díaz^{a,*}, A. Egea^b, A. Calle-Martínez^c, M.Y. Luna^d, M.A. Navas^a, M.S. Ascaso-Sánchez^a, R. Ruiz-Páez^e, C. Asensio^f, A. Padrón-Monedero^g, J.A. López-Bueno^a

Table 4

Number of attributable emergency hospital mental health admissions (EHMHA) per year with 95% confidence intervals due to anthropogenic activities.

	Lag	EHMHA (men and women)
$L_{Aeq7-23h}$ (dBA) threshold ^a	0	745 (283–1207)
		EHMHA (women)
$L_{Aeq7-23h}$ (dBA) threshold ^a	0	437 (147–584)

^a Daily noise threshold refers to the noise level subtracting the minimum noise level recorded (48.1 dB(A)), because for the purposes of the effects of admissions, no zero-noise scenario is deemed to exist.



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Environmental Research

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Does exposure to noise pollution influence the incidence and severity of COVID-19?

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Gerardo Sánchez-Martínez^c, Cristina Linares^a

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^c The UNEP DTU Partnership, Copenhagen, Denmark

Table 3

Lags in which statistically significant associations are established between the daily values of the independent variables and the analyzed COVID-19 variables.

		Leq24 h (dB(A))	PM ₁₀ (µg/ m ³)	NO ₂ (µg/ m ³)
Incidence rate	Single Variable	7/10	12	0/14/21
	All Variables	7/10	<i>Without effect</i>	<i>Without effect</i>
Cumulative average incidence over 14 days	Single Variable	17	25/28	<i>Without effect</i>
	All Variables	17	25/28	<i>Without effect</i>
Hospital admissions rate	Single Variable	17	20	5/19
	All Variables	24	<i>Without effect</i>	5
Intensive Care Unit admissions rate	Single Variable	22	14/19	21/28
	All Variables	22	<i>Without effect</i>	28



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Environmental Research

journal homepage: www.elsevier.com/locate/envres



Direct assessment of health impacts on hospital admission from traffic intensity in Madrid

Ricardo Navares^a, Julio Diaz^{b,*}, Jose L. Aznarte^a, Cristina Linares^b

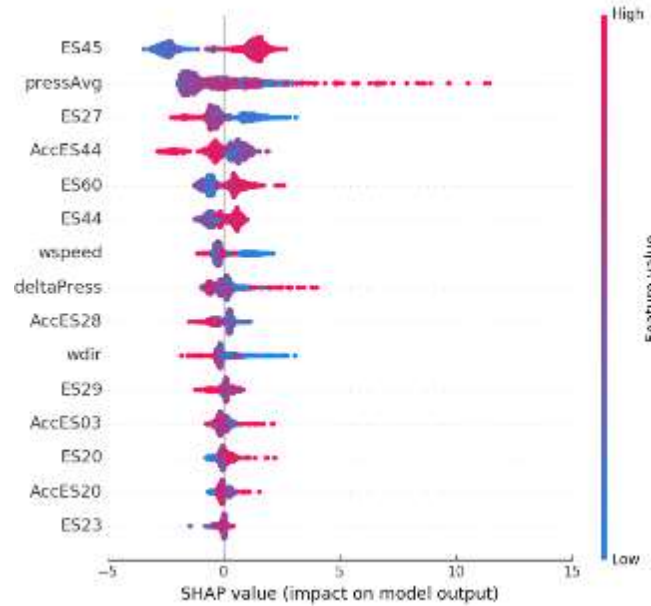
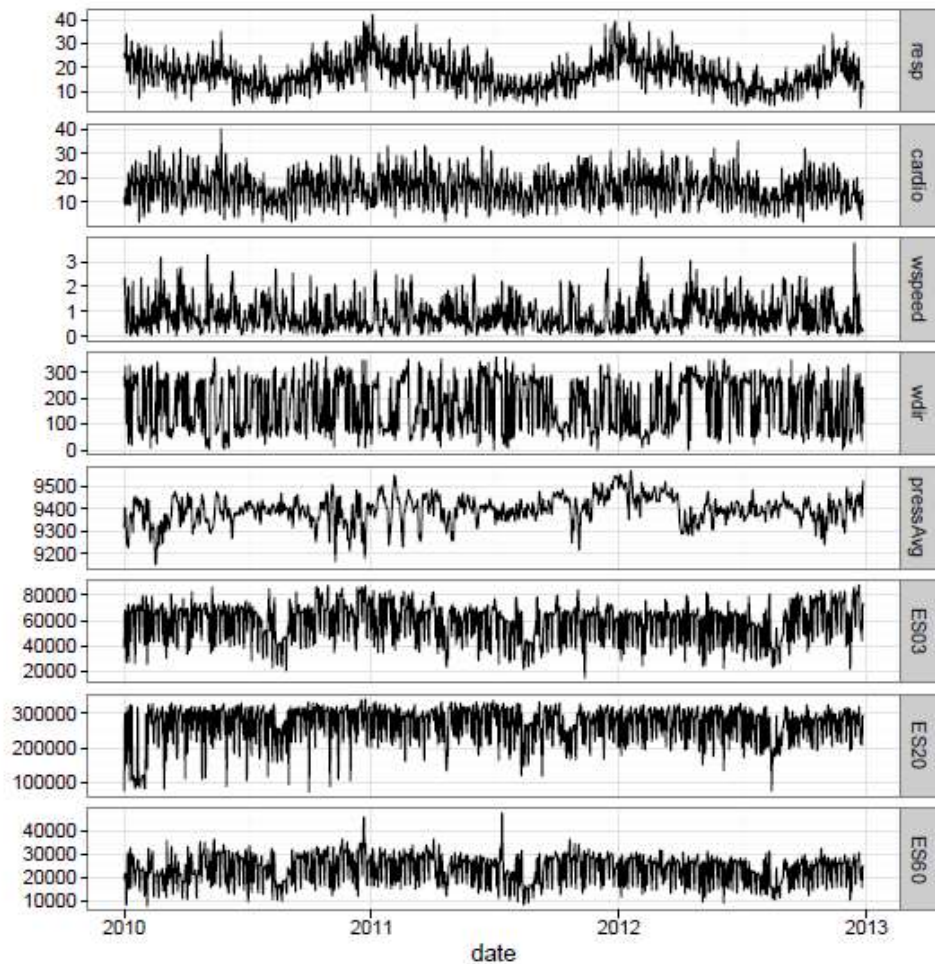


CAMPO	DESCRIPCIÓN
codigo	Identificador del punto de medida y que se corresponde con el código de centralización "COD_CENT" presente en el fichero georreferenciado y que permite su posicionamiento sobre plano y identificación del vial y sentido de la circulación
descripcion	Denominación del punto de medida
accesoAsociado	Código de control relacionado con el control semafórico para la modificación de los tiempos
intensidad	Intensidad de número de vehículos por hora
ocupación	Porcentaje de ocupación del punto de control por los vehículos
carga	Parámetro de carga del vial en función de la intensidad, ocupación y características de la infraestructura
nivelServicio	Nivel de servicio
intensidadSat	Intensidad de saturación de la vía en veh/hora y que se corresponde con el máximo número de vehículos que pueden pasar en el acceso a la intersección manteniéndose la fase verde del semáforo
error	Código de control de la validez de los datos del punto de medida
subarea	Identificador de la subarea de explotación de tráfico a la que pertenece el punto de medida

DEPARTAMENTO DE TECNOLOGÍAS DEL TRÁFICO – SISTEMAS DE INFORMACIÓN. dtecntrafico@madrid.es



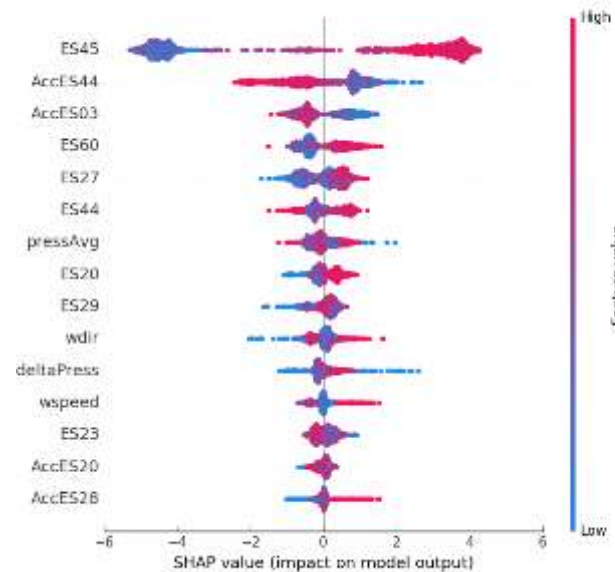
Variable	Location
ES03	Dr. Esquerdo - Sainz de Baranda
ES18	Narvaez - Doctor Castelo - O'Donnell
ES20	M30
ES23	Prado - Espalter - Pl. Canovas Castillo
ES27	Alcalá - Pl. Independencia - Pl. Cibeles
ES28	Ciudad Barcelona - Alberche - Pedro Bosch
ES29	Infanta Isabel - Alfonso XII - Carlos V
ES44	Ayala - Goya
ES45	Velazquez - Jorge Juan - Goya
ES60	Quintana
Hospital	Dr. Esquerdo
Wind	Pl. España
Pressure	Retiro



Riesgo Relativo Respiratorias

Por cada mil coches/día aumentan los ingresos 0,06 al día, es decir el 0,40 % por cada mil coches/día.

- Como la media es de 36,3 coches/día, el **% de los ingresos diarios urgentes por causas respiratorias relacionados con la intensidad de tráfico es del 12%.**



Riesgo Relativo Circulatorias

Por cada mil coches/día aumentan los ingresos 0,17 al día, es decir el 1,19 % por cada mil coches/día.

- Como la media es de 36,3 coches/día el **% de ingresos diarios urgentes por causas circulatorias relacionados con la intensidad del tráfico es del 42,8%**

Características de los estudios realizados

- Efectos a corto plazo.
- Necesidad de que la OMS incluya en su Guía sobre ruido y salud este tipo de impactos en salud y no solo exposiciones crónicas a largo plazo similar a lo que hace para la contaminación atmosférica química.
- Evidencia científica sólida.
- Realizar estudios a corto plazo en otros lugares.



GRACIAS POR SU ATENCIÓN

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