Dati francesi recenti sugli effetti sanitari dell'inquinamento atmosferico

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ARTICLE // Article

IMPACT DE LA POLLUTION DE L'AIR AMBIANT SUR LA MORTALITÉ EN FRANCE MÉTROPOLITAINE : RÉDUCTION EN LIEN AVEC LE CONFINEMENT DU PRINTEMPS 2020 ET IMPACT À LONG TERME POUR LA PÉRIODE 2016-2019

// IMPACT OF AIR POLLUTION ON MORTALITY IN METROPOLITAN FRANCE: REDUCTION RELATED TO THE SPRING 2020 LOCKDOWN AND LONG-TERM IMPACT FOR 2016-2019

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Soumis le 30.03.2021 // *Date of submission: 03.30.2021*

Scénarios, périodes d'étude et choix des risques relatifs

EQIS		Périodes d'étude	Indicateurs de mortalité	Classes d'âge	Risques relatifs pour une augmentation de 10 µg/m^3 [IC95%]	Références
Impact sur la mortalité lié à la baisse des concentrations de polluants de l'air occasionnée par les restrictions d'activité en lien avec la Covid-19 au printemps 2020	Scénario 1 : Impact à court terme sur la mortalité consécutif à la baisse des concentrations journalières de pollution de l'air ambiant occasionnée par les restrictions d'activité et modélisée à partir d'hypothèses portant sur la réduction des émissions pendant le confinement strict et le déconfinement progressif [a]	**Confinement strict :** 16 mars au 11 mai 2020 **Déconfinement progressif :** 11 mai au 22 juin 2020 **Période totale :** 16 mars au 22 juin 2020	Mortalité Non-accidentelle Code CIM-10 : A00-R99	Tous âges	PM_{10} : 1,0030 [1,0013-1,0047] NO_2 : 1,0075 [1,0040-1,011]	Liu *et al.* 2019 [b] [7] Corso *et al.* 2020 [8]
	Scénario 2 : Impact à plus long terme sur la mortalité consécutif à la baisse des concentrations annuelles de pollution de l'air ambiant occasionnée par les restrictions d'activité et modélisée à partir d'hypothèses portant sur la réduction des émissions pendant le confinement strict et le déconfinement progressif [a]	1er juillet 2019 au 30 juin 2020	Mortalité Totale Code CIM-10 : A00-Y98	≥30 ans	$PM_{2,5}$: 1,15 [1,05-1,25] NO_2 : 1,023 [1,008-1,037]	Pascal *et al.* 2016 [4] COMEAP 2018 [9]
Impact à long terme de la pollution de l'air ambiant entre 2016 et 2019 (hors contexte des mesures prises pour limiter la propagation de la Covid-19)		1er janvier 2016 au 31 décembre 2019 (période de 4 ans la plus récente avec des données disponibles)	Mortalité Totale Code CIM-10 : A00-Y98	≥30 ans	$PM_{2,5}$: 1,15 [1,05-1,25] NO_2 : 1,023 [1,008-1,037]	Pascal *et al.* 2016 [4] COMEAP 2018 [9]

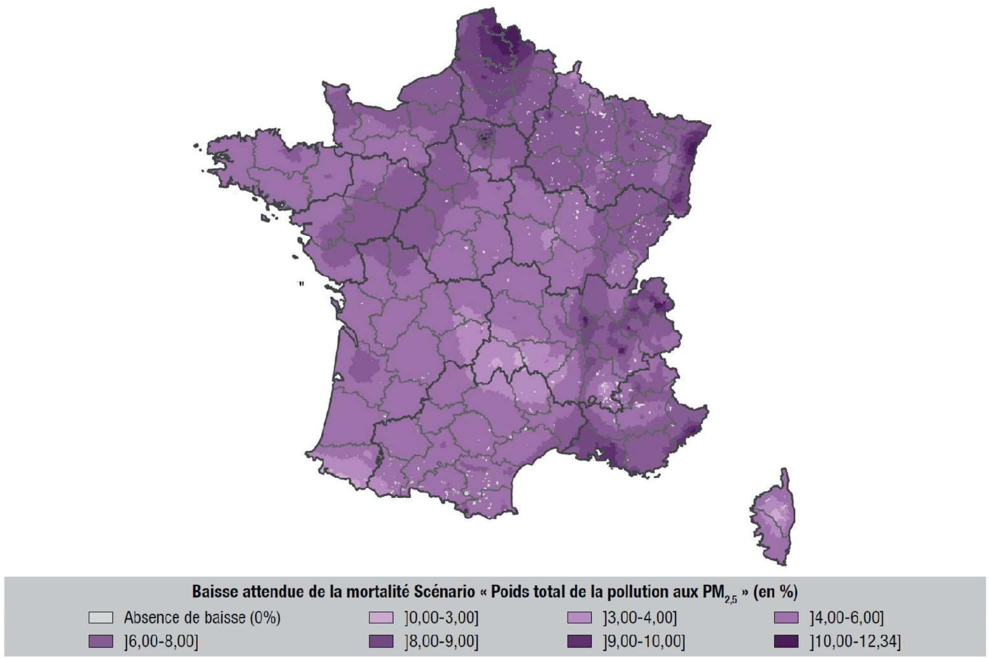
[a] Le déconfinement progressif correspond à une reprise progressive de l'activité à la suite du confinement strict.

[b] Par rapport à l'étude indiquée en référence, les RR reportés ici ne prennent en compte dans la méta-analyse que ceux des pays occidentaux (Canada, République tchèque, Estonie, Finlande, France, Allemagne, Grèce, Italie, Portugal, Espagne, Suède, Suisse, Royaume-Uni et États-Unis) et non l'ensemble des pays de l'étude.

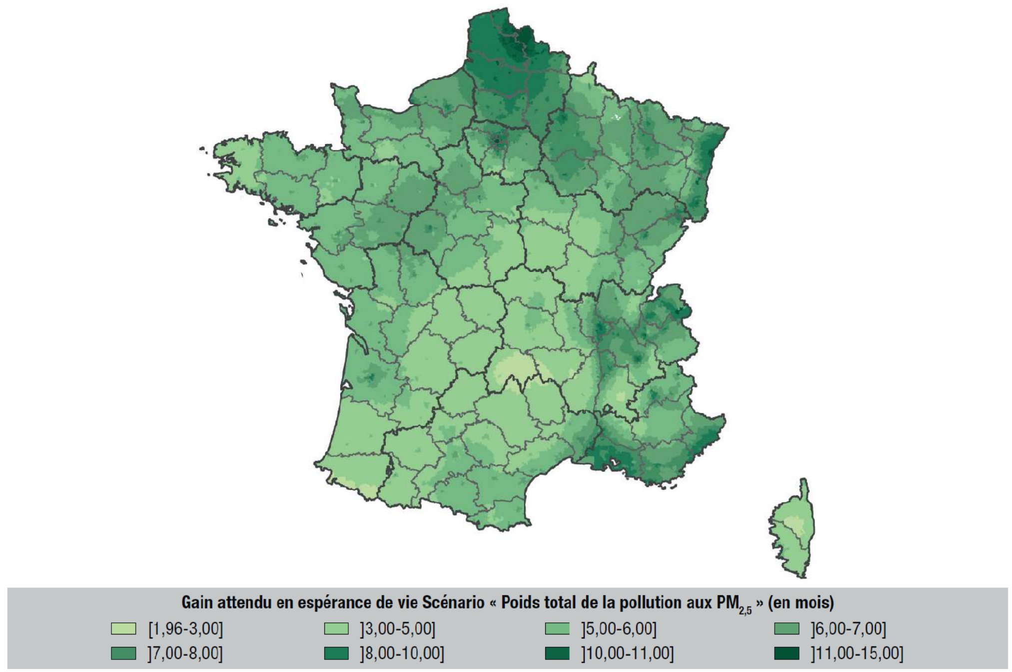
EQIS : Évaluation quantitative d'impact sur la santé ; CIM-10 : Classification internationale des maladies – 10e révision ; IC95% : intervalle de confiance à 95%.

Impact à long terme (2016-19) de l'exposition aux PM2.5 sur la mortalité et l'espérance de vie

Impact à long terme de l'exposition aux $PM_{2,5}$ et au NO_2 sur la mortalité de la population âgée de 30 ans et plus à l'échelle communale, du 1er janvier 2016 au 31 décembre 2019 en France métropolitaine (en %)



Impact à long terme de l'exposition aux $PM_{2,5}$ sur l'espérance de vie de la population âgée de 30 ans et plus à l'échelle communale, du 1er janvier 2016 au 31 décembre 2019 en France métropolitaine (en mois)



Source : Ing-Admin Express, 2018 ; Santé publique France, 2020.

48 000 (*Santé Publique France*, 2016) to 97 242 deaths per year (Vohra et al., 2021) Env Res 2021

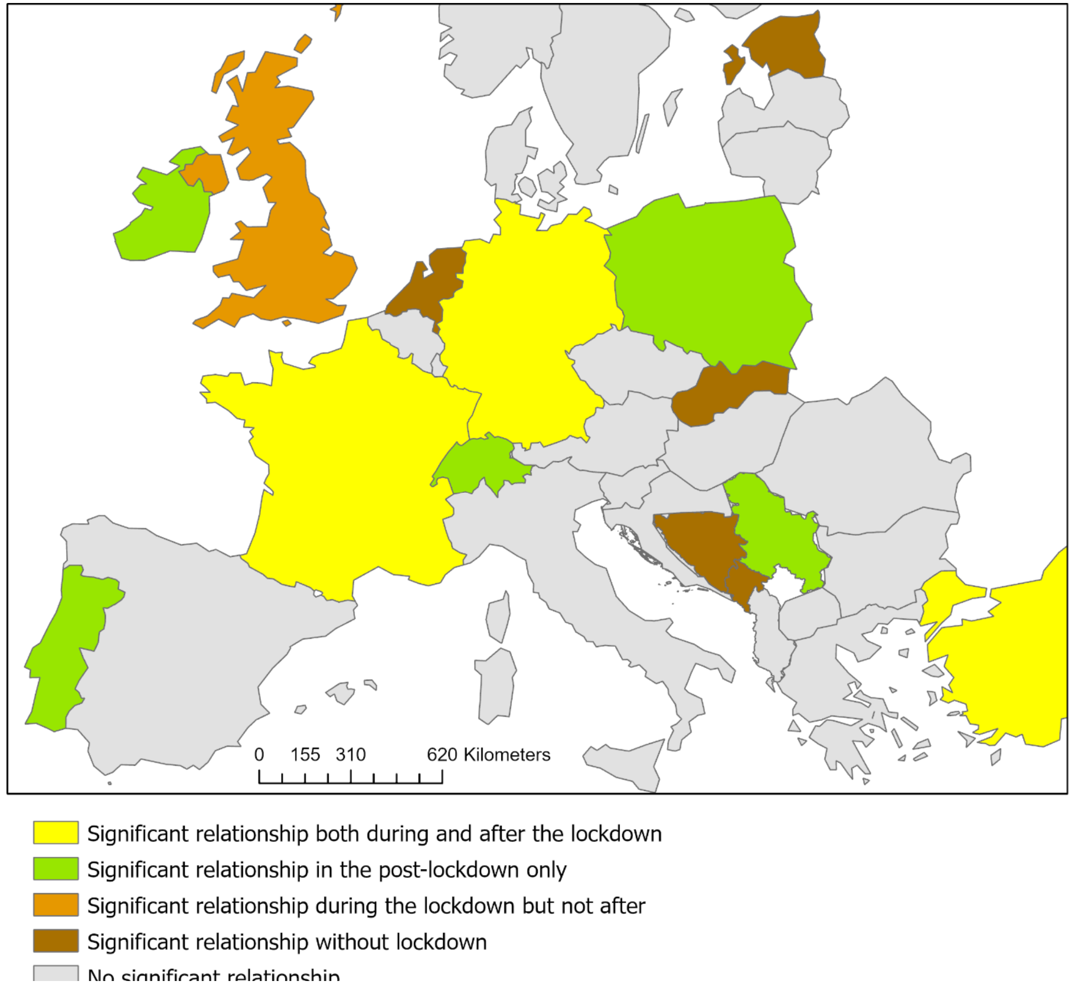
Short term effects of the lockdowns

- Over the period of **strict containment** (from 16 March to 11 May 2020), PM10 level varied between-8.6 and -0.1 µg/m3 and NO2 between -30.8 and -0.3 µg/m3, with average reduction percentages of 12.5% and 44.7% respectively.
  - NO2 reductions prevented 243 [130; 357] deaths
  - PM10 reductions, 61 [26; 97] deaths (i.e. 0.3% and 0.08% respectively of total annual of total annual mortality), of which about half were were concentrated in municipalities belonging to an urban unit with more than 100 000 inhabitants.
- **Phase-out period** (11 May to 22 June 2020) characterized by a smaller decrease in concentrations than during the strict containment, with a positive exposure gradient between the municipalities identified as "rural" and those identified as "urban” more marked for NO2 than for PM10(Table 2).
  - For this period, 39 [16; 61] deaths were avoided by reductions in NO2 and 8 [1; 14] deaths were prevented due to reductions in PM10 concentrations, representing 0.1% and 0.01% of the and 0.01% of total annual mortality respectively.

Allergy (in press)

Has the Spring 2020 lockdown modified the relationship between air pollution and COVID-19 mortality in Europe?

Isabella Annesi-Maesano[1], Cara Nichole Maesano [1], Boris Dessimond[1], Julie Prud'homme[1], Augustin Colette[2], Soutrik Banerjee[1]



International Journal of *Environmental Research and Public Health*

MDPI

Article

Long-Term Effect of Outdoor Air Pollution on Mortality and Morbidity: A 12-Year Follow-up Study for Metropolitan France

Shreosi Sanyal [1], Thierry Rochereau [2], Cara Maesano [1], Laure Com-Ruelle [2] and Isabella Annesi-Maesano [1]

In 2012:

- CHIMERE model (2 km)

- CEPIDC: mortality

all natural causes= 521360
Respiratory=38092
circulatory diseases=141295

- IRDES national cohort (ESPS): morbidity data (>20000 individuals followed-up in time (individual Q)
  - total number of people hospitalized for greater or equal to 2 days amounted to 907 individuals

Long-term morbidity

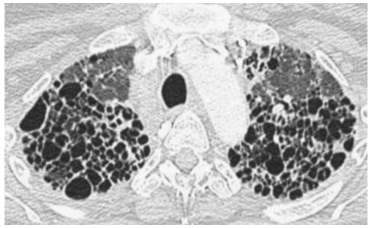
Model 1	Natural Causes	Model 2	Natural Causes
NO_2	1.012 (0.999–1.027) **	NO_2	1.041 (1.024–1.058)
$PM_{2.5}$	1.032 (1.021–1.065)	PM_{10}	1.072 (1.052–1.092)
O_3	1.018 (1.002–1.035)	O_3	0.992 (0.978–1.006)

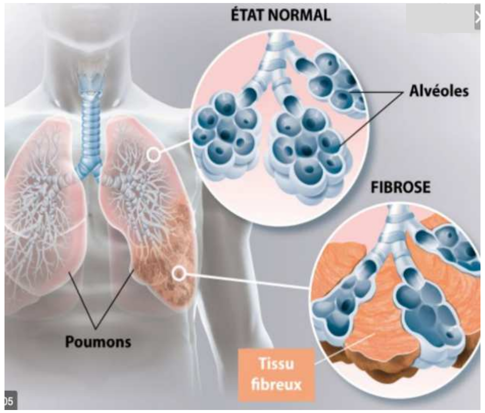
Long-term mortality

Model 1	All-Cause	Cardiovascular Diseases	Respiratory System Diseases	Model 2	All-Cause	Cardiovascular Diseases	Respiratory System Diseases
NO_2	1.029 (1.002–1.057) **	1.084 (0.917–1.281)	1.165 (0.883–1.537)	NO_2	1.046 (1.020–1.074)	1.071 (0.876–1.310)	1.17 (0.904–1.513)
$PM_{2.5}$	1.107 (1.079–1.136)	1.225 (0.967–1.551)	1.2 (0.990–1.454)	PM_{10}	1.099 (1.072–1.128)	1.097 (0.899–1.339)	1.181 (0.970–1.439)
O_3	1.008 (0.974–1.044)	0.742 (0.490–1.123)	0.793 (0.473–1.330)	O_3	0.998 (0.963–1.035)	0.919 (0.700–1.208)	0.869 (0.645–1.172)

Note: * According to the CHIMERE dispersion model; ** RR for 10 μg/m³ increase (95% Confidence Interval) of the air pollutant obtained with Poisson regression analysis controlled for BMI, tobacco smoking, education, and marital status. Regression analysis was performed with $PM_{2.5}$ and PM_{10} in separate models (Model 1 and 2, respectively).

Fibrose pulmonaire idiopathique (FPI)





Contexte

Diffuse Interstitial Lung Disease (ILD) affects 6.27 to 97.9/100,000 population

Idiopathic Interstitial Lung Disease (IIP) is an IDL of unknown cause

IPF the most common and severe form of ILD
Sporadic (80%) or familial form
Short telomeres

Collard et al. *AJRCCM 2016*
Wijsenbeek et Cottin. *NEJM* 2020

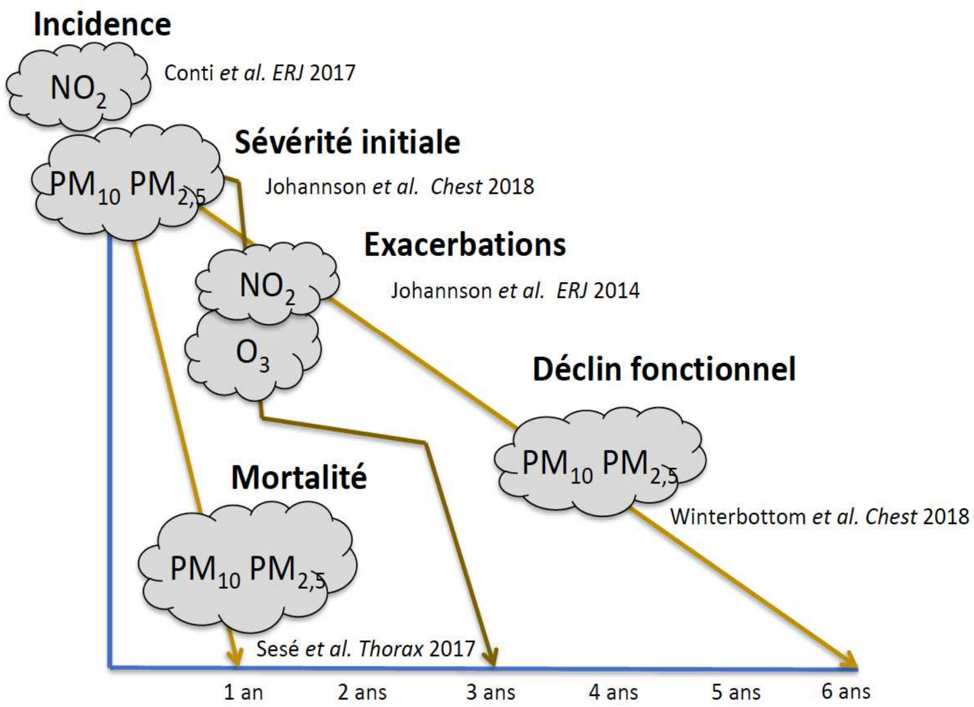
Environmental exposures associated with ILD

Smoking exposure

Occupational exposure

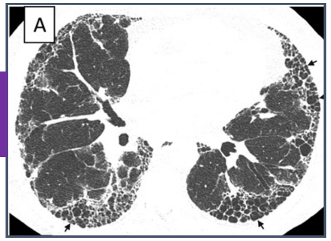
- Silica
- Asbestos
- Wood dust
- Metal dust
- Agriculture, livestock

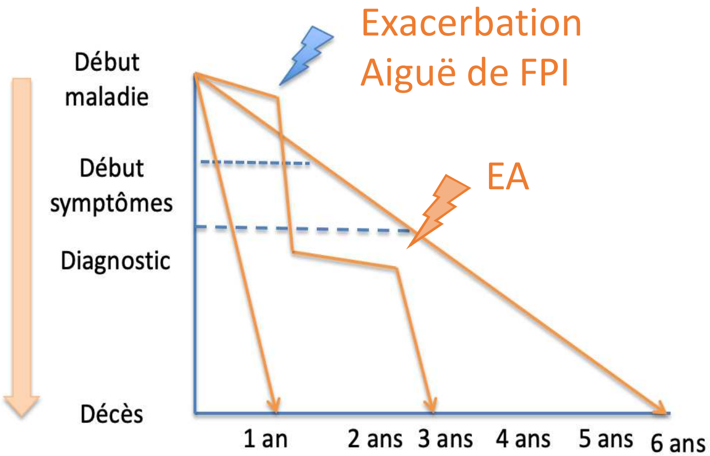
Air pollution exposure



Air pollution role in idiopathic pulmonary fibrosis

IPF





Marqueur pronostique: CVF

- Cohort **COFI** (PHRC, Legs Poix) **PI : Pr D. Valeyre** (CHU Avicenne)
- Air quality monitoring stations close to patients addresses

Table 2 Short-term effect of air pollution on acute exacerbations

Exposure	Increase	HR (95% CI)	p Value
O_3	10 µg/m^3	1.47 (1.13 to 1.92)	0.005
NO_2	10 µg/m^3	0.92 (0.68 to 1.24)	0.584
PM_{10}	10 µg/m^3	0.80 (0.52 to 1.27)	0.347
$PM_{2.5}$	10 µg/m^3	1.29 (0.65 to 2.57)	0.463

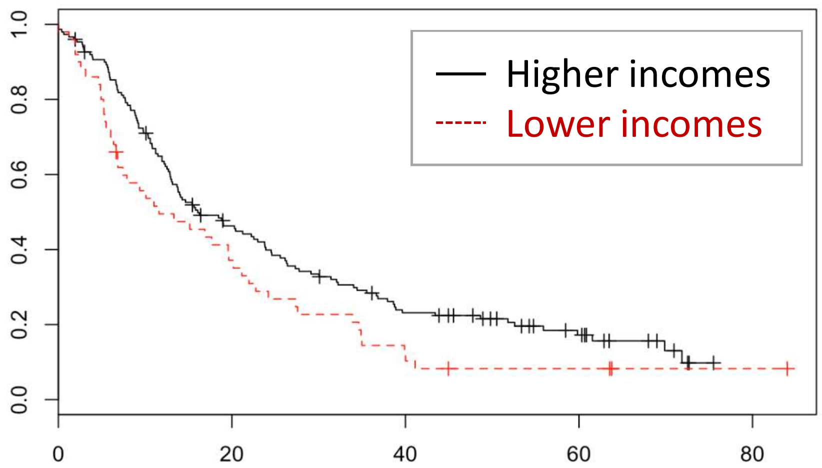
Table 4 Association of cumulative air pollution exposure and mortality

Exposure	Increase	HR (95% CI)	p Value
O_3	10 µg/m^3	0.89 (0.66 to 1.18)	0.43
NO_2	10 µg/m^3	1.01 (0.79 to 1.29)	0.90
PM_{10}	10 µg/m^3	2.01 (1.07 to 3.77)	0.03
$PM_{2.5}$	10 µg/m^3	7.93 (2.93 to 21.33)	<0.001

Sesé L et Annesi-Maesano. *Thorax* 2017

Socio-economic factors related to IPF

- Cohorte **COFI**
- INSEE: Revenu annuel



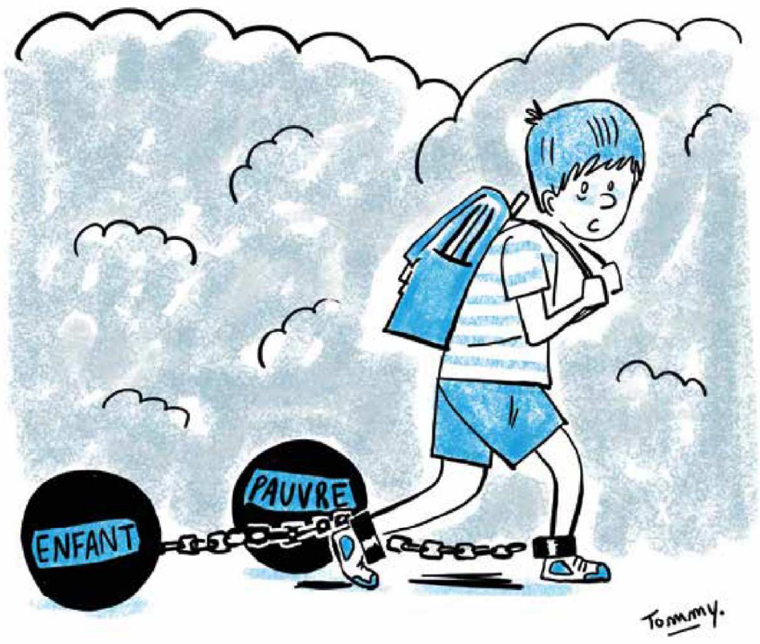
	Lower incomes (n = 50)	Higher incomes (n = 150)	*p*-value
Exposition(s) professionnelle(s)	16 (32%)	20 (13%)	0.006*

HR: 1.49 [95% CI: 1.05-2.10], ***p* = 0.025***

- Patient Registries in Idiopathic Pulmonary Fibrosis: Don't Forget Socioeconomic Status
  Sesé L. et Annesi-Maesano *Am J Respir Crit Care Med*. 2019

- Low income and outcome in idiopathic pulmonary fibrosis: an association to uncover
  Sesé L. et Annesi-Maesano *Respiratory Medicine journal 2021*

LA DOUBLE PEINE



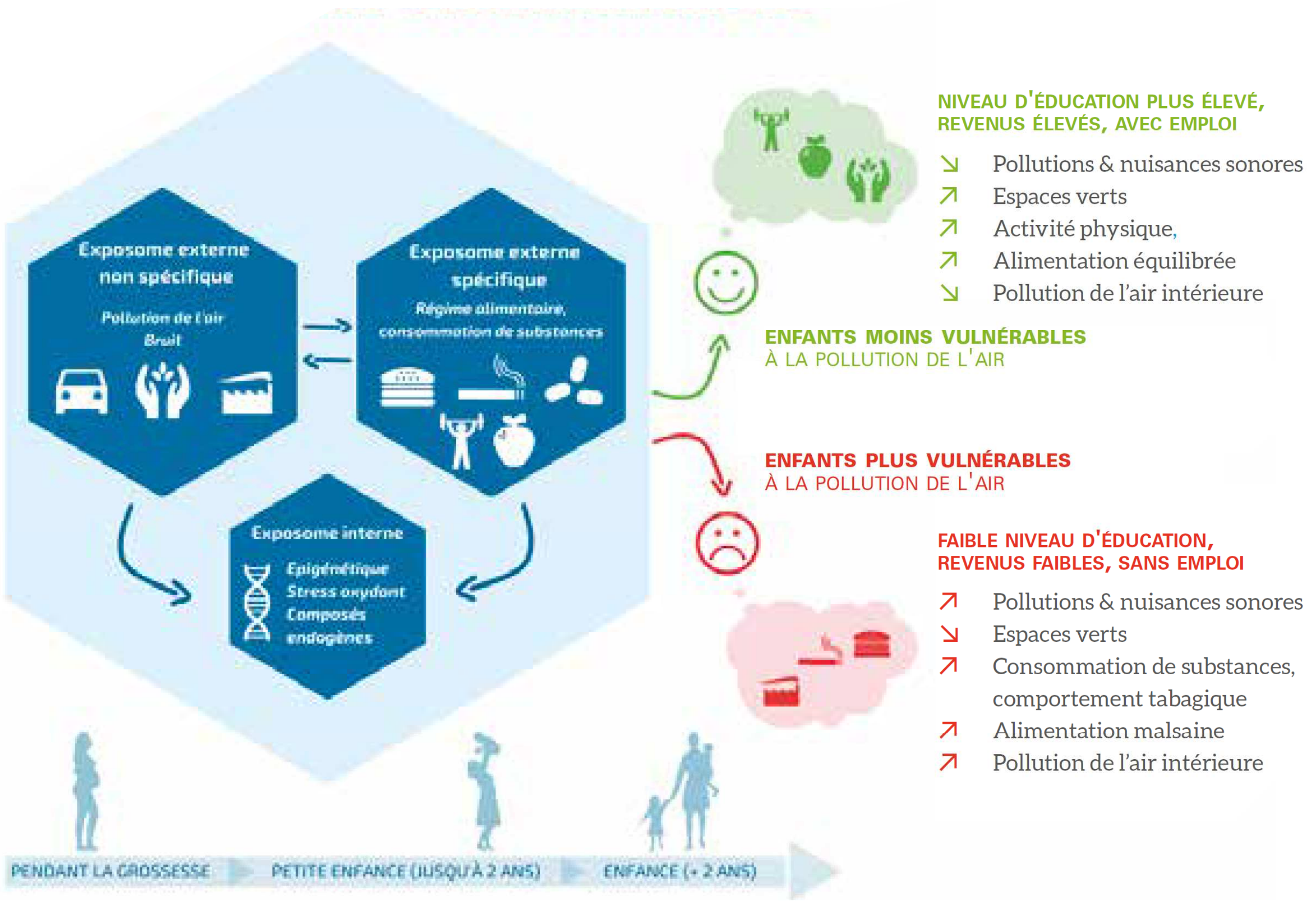
unicef
pour chaque enfant

réseau action climat france

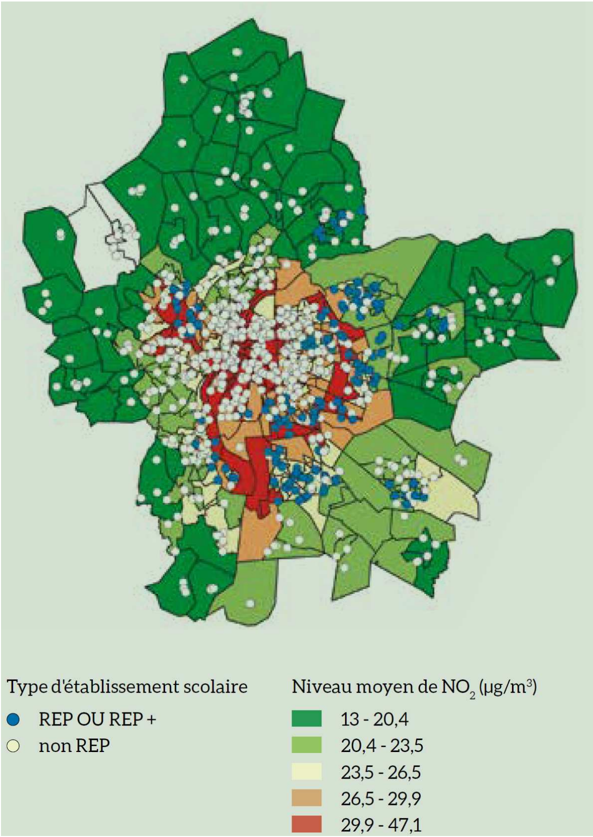
De l'injustice sociale dans l'air

Pauvreté des enfants et pollution de l'air

Santé de l'enfant selon le niveau de pauvreté



Poor children are more exposed and more diseased



Lyon

More asthma

Table 3. Association between traffic-related air pollution exposure during the first year and respiratory health during preschool years in the PARIS cohort.

Respiratory health during the first 4 years of life	*n* (%)	aOR (95% CI)	*p*-Value
Wheeze			
No (reference)	1,181 (69.1)	1	
Early-transient	317 (18.5)	1.03 (0.91, 1.17)	0.67
Late-onset	86 (5.0)	1.09 (0.89, 1.33)	0.40
Persistent	126 (7.4)	1.27 (1.09, 1.47)	0.002
Dry night cough			
No (reference)	1,032 (60.6)	1	
Early-transient	190 (11.2)	1.01 (0.87, 1.18)	0.87
Late-onset	265 (15.5)	1.03 (0.91, 1.18)	0.63
Persistent	217 (12.7)	1.11 (0.97, 1.27)	0.13
Rhinitis symptoms			
No (reference)	934 (55.3)	1	
Early-transient	300 (17.7)	0.95 (0.83, 1.09)	0.45
Late-onset	175 (10.4)	1.06 (0.91, 1.24)	0.45
Persistent	281 (16.6)	1.09 (0.96, 1.24)	0.18
Asthma ever at 4 years			
No (reference)	1,517 (87.2)	1	
Yes	223 (12.8)	1.15 (1.01, 1.31)	0.03
Asthma ever with current respiratory symptoms at 4 years			
No (reference)	1,595 (93.1)	1	
Yes	119 (6.9)	1.20 (1.02, 1.41)	0.03

Notes: aOR, adjusted odds ratio; CI, confidence interval. Odds ratios are calculated for an interquartile range (26 μg/m^3 NO_2 equivalent) increase in average NO_x levels during the first year of life. The categorical outcomes were modeled using multinomial logistic regression models. Models were adjusted for sex, birth weight, family socioeconomic status, maternal education level, maternal history of asthma, allergic rhinitis, or eczema, paternal history of asthma, allergic rhinitis, or eczema, maternal smoking during pregnancy, exposure to environmental tobacco smoke at home during the first year, exclusive breastfeeding during the first 3 months, type of child care during the first 6 months, stressful family events during the first 2 years, body mass index ≥ 85th percentile for age and sex at 2–3 years, use of gas for cooking or heating in the home, and visible mold in the home.

Cohorte PARIS

Rancière F, Bougas N, Viola M, Momas I. Early Exposure to Traffic-Related Air Pollution, Respiratory Symptoms at 4 Years of Age, and Potential Effect Modification by Parental Allergy, Stressful Family Events, and Gender: A Prospective Follow-up Study of the PARIS Birth Cohort. Environ Health Persp. 2016

Cohorte PARIS
(Pollution and Asthma Risk: an Infant Study)
2015 enfants suivis post-natal
Exposition à la pollution la première année de vie : NO2

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https://idesp.umontpellier.fr/

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