

Impact sanitaire de la pollution atmosphérique due aux transports

Partie 2 : principaux résultats

Plan de la présentation

- 1 – Impact à court terme.
- 2 – Impact à long terme.
- 3 – Bénéfices de la prévention.
- 4 – Conclusion.

L'air est le plus puissant agent de tout en tout

Hippocrate, IVème siècle avant J-C

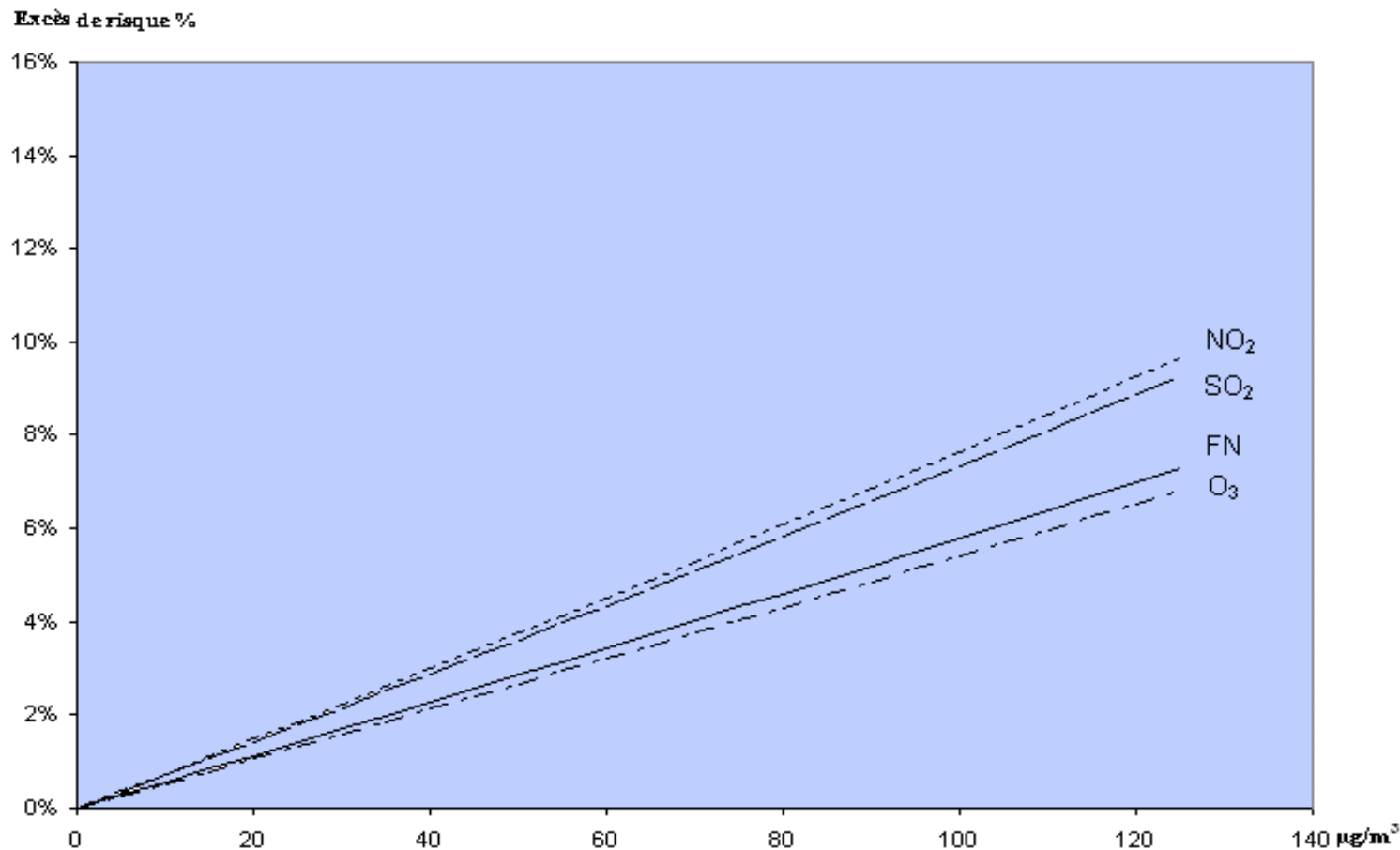
1 – Impact à court terme

- L'effet sanitaire se produit dans les jours suivant l'exposition
- L'exposition aux particules est associée à une augmentation :
 - du risque de décès pour causes cardio-vasculaires (+0,9%) et respiratoires (+1,3%)*, OMS 2004
 - du risque d'hospitalisation pour causes cardio-vasculaires (+0,6%) et respiratoires (+1,2%)*, APHEIS 3 2004
 - des symptômes et affections respiratoires : exacerbation de l'asthme, toux, diminution du volume et du débit expiratoire de pointe
 - des actes médicaux et de la consommation médicamenteuse

Ces relations ne montrent pas de seuil à l'échelle de la population

** pour une augmentation de $10\mu\text{g}/\text{m}^3$ du niveau de PM_{10}*

1 – Impact à court terme : relations dose / risque



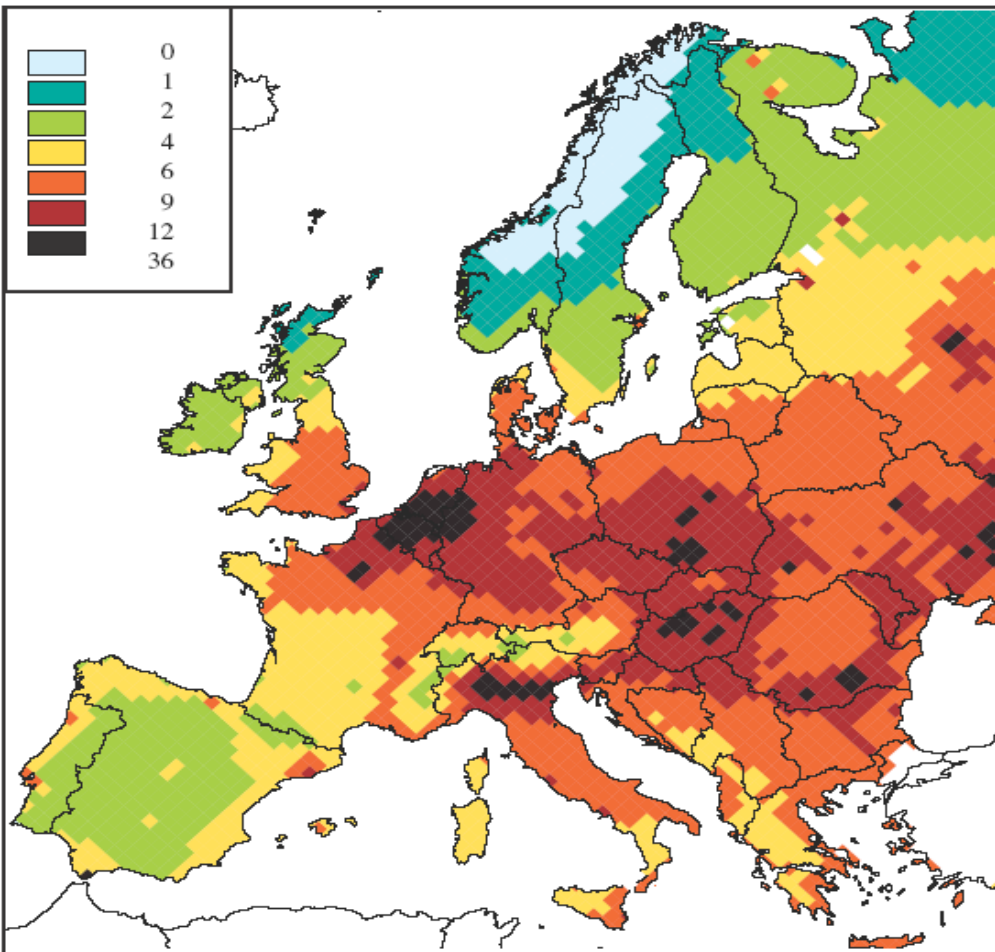
2 – Impact à long terme

- L'effet sanitaire se produit des années après une exposition prolongée
- L'exposition chronique aux particules est associée à une augmentation:
 - du risque de **décès** pour causes **cardio-pulmonaires** (+9%) et par **cancer du poumon** (+14%)*, Pope 2002
 - du risque de décès **post-néonatal** respiratoire (+22%** , Lacasana 2005) et par **mort subite** du nourrisson (+12%** , Woodruff 1997)

* pour une augmentation de $10\mu\text{g}/\text{m}^3$ du niveau de $\text{PM}_{2,5}$

** pour une augmentation de $10\mu\text{g}/\text{m}^3$ du niveau de PM_{10}

2 – Impact à long terme : modélisation PM2,5



Pour l'ensemble de l'Europe des 25 (CAFE, proposition de directive soumise au parlement et au conseil européen) :

En moyenne, perte d'environ 9 mois d'espérance de vie
348 000 décès anticipés

3 – Bénéfices de la prévention

- **Dublin, Irlande** (Clancy et al. 2002) :
suite à l'interdiction du charbon bitumineux le 1^{er} septembre 1990, les niveaux de fumées noires ont diminué de $35,6\mu\text{g}/\text{m}^3$. Les taux de mortalité ont décliné de :
 - 5,7% pour la mortalité toutes causes non accidentelles,
 - 15,5% pour la mortalité respiratoire et
 - 10,3% pour la mortalité cardio-vasculaire
- **Vallée de l'Utah, USA** (Pope et al. 1992) :
les niveaux de PM₁₀ ont diminué de $15\mu\text{g}/\text{m}^3$ pendant les 13 mois de grève dans une aciérie. Le nombre total de décès a diminué pendant la même période de 3,2%.

The NEW ENGLAND JOURNAL of MEDICINE

SPECIAL ARTICLE

Fine-Particulate Air Pollution and Life Expectancy in the United States

C. Arden Pope III, Ph.D., Majid Ezzati, Ph.D., and Douglas W. Dockery, Sc.D.

METHODS

We compiled data on life expectancy, socioeconomic status, and demographic characteristics for 211 county units in the 51 U.S. metropolitan areas with matching data on fine-particulate air pollution for the late 1970s and early 1980s and the late 1990s and early 2000s. Regression models were used to estimate the association between reductions in pollution and changes in life expectancy, with adjustment for changes in socioeconomic and demographic variables and in proxy indicators for the prevalence of cigarette smoking.

3 – Bénéfices de la prévention

RESULTS

A decrease of 10 μg per cubic meter in the concentration of fine particulate matter was associated with an estimated increase in mean ($\pm\text{SE}$) life expectancy of 0.61 ± 0.20 year ($P=0.004$). The estimated effect of reduced exposure to pollution on life expectancy was not highly sensitive to adjustment for changes in socioeconomic, demographic, or proxy variables for the prevalence of smoking or to the restriction of observations to relatively large counties. Reductions in air pollution accounted for as much as 15% of the overall increase in life expectancy in the study areas.

CONCLUSIONS

A reduction in exposure to ambient fine-particulate air pollution contributed to significant and measurable improvements in life expectancy in the United States.

4 – Conclusion 1 : causalité ?

➤ Dab (JAWMA, 2001, 51, 220-235)
When a set of epidemiological studies show with such regularity that an environmental factor is associated to frequent or serious health effects, that a common bias to all these studies is unlikely to exist and that most causality criteria are respected, it is not reasonable, from a public health point of view, to demand that research provides additional arguments before admitting the causal responsibility of this risk factor

TECHNICAL PAPER

ISSN 1047-3289, Air & Waste Manage. Assoc. 51:220-235
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Air Pollution and Health: Correlation or Causality? The Case of the Relationship between Exposure to Particles and Cardiopulmonary Mortality

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ABSTRACT

Many epidemiologic studies have observed, in different contexts, a slight short-term relationship between particles in air and cardiopulmonary mortality, even when air quality standards were respected. The causality of this relationship is important to public health because of the number of people exposed. Our aim was to make a critical assessment of the arguments used in 15 reviews of published studies.

We explain the importance of distinguishing validity from causality, and we systematically analyze the various criteria of judgment within the context of ecologic time studies. Our conclusion is that the observed relationship is valid and that most of the causality criteria are respected. It is hoped that the level of exposure of populations to these particles be reduced. In Europe, acting at the root of the problem, in particular on diesel emissions, will also enable the reduction of levels of other pollutants that can have an impact on health. In the United States, the situation is more complicated, as particles are mainly secondary. It is also essential to continue with research to become better acquainted with the determinants of personal global exposures and to better understand the toxic role of the various physicochemical factors of the particles.

INTRODUCTION

Various recently published epidemiologic studies have observed a statistically significant relationship between

IMPLICATIONS

Numerous epidemiologic studies have observed a relationship between particles in air and mortality. Determining the causality of this relationship is important in prevention. We have analyzed and classified arguments developed in 15 reviews of published studies. This allows the debate on the validity of the relationship between particles in air and mortality to be clearly distinguished from the debate on its causality. Most of the causality criteria have been gathered, and the main question now is validity. We find that the relationship is both valid and causal.

human exposure to urban air particles and various health indicators, in particular mortality, even though air quality standards in force were respected. This relationship exists in very different contexts. Observed relative risks, although statistically significant, are low: generally under 1.1 for an increase of 100 µg/m³ in fine particle content. Nevertheless, the size of the population exposed is such that if the relationship were causal, the impact on health would be significant.

The causality of this relationship has been analyzed and the standards debated in various articles. The Association for the Prevention of Air Pollution (APPA), established in France 40 years ago, is at a crossroad between scientists, public authorities, and manufacturers. A multidisciplinary group of researchers and professionals was mandated by the APPA to make a critical assessment of the main arguments used in discussing the causal nature of the observed associations.

Only the short-term (a few days) relationship between particulate air pollution and health is discussed here. It is thus the health impact of short-term exposure that is evaluated. Although this work focuses on cardiopulmonary mortality risks, it also takes into account results on global mortality and hospital morbidity.

Particles are solid or liquid elements present in air that, at a physical and chemical level, make up a heterogeneous group. The total concentration pertaining to the mass (total suspended particulate matter) is typically measured. Yet most of the epidemiologic studies that are analyzed in this article take an interest in the inhaled fraction of particles because of an average aerodynamic diameter of less than 10 µm (PM₁₀).

MATERIALS AND METHODS

Materials

There are various reviews of studies on the relationship between particulate pollution and health. We have selected 15 reviews that discuss in a structured manner the causality of this association.¹⁻¹⁵ Rather than producing another review,

4 – Conclusion 2 : les enjeux

- Risque individuel faible, mais collectif non négligeable
- Le risque collectif est avant tout lié à la taille de la population exposée
- Seule l'observation populationnelle permet d'estimer le risque
- La quantification est nécessaire pour un débat social plus serein
- La notion de pic n'est plus qu'un abus de langage

Plus on réduit le risque et plus ce qu'il en reste paraît insupportable à la population

Alexis de Tocqueville (1805-1859)