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## **Association between air pollution levels and drug sales for allergies in 63 million people in metropolitan France in 2013.**

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### ► **To cite this version:**

Marwan El Homsy, Stéphane Scison, Domitille Huguet, Boris Dessimond, Julie Prud'homme, et al.. Association between air pollution levels and drug sales for allergies in 63 million people in metropolitan France in 2013.. WAO & BSACI 2022 Joint Conference, Apr 2022, Edimbourg, United Kingdom. British Society for Allergy & Clinical Immunology (BSACI), Clinical and Experimental Allergy, 52 (8), pp.1022-1023 / P073, 2022. <hal-03787340>

**HAL Id: hal-03787340**

**<https://hal.science/hal-03787340v1>**

Submitted on 24 Sep 2022

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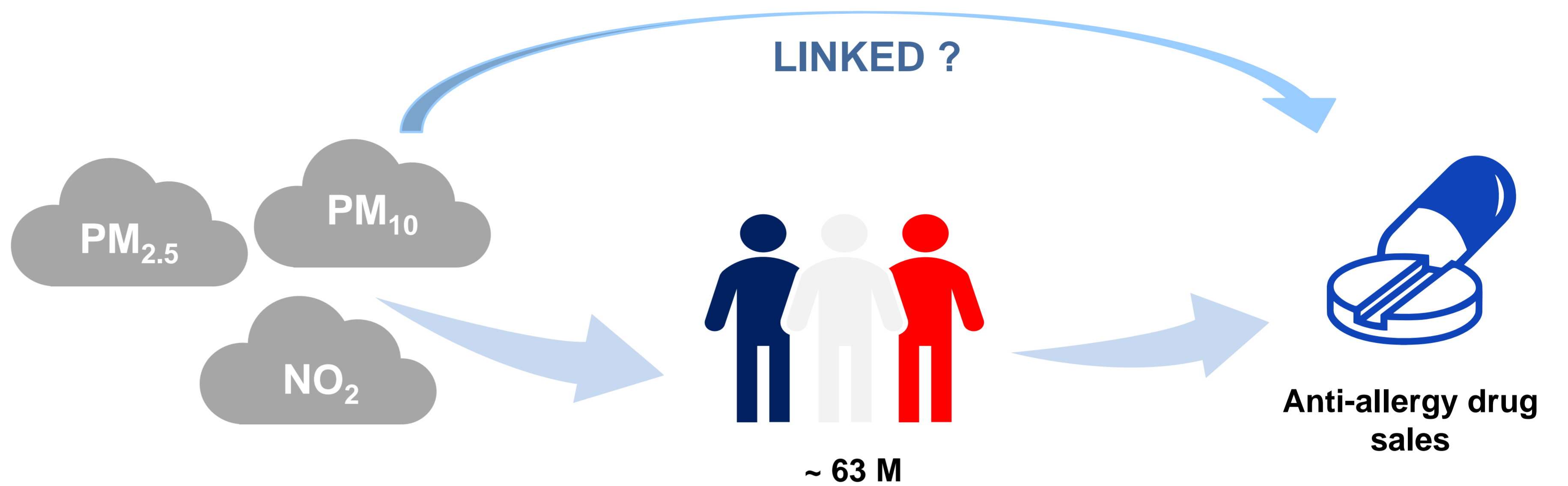
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## Introduction:

- ▶ **Air pollution** is a major **public health** problem because it is ubiquitous and the cause of several **adverse health effects**.
- ▶ The World Health Organization (WHO) estimated in 2016 that **91%** of the **world's population** lived **below the air quality thresholds** set by their guidelines.
- ▶ The study of **drug sales data** provides a **new way to assess the health impacts of air pollution**.

## Aims:

To assess the **short-term associations** between particulate matter less than or equal to a diameter of 10 micrometers (**PM<sub>10</sub>**) and 2.5 micrometers (**PM<sub>2.5</sub>**), nitrogen dioxide (**NO<sub>2</sub>**) with the sale of medication against **allergies (R06)** in **metropolitan France** in **2013**, on a population of **63 million inhabitants** exposed to air pollution.



## Methods:

We created a database from the data of each **French department** in **2013**. We obtained **relative risks** from a Quasi-Poisson regression with a **Generalized Additive Model (GAM)**. We also added smoothing functions to fit the models on seasonal data.

- Allergy drug sales:** R06 ATC class
- Pollution data:** PM<sub>2.5</sub>, PM<sub>10</sub>, and NO<sub>2</sub>
- Confounding factors:** Tobacco consumption and meteorological parameters



Final database

### » Unadjusted models with one pollutant (univariate):

$$y(\text{R06 sales}) = \beta_1(\text{PM}_{2.5}) + \text{intercept}$$

$$y(\text{R06 sales}) = \beta_1(\text{PM}_{10}) + \text{intercept}$$

$$y(\text{R06 sales}) = \beta_1(\text{NO}_2) + \text{intercept}$$

### » Adjusted models with one pollutant (multivariate):

$$y(\text{R06 sales}) = \beta_1(\text{PM}_{2.5}) + s(\text{confounding factors}^*) + \text{intercept}$$

$$y(\text{R06 sales}) = \beta_1(\text{PM}_{10}) + s(\text{confounding factors}) + \text{intercept}$$

$$y(\text{R06 sales}) = \beta_1(\text{NO}_2) + s(\text{confounding factors}) + \text{intercept}$$

### » Adjusted bipollutant models (multivariate):

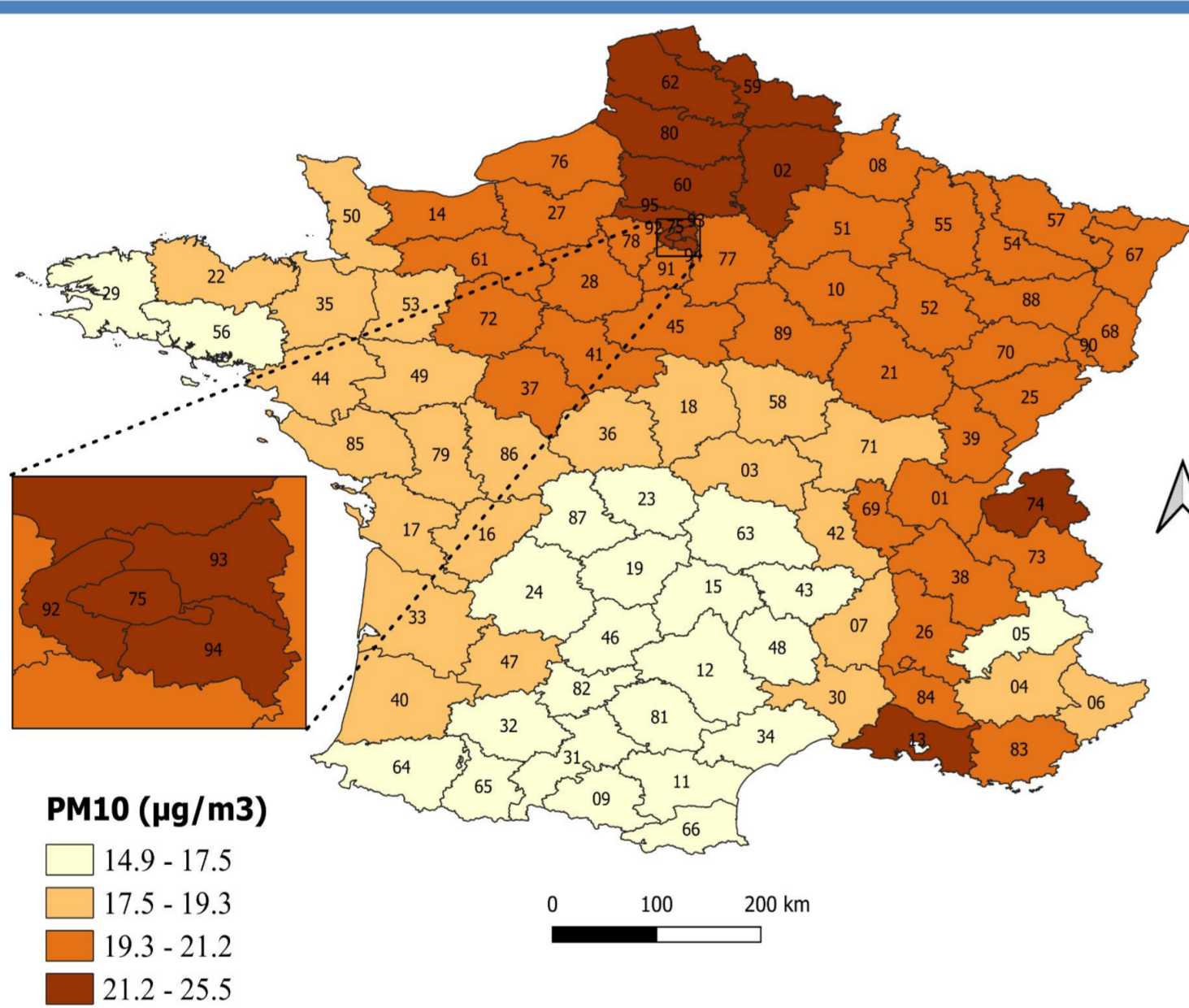
$$y(\text{R06 sales}) = \beta_1(\text{NO}_2) + \beta_2(\text{PM}_{2.5}) + s(\text{confounding factors}) + \text{intercept}$$

$$y(\text{R06 sales}) = \beta_1(\text{NO}_2) + \beta_2(\text{PM}_{10}) + s(\text{confounding factors}) + \text{intercept}$$

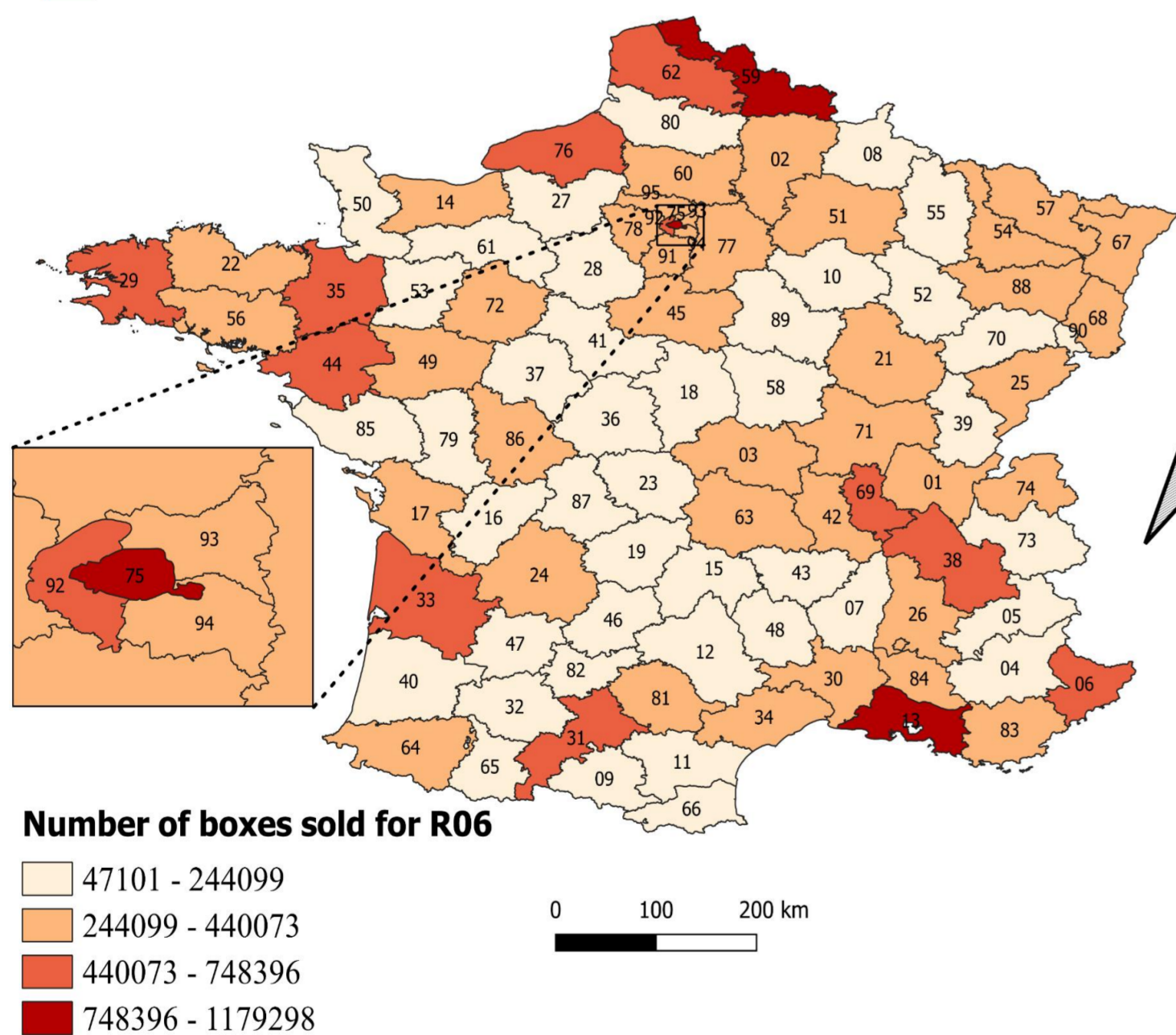
Where  $\beta_i$  represent a coefficient of exposure and  $s$ , represent a smoothing spline function.  
\* Confusions factors are the Tobacco consumption, mean temperature, relative humidity.

## Results:

A



B



	Unadjusted models with one pollutant			Adjusted models with one pollutant **			
	RR	Confidence Interval (95%)	p-value	RRa	Confidence Interval (95%)	p-value	
<b>R06*</b>							
PM <sub>2.5</sub>	1.027	1.019 - 1.036	<0.001	1.039	1.029 - 1.050	<0.001	
NO <sub>2</sub>	1.032	1.028 - 1.036	<0.001	1.034	1.028 - 1.039	<0.001	
PM <sub>10</sub>	1.036	1.028 - 1.043	<0.001	1.043	1.034 - 1.051	<0.001	
	Adjusted bipollutant model ** with PM <sub>2.5</sub>			Adjusted bipollutant model ** with PM <sub>10</sub>			
	RRa	Confidence Interval (95%)	p-value	RRa	Confidence Interval (95%)	p-value	
<b>R06*</b>							
PM <sub>2.5</sub>	1.007	0.996 - 1.019	0.2	PM <sub>10</sub>	1.021	1.012 - 1.031	<0.001
+ NO <sub>2</sub>	1.031	1.025 - 1.038	<0.001	+ NO <sub>2</sub>	1.024	1.018 - 1.030	<0.001

\* Drugs are classified according to the Anatomical Therapeutic Chemical (ATC) Classification System: R06 (Antihistamines for systemic use).

\*\* Models are fitted to mean temperature, relative humidity and crude lung cancer rate.

## Conclusions and perspectives:

Our study confirms the presence of a **short-term association** between **NO<sub>2</sub>**, and **PM<sub>10</sub>** and the **sale of anti-allergy drugs** thus **confirming** previous observations on the **impact of air pollution on allergies**.

