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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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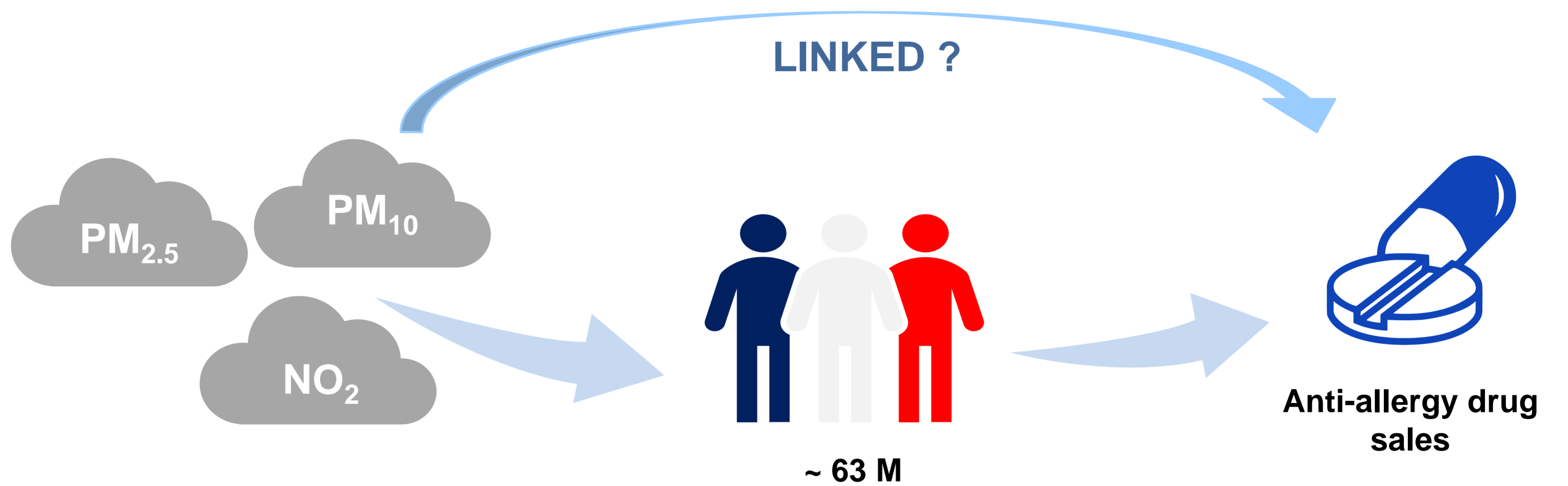
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## Introduction:

- ▶ **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):

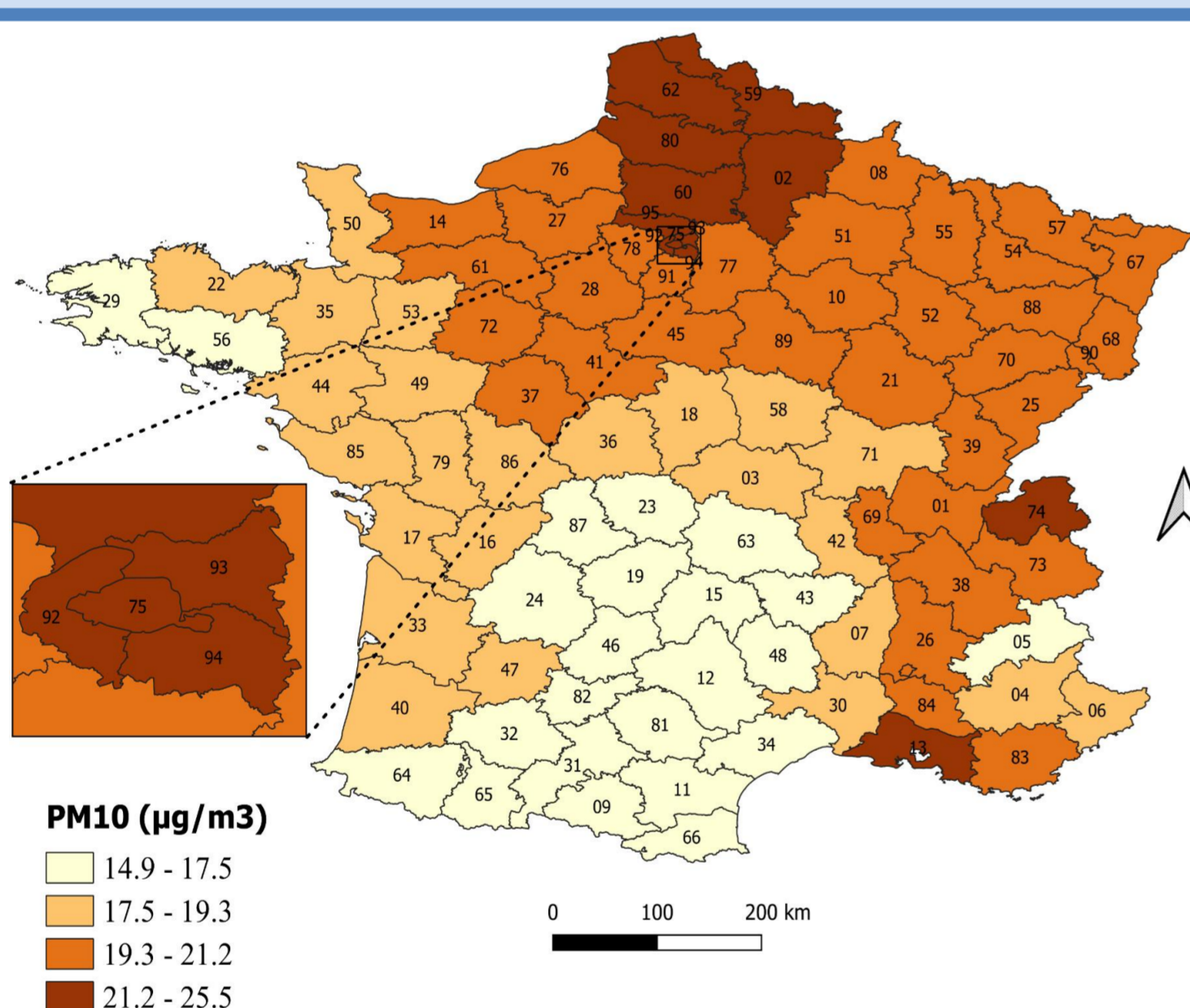
$$y(\text{R06 sales}) = \beta_1(\text{NO}_2) + \beta_2(\text{PM}_{2.5}) + s(\text{confounding factors}) + \text{intercept}$$

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

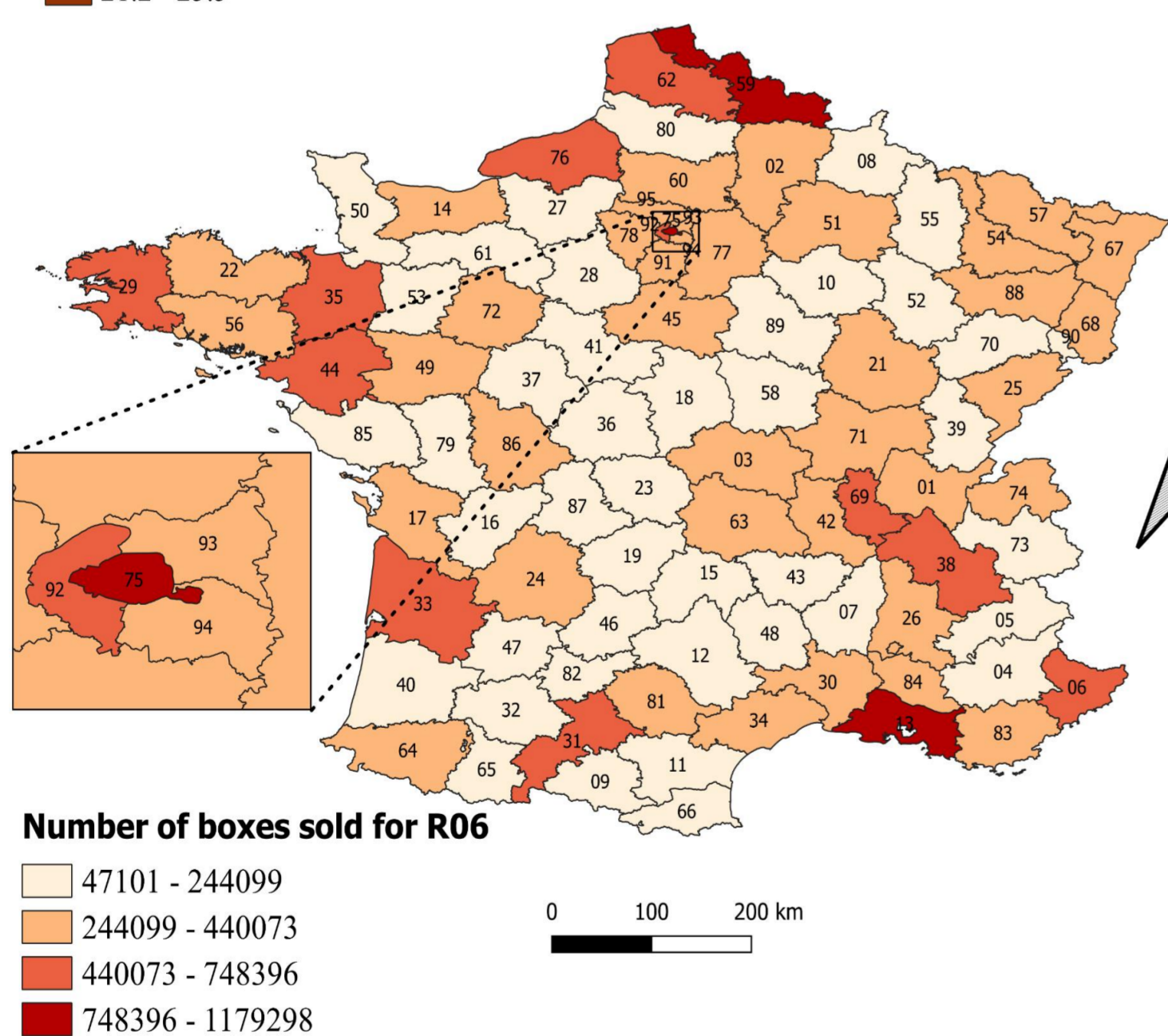
Where  $\beta_i$  represent a coefficient of exposure and  $s$ , represent a smoothing spline function.  
\* Confusions factors are the Tobacco consumption, mean temperature, relative humidity.

## 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**.

