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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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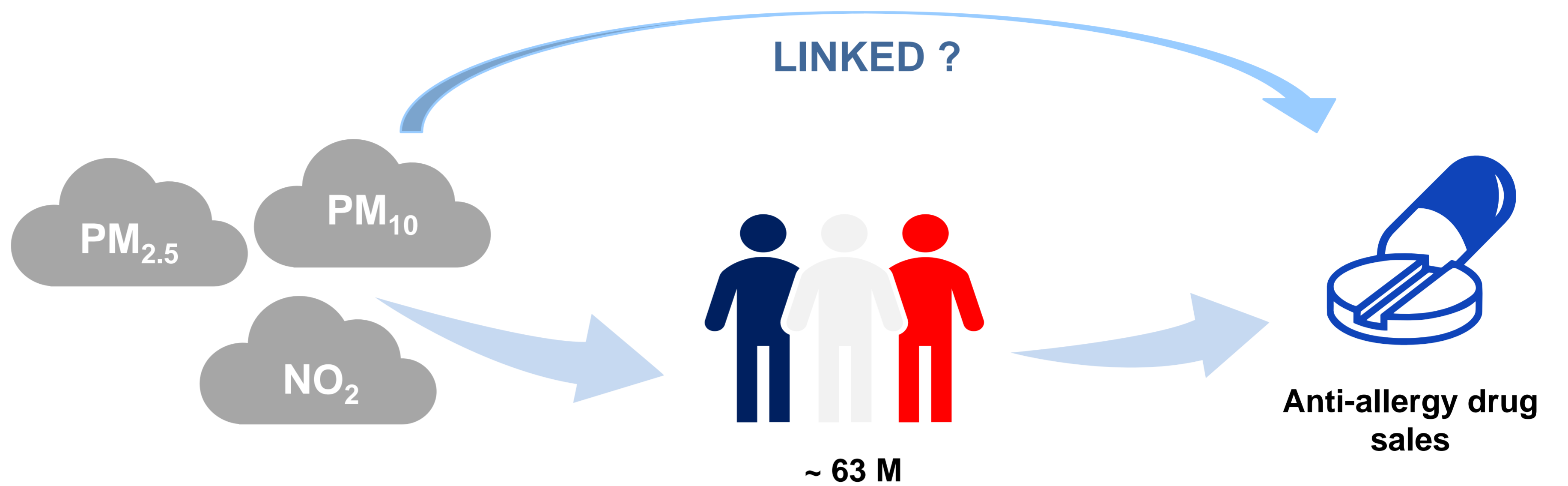
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Introduction:

- ▶ **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 (**PM₁₀**) and 2.5 micrometers (**PM_{2.5}**), nitrogen dioxide (**NO₂**) 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_{2.5}, PM₁₀, and NO₂
- 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):

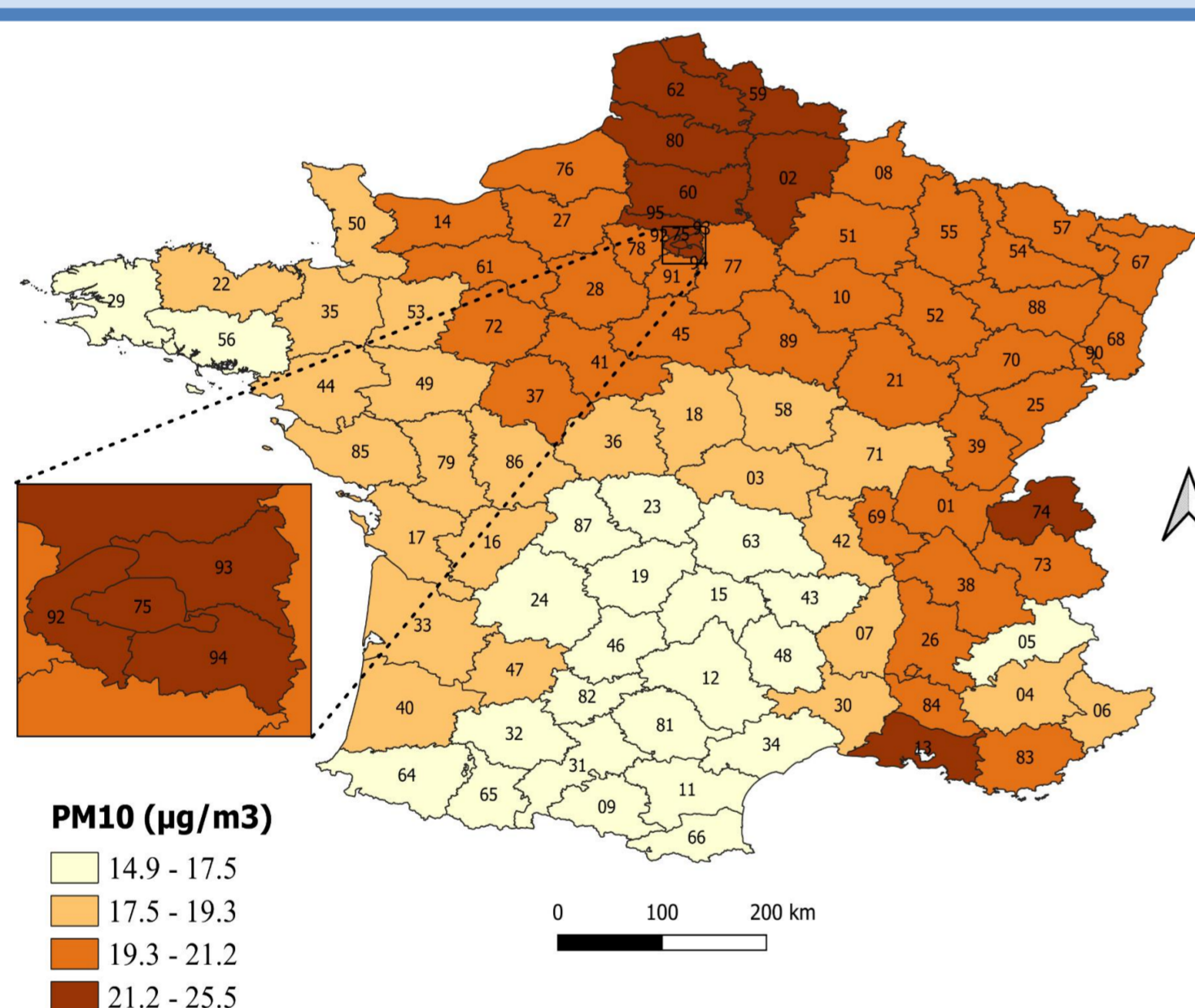
$$y(\text{R06 sales}) = \beta_1(\text{NO}_2) + \beta_2(\text{PM}_{2.5}) + s(\text{confounding factors}) + \text{intercept}$$

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

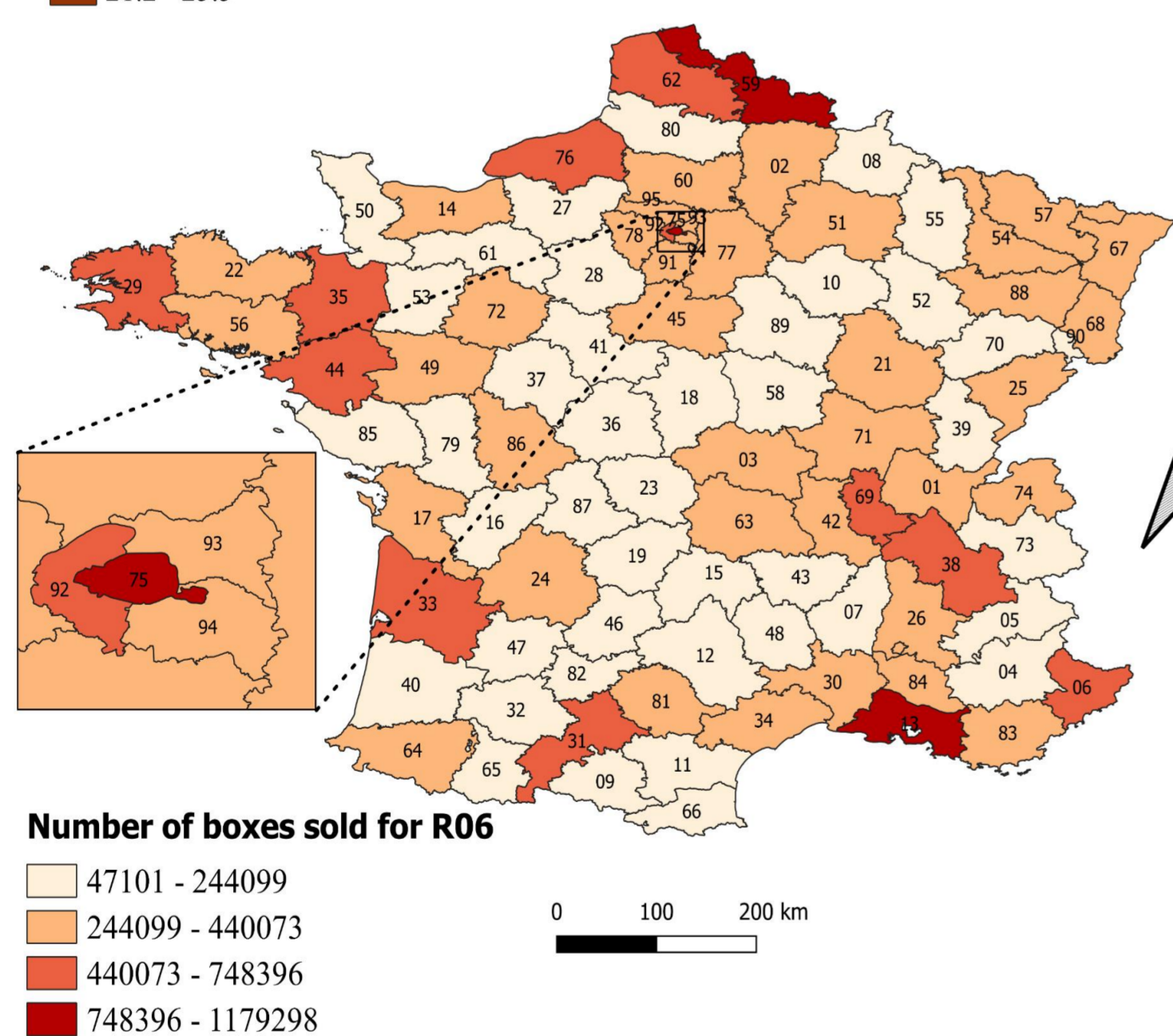
Where β_i represent a coefficient of exposure and s , represent a smoothing spline function.
* Confusions factors are the Tobacco consumption, mean temperature, relative humidity.

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	
R06*							
PM _{2.5}	1.027	1.019 - 1.036	<0.001	1.039	1.029 - 1.050	<0.001	
NO ₂	1.032	1.028 - 1.036	<0.001	1.034	1.028 - 1.039	<0.001	
PM ₁₀	1.036	1.028 - 1.043	<0.001	1.043	1.034 - 1.051	<0.001	
	Adjusted bipollutant model ** with PM _{2.5}			Adjusted bipollutant model ** with PM ₁₀			
	RRa	Confidence Interval (95%)	p-value	RRa	Confidence Interval (95%)	p-value	
R06*							
PM _{2.5}	1.007	0.996 - 1.019	0.2	PM ₁₀	1.021	1.012 - 1.031	<0.001
+ NO ₂	1.031	1.025 - 1.038	<0.001	+ NO ₂	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 **NO₂**, and **PM₁₀** and the **sale of anti-allergy drugs** thus **confirming** previous observations on the **impact of air pollution on allergies**.

