

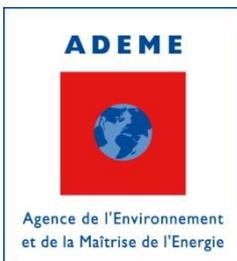


Proximity to industrial plants, neighbourhood socio economic characteristics and the risk of infant mortality- Lyon metropolitan Area – France

23th Congress of the International Society for Environmental Epidemiology, Barcelona, 2011.

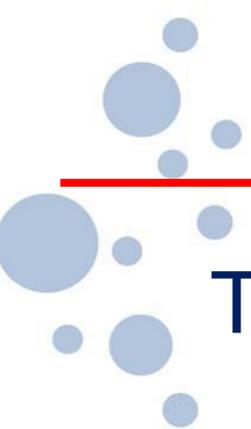
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September, 13th-16th 2011
Palau de Congressos de Barcelona



EHESP

Founding : ANR, DGS, EHESP, ADEME, Region Nord Pas de Calais



Background (1/3)

The infant mortality rate, why ?

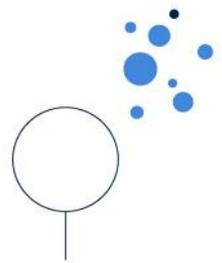
- In France, on average 3.9 babies died before one year old per 1000 live births (defining the infant mortality rate)
- A recognized indicator to measure health status of a population



Background (2/3)

The infant mortality rate, why ?

- Social inequalities related to pregnancy or birth outcomes well documented
 - Deprived populations are more strongly affected by health problems (differential susceptibility)
- Significant associations between birth outcome and environmental exposure, particularly air pollution
 - Deprived populations are exposed to more environmental nuisances and/or exposed at higher level (differential exposure)

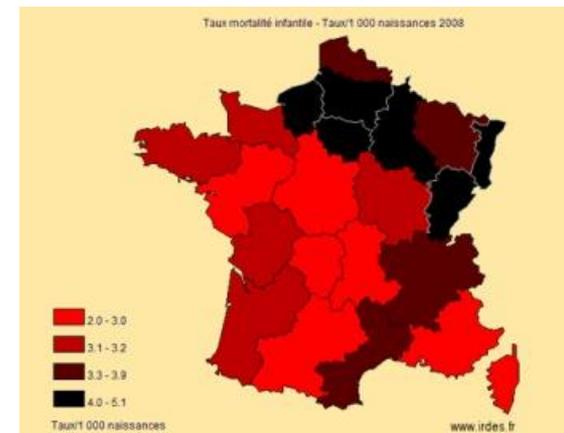
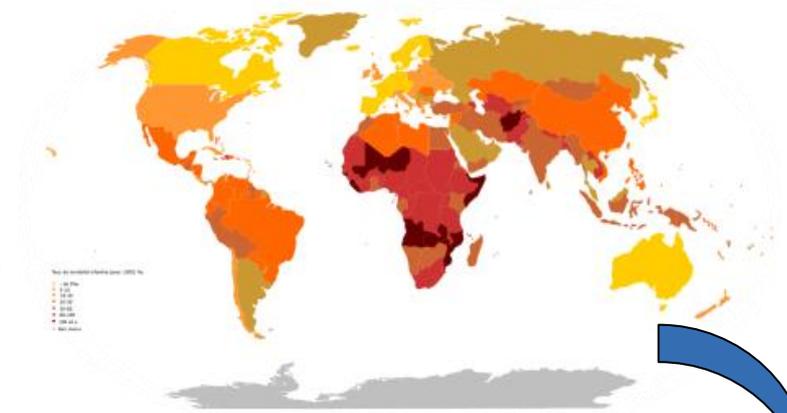




Background (3/3)

A spatial approach, why ?

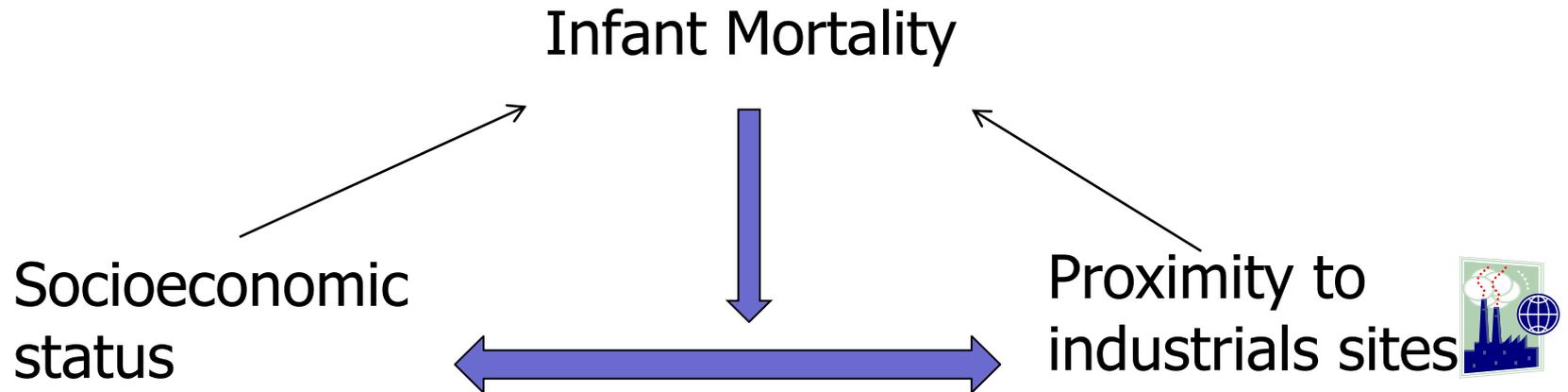
- Existence of spatial inequalities at different geographical levels
 - at a world scale (2008)
 - => minimum ICELAND: 1.8 ‰
 - => maximum MEXICO: 14.7 ‰
 - at a country level: variation of the infant mortality rate between the french regions





Objective of the present study

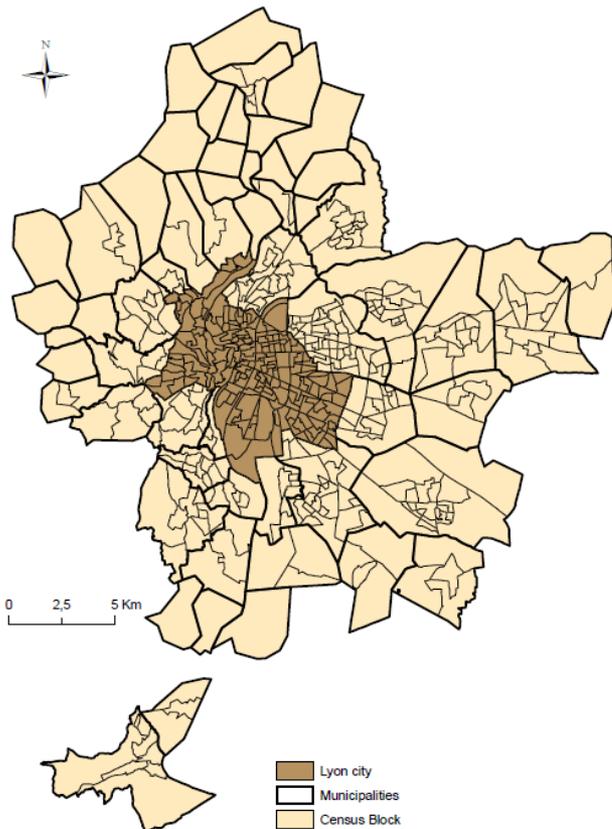
- ➔ To assess the association between the proximity to pollutant industries and the infant mortality rate by neighbourhood socio economic characteristics



Materials & Methods (1/6)

- Study Setting and Small-Area Level

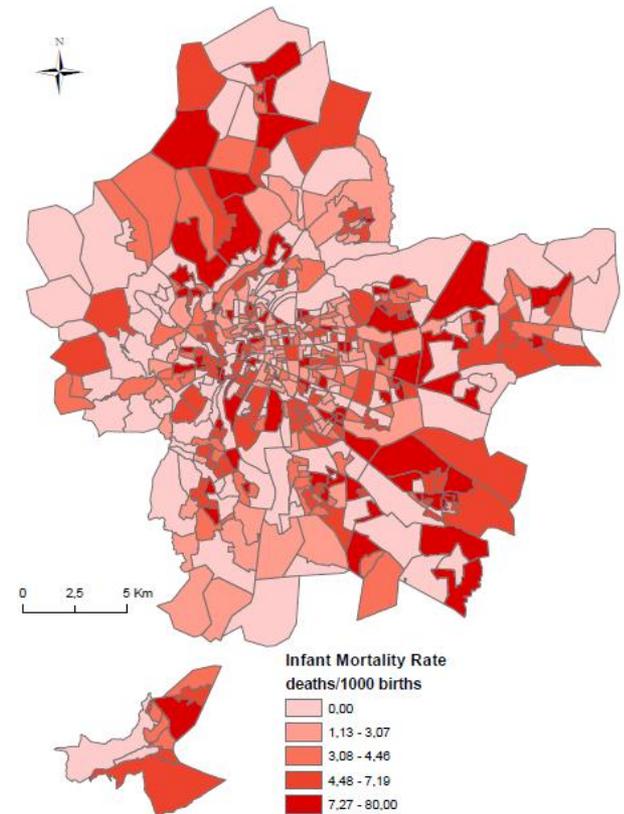
French census block (Named IRIS), the smallest level for available data (corresponding to a residential neighborhood With an average of 2000 inhabitants)



Administration	
Metropole in France	3rd place
Region	Rhone Alpes
Municipalities	58
Census block	511
Statistics	
Population	1 310 000 hab
Density	2485 hab/km ²

Materials & Methods (2/6)

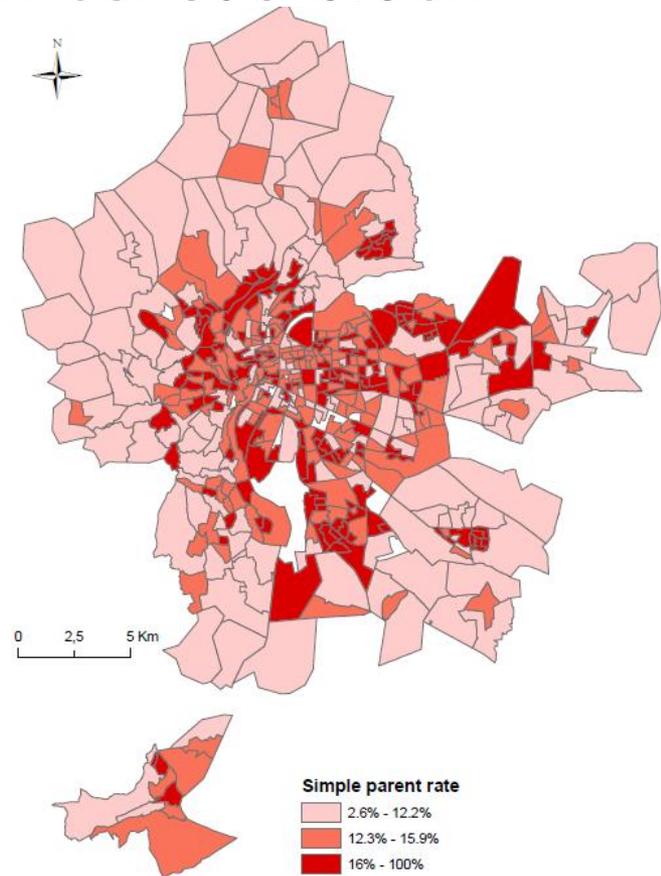
- Spatial distribution of the infant mortality rates (2000-2009)
- 706 cases geocoded at the census block level (on the 715 collected cases)
- Average of the infant mortality rate : 4.1‰
- 31.5% of the IRIS reported no cases on the study period



Materials & Methods (3/6)

- Spatial distribution of the proportion of single parent families at the French census block

- Average of the single parent families rate: 14%
- Existence of an uneven geographic distribution
 - center => high proportion
 - around => low proportion



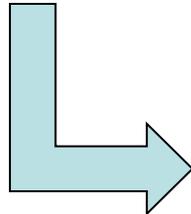


Materials & Methods (4/6)

- Proximity to pollutant industries

1: Database
EPER (2004-2009)

3: Add an other
database National
Spatial Inventory
(2004)



2: Problem with non-precise
geographic coordinates
=> Municipalities coordinates

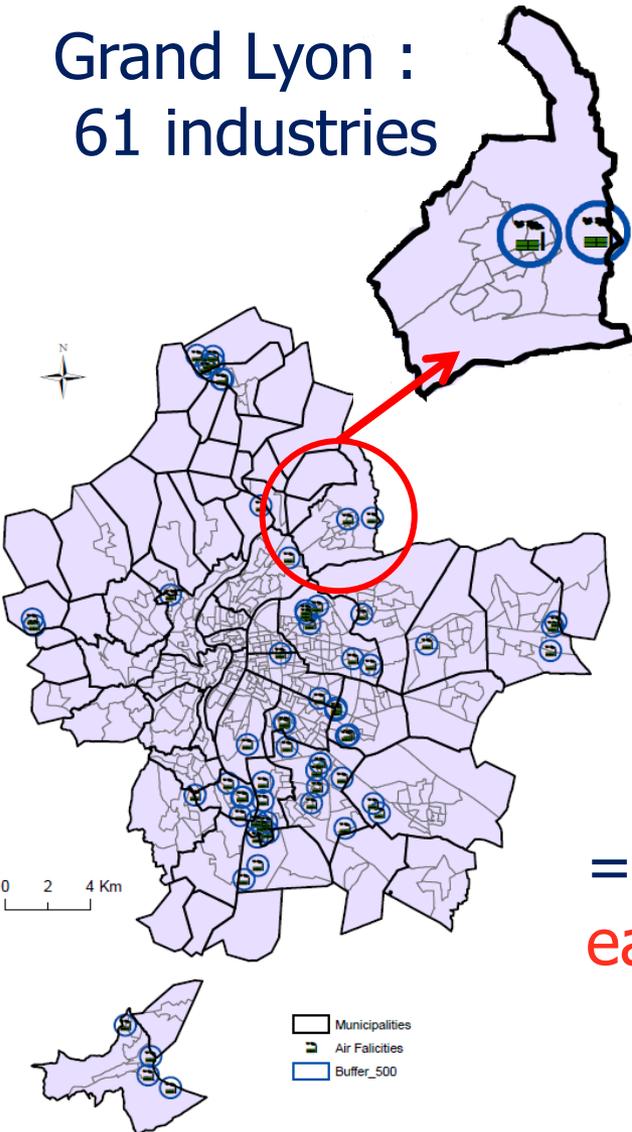
4: To complete the non precise
geographic coordinate
=> Improve the database





Materials & Methods (5/6)

Grand Lyon :
61 industries



- Indicators to take into account proximity to pollutant industries
 - Presence / absence of industries in the IRIS
 - Presence of a **buffer of 500 meters** in the IRIS
 - Number of buffer of 500 meters that intersect the IRIS

=> Industries are mainly located in the **east and south** of the city.





Materials & Methods (6/6)

- Hierarchical Bayesian models as statistical analysis > by B.Lalloue (Besag et al)

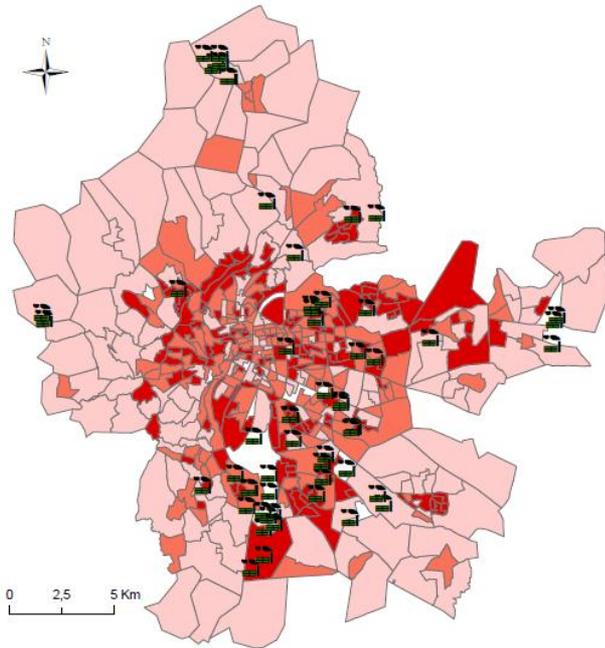
=> Take into account

- the variability of the estimations of infant mortality rates
- the spatial autocorrelation



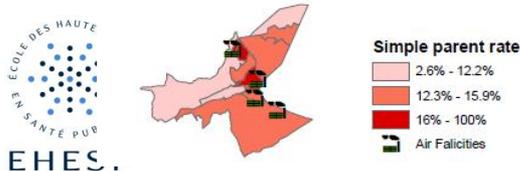
Results (1/3)

- Relation between Single Parent Families rate & the proximity to pollutant industries



Proportion of Single parent families	Mean distance (m)
Class1: 2,6% -12.2%	2066
Class2: 12.3% - 15.9%	1648
Class3: 16% -100%	1397

➤ Mean euclidean distance to the industry is lower among IRIS with higher rate of single parent family





Results (2/3)

- Association between proportion of single parent families and the infant mortality rate

Rate ratio (RR) and 95% Credible interval (CI) of infant mortality rate

	Terms of the model	RR (95%CI)
Proportion of single parent families	Class1: 2,6% - 12.2%	1
	Class2: 12.3% - 15.9%	1.33 [1.06-1.67]
	Class3: 16% -100%	1.26 [1.00- 1.58]

➤ IRIS with a high proportion of single parent families **have higher risk of infant mortality rate**

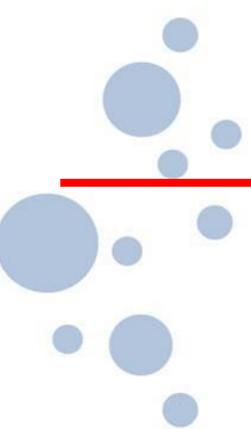


Results (3/3):

- To assess the association between the proximity to pollutant industries and the infant mortality rate according to the single parent families rate

Model	Terms of the model	RR (95%CI)
Single parent families rate	Class1: 2,6% - 12.2%	1
	Class2: 12.3% - 15.9%	1.20 [0.94 - 1.54]
	Class3: 16% - 100%	1.08 [0.84 - 1.40]
Air Facilities	Count buffer 500 †	0.75 [0.60 - 0.93]
Interaction single parent*air facilities	Class2 * Count buffer 500	1.24 [0.96 - 1.63]
	Class3 * Count buffer 500 †	1.35 [1.05 - 1.77]

† number of buffer of 500 meters who intersect with an IRIS



Conclusion

- Evidence of social and environmental inequalities on infant mortality in Lyon metropolitan area
- Differential exposure: residents are more exposed or exposed to higher level
- Differential susceptibility: residents are more sensitive to the effect of exposure



Discussion

- Advantages

The smallest spatial unit available in France

A statistical method adapted to the design of the study

- Limitations

Ecological biases

- Perspectives

Focus on type of industries ?

Use other socioeconomic criteria ?

Use an index of deprivation we are creating ?



Thanks for your attention !

