Using spatial analysis tools to detect mortality clusters in French women on dialysis: major impact of strategies of care

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OBJECTIVES

This ecological study explores spatial patterns in mortality of women on dialysis, considering geographical variations of their excess risk of death and incidence of end-stage renal disease (ESRD).

METHODS

Using data from the national French ESRD REIN registry, we modelled the relative risks of districts for mortality with the BYM (Besag, York and Mollié) Bayesian hierarchical method, before and after controlling for 12 clinical indicators, 5 indicators for strategies of care, and 16 general population characteristics and health resources. Global spatial autocorrelation among the 100 districts was assessed with Moran's I; the local indicator of spatial association (LISA) method identified local clusters.

PRELIMINARY RESULTS

Overall, 7,562 French women on dialysis died in 2012-2014. They accounted for a total of 43,785 person-years of dialysis. Crude mortality rates ranged from 71.4 to 311.2 per 1,000 person-years across districts, and smoothed relative risks (RR) from 0.79 to 1.34. Only 18 districts among the 100 French districts had mean risks significantly different from the national RR (figure 1).

An increase of 0.08 per person-year in the transplantation rate increased the mortality risk on dialysis by 7% (adjRR 1.07; 95% CI 1.02 to 1.12). Likewise, an increase of 44 per 10,000 inhabitants in the cancer mortality among the district's general population of women increased the risk by 8% (adjRR 1.08; 95% CI 1.01 to 1.15). An increase of 9.5% in the percentage of women receiving dialysis who were 75 years old or more was associated with a 7% decrease in the relative risk (adjRR 0.93; 95% CI 0.88 to 0.98). The covariates selected were unable to explain all the variability, and clusters remained (Figure 2).

In any case, our study is not designed to show causality but to propose hypotheses to be investigated, especially at a smaller scale. Thus factors are presented as possibilities; their effect at the patient level may be different, and their RRs must be interpreted with caution.

Figure 1. Spatial distribution of (a) crude 2012-2014 mortality rate, (b) SMR, and (c) smoothed RR of mortality in women on dialysis.

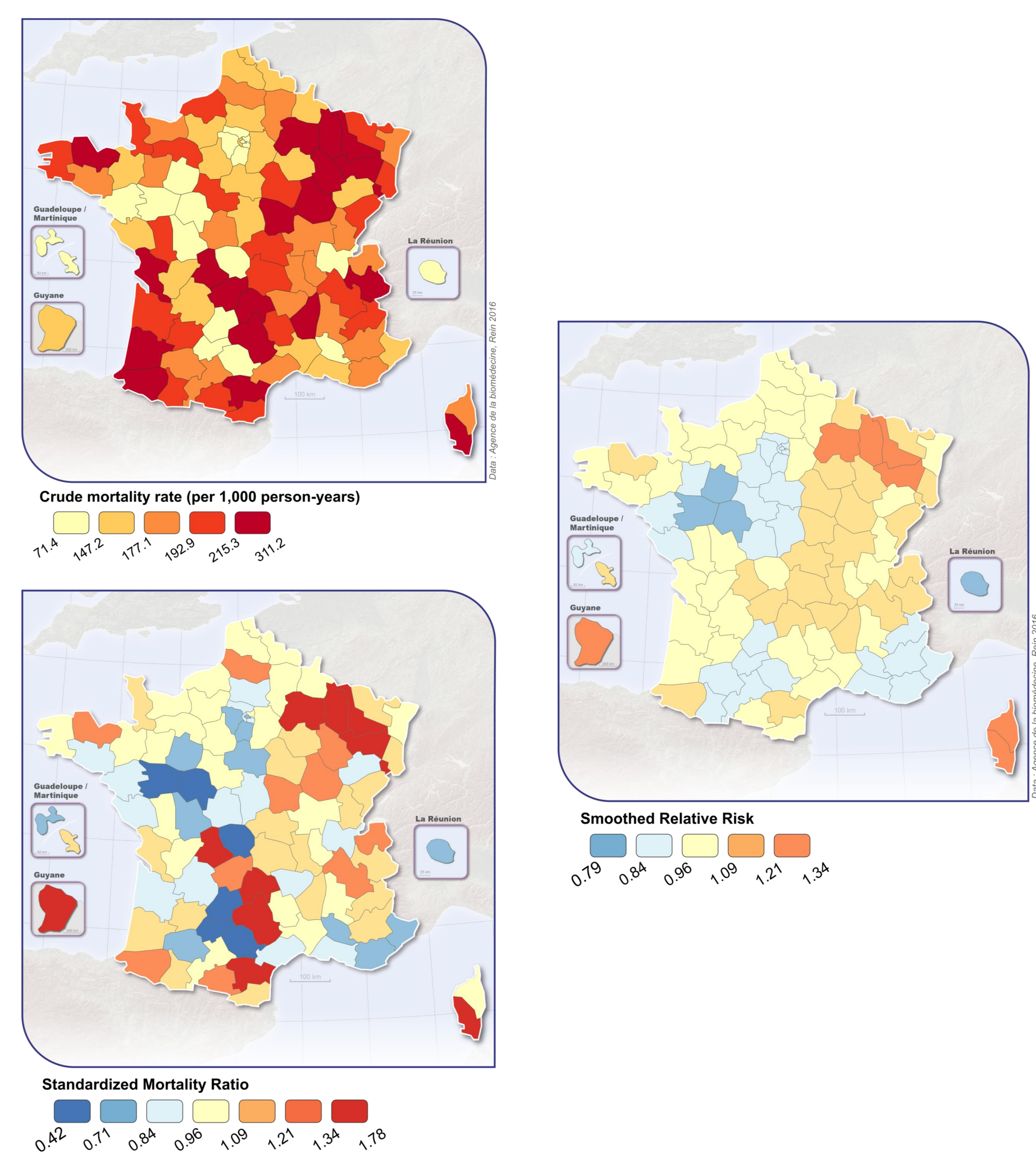
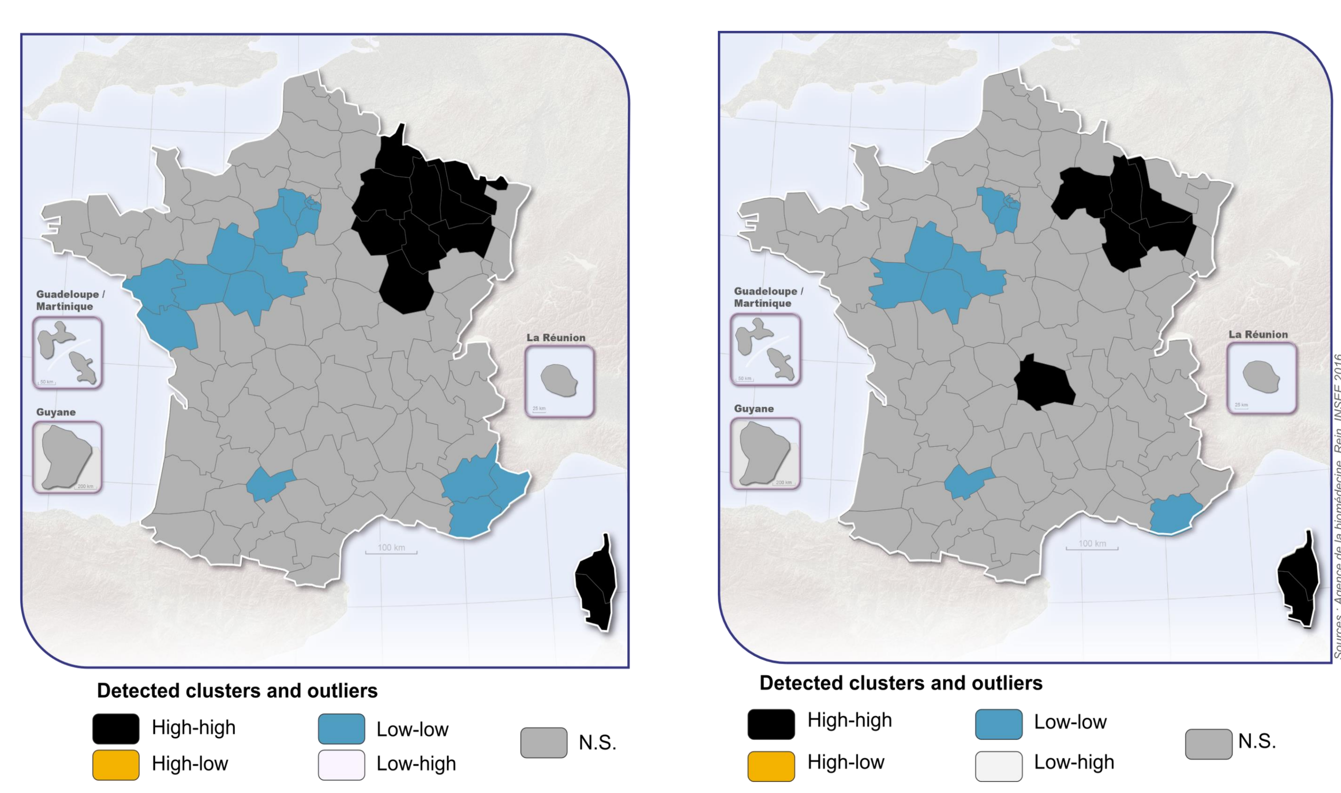


Figure 2. Spatial distribution of the clusters and outliers of low and high mortality detected with the LISA method for smoothed RR without covariates, and with covariates introduced in the model.



High-high : high value in a high values environment. High-low : high value in a low values environment

Model	Decrease of spatial noise	Decrease of non-spatial noise	Delta DIC	Delta I	ε	v	DIC	Moran's I
Standardized mortality ratio	–	–	ref.	–	–	–	786	–
BYM smoothing without covariate	ref.	ref.	-32	ref.	0.0063	0.0051	754	0.57
Model 1	-1.39%	-40.97%	-40	-0.15	0.0064	0.0030	746	0.42
Model 2	-13.44%	-56.02%	-42	-0.21	0.0071	0.0022	744	0.36

Model 1 : Patients' characteristics and clinical practice. Model 2: model 1 + contextual data

DISCUSSION

This study shows significant, albeit limited, geographical disparities in dialysis mortality for women among French districts. Neither patient characteristics nor health resource indicators explained these spatial variations. Highlighting clusters of excess mortality may help us to conduct new and thorough investigations to better understand dialysis morbidity and mortality in these areas — knowledge essential for improving awareness and prevention. Detailed studies of the cluster with low mortality may also help us to identify effective medical practices and policies.

A geographical approach is a pertinent tool to monitor the population on dialysis and to support public health policymaking. It showed small spatial variations in mortality in France, possibly explained by the high level of care for dialysis patients and the universal health insurance coverage here.

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