P2090

# Retrospective study of Lyme borreliosis serologies in France: evolution between 2007 and 2011

**Ferquel E [1], Chartier L [2], Choumet V [1], Trombert-Paolantoni S.[3]**

[1] C.N.R. des *Borrelia*, Institut Pasteur, Paris, France

[2] Unité de Recherche et d'Expertise Epidémiologie des Maladies Emergentes, Institut Pasteur, Paris, France

[3] Laboratoire Cerba, Cergy-Pontoise, France

## INTRODUCTION

Lyme borreliosis is a zoonosis transmitted to humans by the bite of a tick *Ixodes* genus. Infection predominates in temperate climates of North America, North of Europe and Asia. It is related to the multiplication in the host of *Borrelia* spirochetes belonging to the complex burgdorferi sensu lato which includes several pathogen species: *B. burgdorferi* sensu stricto, *Borrelia afzelii*, *Borrelia garinii*, *Borrelia bavariensis* and *Borrelia spielmanii*.
The clinical manifestations result, in the early phase, in the multiplication of the bacteria at the point of injection, which is responsible for a typical skin lesion called erythema migrans. In the absence of treatment, a few weeks to a few months later, the primary phase is followed by neurological manifestations, arthritis and less frequently by late skin and cardiac manifestations.
The clinical manifestations of neuroborreliosis are often characterized by meningoradiculitis and facial paralysis. They are frequent in Europe because mainly related to *B. garinii*, a widespread species in this part of the world. Arthritis is a late manifestation targeting large joints. It is mostly reported in North America dominated by *B. burgdorferi* sensu stricto species.
If the contribution of biology is low during the early manifestations of the disease, it is necessary for the diagnosis of late manifestations.
Monitoring of this zoonosis is encouraged as it could be favored by global warming. In France, the incidence varies greatly by regions and has been estimated at an average of 40 per 100,000 inhabitants. In this study, we describe the evolution, over time and across regions of France, of the percentage of Lyme borreliosis positive serologies between 2007 and 2011.

## METHODS

The sera studied were those received at Cerba Laboratory for borreliosis diagnosis. IgG and IgM serum isotypes were detected by EIA with the Siemens Enzygnost Lyme kits using microtitration plates coated with *B. afzelii* strain antigens and in addition, for IgG, the recombinant VlsE protein. IgG and IgM CSF isotypes were detected with the Vidas bioMérieux kit.
Antibodies specificity was analysed by using the Euroimmun western blot. The strips included separated proteins of a *B. afzelii* strain plus the recombinant VlsE protein.
The percentage of patients with Lyme positive serology was estimated by the number of patients with positive serology divided by the total number of patients. Nine departments belonging to 6 regions were excluded from the study because of the low number of requests recorded.
Regions of France were classified in 6 groups corresponding to a percentage of patients with Lyme positive serology from 0 to more than 30%. The first class corresponds to a percentage less than 1%, class 2 between 1 and 5%, class 3 between 5 and 10%, class 4 between 10 and 20%, class 5 between 20 and 30%, and class 6 with a percentage higher than 30%.
Quantitative data were expressed as mean; qualitative data were expressed as percentages. Univariate analyses were based on the Chi² test or Fisher's exact test for discrete variables. Two-by-two comparisons were performed, followed by the Bonferroni correction. A p value of ≤0.05 was considered to denote statistical significance. Data were analysed with STATA software version 12.0 (Stata Corporation, College Station, Texas).

## RESULTS

Among 134 332 requested patients' serology between 2007 and 2011, 6 884 (5.9%) were positive in the IgG and/or the IgM screening confirmed by western blot (table 1). The percentage of patients with a positive serology varied between 0.4 and 31.3% according to the region. The highest percentage (figure 1) was observed in Limousin (31.3%) followed by Lorraine (28.9%), Franche-Comté (27%), and Alsace (24.6%). The lowest percentage was observed in the South-East of France (Provence-Alpes-Côte-d'Azur (0.4%), Corse (0.4%) and Languedoc-Roussillon (0.9%)).
Figure 2 shows a parallel evolution between the mean of maximal temperatures in France and the percentage of patients with Lyme positive serology. Between 2007 and 2011, the percentage of patients with a positive serology varied from 5.1 to 7% in France. No difference was observed in 2007, 2008 and 2011. A significant increase was observed in 2009 to reach a peak of 7% ($p<0.001$). The percentage was significantly lower in 2010 compared to the others ($p<0.001$) (table 2).
More than half of the regions had a stable percentage of positive patients between 2007 and 2011. A significant decrease was observed in 2008 for two regions (Aquitaine and Limousin). In 2009, a significant increase was shown in six regions (Aquitaine, Auvergne, Basse Normandie, Limousin, Lorraine and Midi-Pyrénées) whereas a significant decrease was observed in Centre. In 2011, two regions of the North of France (Champagne-Ardenne and Picardie) had a strong increase of percentage of patients with Lyme positive serology.

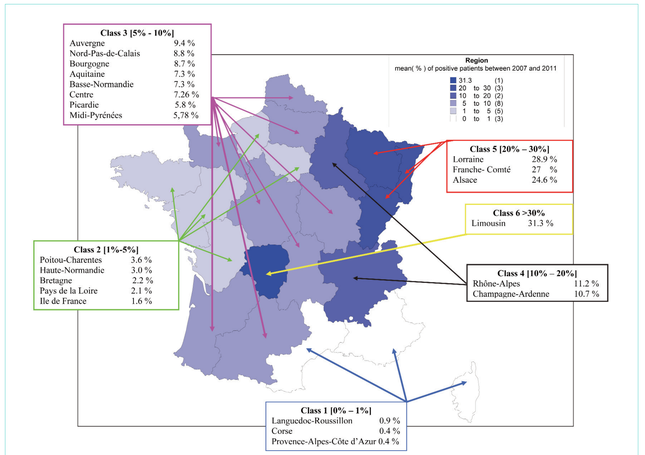


**FIGURE 1:** Mean (%) of positive patients between 2007 to 2011

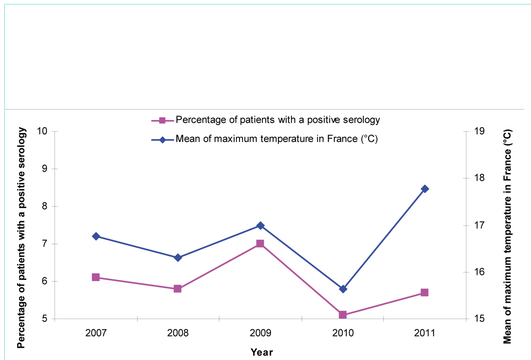


**FIGURE 2:** Comparison between the percentage of patients' positive serology and mean maximum temperature over years

| | 2007 | 2008 | 2009 | 2010 | 2011 | Total |
|---|---|---|---|---|---|---|
| **Number of queries for analysis** | 27 174 | 27 647 | 27 842 | 26 744 | 24 925 | 134 332 |
| **Number of patients** | 22 037 | 23 253 | 23 184 | 22 513 | 24 915 | 115 902 |
| **Number of patients with positive serology** | 1 337 | 1 346 | 1 620 | 1 154 | 1 427 | 6 884 |
| **Percentage of patients with a positive serology (%)** | 6.1 | 5.8 | 7 | 5.1 | 5.7 | 5.9 |
| **Minimal temperature in France (°C)*** | 7.73 | 7.39 | 7.43 | 6.64 | 8.03 | |
| **Maximal temperature in France (°C)*** | 16.77 | 16.31 | 16.99 | 15.63 | 17.77 | |

**TABLE 1:** Evolution of serology requests and temperatures over years * mean

| | Percentage of positive patients / request | | | | | |
|---|---|---|---|---|---|---|
| **REGION** | **2007** | **2008** | **2009** | **2010** | **2011** | **2007 to 2011** |
| **ALSACE** | 23.7 | 27.1 | 29 | 22 | 20.1 | **24.6** |
| **AQUITAINE** | 8.9 | 5.9 | 8.4 | 7 | 7 | 7.3 |
| **AUVERGNE** | 5.9 | 6.1 | 15.8 | 15.4 | 13.6 | 9.4 |
| **BASSE-NORMANDIE** | 7 | 4.9 | 10.3 | 7 | 7.7 | 7.3 |
| **BOURGOGNE** | 6.1 | 8.9 | 8.4 | 9.8 | 11.7 | 8.7 |
| **BRETAGNE** | 1.8 | 2 | 2.5 | 1.5 | 3.1 | 2.2 |
| **CENTRE** | 10.3 | 10.2 | 6.5 | 6.2 | 4.7 | 7.3 |
| **CHAMPAGNE-ARDENNE** | 10.6 | 8.6 | 10.8 | 8.6 | 14.5 | 10.7 |
| **CORSE** | 2.1 | 0.0 | 0.0 | 0.3 | 0.8 | 0.6 |
| **FRANCHE-COMTE** | 35.1 | 30.8 | 23.9 | 14.8 | 16.7 | **27** |
| **HAUTE-NORMANDIE** | 2.1 | 4.6 | 3.4 | 2.2 | 2.9 | 3 |
| **ILE-DE-FRANCE** | 1.4 | 1.6 | 1.6 | 1.8 | 1.7 | 1.6 |
| **LANGUEDOC-ROUSSILLON** | 0.7 | 0.6 | 0.9 | 1.1 | 1 | 0.9 |
| **LIMOUSIN** | 31.5 | 25.5 | 37.6 | 28.4 | 34.5 | **31.3** |
| **LORRAINE** | 28.3 | 25.2 | 34.5 | 25.8 | 29.8 | **28.9** |
| **MIDI-PYRENEES** | 5.1 | 5.1 | 8.6 | 6.4 | 4.4 | 5.8 |
| **NORS-PAS-DE-CALAIS** | 10.0 | 10.5 | 12.3 | 8.6 | 4.4 | 8.8 |
| **PAYS-DE-LOIRE** | 7.1 | 1.8 | 2.2 | 0.8 | 0.9 | 2.1 |
| **PICARDIE** | 4.8 | 2.6 | 4 | 4.2 | 10.8 | 5.8 |
| **POITOU-CHARENTES** | 3.4 | 4.2 | 3.8 | 2.6 | 4.2 | 3.6 |
| **PACA** | 0.4 | 0.4 | 0.5 | 0.4 | 0.3 | 0.4 |
| **RHONE-ALPES** | 8.2 | 12.1 | 14.9 | 13.8 | 8.2 | 11.2 |
| **TOTAL** | **6.1** | **5.8** | **7.0** | **5.1** | **5.7** | **5.9** |

**TABLE 2:** Evolution of positive Lyme serologies per request according to the regions of France over years significant decrease ($p\leq0.05$) significant increase ($p\leq0.05$)

## DISCUSSION

High percentages of patient with Lyme positive serology are observed in regions with dense tree covers of deciduous trees. Percentage of positive patients over years was correlated to the annual temperatures. An exception is however observed in 2011 during which a high annual temperature was recorded. Interestingly, a low temperature was observed in July, month during which, usually, there are high incidence rates of tick bites. This result is probably explained by a low exposure to recreational risks during this month due to bad climate conditions. The strong increase of the percentage of positive Lyme serologies identified in the North of France may be correlated with global warming.

## CONCLUSION

A low rate of patients with Lyme borreliosis positive serology was observed in France between 2007 and 2011 but with large differences between regions and between years.

*ECCMID_AVRIL2013/Laboratoire Cerba/ST/NG*

Laboratoire CERBA