The use of GIS and spatial statistics to study the spatial distribution of strokes in Rhone-Alpes (France) to target health care location priorities

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Stroke is a disease with a major impact on societies, particularly in developed countries. Thus, it is essential to understand this public health issue, especially in its spatial distribution and its possible relations with the surrounding areas. Consequently, a GIS (Geographic Information System) is really useful to make a spatial and statistical analysis of this phenomenon. The results are based on the AVC69 2007 study in Rhone-Alpes, on a cohort of about 1,000 patients. Rhone-Alpes is a region in south-eastern France which covers nearly 44,000 km². The city of Lyon, main town of Rhône-Alpes, is the second city in France after Paris.

In the presented study, GIS is a tool for the analysis of spatial distribution. Indeed, it has allowed studying the spatial distribution of stroke, particularly to identify the presence of clusters. Thus, after data processing, 900 patients were selected for analysis. The distribution of stroke has been studied from the stroke density per 1,000 inhabitants across the town (fig. 1). To characterize this distribution, calculating Moran's index was performed. This index indicates that the distribution of stroke is clustered (Moran's I = 0.16 ; z-score = 27.5 and p-value < 0.001). In addition, the LISA (Local Indicator of Spatial Association - Anselin, 1995) method is applied to explore the spatial patterns of stroke in different clusters (Marijon et al., 2013 ; Sasson et al., 2012). LISA method allows in particular identifying the High High-type clusters (HH), bringing together towns with high stroke rates surrounded by towns with similar characteristics. It also identifies the High Low-type clusters (HL) that are towns having lots of strokes surrounded by cities with few of them, thus being isolated. In addition, the Hot Spot Analysis Getis-Ord Gi* statistic is applied to identify spatial clusters of statistically significant areas with high strokes rate (Ord and Getis, 1995). The Getis-Ord Gi* statistic indicates whether high or low values of strokes are likely to cluster, and confirms the results obtained with the LISA method (fig. 1). The clusters (HH) are mainly distributed along the eastern part of the Rhône-Alpes (fig. 1). These results are used by the health and social services to target health care location priorities and focus on these precise cities. The HH and HL clusters are mainly rural. This factor might start explaining this distribution. However, additional socioeconomic and environmental factors (Mechtouff et al., 2012) are also considered to understand this dissemination, using a PCA with varimax rotation whose results will be mapped by using a GIS.

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