DETECTION OF UNUSUAL EVENTS USING EXTREME THEORY

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Numerous statistical methods have been developed for many years in order to monitor epidemiologic surveillance data. They have proved to be useful, particularly for the early detection of unusual events over time (Farrington and Andrews, 2004; Le Strat, 2005). The recent bioterrorist threats have increased the importance of surveillance systems and consequently of appropriate statistical methods (Lawson and Kleinman, 2005). In this context, intensive analyses are currently performed regarding (i) the increasing number of time series to be analyzed, (ii) the multiplicity of data sources, (iii) the necessity to take into account the spatial information (geographic coordinates of cases).

Even if current statistical methods provide help to people in charge of monitoring a surveillance system, new statistical developments are required. We propose a statistics of extremes approach to answer questions related to the time and/or spatial detection of unusual events from a surveillance system. Extreme value theory has a rich mathematical foundation (Leadbetter *et al*, 1983) and its statistical aspect has been well developed this last decade (Coles, 2001; Embrechts *et al*, 1997), because of its applications to new fields such as insurance, finance, teletraffic or environment science; multivariate extreme value models have been under some dependence hypothesis.

This work takes place in this context and our approach is theoretically compared with more traditional ones and is applied on infectious diseases surveillance based in the French national institute for public health surveillance (InVS). Benefits and perspectives of this approach are discussed.