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Interest of Prospective Spatio-Temporal Analysis from ED Data to Detect Unusual Health Events

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Objective

To present the implementation and the first results of a prospective spatio-temporal analysis from emergency department (ED) data in Reunion Island.

Introduction

Many syndromic surveillance systems use spatio-temporal analysis to detect local outbreaks such as gastrointestinal illnesses and lower respiratory infections [1, 2]. In Reunion Island, the syndromic surveillance system is based mainly on ED visits. Spatial analysis was first used in 2013 to validate retrospectively a cluster of viral meningitis [3]. At the end of 2014, the Regional Office of French Institute for Public Health Surveillance implemented a prospective computer-automated space-time analysis in order to launch daily analyses of ED visits.

Methods

To realize the prospective space-time analysis, a R program generate the parameter files of SaTScan™ and then run the software in batch mode. The results are displayed in a web interface. The space-time permutation model is used with the following parameters: the upper limit on the geographical size of the outbreak is a circle with a 5-km radius, the maximum temporal length is set at 1 and 7 days, the number of days included in the calculation of the expected number is 60 days and the number of replications is set at 999. If the recurrence interval of a signal is 2.7 years for a temporal window of 1 day ($p<0.001$) or 19.1 years for a temporal window of 7 days ($p<0.001$) then an investigation is carried out.

Results

Between January 1st and May 31 2015, the prospective spatio-temporal analyses from ED data generated 13 cluster-signals for a temporal window of 7 days and 3 cluster-signals for a temporal of 1 day (Table 1). From 25 to 31 January 2015, several consecutive signals of gastroenteritis were generated. The epidemiological investigation allowed to confirm the outbreak nevertheless the source of contamination has not been identified. At the end of January 2015, the surveillance system detected a significant increase of conjunctivitis cases. During the investigation, the general practitioners (GPs) of the area confirmed the signal and laboratories identified the coxsackievirus A24 as the agent of this epidemic that spread throughout the island. On February 24, 2015 an ear, nose and throat (ENT) infections signal was generated. The GPs of the area have confirmed this heath event that remained localized. On April 2, 2015 a significant increase of bronchiolitis was detected but was not confirmed by GPs. In consequent the signal has been invalidated.

Conclusions

The implementation of a prospective computer-automated space-time analysis based on ED data allowed the early detection of several infectious diseases outbreak. Though the source of contamination is not always identified, it makes possible early implementation of control measures.

Table 1: Results of space times analyses from ED data, January 1 to May 31, 2015, Reunion Island

Syndrome	Temporal window (days)	Signal date	Postal code	Number of observed cases	Number of expected cases	p-value	Recurrence interval (years)
Gastroenteritis	7	1/25/2015	97490	22	7.6	2.10^{-5}	952.8
Gastroenteritis	7	1/26/15	97490	24	8	2.10^{-6}	9231.2
Gastroenteritis	7	1/27/15	97490	27	9.1	3.10^{-7}	64532.1
Gastroenteritis	7	1/28/15	97490	29	8.9	1.10^{-8}	1621169.5
Gastroenteritis	7	1/29/15	97490	30	9.2	6.10^{-9}	3446101.6
Gastroenteritis	7	1/30/15	97490	31	9.4	1.10^{-9}	5883516.8
Gastroenteritis	7	1/31/15	97490	25	9.2	1.10^{-5}	1789.1
Conjonctivitis	7	1/26/15	97435	6	0.9	1.10^{-4}	157.6
Conjonctivitis	7	1/27/15	97435	6	0.9	2.10^{-4}	110.6
ENT Infections	7	2/24/15	97419	11	2.7	7.10^{-4}	27.5
Bronchiolitis	7	4/2/15	97427	3	0.1	5.10^{-4}	36.7
Conjonctivitis	7	4/11/15	97427	7	1.4	9.10^{-4}	21.2
Conjonctivitis	7	4/12/15	97427	6	0.9	9.10^{-4}	22
Gastroenteritis	1	1/24/15	97490	7	1.1	8.10^{-4}	3.2
Conjonctivitis	1	1/26/15	97435	4	0.3	2.10^{-4}	11.2
Conjonctivitis	1	3/8/15	97438	6	0.8	1.10^{-4}	20.1

Keywords

Syndromic surveillance; Emergency Department; Spatial analysis

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All emergency departements of the Reunion Island

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