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Epidemiology and real-time surveillance by MALDI-TOF of bacterial species in public hospitals of Marseille, France over a 2-year period

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Background: Bacterial have an amazing capacity to emerge and spread in unpredictable ways and their diversity in human clinical samples expands with new identification tools. Their real-time surveillance is therefore critical to improve their prevention and epidemiological management. We present the epidemiology of bacterial species identified in our hospitals over a 2-years period as detected by our real time surveillance system.

Material/methods: Marseille area counts nearly 2 millions inhabitants. We have analysed the results of our real-time bacterial surveillance system BALYSES which monitor the number and type of bacterial species isolated in our laboratory in Marseille, France and use cumulative sum (CUSUM) for detecting epidemiological abnormal events. Rare bacterial species were defined as bacterial isolated less than 20 times over the 2 years.

Results: Over the 2-year period of the study, 499 different bacterial species were isolated from 87,880 clinical samples. The 10 most frequent bacterial species were *Escherichia coli* (19,906 ; 21%), *Staphylococcus aureus* (14,175 ; 16%), *Staphylococcus epidermidis* (6718; 8%), *Pseudomonas aeruginosa* (6225; 7%), *Klebsiella pneumoniae* (5923; 7%), *Enterococcus faecalis* (4142; 5%), *Enterobacter cloacae* (3267 ; 4%), *Streptococcus agalactiae* (2366 ; 3%), *Gardnerella vaginalis* (2118 ; 2.4%), *Proteus mirabilis* (1806 ; 2%), representing 75% of all isolates.

Frequently cultured samples were urines (26,091; 30%), blood (17066; 19%), biopsies (10,502; 12%), expectorations (9187, 10%), genital specimens (5170; 6%), otorhinolarynological samples (2659; 3%), stools (581; 1%) and cerebrospinal fluid (186; 0,2%).

Out of these bacterial species, 323 were rare based on our definition. They were isolated from 1,208 clinical samples (1% of all clinical samples). 101 bacterial species (31%) were isolated only once, 121 (37%) were isolated between 2 and 5 times, 50 (15%) between 6 and 10, 37 (11%) between 11 and 15 and 14 (4%) between 16 and 20. Rare bacterial species were significantly more frequent in blood cultures as compared to other samples (33% vs. 19%; p<1e-3). From these rare bacterial species, 55% were gram-positive bacterial and were 45% gram-negative bacterial.

BALYSES detected 32 alarms (11 confirmed events) and allowed us to detect an abnormal increase in the number of strains (97) for *Klebsiella pneumoniae* in urines for 3 weeks during September, 2016.

Conclusions: Our study confirms the capacity of MALDI-TOF to correctly identify bacterial species in clinical microbiology including new and or emerging pathogens. Real time surveillance with automatic alarm extends its usefulness in public health, allowing to better define the epidemiology and clinical significance of these new and/or emerging pathogens.