

# Back-calculation methods as an aid to Legionnaires' disease outbreak investigation

**Authors:** P. Bernillon<sup>1</sup>, D. Che<sup>1</sup>, C. Campese<sup>1</sup>, Karin Nygård<sup>2</sup>, B. Schimmer<sup>2,3</sup>, P. Aavitsland<sup>2</sup>, J.C. Desenclos<sup>1</sup>

## **Affiliations:**

1. Institut de Veille Sanitaire, Département des Maladies Infectieuses, Saint-Maurice, France
2. Norwegian Institute of Public Health Oslo, Norway
3. European Programme for Intervention Epidemiology Training

## **Background, Methods, Results and Conclusion:**

A large outbreak of Legionnaires' disease (LD) occurred in Pas-de-Calais, France, November 2003 - January 2004. Extensive epidemiological and environmental investigations were carried out and identified the aerosols emitted by industrial cooling towers as the primary source of the outbreak. To refine the analysis, we carried out a back-calculation analysis in order to estimate the most likely times of exposure of the cases and compare them with the time sequence of events potentially capable of generating aerosols that took place at the plant.

Back-calculation methods allow to estimate the number of infections as a function of time, by using the numbers of diagnosed cases by date of symptom onset together with information on the distribution of the incubation period. We developed a back-calculation model and applied it to the 86 confirmed cases reported during the French outbreak. The incubation period distribution was derived from curve fitting to two separate incubation period data sets collected during outbreaks that recently arose in the Netherlands and Australia. Sensitivity analysis - varying distribution shape - were also carried out.

All estimated infection curves exhibit two major infection waves, with a slight shift to the left as compared to the epidemic curve, within each several peaks can be identified. The three incubation period distributions derived from each data set gave similar results in terms of infection curve. Considering that infection rates can be seen as a proxy of exposure rates, comparison of estimated infection curve with timing of interventions on the plant site corroborates initial suggestions and helps to distinguish between the respective roles of cooling towers and high pressure cleaning operations.

This work illustrates how back-calculation techniques can be used as an aid to outbreak investigation. An application of the approach to the LD outbreak that occurred in May 2005 in Frederikstad/Sarpsborg (Norway) will also be presented (work in progress).