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Impacts of weather and air pollution on Legionnaires' disease in Switzerland: a national case-crossover study

BACKGROUND: The number of reported cases of Legionnaires' disease (LD) has risen markedly in Switzerland (6.5/100,000 inhabitants in 2021) and abroad over the last decade. Legionella, the causative agent of LD, are ubiquitous in the environment. Therefore, environmental changes can affect the incidence of LD, for example by increasing bacterial concentrations in the environment or by facilitating transmission. OBJECTIVES: The aim of this study is to understand the environmental determinants, in particular weather conditions, for the regional and seasonal distribution of LD in Switzerland. METHODS: We conducted a series of analyses based on the Swiss LD notification data from 2017 to 2021. First, we used a descriptive and hotspot analysis to map LD cases and identify regional clusters. Second, we applied an ecological model to identify environmental determinants on case frequency at the district level. Third, we applied a case-crossover design using distributed lag non-linear models to identify short-term associations between seven weather variables and LD occurrence. Lastly, we performed a sensitivity analysis for the case-crossover design including NO(2) levels available for the year 2019. RESULTS: Canton Ticino in southern Switzerland was identified as a hotspot in the cluster analysis, with a standardised notification rate of 14.3 cases/100,000 inhabitants (CI: 12.6, 16.0). The strongest association with LD frequency in the ecological model was found for large-scale factors such as weather and air pollution. The case-crossover study confirmed the strong association of elevated daily mean temperature (OR 2.83; CI: 1.70, 4.70) and mean daily vapour pressure (OR: 1.52, CI: 1.15, 2.01) 6-14 days before LD occurrence. DISCUSSION: Our analyses showed an influence of weather with a specific temporal pattern before the onset of LD, which may provide insights into the effect mechanism. The relationship between air pollution and LD and the interplay with weather should be further investigated.