# Predicting outbreaks of meningococcus W-135 infections in Spain

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**Abstract**

The genogroups of meningococcal and other bacteria are in competition in the ecosystem they form with the human hosts. Changes in vaccination strategies, prophylactic measures or usual habits, may also change the distribution of the genogroups in the ecosystem but, usually, this competition is ignored in most epidemiological models, despite it can be highly influential in the evolution of infection diseases and outbreaks.

Our goal is to propose a susceptible-carrier-susceptilbe (SCS) epidemiological model to determine the percentage of carriers in the population, and introduce a fractional Lokta-Volterra competition model to describe the evolution of the meningococcal genogroups in Spain among the carriers.

Using data from the distribution of the genogroups in Spain in 2011 and 2012, we find the model parameters and their uncertainties according to a probabilistic fitting approach. On this basis, we predict the evolution of the carriers of the different genogroups over the next few years and, in particular, the percentage of carriers of meningococcus W-135 with a confidence interval of 95%. Then, we estimate the probability of having a possible outbreak of meningococcus W-135 in Spain over the next few years. According to our model and, under the present conditions, the risk of a serious outbreak of W-135 in Spain in the next 3 years is below 0.3%.

*Key words:* W-135 meningitis, Fractional dynamics, Probabilistic fitting, Epidemiological models

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