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The seasonality and effects of temperature and rainfall on Campylobacter infections

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Background

Campylobacteriosis is a major public health concern. Despite evidence that climate factors influence the spatio-temporal patterns of the infections; their impact is not fully described and understood.

Objectives

To examine methods for determining the impact of rainfall and temperature on Campylobacter cases in England and Wales.

Methods

Reported cases for England and Wales were linked to local temperature and rainfall at laboratory postcode locations in the 30 days before the specimen date. Descriptive, statistical and spatial methods included a novel Comparative Conditional Incidence (CCI), wavelet analysis, hierarchical clustering, generalized additive model (GAM) and generalized structural time series model (GEST).

Results

The Campylobacter increase in late spring was linked to temperature two weeks prior, with an increase in CCI of 0.175 cases per 100,000 per week for weeks 17 to 24; the relationship was non-linear and changed through the year. GEST with penalized varying temperature coefficient found 33% of the seasonal change was attributable to temperature, while with a fixed temperature coefficient found 8%. Wavelet analysis showed a strong annual cycle, with harmonics at six and four months and no simple association with temperature or rainfall. Geographic clustering showed three clusters with geographic similarities, representing metropolitan, rural, and other areas.

Conclusions

Our analyses provide more robust and convincing associations than simple regression analysis. The association with temperature is likely to be indirect and the primary driver remains to be determined. Local-temporal linkage of weather parameters and cases is important in improving the resolution of climate associations with infectious diseases and provides methods which can improve disease predictions. Further examination of data from a wider geographic area and longer time series should improve the understanding of the epidemiology and drivers of human Campylobacter infections.

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