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Analysis of the potential drivers of seasonality in COVID-19 transmission dynamics in 409 locations across 26 countries

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More than a year since its emergence, there is conflicting evidence on the potential influence of weather conditions on SARS-CoV-2 transmission dynamics. We used a two-stage ecological modelling approach to estimate weather-dependent signatures in SARS-CoV-2 transmission in the early phase of the pandemic, using a dataset of 3 million COVID-19 cases reported until 31 May 2020, spanning 409 locations in 26 countries. We calculated the effective reproduction number (R_e) over a location-specific early-phase time-window of 10-20 days, for which local transmission had been established but before non-pharmaceutical interventions had become established as measured by the OxCGRT Government Response Index. We calculated mean levels of meteorological factors, including temperature and humidity observed in the same time window used to calculate R_e. Using a multilevel meta-regression approach, we modelled nonlinear effects of meteorological factors, while accounting for government interventions and socio-demographic factors. A weak non-monotonic association between temperature, absolute humidity and R_e was identified, with a decrease in R_e of 0.087 (95% CI: 0.025; 0.148) between mean temperature of 10.2°C (maximum) and 20°C (minimum) and a decrease in R_e of 0.061 (95% CI: 0.011; 0.111) between absolute humidity of 6.6 g/m3 (maximum) and 11 g/m3 (minimum). However, government interventions explained twice as much of the variation in R_e compared meteorological factors. We find little evidence of meteorological conditions having influenced the early stages of local epidemics, and conclude that population behaviour and governmental intervention are more important drivers of transmission.

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