COVID-19 cases: maximum temperature, atmospheric pressure at sea level and other relevant meteorological variables

Background

Coronavirus disease (COVID-19) is an infectious disease caused by severe acute respiratory syndrome-related coronavirus 2 (SARS-COV-2). Wuhan Municipal Health Commission, China first reported COVID-19 as a cluster of cases of pneumonia on 31 December 2019 [1]. Although the COVID-19 cases in West Africa are gradual relative to other parts of the world, the infection has risen exponentially in recent weeks and still spreading. Also, the epidemiological characteristics of COVID-19 dynamism in West Africa is different from other parts of the world. Yet, the uncertainties surrounding the COVID-19 spread in West Africa cannot be underemphasized.

COVID- 19 incidence increases with increasing atmospheric pressure at sea level and decreasing maximum air temperature; uncertainties reduced

This article contributes to the existing knowledge [e.g. 2, 3] of COVID-19 dynamism using the exponential growth (EG) and Markov chain Monte Carlo (MCMC) modelling approaches of estimating the COVID-19 reproduction number i.e. the average number of healthy people infected per sick person. Subsequently, these variables are projected for the future. The uncertainties associated with the reproduction numbers are quantified whilst the correlation between COVID-19 incidence and five meteorological variables i.e. daily observed maximum air temperature (°C), atmospheric pressure at sea level (hPa), humidity (%), rainfall (mm) and maximum sustained wind speed (Km/h) are further assessed. As an example, results of COVID-19 analyses in Nigeria show that the highest incidences are recorded on days with either religious activities or on market days while this trend decreases towards the weekend.

The Pearson's correlation (r) between the outbreak and the meteorological variables considering a 7-day lag period shows that COVID-19 incidence increases significantly with increasing atmospheric pressure at sea level ($r = 0.71$ at $P \leq 0.001$). However, it decreases with increasing maximum temperature ($r = -0.34$ at $P \leq 0.01$). The lowest correlation is with the maximum sustained wind ($r = -0.03$ at no significant level). In general, the maximum air temperature and atmospheric pressure at sea level appear to be the main meteorological variables affecting the COVID-19 incidence in the country. Given this relationship, more incidence and subsequent transmission of COVID-19 could be expected in the coming months.

Whilst COVID-19 outbreak is still evolving in West Africa, its generation distribution time for the optimal reproduction number estimate may be uncertain, which could lead to misleading COVID-19 cases projections. To reduce this uncertainty, a sensitivity analysis is carried out based on deviance R-squared statistic. It is worthy to note that choosing an optimal period reduces the variability between estimates. Therefore, it is pertinent to carry out a sensitivity analysis with respect to the mean generation time to quantify the associated uncertainties. Using the MCMC approach and incorporating the above mentioned approach in ameliorating projections uncertainties the projections till December shows values approaching 1,000,000, 120,000 and 3,000,000 for forecasted incidence, cumulative death and cumulative confirmed cases respectively.

A need to be more proactive and remain resilient

Considering the present realities and future projections, there is a need for crucial preparations and assessments of the consequences and complications that could arise from the COVID-19 pandemic as well as dedicating relevant resources to understanding and managing its probable effects on the economy, livelihood and wellbeing of the citizens in the sub-region.

References

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