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Scientific Letter

Forecasting COVID-19 Infection Trends and New Hospital Admissions in Spain due to SARS-CoV-2 Variant of Concern Omicron

Estimación de las tendencias de infección por COVID-19 y de nuevos ingresos hospitalarios en España debido a la variante Ómicron del SARS-CoV-2

To the Director:

Spain has been among the hardest hit countries by COVID-19 worldwide, particularly during the first wave and the ongoing sixth wave.[1] There have been several successful attempts to forecast trends of incidence and mortality of COVID-19, most based upon knowledge on viral dynamics from previous pandemics, recent COVID-19 geographical information of diverse granularity, and newly discovered viral characteristics.[2–4] However, SARS-CoV-2 inherent poor quality RNAm copy-editing gene replication makes it prone to mutate and spontaneously create new variants of concern (VoC) (Fig. 1),[5] that adapt to any hostile environment, produce new outbreaks, and modify existing epidemiological projections.[6]

On November 26, 2021, WHO designated the variant B.1.1.529 as a new VoC, named Omicron, originally identified in South Africa,[7] on the evidence that mutations in Omicron may have an impact on how it spreads, resistance to vaccination, or the severity of illness it causes.[8] In particular, in South Africa up to December 2, 2021 it was observed a doubling time for the first 3 days after the wave threshold of ten cases per 100 000 population.[9,10] In Denmark, a European leader in sequencing SARS-CoV-2 VoC, where testing of all positive PCR tests is commonplace, cases of Omicron were reported to double every second day,[11] despite almost 75% of those infected by Omicron had received full (two doses of) COVID-19 vaccination already.

We used our previous modelling algorithms,[12–14] to forecast the spread of Omicron in Spain, and report trends in daily cases with a 7-day moving average and of new hospitalisations. We followed EQUATOR's TRIPOD guidance for multivariable prediction models.[15] By applying firstly a third-degree polynomial curve in existing epidemiological trends on the spread of Omicron in Spain, starting from the first 17 days of the Omicron outbreak (from December 12, 2021), and secondly a Gaussian curve following a parametric growth,[12–14] we were able to model new infections of COVID-19 in Spain. Overall, the worse scenario is forecasting up to 431,348 COVID-19 daily infections on January, 24, 2022 while the "best" scenario is 247,620 (Fig. 2).

Then we modelled these trends for new COVID-19 cases and hospital admissions using a new Gaussian curve to estimate a downward trend after a peak,[16] and we obtained the expected curve of new COVID-19 infections in Spain, and with a 5-day lag time, new hospital admissions. It will likely produce crowding in hospitals, as new hospital admissions per day might peak on January 30, 2022, with a range in between 4210 ("best" scenario) and

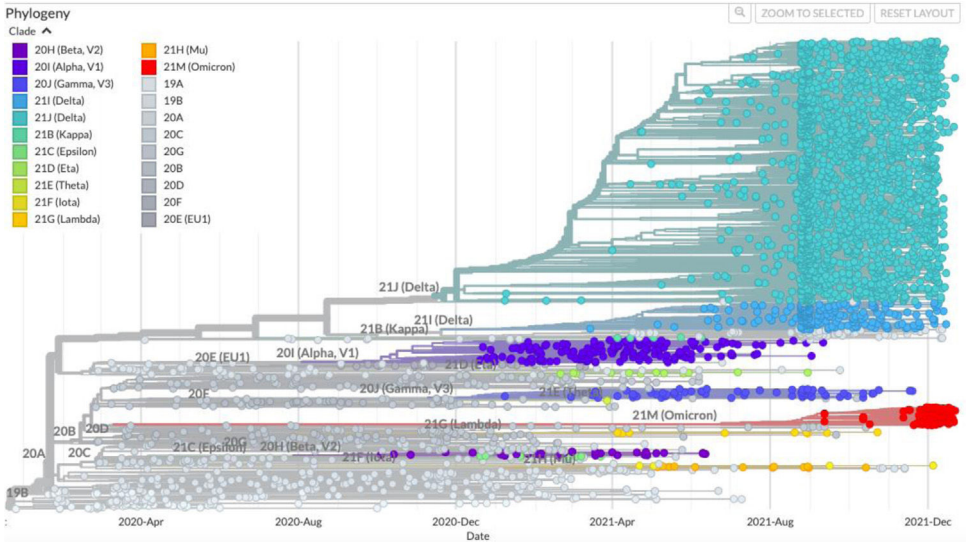

Fig. 1. Genomic epidemiology of novel coronavirus – global subsampling. Footnote: Note in red colour the recent surge of VOC Omicron.

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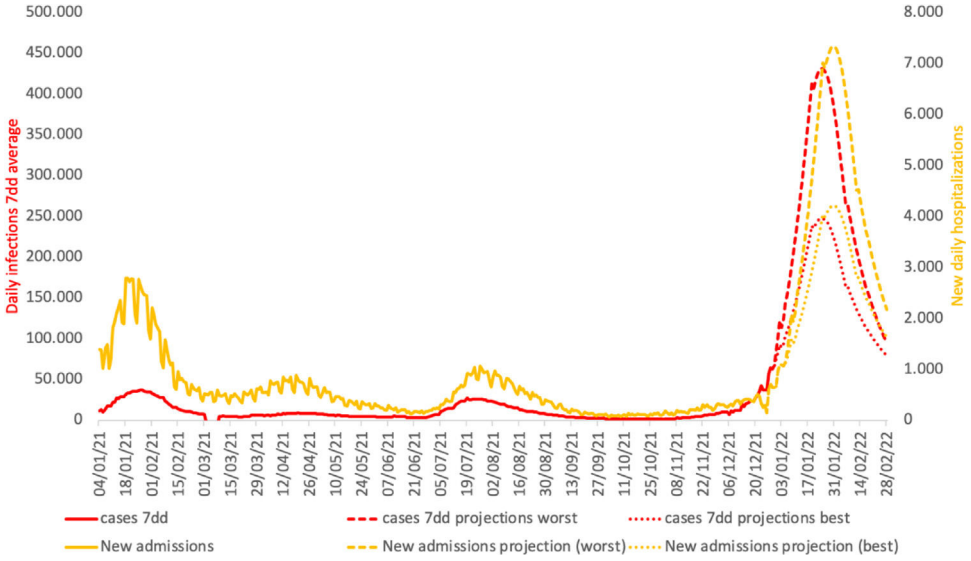

Fig. 2. Trends in COVID-19 daily new infections with a seven-day moving average and of new hospital admissions in Spain, observed and expected up to February 15, 2022.

7333 (worse scenario). Both epidemiological indicators will surpass previous rates observed in the previous five waves, unless both individual and group interventions are taking place. Beyond the futility of debating on an alleged lower severity of Omicron's acute COVID-19 clinical expression, any further consequences on its sequelae and long COVID will require close monitoring.[17]

In probability theory, the conditional expectation of any warning system for an eventual surge of an infectious outbreak, as could happen with Omicron substituting other SAR-CoV-2 VoC, modifies (reduces) the eventual magnitude of the event itself.[18] Given preliminary evidence from South Africa, our forecast anticipates a large COVID-19 increase in Spain despite the high levels of vaccination.[19] Therefore, this warning is calling for further reinforcing of universal hygiene interventions (indoor ventilation, social distance, and face masks), and anticipating the need of new lockdowns,[11] the latter being extremely detrimental to the economy.

All viruses change in time and space by natural or artificial Darwin's selection, and survival of the fittest,[20] due either to high levels of herd immunity or low vaccination coverage. The toll associated with Omicron underlines WHO's COVID-19 message that "No one will be safe, until the entire World is safe (ergo vaccinated)".

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