**Title**: International risk of the new variant COVID-19 importations originating in the United Kingdom

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**Abstract:** A fast-spreading SARS-CoV-2 variant identified in the United Kingdom in December 2020 has raised international alarm. We estimate that, in 16 out of 19 countries analyzed, there is at least a 50% chance the variant was imported by travelers from the United Kingdom byDecember 7th.

**Keywords:** SARS-CoV-2, variant, epidemiology, importation

The United Kingdom (UK) has detected a new variant of SARS-CoV-2 from samples initially taken in Kent on September 20th and London on September 21st, 2020 (1,2), which was found associated with increased transmissibility (3–5). The UK government tightened measures in London and southeast England in mid-December to mitigate the transmission of the fast-spreading virus variant with 69-70del (6). On January 5th, 2021, England initiated a national lockdown including closure of all schools and non-essential businesses until mid-February (7). By December 20th, over 40 countries had implemented travel restrictions on travellers from the UK (8). The new variant was subsequently reported worldwide, including in the USA (9), Spain, Sweden and France, and might be spreading without detection in countries with limited virus sequencing capacity (8).

We collected the data from 19 countries and estimated the probability of introduction of this new variant by travellers from the UK to each of these countries and the extent of local transmission, based on the changing proportion of the new variant among infections identified in the UK (10) and population mobility from UK to each country, as estimated from Facebook Data for Good (11). Ireland and Hungary had the highest and lowest importation risk between September 22 and December 7, 2020, respectively. By October 22nd (a month after its first detection in the UK), 13 of the 19 countries had at least a 50% chance of receiving one importation case from the UK (**Figure 1**), except for Turkey, Bulgaria, Cyprus, United Arab Emirates, Sweden, and Hungary, while Turkey, Bulgaria and Cyprus had exceeded this risk threshold by November 1st.

Using COVID-19 hospital admission data (12), we further estimated the local prevalence of the new virus variant in 11 of the 19 countries, assuming that the new variant is 50% more transmissible than the circulating 501N strain (5) (**Figure 1**). The variant appears to have ascended fastest in Ireland before slowing in mid November and is expected to be spreading rapidly in many of the other countries. As of December 7, Italy has the highest expected prevalence of 903 [95%CI: 0-3101] cases (**Figures 1 and S1**).

These projections suggested that countries with substantial population movement from the UK were likely to harbor cases of the new variant by late October, 2020. Our conclusions were based

on several key assumptions. The mobility estimates might be demographically biased by the user profile of Facebook, a major social media company with ~2.7 billion monthly active users in the third quarter of 2020 (13). Furthermore, we assumed a 9.5-day lag between infection and hospitalization based on estimates from the United States (14) and the same natural history and symptomatic proportion shared by the two variants (501Y and 501N) (10). We expect that the estimates will improve as reconstructed linelists (15) and more granular epidemiological data reduce uncertainty in these key epidemiological quantities. However, our findings should be robust in suggesting that the new virus variant has likely been introduced by travelers from the UK and spreading undetected for months in many countries.

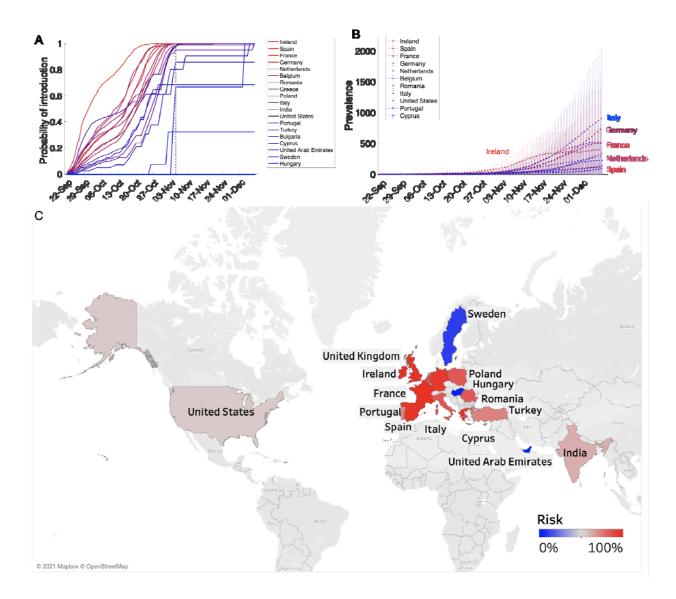


Figure 1. Estimated risks for introduction of the 501Y variant of SARS-CoV-2 from the UK to other 19 countries before December 7, 2020. (A) The probability that at least one person infected with the new COVID-19 variant has arrived at the target country from the UK by the date indicated on the x-axis, based on Facebook mobility data. (B) Estimated daily prevalence of the 501Y variant of SARS-CoV-2 in 19 countries between September 22 and December 7, 2020, assuming that the variant is  $\sigma$ = 50% more transmissible than the 501N variant (5). Points and bars indicate means and standard deviation based on 100 simulations. (C) Risk of at least one importation by November 1, 2020 (also indicated as line colors in A). The 16 countries above and 3 countries below the risk threshold of 50% are indicated in red and bluegreen, respectively. Grey indicates countries/regions where mobility data were not available.

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