Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Serial intervals in SARS-CoV-2 B.1.617.2 variant cases

The SARS-CoV-2 lineage B.1.617.2, also known as the delta variant, was declared a variant of concern by WHO on the basis of preliminary evidence suggesting faster spread relative to other circulating variants.[1] However, the epidemiological factors contributing to this difference remain unclear. In particular, an increase in observed growth rate of COVID-19 cases could be the result of a shorter generation interval (ie, the delay from one infection to the next) or an increase in the effective reproduction number, R, of an infected individual (ie, the average number of secondary cases generated by an infectious individual), or both.[2] Whereas a shorter generation interval would increase the speed but not the number of individual-level transmissions, a larger value of R would require both faster and wider coverage of outbreak control measures such as vaccination or physical distancing to suppress transmission.

In Singapore, whole-genome sequencing is done for respiratory samples from individuals who tested positive for SARS-CoV-2 by PCR with a cycle threshold of 30 and below. The B.1.617.2 variant was first identified in local cases on April 27, 2021. Despite high levels of adherence to mask wearing and physical distancing in the country,[3,4] clusters of B.1.617.2 variant were detected, and some clusters displayed rapid growth of infections.

We investigated possible drivers of B.1.617.2 variant growth by studying the serial intervals (ie, onset-to-onset delay, a proxy for the generation interval) between pairs of a primary case and a secondary case occurring among household members. Exposure histories were reviewed for all household transmission pairs involving individuals infected with the B.1.617.2 variant and notified between April 27 and May 22, 2021. The B.1.617.2 variant was detected in 97% of the sequenced samples from local cases of COVID-19 identified in this period. Secondary cases with potential exposure to either more than one primary case in the household or to other cases outside the household were omitted from analysis. Households with secondary cases having different symptom onset dates were also omitted from the analysis as we were unable to rule out multiple generations of transmission.

For comparison, we identified household transmission pairs before the partial lockdown in Singapore on April 7, 2020, and applied the same exclusion criteria. This time period precedes the occurrence of the major global SARS-CoV-2 variants and most closely matches the social activity and workplace arrangements in April, 2021,[5] when working from home was not the default. Preliminary analysis showed that the primary cases in this period had a wider range of time from symptom onset to isolation as compared to the B.1.617.2 primary cases (appendix). As such, the following sampling procedure was done to ensure that we matched the number of transmission pairs and the distribution of time from symptom onset to isolation of primary cases. For a given time from symptom onset to isolation of a B.1.617.2 primary case, we randomly sampled, with replacement, the serial intervals of primary cases in the earlier period with matching time from onset to isolation. We then fitted a skewed normal distribution to the sample of serial intervals to account for negative serial intervals arising from pre-symptomatic transmission. The process was repeated 1000 times to obtain the mean and 95% CI of the sample mean, the median, mode, and the difference of these statistics between the B.1.617.2 variant cases and those cases detected before the lockdown.

There were 32 B.1.617.2 variant household transmission pairs, and 63 household transmission pairs identified before April 7, 2020. The median serial interval of the B.1.617.2 variant cases was 3 days, whereas in cases identified before April 7, 2020, the median serial interval was 3 days (95% CI 2 to 4) after matching the time from symptom onset to isolation (figure). The mode of the serial interval was 2 days for B.1.617.2 variant cases and 2·7 days (95% CI –1 to 4) for cases detected before the lockdown. The mean, median, and mode of the serial interval distributions of B.1.617.2 variant cases and the sampled cases before the lockdown was not statistically different (appendix).

This early investigation of recent B.1.617.2 variant cases offers no evidence to support a large difference

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For more on **SARS-CoV-2 variants** see https://www.who.int/en/activities/tracking-SARS-CoV-2-variants/

See Online for appendix

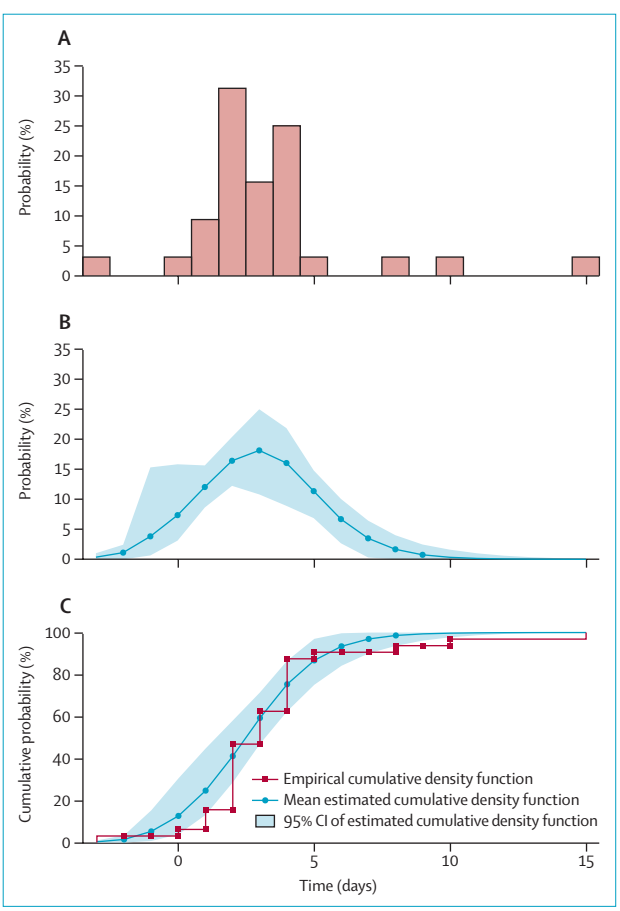

***Figure*: Probability mass function of serial interval of SARS-CoV-2 variant B.1.617.2 cases (A), probability density function of serial interval of cases identified before the partial lockdown on April 7, 2020 (B), and empirical cumulative density function of serial intervals and estimated cumulative density function of serial intervals (C)**

Most primary cases had known exposure (or exposures) outside the household and secondary cases do not have the same exposure as the primary case thereby allowing the directionality of infection to be identified. Negative serial intervals, which signify pre-symptomatic transmission, were also included in the analysis.

(ie, >1 day) in serial intervals among the samples studied, which had an exclusion criteria applied to ensure consistency. In turn, this lends support to the hypothesis that the recent rapid growth is potentially driven by an increase in the average number of secondary cases generated by a case infected with the B.1.617.2 variant. Studies with proper control of confounding factors are thus crucial to tease out the key epidemiological factors that facilitate the increased transmissibility of the B.1.617.2 variant. These factors include, but are not limited to, the viral load and shedding dynamics in individuals infected with the B.1.617.2 variant of SARS-CoV-2, the exposure settings, and the vaccination status of infected individuals. Without signs of lowered disease severity for the B.1.617.2 variant, contact tracing and testing around COVID-19 cases, along with vaccination and non-pharmaceutical interventions, continue to remain key SARS-CoV-2 outbreak control measures in the short term.

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See **Online** for appendix

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Towards a European strategy to address the COVID-19 pandemic

Reduction of COVID-19 incidence across Europe in the early spring months of 2021 led to substantial relaxation of restrictions in summer, despite the emergence and spread of the more transmissible SARS-CoV-2 delta variant. As expected, this relaxation led to a renewed increase in incidence. How should Europe act, what strategies should it adopt, and what specific risks should it consider moving forward?[1] These questions become even more pressing, since emerging data indicates the delta variant is more infectious and partially evades immune response. Europe needs a coherent and effective strategy before schools fully reopen and the transmission of SARS-CoV-2 further increases due to seasonality in autumn.

Two opposing strategies are considered: either continue to rapidly lift restrictions, assuming the combination of past natural exposure and current vaccination coverage would allow a high incidence to continue, without overburdening health-care systems; or lift restrictions at the pace of vaccination progress with the core aim to keep incidence low, given this effectively and efficiently controls the pandemic via test-trace-isolate (TTI) programmes.[2,3]

Given immunisation levels as of August, 2021, the first strategy can lead to an incidence of several hundred cases per million per day, whereas the second strategy would require an incidence of well below one hundred cases per million per day. Such a discrepancy of incidence poses considerable friction to European cooperation, economy, and society: high incidence in one country puts the low-incidence strategy in a neighbouring country at risk. Because of this conflict of interest, some countries impose testing and quarantine requirements, hampering international exchange. Thus, either strategy can only work effectively if European countries stop acting as if they could fight the pandemic on their own.

The EU's Digital Covid Certificate (EU DCC) has been introduced to facilitate cross-border travel. However, no vaccine is completely effective at preventing virus transmission. Therefore, the implementation of the EU DCC must be accompanied by systematic evaluation of its contribution to the spread of present and future variants of concern (VOCs).[4] The development of a European strategy for testing travellers and commuters is therefore warranted.[5]

The advantages of low incidence are known and include: (1) less mortality, morbidity, and long COVID; (2) solidarity with those not yet protected; (3) lower risk of new VOCs emerging and spreading; (4) increased feasibility of comprehensive TTI; (5) less workforce in quarantine and isolation, including those in health care; and (6) ensuring schools and childcare remain open during the coming autumn-winter season.[6] In contrast, a high incidence might still overwhelm hospitals and intensive care units in some countries, as estimated in the appendix.