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Travel measures in the SARS-CoV-2 variant era need clear objectives

Published **Online** March 2, 2022 https://doi.org/10.1016/S0140-6736(22)00366-X

The rapid global spread of new SARS-CoV-2 variants despite travel restrictions has revealed deficiencies in existing strategies and a need to evaluate them.[1] Such strategies—eg, vaccine passports, reactive flight bans, isolation of travellers who test positive for SARS-CoV-2 or blanket quarantines, and major changes to travel protocols—have often had weak accompanying justifications. Many governments continue to adapt various combinations of international travel measures and, increasingly, scale them back (figure) without stating clear objectives or the evidence behind them. In an era of SARS-CoV-2 variants and for future pandemic preparedness, there is a need for a transparent and evidence-based approach to travel strategies, supported by the development of clear international standards.

In our view, there are several potential objectives that travel testing and restrictions can help address, including: monitoring incoming SARS-CoV-2 variants among travellers; reducing risk of outbreaks resulting from imported cases; delaying introduction and establishment of new variants of concern; and estimating SARS-CoV-2 prevalence in other countries to inform risk assessments. The choice of an objective for travel measures should depend on local and global prevalence of SARS-CoV-2 variants. When there is initially a low domestic prevalence of a particular variant, as occurred early in the COVID-19 pandemic, temporary travel restrictions can delay introductions[4] and could provide governments time to develop long-term strategies, such as reinforcing surveillance, contact tracing, public health measures, and vaccination campaigns. However, the marginal value of delaying importation of variants such as omicron (B.1.1.529) has declined in many countries because the speed of importations far exceeded the ability of most governments to implement reactive travel policies. Once variants are established locally, ongoing travel restrictions will have extremely limited impact on the local epidemic.[5] Furthermore, imposing travel restrictions on countries that discover and report new variants could be a disincentive to rapidly reporting findings, damaging a vital early warning system for the rest of the world.

If the objective is to monitor importation of SARS-CoV-2 variants, full genome sequencing of incoming infections is typically required, but a lag in

reporting data will hinder reactive travel measures. Given the costs and delays involved, targeted national genomic sampling would be more efficient if the objective is to identify variants of concern and provide early situational awareness to support local planning and response.[6]

Although SARS-CoV-2 testing can help identify infections, quarantine has been used in many countries to reduce risks of onward transmission from incoming travellers with unknown or uncertain infection status. Quarantine is unable to fully prevent local transmission;[7] stringent domestic restrictions were required to contain subsequent outbreaks in the pre-vaccine era, and containment has become harder with more transmissible variants. Stringent quarantine for all travellers also comes with substantial individual and societal costs. However, such costs may be mitigated through the use of testing after arrival, with test-to-release schemes decreasing the time required for quarantine.[8]

Given the volume of indirect connections in the global flight network, efforts to merely delay introductions—rather than prevent them entirely—have limited value unless the aim is simply to delay spread by a few days, or if the delay is supplemented by additional domestic measures. In the face of new variants, a less economically disruptive alternative to outright travel bans is to use arrival SARS-CoV-2 testing, as many countries require. Although rapid antigen tests are less sensitive than PCR tests in detecting infection, most have high sensitivity for detecting individuals at the point they are likely to transmit infection.[9] Modelling studies have estimated that repeat rapid antigen tests are more likely to detect active infection than less frequent PCR tests, which are often associated with slower results and higher costs.[10] Daily testing of individuals considered a potential transmission risk with rapid antigen tests might also feasibly replace home quarantine with no expected increase in onwards transmission.[11] Another potential approach might include trained dogs that distinguish between infected and uninfected individuals using odour samples.[12,13] An advantage of this approach would be its speed and the fact that a laboratory specimen or test kit is not required; dogs can potentially screen up to 250 travellers per hour per dog, and trials are underway in the UK.[14] However, more evidence is needed before such an approach could be routinely implemented.

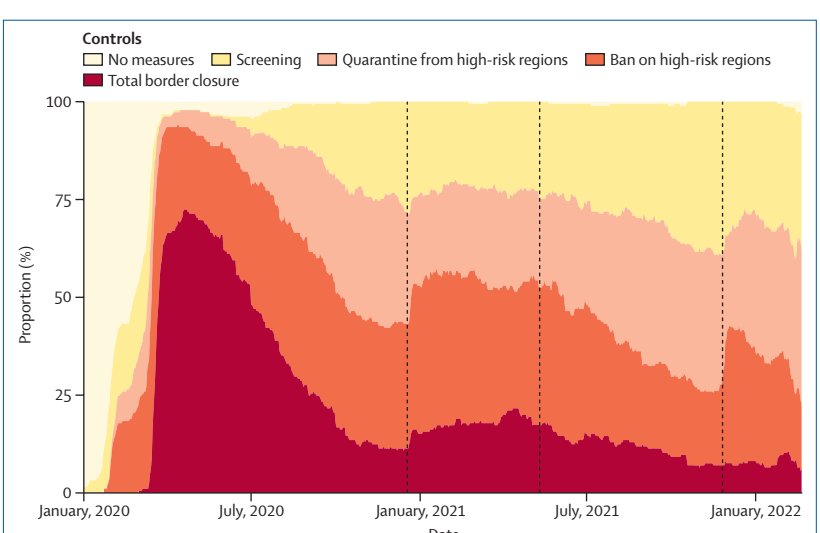

Figure: **Changes in proportion of countries with particular stringency of travel control measures over time**
Data are from the Oxford COVID-19 Government Response Tracker via Our World In Data.[23] Dashed lines show when alpha, delta, and omicron were declared variants of concern on Dec 18, 2020, May 11, 2021, and Nov 26, 2021, respectively.

Alongside testing, COVID-19 vaccination certification has increasingly been used in international travel requirements, and in some cases as a substitute for more disruptive testing and quarantine measures. However, if a strategic objective is to reduce the risk from variants against which vaccines are less effective,[15] then proof of vaccination alone would not be sufficient to prevent the importation of such variants, as shown by the spread of omicron. Certification can therefore only be one component of a wider risk mitigation strategy. Moreover, fake vaccination certificates and test results are being identified in many countries,[16] and as more countries redefine fully vaccinated to include boosters and introduce domestic vaccine passport policies, ensuring alignment of standards internationally will become increasingly important.

As governments reassess barriers to international travel, a principle that many have used is equivalent epidemiology—ie, permitting travel between countries with similar levels of SARS-CoV-2 transmission and variants of concern. In 2020, this was successfully used to permit less restrictive travel between countries with low SARS-CoV-2 prevalence, such as in the Western Pacific or Baltic regions.[17] However, use of reported cases as a measure of equivalency is fraught with difficulty: routine case data do not account for the limited reporting capacity in many countries or variation in actual testing strategy from country to country. Given the extensive SARS-CoV-2 testing for travel that is being

used globally, it is a missed opportunity that test data have not been better used to improve understanding of global SARS-CoV-2 dynamics. Testing at arrival not only provides information about incoming infections, it also enables estimation of prevalence in countries of departure. Routine sharing of such data could inform risk assessments for any future measures based on equivalent epidemiology.

Governments have a strong evidence base to help them identify and address rational objectives for international travel. As population immunity to SARS-CoV-2 increases in countries both from natural infection and vaccination, earlier objectives will change. However, the rise of omicron has shown that it is crucial to have objectives and travel measures that are transparent and well aligned. The International Health Regulations (2005),[18] negotiated by WHO member states, could serve as a clearing house for evidence obtained from various government strategies, and help coordinate actions by governments to decrease variant risk and disruption to international travel.

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