

Public Health Implications of SARS-CoV-2 VOC, updated December 3, 2021

Supplementary Table 1. Summary of studies (n=166)

Author, date	Date of publication	Date of data collection	Source	Study design	Country	Setting	Sample size	Outcome measures	Objective	VOC	Main Findings
<b>INCLUDED STUDIES FROM OCTOBER 4 TO NOVEMBER 15, 2021 (N=44)</b>											
<b>Atmar, 2021<sup>1</sup></b>	15-Oct-21	Not reported	medRxiv [preprint]	Clinical trial	USA	Community	458	Reactogenicity and immune response to booster vaccine	To evaluate homologous and heterologous booster vaccination in persons who had received an EUA Covid-19 vaccine regimen	Beta, Delta	Both homologous and heterologous booster vaccines were well-tolerated and immunogenic in adults who completed a primary vaccine regimen at least 12 weeks earlier
<b>Atyeo, 2021<sup>2</sup></b>	14-Nov-21	Jan - Sep 2021	medRxiv [preprint]	Observational cohort study	USA	Community	158	Anti-spike antibodies or FcR-binding	Assess antibody profile after vaccination in pregnant individuals, and evaluate transplacental antibody transfer	Alpha, Beta, Gamma, Delta	Results support vaccination early in pregnancy to maximize maternal protection throughout gestation, without compromising neonatal antibody protection
<b>Barda, 2021<sup>3</sup></b>	29-Oct-21	Jul 30, 2020 - Sep 23, 2021	The Lancet	Observational study	ISR	Community	1,158, 269	COVID-19 related admission to hospital, severe disease, COVID-19 related death	Evaluate effectiveness of a third dose of the BNT162b2 mRNA vaccine for preventing severe COVID-19 outcomes	Delta	A third dose of the vaccine is effective in protecting individuals against severe COVID-19 outcomes, compared with receiving only two doses at least 5 months ago
<b>Bowie, 2021<sup>4</sup></b>	07-Oct-2021	Feb 2020 - Sep 2021	medRxiv [preprint]	Modelling	UK	Community	N/A	Infections, long-COVID, hospital admissions, deaths	To estimate the model parameters of the epidemic, such as vaccine effectiveness and increased transmissibility of variants, the vaccine programme roll-out and changes in contact rates	Alpha, Delta	Two dose vaccinations given to 66% of population prevents transmission following infection by 44%, serious illness by 86% and death by 93%. With no other public health measures used, cases, hospital admissions and deaths will still rise substantially over twelve months

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<b>Bracis, 2021<sup>5</sup></b>	04-Oct-21	Not reported	medRxiv [preprint]	Modelling	USA	Schools	N/A	Transmission, hospitalization, time at maximum social distancing	Analyze the expected benefits of offering vaccination to children ages 5-11 under differing conditions for in-person schooling	Delta	Rapid vaccination of all school-aged children will provide meaningful reduction of the COVID health burden over this school year but only if implemented early
<b>Cai, 2021<sup>6</sup></b>	23-Nov-21	Nov 21, 2021	medRxiv [preprint]	Modelling	CHN	Community	N/A	Age-specific incidence of infections, cases, hospitalizations, ICU admissions, deaths	Assess is Delta variant infections could shift COVID-19 burden from adults to children in this vaccination landscape	Delta	It is important to include children among the target population and the need to strengthen vaccination efforts by increasing vaccine effectiveness
<b>Chen, 2021<sup>7</sup></b>	29-Sep-21	Not reported	medRxiv [preprint]	Observational cohort study	USA	Community	74	Antibody response in chronic inflammatory disease (CID) patients	Evaluate functional antibody responses after immunization against historical and emerging virus strains in a cohort of adults with CID	Delta	Lower antibody neutralizing observed among those receiving immunosuppressive therapy, with responses lower against VOC. This highlights importance of boosting and functional monitoring of immunity among CID patients
<b>Chen, 2021<sup>8</sup></b>	03-Nov-21	Jul 21 - Aug 13, 2021	Risk Management and Healthcare Policy	Observational study	CHN	Community	646	COVID-19 infections, epidemiological history, attitude of quarantined pregnant women, time needed for obtaining epidemiological history	Report experience of health QR code application including circle-layer management, hospital triage system and healthcare plan for quarantined pregnant women and children during summer outbreak of Delta strain and evaluate these measures	Delta	The "circle-layer" policy successfully exterminated initial cases and avoided community transmission through application of epidemiological history tracing technology, rigorous containment efforts of the communities where confirmed lived and where relatively less strict management of surrounding areas. Health code based 3-level triage system also prevented nosocomial infection
<b>Cheng, 2021<sup>9</sup></b>	01-Dec-21	Dec 31, 2019, - May 13, 2021	The Lancet Regional Health – Western Pacific	Descriptive study	CHN	Community	11,818	Positive tests	Describe how mass testing and phylogenetic analysis prevented local transmission in a densely populated	Beta	Outbreaks can easily occur in low incidence areas with an undetected imported case. Targeted mass testing can be a useful strategy, when targeting those with common exposure to confirmed cases

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									city with low herd immunity		
<b>Chu, 2021</b> <sup>10</sup>	28-Oct-21	Jul 1, 2021 - date of publication	SSRN [preprint]	Modelling	AUS	Community	N/A	Hospitalizations, ICU admissions, ventilation requirements, COVID cases and recoveries, vaccinations, deaths, public health costs	Develop stage-based age-structured models calibrated to Delta variant to assess public health capacity, and estimate lock down costs	Delta	Current target vaccination rates under Australia's National plan are lower than that estimated rates that are projected to minimize societal costs
<b>Chu, 2021</b> <sup>11</sup>	01-Oct-21	Until Jun 11, 2021	medRxiv [preprint]	Cohort study	USA	Community	600	Reactions to booster dose	Evaluate safety and reactogenicity of single booster dose 6 months or more after initial doses	Delta	Booster dose has potential for establishing durable vaccine efficacy and restoring antibody capability. Third doses may improve protection against Delta variant
<b>Dagpunar, 2021</b> <sup>12</sup>	11-Nov-2021	Not reported	medRxiv [preprint]	Modelling	UK	Community	N/A	Vaccine waning rates, vaccine efficacy, rate of vaccination, target vaccination coverage, control reproduction number	Develop vaccination model that examines the impact of various controls on long-term behaviour of COVID-19	Delta	Vaccination alone would not eliminate COVID-19
<b>Elbanna, 2021</b> <sup>13</sup>	04-Oct-21	Not reported	medRxiv [preprint]	Modelling	USA	Community	N/A	Viral dynamics of wild type and Delta variant COVID strains	Estimate how frequently it is required to surveillance test a population to prevent transmission	Delta	Twice a week testing is necessary to reduce transmission of wild type strain, but this is insufficient for Delta. The Delta variant would require every other day testing, and some variants may be too transmissible to only rely on surveillance testing
<b>Forde, 2021</b> <sup>14</sup>	18-Oct-21	Not reported	medRxiv [preprint]	Modelling	NR	Community	N/A	Cumulative cases	Develop mathematical model to predict the role of	Alpha, Delta	With moderate vaccination, frequent testing can significantly reduce cumulative size of Delta outbreak,

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									testing in outbreaks of Alpha and Delta variants		with the greatest impact when testing is focused on non-vaccinated individuals
<b>Gardner, 2021</b> <sup>15</sup>	29-Nov-21	Summer to Nov 2021	medRxiv [preprint]	Modelling	USA	Community	N/A	Reproductive number, Rt	Use measurements of waning neutralizing antibody titers and boosting with a third dose to estimate the impact on protection of all infections and the reproductive number of the virus	Delta	A third dose of the Pfizer vaccine could reduce transmission of COVID-19, which would reduce infection in unvaccinated individuals and breakthrough infections in vaccinated individuals
<b>Ge, 2021</b> <sup>16</sup>	05-Nov-21	Aug 1, 2020 - Sep 20, 2021	Research Square [preprint]	Modelling	EU & ISR	Community	N/A	Instantaneous reproduction number	Explore changing effectiveness of NPIs and vaccination based on large-scale dataset	Alpha, Beta, Gamma, Delta	NPIs were complementary or synergistic to vaccination in the effort to curb infection before reaching herd immunity. Effectiveness of NPIs declined since the introduction of vaccination strategies where relaxation of NPIs promoted the decline from May 2021
<b>Hanly 2021</b> <sup>17</sup>	11-Oct-21	Not reported	The Medical Journal of Australia	Modelling (Population-level deterministic compartmental epidemic)	AUS	Community	N/A	Numbers of people admitted to hospital with COVID-19	To estimate the numbers of COVID-19-related hospitalizations in Australia after re-opening the international border	Alpha, Delta	If Australia re-opens to international travelers while local risk-mitigating restrictions are limited to masks and social distancing, highly disruptive outbreaks will be possible even with 80% vaccination coverage for people aged 16 years or more.
<b>Havervall 2021</b> <sup>18</sup>	08-Nov-21	Jan - July 2021	MedRxiv [preprint]	Observational cohort study	SWE	Hospital	517	Binding and pseudo-neutralizing antibody titers and memory T cell responses, collected from blood samples	To investigate the long-term impact of prior SARS-CoV-2 infection on humoral and cellular immune responses in healthcare workers receiving the mRNA BNT162b2 or the adenovirus vectored ChAdOx1 nCoV-19 vaccine	Alpha, Beta, Gamma, Delta	Vaccination with both platforms resulted in substantially enhanced T cell immune responses, antibody responses to spike and neutralizing antibodies effective against ten variants following SARS-CoV-2 infection, compared to in naïve individuals. The enhanced immune responses sustained over seven months following vaccination.

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<b>Holmdahl 2021</b> <sup>19</sup>	26-Oct-21	Not reported	MedRxiv [preprint]	Modelling (Agent-based)	USA	Nursing home	N/A	Cumulative incidence of symptomatic infections, cumulative incidence of infections in residents and staff of a nursing home	To examine the impact of high community prevalence and Delta on the expected distribution of infections, as well as the effect of different vaccination strategies for nursing home residents and staff	Delta	Increased staff primary series coverage and high booster vaccine effectiveness (VE) in residents leads to fewer infections. The cumulative incidence is highly dependent on community transmission. Despite high VE, high community transmission resulted in continued symptomatic infections in nursing homes.
<b>Ko 2021</b> <sup>20</sup>	03-Nov-21	Feb 26 – Sep 10, 2021	MedRxiv [preprint]	Modelling	KOR	Community	N/A	Transmission in the context of NPIs and vaccination	This study aims to understand how vaccination and variants contribute to the spread of COVID-19 so that appropriate measures are implemented	Delta	The estimated transmission rate matrices show distinct pattern, with the transmission rates of younger age groups (0-39 years) much larger than non-Delta. Even with fast vaccination, resurgence of cases is still possible if NPIs are eased too early or screening measures are relaxed.
<b>Leung 2021</b> <sup>21</sup>	20-Oct-21	Aug 1, 2021	MedRxiv [preprint]	Modelling (Predictive, age-structured susceptible-infectious-removed)	JPN, HKG, VN, MM	Community	N/A	Symptomatic infections, hospitalizations, deaths	To evaluate the impact of various allocation strategies of COVID-19 vaccines and antivirals such that the pandemic exit strategy could be tailored to risks and preferences of jurisdictions in the East Asia and Pacific region (EAP) to improve its efficiency and effectiveness	Alpha, Beta, Delta	Increasing primary vaccination coverage was the most important contributing factor to reduce COVID-19 hospitalizations and deaths in the mass vaccination programmes. The effects of increasing primary vaccination coverage were most prominent when the vaccine uptake among older adults was low, such as in the population of Hong Kong, suggesting allocation strategies should prioritise protecting the most vulnerable groups to reduce COVID-19 disease burden through vaccination.
<b>Levine-Tiefenbrunn 2021</b> <sup>22</sup>	03-Nov-21	June 28 – Sep 9, 2021	Nature Medicine	Retrospective cohort study	ISR	Community	16,553	Positive COVID cases	To analyze viral loads in during the current wave of the Delta variant to compare viral load amongst various vaccination statuses and determine whether the observed	Delta	Although the initial vaccine effectiveness in reducing viral loads of Delta-variant BTIs is similar to its observed effectiveness in pre-Delta surges, this effectiveness is reduced with post-vaccination time and can then be restored with a third booster dose, consistent with immunity

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									decreased effectiveness of the vaccine in reducing viral loads is inherent to the Delta variant		against infection waning and third inoculation boosting.
<b>Li 2021</b> <sup>23</sup>	08-Nov-21	Sep 10 -Oct 20, 2021	MedRxiv [preprint]	Observational cohort study	CHN	Community	226	Clinical characteristics/disease severity (i.e., ICU admission), length of stay, serological profile	To evaluate the necessity of vaccination in children aged < 12 y by comparing the clinical characteristics in unvaccinated children with vaccinated patients aged ≥ 12y during the Delta surge	Delta	The Delta surge in Putian spread from children in schools to factories, mostly through family contact. Compared with those aged ≥ 12y, patients aged < 12y accounted for 34.07% of the total and showed milder fever, less cough and fatigue; they reported higher peripheral blood lymphocyte counts, higher normal CRP rate, and lower IL-6 levels.
<b>Li 2021</b> <sup>24</sup>	28-Oct-21	Not reported	MedRxiv [preprint]	Modelling	CHN	Community	N/A	Infections, deaths, transmission severity	To quantify the impact of NPIs in order to prioritize target populations for booster dosing, to optimize herd immunity thresholds, and to establish optimal international quarantine period	Delta	NPIs (masks, distancing) enhance booster vaccine performance as well as herd immunity thresholds in a context of maintaining 7-day international travel quarantine. High-risk workers get priority for booster vaccination.
<b>Li 2021</b> <sup>25</sup>	08-Nov-21	Not reported	MedRxiv [preprint]	Single-arm open label trial	CHN	Community	43	Immunogenicity post-booster vaccination	To assess the immunogenicity and safety of a booster dose in participants previously primed with two-dose V-1	Alpha, Beta, Delta	The booster dose of V-01 in participants previously primed with 21 day apart two-dose 10µg V-01 in phase I trial elicited potent humoral response against both wild-type and Delta strain of SARS-CoV-2 and exhibited a favorable and well-tolerated safety profile.
<b>Lv 2021</b> <sup>26</sup>	01-Oct-21	June 10-24, 2021	Journal of Travel Medicine	Cohort study	CHN	Airplane	203	Positive Delta variant test	To understand in-flight Delta VOC transmission	Delta	Inflight transmission considered to be by droplet likely related to periodic mask removal to eat, drink or for reasons of mask fatigue – further transmission was reported from shared rooms during quarantine.

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<b>Mahasiri mongkol 2021</b> <sup>27</sup>	12-Nov-21	Apr – Aug 2021	MedRxiv [preprint]	Observational cohort study	THA	Community (vaccination centre)	403	Immunogenicity at 2 weeks following 2nd dose, as well as neutralization activity against VOCs	To evaluate the immunogenicity and adverse events of this regimen by comparison with homologous CoronaVac, ChAdOx1 nCoV-19, and convalescent serum	Delta	A heterologous vaccine schedule (the CoronaVac viral vector vaccine followed by the AstraZeneca prime-boost vaccine [I/V]) produced a higher level of antibody response and neutralizing activity at 4 weeks against the Delta variant than a homologous one, and may provide the highest level of immunogenicity to Delta in a setting where only these vaccines are available.
<b>Mikszewski 2021</b> <sup>28</sup>	03-Nov-21	Not reported	Science of the Total Environment	Modelling	N/A	N/A	N/A	Transmission	To estimate the increased transmissivity of the Delta variant through the close proximity airborne route	Delta	SARS CoV 2 transmission is airborne, and a higher proportion of Delta cases will reproduce infection in their close proximity contacts (64-69% vs 29% for wild type). High risk workers need to wear N95 masks at all times. Social distancing and masking are essential in the presence of low vaccination rates. Ventilation and air filtration/disinfection are necessary to mitigate community spread in the presence of all variants.
<b>Milne 2021</b> <sup>29</sup>	04-Oct-21	2021 census data used in modelling	MedRxiv [preprint]	Modelling (Agent-based)	AUS	Community	N/A	Cases, hospitalizations, deaths	To evaluate the use of NPIs coupled with alternative COVID-19 vaccination strategies to determine feasible Delta mitigation strategies for Australia, understand interplay between high vaccine levels and NPI, and establish benefit of vaccinating children and adolescents	Delta	Cases, hospitalizations and deaths are reduced by: i) increasing coverage to include children aged 5 to 11 years, ii) activating moderate NPI measures, and/or iii) increasing coverage levels above 80%. Combining all three measures is shown to reduce cases to 398, hospitalisations to 2 and deaths to zero.
<b>Mok 2021</b> <sup>30</sup>	03-Nov-21	Aug 18 - Oct 26, 2021	MedRxiv [preprint]	Randomized controlled trial	CHN	Community	80	Levels of SARS-CoV-2 neutralizing and spike binding	To compare the immunogenicity and safety of using BNT162b2 and CoronaVac as a	Beta, Gamma, Delta	A BNT162b2 booster elicits significantly higher neutralizing antibodies against SARS-CoV-2, including different VOC, for those people who poorly responded to the

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								antibody in plasma	booster dose for adults with low antibody response to two doses of CoronaVac		previous vaccination of CoronaVac, compared to using CoronaVac as a booster dose.
<b>Naranbhai 2021<sup>31</sup></b>	11-Nov-21	Apr 21 - July 21, 2021	MedRxiv [preprint]	Prospective cohort study	USA	Hospital	178	Magnitude and breadth of neutralization of SARS CoV-2 variants and wild-type following vaccination	To study the magnitude and breadth of neutralization of variants following primary series, and after booster doses, of vaccination in patients with cancer who received one of the FDA Emergency Use Authorized (EUA) vaccines.	Alpha, Beta, Gamma, Delta	Vaccination with SARS-CoV-2 vaccines induces lower neutralization of variants, particularly beta, than wildtype. The vaccine types varied in magnitude of response but crucially, the magnitude of wildtype neutralization response was the primary correlate of breadth of neutralization.
<b>Nordstrom 2021<sup>32</sup></b>	18-Oct-21	July – Aug 2021	The Lancet Regional Health - Europe	Nationwide observational cohort study	SWE	Community	721,787	Confirmed symptomatic Covid-19 infection; hospitalisation for Covid-19	To investigate the effectiveness of heterologous ChAdOx1 nCoV-19 and mRNA prime-boost vaccination against symptomatic Covid-19 infection and report cases of hospitalisation and risk of thromboembolic events	Delta	Heterologous Covid-19 vaccination using ChAdOx1 nCoV-19 as a first dose followed by either the BNT162b2 or mRNA-1273 as the second dose was associated with 67% to 79% effectiveness against symptomatic Covid-19-infection. The effectiveness of the two heterologous schedules combined was significantly higher compared with the 50% effectiveness from homologous vaccination using ChAdOx1 nCoV-19 / ChAdOx1 nCoV-19.
<b>Payne 2021<sup>33</sup></b>	11-Nov-21	Dec 7, 2020 - Mar 12, 2021	Cell	Prospective observational cohort study	UK	Community	589	Serologic and antibody responses (neutralizing antibody levels, Immunoglobulin G levels, B cell response, T	To track antibody and T cell responses after the first dose of BNT162b2 and compare the magnitude of Ab and T cell responses 4 weeks after dose 2 between short and long vaccination regimens, coupling	Alpha, Beta, Gamma, Delta	The first vaccine dose induced protection from infection from the circulating alpha (B.1.1.7) variant over several weeks. This single dose induces SARS-CoV-2 neutralizing antibody (NAb) responses and a sustained B and T cell response to the spike protein. Prior SARS-CoV-2 infection amplified and accelerated the response.



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								cell response)	this with protective efficacy data		
<b>Pung 2021</b> <sup>34</sup>	14-Nov-21	Nov 2020 – Feb 2021	MedRxiv [preprint]	Modelling (Social network analysis)	SGP	Cruise ships	N/A	SARS-CoV-2 Delta variant transmission and outbreaks	To simulate SARS-CoV-2 Delta variant outbreaks and assess how different combinations of interventions and network formulations influence transmission in a range of settings during a large-scale event	Delta	In simulated outbreaks, vaccination coverage and rapid antigen tests had a larger effect than mask mandates alone, indicating the importance of combined interventions against Delta to reduce event risk in the vaccine era.
<b>Roy 2021</b> <sup>35</sup>	28-Sep-21	Jan 9 - Mar 6, 2021; Mar 6 - May 8, 2021; May 8 - June 12, 2021; June 12 - July 31, 2021	MedRxiv [preprint]	Modelling	USA	Community	N/A	Infections, deaths, vaccinations	To simulate COVID-19 transmission in the US, specifically: to evaluate increased transmission of Delta and increased vaccine inefficacy; to design optimum vaccine distribution strategy prioritizing the most affected age groups; and to account for the effect of anti-vaxxers	Delta	Prioritizing children and adult vaccinations over that of seniors can contain the spread of the active cases, thereby preventing the healthcare system from being overwhelmed and minimizing subsequent deaths. The only option to curb the effects of this pandemic is to reduce the population of unvaccinated individuals. A higher fraction of 'Anti/Non-vaxxers' can lead to the resurgence of the pandemic.
<b>Ryckman 2021</b> <sup>36</sup>	05-Aug-21	Jan 1, 2020 - May 15, 2021	The Lancet Public Health	Modelling (Transmission-dynamic stochastic microsimulation)	USA	State prisons (CA)	N/A	Total resident infections and severe cases over 200 days	To use mathematical modelling to assess the risks and harms of COVID-19 outbreaks in prisons under a range of policies, including resumption of activities	Alpha	If a viral variant is introduced into a prison that has resumed pre-2020 contact levels, has moderate vaccine coverage, and no baseline immunity, 23–74% of residents are expected to be infected over 200 days. High vaccination coverage (90%) coupled with NPIs reduces cumulative infections to 2–54%.
<b>Salvadore 2021</b> <sup>37</sup>	02-Nov-21	Feb 24 - Apr 16, 2021	Computers in Biology and Medicine	Modelling (Integro-differential)	ITA	Community	N/A	Infections, deaths, recoveries	To understand the effect of different confinement measures implemented in	Alpha	More reactive criteria at the start of the second wave would have limited the peak at a very low cost in terms of restrictive measures. Leaving the subsequent trend unchanged, this

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									various Italian regions to have quantitative estimates of effects of adopted measures in management of the epidemic trend		would have led to a much lower number of total infections.
<b>Siedner 2021</b> <sup>38</sup>	17-Oct-21	Jan – Aug 2021	MedRxiv [preprint]	Observational cohort study	USA	Community	22	Time to negative viral by PCR testing; Time to negative viral culture	To follow a cohort of ambulatory patients with post-vaccination breakthrough infections with longitudinal collection of nasal swabs for viral load quantification, whole genome sequencing, and viral culture	Delta	All Delta infections were symptomatic, and Delta variant breakthrough infections were characterized by higher initial viral load, longer duration of virologic shedding by PCR, greater likelihood of replication-competent virus at early stages of infection, and longer duration of culturable virus compared to non-Delta variants. No individuals with Delta had replication-competent virus by day 10 after symptom onset or 24 hours after resolution of symptoms.
<b>Skowronski 2021</b> <sup>39</sup>	26-Oct-21	May 30 -Oct 2, 2021	MedRxiv [preprint]	Observational test-negative design study	CAD	Community	1,235, 447	Infections, hospitalizations	To report two-dose VE by type, by interval between doses, and time since second dose against infection and hospitalization, including due to the Delta VOC, among adults	Delta	Two doses of mRNA and/or ChAdOx1 vaccines (homologous and mixed) provided powerful and persistent protection against hospitalization, including due to the Delta variant, without sign of decline by 5-7 months post-vaccination among community-dwelling adults, including older adults. VE improved with longer intervals between 1st and 2nd dose
<b>Sonabend 2021</b> <sup>40</sup>	13-Nov-21	Up to Mar 8 2021, and Mar 8 – July 31, 2021	The Lancet	Modelling (Mathematical)	UK	Community	N/A	Lifting of NPIs on deaths, hospital admissions and bed occupancy; serological data and PCR testing data	To assess the UK Government's four-step process to easing lockdown restrictions in England, UK, as well as the impact of the Delta (B.1.617.2) variant of SARS-CoV-2 and potential future epidemic trajectories	Alpha, Delta	Phased lifting of NPIs in England and vaccine roll-out have successfully kept hospital admissions and deaths at low levels since March 2021. However, high transmissibility of Delta, imperfect VE, and future increases in contact rates are likely to lead to a substantial wave of transmission in the autumn

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<b>Wells 2021</b> <sup>41</sup>	27-Oct-21	Aug 8, 2021	MedRxiv [preprint]	Modelling (Case study)	EUR	Community	N/A	Country-specific imminent (a measure of transmission)	To develop a generalized analytical framework to identify travel quarantine and testing strategies to prevent case increase in the destination country when compared to a strategy of complete border closure	Alpha, Delta	For nearly half of country pairs, no quarantine or test is necessary to prevent increased imminent transmission from travellers; for most, a test with no quarantine would be sufficient. For many other country pairs, a travel quarantine of a few days combined with testing on exit would suffice.
<b>Wu 2021</b> <sup>42</sup>	July-Aug 2021	Feb 2020 - June 2021	Canada Communicable Disease Report (CCDR)	Modelling (Transmission dynamics)	CAD	Community	N/A	Cases; contact rate; transmission; symptomatic case detection rate; contacts traced, quarantined or isolated	To quantify conditions that combined public health interventions must meet to reopen the economy without a large outbreak	Alpha	Prevention of a new outbreak is feasible even under the worst case scenario that VOC becomes dominant, but requires substantial increase in the proportion of cases that are detected, and in the proportion of contacts that are traced and quarantined.
<b>Yen 2021</b> <sup>43</sup>	23-Oct-21	Jan 1, 2020 - July 31, 2021	MedRxiv [preprint]	Modelling (Epidemic surveillance)	TWN	Community	N/A	Cases, reproductive number (Rt), effectiveness of NPIs	To present two kinds of epidemic surveillance models for containing the spread of variants so as to avert a community-acquired outbreak (CAO) with NPIs, tests, and vaccination	Alpha, Delta	An increase in one imported case prior to one week would lead to 9.54% higher risk of domestic cluster infection. The risk of domestic cluster infections was gradually elevated to 14.14%, leading to the Alpha VOC CAOs of six hotspots mid-May 2021. It took two-and-half months to contain this CAO within level three of NPI alert with rapid testing and vaccine rollout.
<b>Yue 2021</b> <sup>44</sup>	16-Nov-21	Not reported	Emerging Microbes & Infections	Cohort	N/A	Community	53	Anti-S IgG antibody, neutralizing antibody titre, specific IFN- $\gamma$ -secreting	To explore whether a booster dose of inactivated vaccine can evoke immune memory quickly to provide important protection	Alpha, Beta, Delta	Third booster dose of inactivated SARS-CoV-2 vaccine is effective against VOCs

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								T-cell response			
<b>INCLUDED STUDIES FROM AUGUST 25 TO OCTOBER 4, 2021 (N=41)</b>											
<b>Abu-Raddad 2021<sup>45</sup></b>	28-May-21	Feb 1 <sup>st</sup> to Mar 31 <sup>st</sup> 2021	Journal of Travel Medicine	Case control	QAT	Community	333,764	Vaccine effectiveness	Document Pfizer-BioNtech vaccine protection on weekly basis after first dose	Alpha, Beta	75% protection reached after 15-21 days since initial dose. Protection increased most rapidly against hospitalization and death, and slowest against B.1.351 infection.
<b>Adamoski 2021<sup>46</sup></b>	17-Sept-21	Oct 10 <sup>th</sup> 2020 to May 24 <sup>th</sup> 2021	Emerging Infectious Diseases	Cross Sectional	BRA	University	7,249	Positive test sample, genotype	Implement large screening campaign to provide safer environment for individuals on-site of university	Gamma	Analyzing saliva samples provides a cheap and easy asymptomatic screening strategy.
<b>Antonini 2021<sup>47</sup></b>	17-Aug-21	Sep 1 <sup>st</sup> 2020 to May 1 <sup>st</sup> 2021	Vaccines	Modelling	ITA	Community	N/A	Disease severity, hospitalizations, ICU admissions, deaths	Explore the dynamics of COVID-19 with different vaccination paces and a policy of gradual reopening	Alpha, Gamma	The control of COVID-19 can be accomplished by a multi-strategy approach combining highly effective vaccines, social distancing, and isolation of positive cases.
<b>Avila 2021<sup>48</sup></b>	26-Sep-21	Dec 20 <sup>th</sup> 2020 to Aug 17 <sup>th</sup> 2021	medRxiv [preprint]	Modelling	USA	Community	N/A	Infections, asymptomatic vs. symptomatic infections, deaths, vaccination rates	Model virus spread in unvaccinated and vaccinated subpopulations with parameters associated with delta variant, two-dose vaccination, and the variant's partial vaccine resistance	Delta	Combination of strengthening vaccine induced immunity, and preventative behaviour measures will decrease the rise of variants.
<b>Bauer 2021<sup>49</sup></b>	02-Sep-21	May 2021 to Fall 2021	PLOS Computational Biology	Modelling	EUR	Community	N/A	Rate of NPI relaxation	Study how planned vaccine rollout in EU allows for restriction relaxation.	Alpha, Beta, Gamma, Delta	Keeping moderate preventative measures such as improved hygiene, use of face masks and moderate contact reduction is recommend to control virus spread.
<b>Chen 2021<sup>50</sup></b>	27-Sep-21	N/A	medRxiv [preprint]	Modelling	CHN	Community	N/A	Infections, symptomatic COVID-19, severe COVID-19	Evaluate long-term dynamics of neutralizing antibody and predict time-varying efficacy against Delta variant	Delta	Timely boosting with vaccines can provide protection against Delta variant. Better performance associated with mRNA vaccines rather than protein and inactivated vaccines.

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									by vaccine, age group and clinical severity		
<b>Cipriano 2021</b> <sup>51</sup>	05-Sep-21	Aug to Dec 2021	medRxiv [preprint]	Modelling	CAD	Community	N/A	Infections, hospitalizations, time to reinstate public health measures, vaccine coverage, level of contact reduction	Project number of COVID-19 cases and demand for hospital resources for Fall 2021. Evaluate if current levels of vaccine coverage and contact reduction could mitigate 4 <sup>th</sup> wave, or if public health measures should be reinstated	Alpha, Delta	High vaccination coverage and mask wearing in public will not be sufficient to prevent a resurgence of COVID-19 in Fall 2021. Immediate moderate public health measures can prevent the need for more intense measures to be implemented later.
<b>Cowley 2021</b> <sup>52</sup>	08-Sep-21	Nov 2020 to Apr 2021	Nature Microbiology	Bayesian time-scaled phylogenetic analysis	BGD	Community	152	Infections, COVID-19 lineages, population mobility	Track the spread of COVID-19 lineages and identify outbreak dynamics.	Alpha, Beta	Repeated international importations until late March were followed by a period of sustained community transmission. Stay-at-home orders can exacerbate transmission.
<b>Cuesta-Lazaro 2021</b> <sup>53</sup>	23-Sep-21	July 10th, 2021, to Feb 1st, 2022 (simulations)	medRxiv [preprint]	Modelling	UK	Schools	N/A	Infections, deaths	Simulate the spread of COVID-19 infections after reopening of schools and compare the influence of three different vaccination campaigns, as well as the impact of continuing NPIs in schools.	Delta	The primary result from the comparison of vaccine scenarios is that vaccinating 80% of 12–17 year olds prior to July 2021 would have had a major effect on the epidemic progression — significantly more than just vaccinating those 16 and older or adults alone.
<b>De-Leon 2021</b> <sup>54</sup>	20-Sep-21	July 2020 to June 2021	medRxiv [preprint]	Modelling	ISR	Community	N/A	Confirmed cases, severe hospitalizations, vaccine effectiveness	Examine the extent of the impact of the Delta variant on morbidity and whether it can solely explain the outbreak, or if waning vaccine effectiveness also played a role.	Delta	Both Delta infectiousness and waning vaccine effectiveness could have been able to push Israel below the herd immunity threshold (HIT) independently; thus, to mitigate the outbreak, effective NPIs are required.
<b>Doyle 2021</b> <sup>55</sup>	03-Sep-21	March 15 to May 3, 2021	Morbidity and	Case series	USA	Schools	158	Infections	Evaluate the role of travel and social	Alpha	Student travel by unvaccinated students during a university break

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			Mortality Weekly Report (MMWR)						connections, as well as the potential impact of SARS-CoV-2 variants, on transmission among a cluster of students with COVID-19 at an urban university.		and subsequent on-campus gatherings drove introduction and transmission of several lineages.
<b>Eyre 2021</b> <sup>56</sup>	01-Oct-21	January 1 to July 31, 2021	medRxiv [preprint]	Retrospective cohort	UK	Community	146,243	Infections, SARS-CoV-2 lineages, transmission, index case and contact vaccination	Investigate associations between transmission and index case and contact vaccination, and how these vary with Alpha and Delta variants and time since second vaccination.	Alpha, Delta	Vaccination reduces transmission of Delta, but by less than the Alpha variant. The impact of vaccination decreased over time. Factors other than PCR Ct values at diagnosis are important in understanding vaccine-associated transmission reductions. Booster vaccinations may help control transmission together with preventing infections.
<b>Fiori 2021</b> <sup>57</sup>	21-Sep-21	January to June 2021	medRxiv [preprint]	Time series analysis/modeling	ARG, BRA, CHL, PRY, URY	Community	N/A	Infections (incidence data), viral transmissions (reproduction rate), deaths, vaccinations, population mobility	Investigate the impact of national vaccination programs and natural infection on viral transmission in select South American countries.	Gamma	Populations from the South American Southern cone probably achieved the conditional herd immunity threshold to contain the spread of regional SARS-CoV-2 variants.
<b>Gollier 2021</b> <sup>58</sup>	09-Jun-21	Not reported	Journal of Benefit-Cost Analysis	Modelling	FRA	Community	N/A	Infections, ICU admissions, deaths, rate of vaccination, economic/GDP loss	To measure the welfare benefit for France of the optimal vaccination campaign (of prioritizing older people, together with people with comorbidities), by combining its wealth and health impacts; and to measure the welfare cost of the	Alpha	Three-quarters of the welfare benefit of the vaccine can be achieved with a speed of 100,000 full vaccination per day. A 1-week delay in the vaccination campaign raises the death toll by approximately 2,500 and reduces wealth by 8 billion euros. Prioritizing the allocation of vaccines to the most vulnerable people saves 70,000 seniors, but it also increases the death toll of younger people by 14,000. If the production country vaccinates its entire population before exporting to

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									misallocation of the vaccine.		another, the global death toll would be increased by 20%.
<b>Hagan 2021</b> <sup>59</sup>	24-Sep-21	July 12 <sup>th</sup> to Aug 14 <sup>th</sup> , 2021	Morbidity and Mortality Weekly Report (MMWR)	Case study	USA	Prison	172	Positive COVID cases	Describe an outbreak involving the Delta variant in a highly vaccinated incarcerated population	Delta	Widespread vaccination among incarcerated persons and staff members in coordination with other prevention strategies remain critical to limiting SARS-CoV-2 transmission and COVID-19–related illness and death in congregate settings, including correctional and detention facilities.
<b>Kost 2021</b> <sup>60</sup>	22-Sep-21	Not reported	Archives of Pathology & Laboratory medicine	Modelling	USA	Community	N/A	Tiered sensitivity/specificity	Use original mathematics and visual logistics for interpreting COVID-19 rapid antigen test performance patterns, gauge the influence of prevalence, and evaluate repeated testing	Delta	Performance of self- and home-antigen tests with Food and Drug Administration Emergency Use Authorization peaks in low prevalence. Fall-off in performance appears with increasing prevalence because suboptimal sensitivity creates false negatives.
<b>Lam-Hine 2021</b> <sup>61</sup>	03-Sep-21	May 23 <sup>rd</sup> to June 12 <sup>th</sup> , 2021	Morbidity and Mortality Weekly Report (MMWR)	Case study	USA	School	26	Positive COVID cases	To describe the case of an outbreak in an elementary school.	Delta	Due to the delta variant's high transmissibility, masking is highly recommended in schools. Other NPIs are also very important in protecting the vulnerable school children, as they are ineligible for vaccination.
<b>Lasser 2021</b> <sup>62</sup>	29-Sep-21	Not reported	medRxiv [preprint]	Modelling	AUT	School	616 clusters; 3,498 cases	Effectiveness of mitigation measure to reducing cluster size	Quantify how many transmissions can be expected for different scenarios/school types, in a way that is appropriate to derive evidence-based policies for keeping schools open at a controllable infection transmission risk.	Delta	Different types of schools require different combinations of preventive measures. The ideal mix of mitigation measures needs to be more stringent in secondary schools than in primary schools, and needs to preferentially focus on teachers as sources of infection.
<b>Li 2021</b> <sup>63</sup>	31-Aug-21	June 1 <sup>st</sup> , 2020 to Feb 13 <sup>th</sup> , 2021	The Lancet	Modelling	UK	Community	N/A	Data on community mobility; reproduction	Determine association between community mobility	Alpha	Increased visits to retail and recreation places, workplaces, and transit stations in cities are important drivers of increased SARS-CoV-2

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								n number (R) of SARS-CoV-2 across UK local authorities	and COVID-19 transmission.		transmission; the increasing trend in the effects of these drivers in the first 6 weeks of 2021 was possibly associated with the emerging alpha (B.1.1.7) variant.
<b>MacIntyre 2021</b> <sup>64</sup>	16-Sep-21	March 1 <sup>st</sup> , 2020 to June 29 <sup>th</sup> , 2021	Vaccine	Modelling	USA	Community	N/A	Number of cases, number of deaths, mask usage and efficacy	Estimate the impact of community face mask use, at varying levels of mask uptake and mask effectiveness during the roll out of vaccination in NYC	Delta	The epidemic curve is suppressed by 50% with mask wearing but surges when mask usage drops below 30%. NPIs are needed during vaccine rollout, and the ongoing need is contingent upon waning of vaccine immunity, VOCs and use of boosters.
<b>Majeed 2021</b> <sup>65</sup>	20-Sep-2021	Not reported	Mathematical Biosciences	Modelling	CAD	Community	N/A	Infections, impact of variability in COVID-19 and whole genome testing capacity on spread	Examine the impact of NPIs, including test capacity and contact tracing and quarantine strength, on the VOC-induced epidemic wave.	Alpha, Beta, Gamma, Delta	A combination of large COVID-19 clinical test capacity, a short delay in both the clinical test and WGS test and the subsequent contact-tracing and quarantine, and moderate level of additional strain-specific quarantine is a feasible and optimal approach to prevent or mitigate a VOC-driven outbreak.
<b>Mathiot 2021</b> <sup>66</sup>	01-Sep-21	December 2019 to July 2021	medRxiv [preprint]	Modelling	FRA, DEU, ITA	Community	N/A	Virus spread of initial strain, Alpha variant, and Delta variant	Examine density and intensity of social relationships to further understanding of epidemic propagation via the respiratory tract.	Alpha, Delta	Variant spread is determined by escape from vaccine protection/or COVID infected non-vaccinated, and no continuity of vaccine strategy such as third doses to extend immunity.
<b>McBryde 2021</b> <sup>67</sup>	03-Sep-21	Not reported	The Medical Journal of Australia	Modelling	AUS	Community	N/A	Number of infections, hospitalizations, deaths; number of years of life lost	Analyse outcomes of COVID-19 vaccination by type of vaccine, age, eligibility, vaccination strategy and coverage	Delta	Vaccinating vulnerable population first is important when overall vaccine coverage is low; vaccinating more socially active groups becomes more important as R(eff) declines and vaccination coverage increases. Based on an R(eff) of 5, herd immunity only likely to occur if 85% of population aged 5+ are vaccinated.
<b>McPeck 2021</b> <sup>68</sup>	20-Sep-21	Not reported	medRxiv [preprint]	Modelling	USA	Schools	N/A	Total number in	To test the effects of vaccination and	Delta	Universal masking with N95 masks and 100% vaccination of susceptible



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								infectious and recovered classes, representing total disease burden	masking in a scenario containing a quantity of agents representing double occupancy of the 20 dorm rooms on the map (40 agents).		people resulted in significantly lower prevalence after 3 weeks compared to all other scenarios, but still led to a substantial number of infections. Increased vaccination levels from 52% to 100% by itself did not result in a significant difference in prevalence due to symptomatic and asymptomatic breakthrough infections. These results suggest that universal masking is the best way forward.
<b>Mele 2021</b> <sup>69</sup>	15-Sep-21	Not reported	medRxiv [preprint]	Modelling	USA	Schools	N/A	Infections, hospitalizations, deaths, reinfections	To project the impact of school-masking on the community, which can inform policy decisions, and support healthcare system planning.	Delta	The implementation of masking policies in school settings can reduce additional infections post-school opening by 23-36% for fully-open schools, with an additional 11-13% reduction for hybrid schooling, depending on mask quality and fit. Masking policies and hybrid schooling can also reduce peak hospitalization need by 71% and result in the fewest additional deaths post-school opening.
<b>Milne 2021</b> <sup>70</sup>	02-09-21	Not reported	Preprints with The Lancet [preprint]	Modelling	AUS	Community	N/A	Infections, hospitalizations, deaths	To model a range of COVID-19 vaccination strategies to determine their effectiveness in preventing local epidemics of the B.1.617.2 Delta variant.	Delta	High vaccine efficacy and extremely high vaccination coverage (90%) was shown to be required to mitigate highly transmissible variants such as Delta without activation of strong lockdown measures, in contrast to the Alpha variant. Greater than 70% vaccine coverage in those 12+ years, together with a vaccine boosting regimen, would be sufficient to halt a Delta outbreak if coupled with early, moderate lockdown measures.
<b>Patalon 2021</b> <sup>71</sup>	31-08-21	Jan to Aug 21 <sup>st</sup> , 2021	medRxiv [preprint]	A test-negative design and a matched case-	ISR	Community	153,753	Positive Covid-19 PCR (test negative analysis)	To evaluate initial short-term marginal effectiveness of the third dose of the BNT162b2 vaccine against the Delta	Delta	We found that 7-13 days after the booster shot there is a 48-68% reduction in the odds of testing positive for SARS-CoV-2 infection and that 14-20 days after the booster the

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				control design					variant compared to a two-dose regimen.		marginal effectiveness increases to 70-84%.
<b>Pettit 2021</b> <sup>72</sup>	21-09-21	N/A	medRxiv [preprint]	Scenario-based modelling	USA	Workplace	Modeling	Community acquired infections (CAI), number of workplace-acquired infections (WAI), number of acquired infections (TAI, of CAI + WAI)	To test the rates of WAI and CAI based on applied isolation strategies, community infection rates (CIR), scales of testing, NPIs, variant predominance and testing strategies, vaccination coverages, and vaccination efficacies	Delta	The study identified different thresholds at which NPI can be changed - for example, when the CIR is 5 new confirmed cases per 100,000 or fewer, and at 50% of the workforce is vaccinated with a 95% efficacious vaccine, then testing daily with an antigen-based or PCR-based test in only unvaccinated workers will result in less than one infection through 4,800 person weeks.
<b>Reingruber 2021</b> <sup>73</sup>	21-02-21	Jan 20 to Feb 21, 2021	medRxiv [preprint]	Modelling	FRA	Community /hospital modeling	586 patients' clinical data	Number of new infected per age group	To develop a data-driven modelling framework with the aim to provide reliable near-future predictions under constantly evolving social and pandemic conditions	Delta	Reproduction numbers and herd immunity levels are not universal but depend on the underlying social dynamics, and in the presence of the delta variant should be above 90%. Finally, we conclude that vaccination of the young generation should be pursued before all social restrictions are relieved.
<b>Rose 2021</b> <sup>74</sup>	02-02-21	Not reported	medRxiv [preprint]	Laboratory	DEU	Laboratory	N/A	Immunoglobulin G and neutralizing capacities against VOC after vector vaccine followed by mRNA boost compared to double immunization with mRNA	To compare immunoglobulin G response after heterologous immunization with that elicited by homologous vaccination schedules; to assess various methods to investigate the development of VNA against two prevalent VOCs	Alpha, Delta	The heterologous SARS-CoV-2 vaccination leads to a strong antibody response with anti-SARS-CoV-2 IgG and VNA titres at a level comparable to that of a homologous BNT162b2 vaccination scheme. The observed reduction in the VNA titre against VOC B.1.617.2 is remarkable and may be attributed to a partial immune escape of the Delta variant.
<b>Sarkar 2021</b> <sup>75</sup>	21-09-21	March 2020–February 2021 and March	Pathogens Journal	Epidemiological	IND	Community	N/A	Descriptive, analytical comparison	To comprehensively analyze the key factors responsible	Delta	Lineage analysis in India showed the emergence of new SARS-CoV-2 variants, i.e., B.1.617.1 and B.1.617.2,

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		2021–first week of April 2021						of two waves	for the sharp rising of confirmed COVID-19 cases in India in the second wave of infection as compared to the first wave.		during April–May 2021, which might be one of the key reasons for the sudden upsurge of confirmed cases/day. Furthermore, the emergence of the new variants contributed to the shift in infection spread by the G clade of SARS-CoV-2 from 46% in period II to 82.34% by the end of May 2021.
<b>Šmíd 2021</b> <sup>76</sup>	29-09-21	June 4, 2020 to Apr 7, 2021	medRxiv [preprint]	Modelling	CZE	Schools	4,235 + modeling	In-cohort growth rates of infection	To assess impact of school opening with various mitigation measures (masks, rotations, mass testing) on growth rate of new cases in child cohorts	Alpha	The estimates of in-cohort growth rates were significantly higher for normally opened schools compared to closed schools. For secondary education, mitigation measures reduce school-related growth 2-6 times.
<b>Tauzin 2021</b> <sup>77</sup>	21-09-21	Not reported	medRxiv [preprint]	Laboratory	Not reported	Laboratory	43 (22 SARS-CoV-2 naïve, 21 previously infected)	Presence of SARS-CoV-2-specific antibodies (Abs) (IgG, IgM, IgA) recognizing the receptor-binding domain	To characterize vaccine-elicited humoral responses in a cohort of SARS-CoV-2 naïve and previously infected individuals that received the two doses with an extended interval of sixteen weeks	Alpha, Beta, Gamma, Delta	Despite initial concerns, the long interval between doses did not result in poor immune responses. Delayed second vaccine boost in naïve individuals significantly enhances several immune responses and tightens the network of linear correlations among those. Previously infected individuals who received one dose had better responses 19 weeks after their dose.
<b>Truelove 2021</b> <sup>78</sup>	02-09-21	9 different models using data available through July 3, 2021	medRxiv [preprint]	Modelling	USA	Community	N/A	Weekly reported cases, hospitalizations, and deaths	To project weekly reported cases, hospitalizations, and deaths, both nationally and by jurisdiction (50 states and the District of Columbia), for four different epidemiological scenarios	Delta	Increased vaccination uptake is critical to limiting transmission and disease, particularly in states with lower current vaccination coverage. Higher vaccination can potentially avert 1.5 million cases and 21,000 deaths and improve the ability to safely resume social, educational and business activities. Continued or renewed NPIs can limit transmission, particularly as schools and businesses reopen.
<b>Urbanowicz 2021</b> <sup>79</sup>	01-09-21	Beginning in January 2021, up to 14 and	Science Translatio	Cohort study	UK	Community (cohort of healthcare	45 HCWs	Presence of spike-reactive or	To evaluate antibody reactivity and neutralization	Beta, Gamma	Regardless of prior infection status, vaccination elicited antibodies that bound to SARS-CoV-2 spike proteins,

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		21 days after participants had received second dose	nal Medicine			workers [HCWs])		virus- neutralizing antibodies against lineage A and B.1.351 virus	potency in serum samples collected from individuals who received the BNT162b2 SARS-CoV- 2 vaccine with or without a prior history of infection		including spike proteins from variants of concern. However, prior infection further enhanced anti-spike protein antibody responses against variants.
<b>Vignals 2021</b> <sup>80</sup>	30-Aug-21	Aug - Dec 2021	medRxiv [preprint]	Modelling	FRA	Community	N/A	Number of cases, severe infections, ICU hospitalizati ons	To estimate if barrier gestures (i.e., public health measures) can be relaxed without causing a resurgence of severe infections	Alpha, Beta, Gamm a, Delta	Maintaining application of barrier gestures appears essential to avoid a resurgence of severe infections that would exceed health care capacities, while surmounting vaccine hesitancy represents the key to consider their relaxation.
<b>Wang 2021</b> <sup>81</sup>	05-09-21	N/A	medRxiv [preprint]	Laborator y	CHN	Community	66	Level of humoral immune response	To evaluate the nature of humoral immune response elicited by a booster dose of CoronaVac and to compare humoral immune responses elicited against circulating SARS-CoV-2 variants	Alpha, Beta, Gamm a, Delta	A third-dose booster of inactivated vaccine can elicit an expeditious, robust and long-lasting recall humoral response which continues to evolve with ongoing accumulation of somatic mutations, emergence of new clones and increasing affinities of antibodies to antigens, conferring enhanced neutralizing potency and breadth.
<b>Woodhou se 2021</b> <sup>82</sup>	02-09-21	Used data from fall 2020 to model outcomes for fall 2021	medRxiv [preprint]	Modelling	UK	Schools	N/A	Infection prevalence and incidence rate	To compare the effects of different mitigation strategies on infection transmission rates within schools	Delta	Testing-based surveillance of infections in the classroom population with isolation of positive cases is a more effective mitigation measure than bubble quarantine both for reducing transmission in schools and for avoiding pupil absence. Maintaining reduced contact rate has a major beneficial impact for managing Covid-19 in school settings.
<b>Wu 2021</b> <sup>83</sup>	27-09-21	Not reported	medRxiv [preprint]	Modelling	CAD	Community	N/A	Attack ratio	To estimate the attack ratio of COVID- 19 among children (0- 11 years) when a large proportion of eligible population is vaccinated (age 12+)	Delta	With the increased transmissibility of the Delta variant, a reduction from 12.73 to 10 contacts per day within the vaccine-eligible population in Ontario is necessary to avoid an outbreak sustained by the vaccine- eligible population due to lower

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									and other NPIs are in place		vaccine coverage or vaccine efficiency against infection.
<b>Yinon 2021</b> <sup>84</sup>	31-08-21	July 30 to August 22, 2021	medRxiv [preprint]	Cohort study	ISR	Community	No booster = 4,018,929 persons days; booster = 3,351,598 persons days	Infection (confirmed, i.e., PCR positivity), severe illness	To estimate the reduction in relative risk for confirmed infection and severe COVID-19 provided by the booster dose.	Delta	The booster dose of the BNT162b2 (Pfizer) vaccine is highly effective in reducing the risk of both confirmed infection and severe illness.
<b>Yorsaeng 2021</b> <sup>85</sup>	21-09-21	June and July 2021	medRxiv [preprint]	Cohort study	THA	Community	549	Immunological (humoral) response to vaccination, and neutralizing activity against the wild type and all VOC	To characterize the increase in immune response and neutralizing antibody induced by heterologous vaccination with AZD1222 in HCWs who were previously fully vaccinated with CoronaVac.	Alpha, Beta, Delta	A three-dose heterologous regimen, two initial CoronaVac followed with a third AZD1222 vaccine, indicated a strong immunological response. Sera samples from booster dose vaccine recipients elicited higher neutralizing activity against the wild type and all variants of concern than those in the recipients of the two-dose CoronaVac and AZD1222 vaccines.
<b>INCLUDED STUDIES FROM JULY 14 TO AUGUST 25, 2021 (N=30)</b>											
<b>Adenaiye 2021</b> <sup>86</sup>	13-Aug-21	May 2020 to Apr 2021	medRxiv [preprint]	Observational	USA	Community	61	Amount of RNA exhaled in alpha variant infection; face mask efficacy	Examine impact alpha variant has on aerosol shedding and the efficacy of face masks as a source of control	Alpha	Face masks provided significant protection against infectious aerosols, indicating importance of community wide masking in the prevention of virus transmission.
<b>Amirthalingam 2021</b> <sup>87</sup>	28-Jul-21	Jan to May 2021	medRxiv [preprint]	Observational	UK	Primary care networks	750	Antibody responses	Compare serological response to vaccination with different intervals in between doses	Alpha & Delta	Prioritizing the first dose of vaccine was supported, as the evidence suggested that there was higher protection on extended vaccination schedules.

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<b>Aruffo 2021</b> <sup>88</sup>	13-Aug-21	Dec 28 <sup>th</sup> 2020 to May 19 <sup>th</sup> 2021	medRxiv [preprint]	Modelling	CAD	Community	N/A	Impact of lifting NPIs on dates of cases, hospitalizations, and deaths	Determine the optimal strategy to lifting NPIs	Alpha	Efforts should be directed towards individuals ages 20-59. NPIs should be considered when reopening, as a complete reopening lacking NPIs would result in substantial spread of the virus, regardless of vaccination coverage.
<b>Arumuru 2021</b> <sup>89</sup>	21-Jul-21	NR	Physics of Fluids	Laboratory	IND	Community	NR	Leakage of droplets from various masks and mask combinations	Determine optimal masking strategies	Alpha, Beta & Gamma	Double masking is effective in improving mask fitment and protection. The most effective combination was cotton mask with N95 mask.
<b>Bablani 2021</b> <sup>90</sup>	21-Aug-21	NR	medRxiv [preprint]	Modelling	AUS	Community	N/A	Determine number of cases, hospitalizations and deaths 100 days after Aug 1	Estimate length of time for cases to reach less than five per day, under various lockdown strategies	Delta	Accelerating vaccine rollout is important to making the population more resilient to outbreaks. Until vaccination coverage is at an effective level, the strength of lockdowns, public health and social measures which will have the largest impact on preventing COVID-19 hospitalizations and deaths.
<b>Cazelles 2021</b> <sup>91</sup>	03-Aug-21	June 2020 to March 25 <sup>th</sup> 2021	BMC Infectious Diseases	Modelling	IRL	Community	N/A	Observed daily infections, hospital and ICU admissions, daily deaths, and hospital discharges and cases	Examine the dynamics of COVID-19 in Ireland using public data	Alpha	Sharp decline of cases seems to be the result of mitigation measures, when in the presence of the Alpha variant.
<b>Chang 2021</b> <sup>92</sup>	10-Aug-21	June to July 2021	Research Square [preprint]	Modelling	AUS	Community	N/A	Agent based modelled tested the adequacy of outbreak control measures	Calibrate R0 of the Delta variant, and using the model, NPIs are investigated for feasibility in virus control. Outbreak suppression	Delta	Current social distancing requirements are not adequate for control. With 80% compliance, and month will be needed to control case numbers.

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									conditions are quantified.		
<b>Colosi 2021</b> <sup>93</sup>	21-Aug-21	Mar 8 <sup>th</sup> – Jun 7 <sup>th</sup> 2021	medRxiv [preprint]	Modelling	FRA	Schools	683 schools	Empirical contact data: examination of screening protocols was used to perform a cost-benefit analysis for varying scenarios	Model transmission of COVID-19 in schools	Delta	COVID-19 will still pose a risk to the safe opening of schools. Vaccination coverage of adolescents should be increased, and regular testing should be prioritized.
<b>Contreras 2020</b> <sup>94</sup>	25-Aug-21	Feb 2021	medRxiv [preprint]	Modelling	EU	Community	N/A	Effectiveness of NPIs, spreading dynamics	Model a stable equilibrium at low case numbers, where test-trace-and-isolate policies compensate for local spreading events and only moderate restrictions remain	Alpha	A lockdown and regain control over the spread of COVID-19, vaccination helps mitigate VOCs. In the future, immunization, large scale testing and international coordination will further facilitate virus control.
<b>Dick 2021</b> <sup>95</sup>	24-Aug-21	Data up to Jun 27 <sup>th</sup> , 2021, projections to Mar 2022	medRxiv [preprint]	Modelling	CAD	Community	N/A	Distribution of immunity in the Canadian population, by age, from infection and from vaccination.	Estimate the distribution of immunity to COVID-19 in the Canadian population, and determine the risk of resurgence in Fall 2021-Winter 2022.	Delta	Model predicts 60-80% of population will have some immunity to COVID-19 by the end of the vaccination campaign. Population is vulnerable to resurgence of virus because of the relaxation of NPIs and the reopening of schools.
<b>Enright 2021</b> <sup>96</sup>	04-Aug-21	Sep 2020 to Dec 2020	Royal Society Open Science	Modelling	UK	Universities	N/A	Contributing factors to within-institution spread	Summarize the understanding of COVID-19 patterns from Fall 2020 and explore strategies for the safe return of students in the future	Alpha	Residences with higher populations posed a greater risk of higher transmission. The proposal of staggering the return of students was not successful in reducing transmission. Adherence to testing and self-isolation is modelled to be much more effective in reducing transmission.

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<b>España 2021</b> <sup>97</sup>	07-Sep-21	NR	medRxiv [preprint]	Modelling	COL	Community	N/A	Time-varying trends of cases and deaths; population based seroprevalence data	Explore the impact of circulating VOCs	Alpha, Beta & Gamma	COVID-19 in the city could be explained by higher mobility and higher number of social contacts. A preferred strategy to mitigation is maintaining moderate levels of social mixing, combined with a rapid increase in vaccination rates.
<b>Giardina 2021</b> <sup>98</sup>	07-Aug-21	N/A	medRxiv [preprint]	Modelling	USA	Schools	N/A	Agent-based dynamic transmission model	Evaluate the probability of in-school transmission and the increase of infections	Alpha & Delta	The risk of transmission between students and their households remains high. Mitigation measures and student vaccinations can reduce these risks significantly.
<b>Gorji 2021</b> <sup>99</sup>	16-Jul-21	Feb to Mar 2021	medRxiv [preprint]	Observational	CHE	Community	27514 employees	Mass testing campaign relying on voluntary repetitive testing	Provide empirical evidence that repetitive mass testing can be effective in preventing the spread of COVID-19	Alpha & Beta	Applying a mass testing strategy can prevent the spread of COVID-19. Program should consider and try to control for the population outside of the program.
<b>Head 2021</b> <sup>100</sup>	23-Aug-21	Feb to Apr 2021	medRxiv [preprint]	Modelling	USA	Schools	N/A	Individual based transmission model to simulate Delta variant transmission, to examine school reopening policies	Characterize the risks to students and teachers in schools under various scenarios (varying NPIs and vaccination coverage)	Delta	Vaccination of adult community members can protect unvaccinated elementary school students. Schools can have low risks with high community vaccination levels and universal masking. If schools support additional measures such as cohorts and testing, they should consider doing so.
<b>Hillus 2021</b> <sup>101</sup>	13-Aug-21	Dec 27, 2020 - June 14, 2021	The Lancet Respiratory Medicine	Observational	DEU	Community (population: healthcare workers)	380 participants	Reactogenicity (by use of electronic questionnaires); immunogenicity (by the presence of	To assess the reactogenicity and immunogenicity of heterologous immunizations with homologous ChAdOx1 nCov-19 or heterologous	Alpha & Beta	The heterologous ChAdOx1 nCov-19–BNT162b2 immunization with 10–12-week interval, recommended in Germany, is well tolerated and improves immunogenicity compared with homologous ChAdOx1 nCov-19 vaccination with 10–12-week interval and BNT162b2 vaccination with 3-



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								SARS-CoV-2-specific antibodies, an RBD-ACE2 binding inhibition assay, a pseudovirus neutralisation assay and anti-S1-IgG avidity); T-cell reactivity (by IFN- $\gamma$ release assay)	ChAdOx1 nCov-19-BNT162b2 vaccination with a 10-12-week vaccine interval or homologous BNT162b2 vaccination with a 3-week vaccine interval		week interval. Heterologous prime-boost immunization strategies for COVID-19 might be generally applicable.
<b>Karaba 2021</b> <sup>102</sup>	14-Aug-21	Blood samples submitted 0-4 weeks before third dose and 2 weeks after	medRxiv [preprint]	Observational	USA	Community (particularly solid organ transplant recipients [SOTRs])	31 SOTRs	Pre and post-third dose samples of recipients were compared for immunogenicity	Investigate the efficacy of third-dose vaccinations in organ transplant recipients	Delta	A third dose of the vaccine showed an increase of antibody levels as well as neutralizing abilities against VOCs in some organ transplant recipients.
<b>Koslow 2021</b> <sup>103</sup>	14-Jul-21	June to August 2021 (90-day period beginning June 6, 2021)	medRxiv [preprint]	Modelling	DEU	Community	N/A	Effects of non-pharmaceutical interventions in Germany, age-dependent factors and commuting activities between regions;	To analyze different strategies for removing the restrictions of non pharmaceutical interventions that were in effect during the SARS-CoV-2 pandemic, while accounting for the new Delta variant and the ongoing vaccination process	Alpha & Delta	At the current rate of vaccination, there is still a great risk of another wave of infections if NPIs are lifted too early. The severity of these infections will be significantly reduced compared to previous waves due to the prioritization of the older population during the vaccination process. In all scenarios, rising infection numbers will hit school children the hardest. A key role will be played by the duration of immunity conferred by the licensed vaccines.

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								vaccination process; timing of return to pre-pandemic contacts and suspension of mask wearing and testing			
<b>Krueger 2021</b> <sup>104</sup>	18-Jul-21	Not reported	medRxiv [preprint]	Modelling	FRA, UK	Community	N/A	Vaccine effectiveness, re-vaccination rate, waning immunity	To illustrate vaccination dynamics and possible different restrictions for VP holders in relation to the Alpha & Delta variants	Alpha & Delta	Risk of virus resurgence is higher with the introduction of vaccine passports and exempting holders from wearing masks and testing. Resurgence (particularly Delta-driven) can be mediated with high restrictions for the general population and small-moderate restrictions for holders. Public health measures flexibility is favored in a model where there is high vaccine effectiveness, low number of never-vaccinated, high re-vaccination rate, slowly waning immunity, and proportional social mixing
<b>Layton 2021</b> <sup>105</sup>	12-Aug-21	January 1, 2020, to December 31, 2021 (projections)	Research Square [preprint]	Modelling	CAD	Community	N/A	Dynamics and interactions of 3 SARS-CoV-2 strains, including (i) asymptomatic and symptomatic infections, (ii) two-dose vaccinations with variable	To develop and apply a much expanded Susceptible-Infection-Recovered-type model to better understand to what extent the competition and interaction of VOC impact the spread of SARS-CoV-2	Alpha & Delta	In addition to infectivity, the extent of the NPI, and vaccination rate, factors that determine how fast COVID-19 spreads include: the prevalence of asymptomatic infections; enhanced infectivity of asymptomatic patients; fraction of the population who are vaccinated; types of vaccines distributed; and contextual differences between countries/regions. Both simultaneous and rapid deployment of pharmaceutical and NPI are needed to combat a dangerous VOC.

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								dosing intervals, (iii) effects of NPI			
<b>Liu 2021</b> <sup>106</sup>	23-Jul-21	Vaccination capacity data up to May 23, 2021	medRxiv [preprint]	Modelling	CHN	Community	N/A	Herd immunity under three scenarios	To evaluate the feasibility of reaching herd immunity against SARS-CoV-2 through vaccination, considering heterogeneity in population age, age-specific patterns, vaccine efficacy and virus plus variants characteristics	Alpha, Beta, Gamma, Delta	Reaching herd immunity is challenging; authorizing vaccines for children is essential; highly efficacious vaccines in particular against the variants is necessary; despite all, vaccination is paramount to pandemic control.
<b>Marziano 2021</b> <sup>107</sup>	19-May-21	Daily vaccination supply estimates cover each quarter of 2021 and first half of 2022	medRxiv [preprint]	Modelling	ITA	Community	N/A	Fraction of individuals recovered (and immune) from SARS-CoV-2 infection; age-specific vaccination rates over time; COVID-19-related deaths; alternative prioritization orders for vaccination; vaccine coverage; duration of vaccine protection; incidence level of	To simulate the effect of a vaccine rollout assuming that governments will be capable to maintain an approximately constant incidence by adjusting physical distancing restrictions as immunity accumulates.	Alpha	The combination of vaccine roll-out and effective mitigation strategies is expected to prevent a large proportion of deaths while at the same time allowing a progressive lifting of physical distancing restrictions. A complete return to a pre-pandemic lifestyle can be expected between 9 and 15 months since the start of vaccination, only if a number of conditions are simultaneously met.

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								reported cases; vaccine efficacy			
<b>Paassen 2021</b> <sup>108</sup>	22/Jul/21	Not reported	medRxiv [preprint]	Modelling	DEU	Community (Workplace)	N/A	Testing strategies, isolation and quarantine management; these are combined to develop a novel risk strategy	To develop and present epidemiologic modelling that calculates infection risks and the expected success of the measures across virus generations and that allows for a differentiated risk analysis for contact persons based on the day-dependent infectivity	Alpha	Public health measures implemented in workplaces can be effective, particularly combined measures (isolation, quarantine, symptom monitoring, testing) compared to single measures. It is imperative to implement measures early.
<b>Panovska-Griffiths 2021</b> <sup>109</sup>	22/Jul/21	Model was calibrated until January 25, 2021, to simulate the impact of a full national lockdown with schools closed until April 19, 2021	medRxiv [preprint]	Modelling	UK	Community	N/A	Cumulative diagnoses, cumulative deaths and cumulative hospital admissions under various partial and full lockdown scenarios, accompanied by social distancing and ongoing Test, Trace and Isolate intervention	To use mathematical modelling to simulate the impact of a full national lockdown (FNL) in England from January 4, 2021 compared to partial national lockdowns (PNL) in which some elements of in-person schooling remained open	Alpha	The strict social distancing measures, i.e. national lockdown, imposed from January 2021 with schools closed was likely to have been successful in suppressing the wave of COVID-19 cases that emerged towards the end of 2020. Continued epidemic control was achievable even with cautious reopening of schools from March 8, 2021 whilst continuing the vaccination efforts initiated from December 2020. It is important to effectively roll out a mass vaccination strategy during lockdowns.
<b>Plan 2021</b> <sup>110</sup>	5-Aug-21	From beginning of pandemic	medRxiv [preprint]	Modelling	VNM	Community	N/A	Total number of confirmed	To examine the temporal aspects of the lockdown in Ho	Delta	An earlier lockdown is always advised as this avoids the exponential increase in the number of cases. Moreover, a

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		until June 27, 2021						cases; rate of transmission (as a function of the mobility of people) and infection; effects of containment measures such as lockdown severity and temporal aspects of lockdown and isolation and testing strategies	Chi Minh City and predict the progress of the outbreak in terms of the total number of confirmed cases		lockdown duration of at least 3 weeks is ideal as there are noticeable improvements compared to a 15-day lockdown - there could be half as many cases had the inevitable lockdown started a week earlier.
Si 2021 <sup>111</sup>	21-Jul-21	Mar 1 - 21, 2021	Frontiers in Public Health - Health Economics	Observational	CHN	Community	4,540 participants	Participants' health-protective measures, that is, wearing masks, handwashing, and keeping physical distance	To analyze the impact of vaccination against COVID-19 on participants' attitudes toward protective countermeasures	Alpha, Beta, Gamma, Delta	Vaccination lessened participants' frequency of hand washing by 1.75 times and their compliance frequency intensity of observing physical distancing by 1.24 times. However, the rate of mask-wearing did not reduce significantly. A reduction in the frequency of hand washing and observing physical distance could cause a resurgence of COVID-19. Participants' gender, age, education level, individual health risk perception, public health risk perception, social responsibility, peer effect, and government supervision are the main factors affecting their vaccination choice. However, cultural roots and accessibility to health-protection products do not significantly influence participants' vaccination intention.

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<b>Susswein 2021</b> <sup>112</sup>	10-Aug-21	Not reported	medRxiv [preprint]	Modelling	USA	Community	N/A	Transmission dynamics and spatial mobility data	To demonstrate the roles of within-community contact versus between-community mobility in transmission risk, the role of natural versus vaccine-induced immunity in structuring the susceptibility landscape, the variable impact of potential variant mutations on disease dynamics, and the influence of altering each of these mechanisms in the effectiveness of public health intervention	Alpha, Delta	Regional mobility networks drive patterns of COVID-19 transmission throughout the United States. The COVID-19 pandemic in the US is characterized by a geographically localized mosaic of transmission along an urban-rural gradient, with many outbreaks sustained by between-county transmission. There is a dynamic tension between the spatial scale of public health interventions and population susceptibility as pre-pandemic contact is resumed. Due to spatial connectivity, certain regions are rendered particularly at risk from invasion by variants of concern.
<b>Tran Kiem 2021</b> <sup>113</sup>	14-Jul-21	September 1 <sup>st</sup> , 2021, to April 1 <sup>st</sup> , 2022	EClinicalMedicine	Modelling	FRA	Community	N/A	Risk of severe disease by age and comorbidity and transmission dynamics	To understand how vaccine characteristics, levels of vaccine coverage and heterogeneities in individual risks may affect the impact of vaccination in the short and medium term, using France as a case study	Alpha	Prioritizing at-risk individuals reduces morbi-mortality the most if vaccines only reduce severity, but is of less importance if vaccines also substantially reduce infectivity or susceptibility. Age is the most important factor to consider for prioritization; additionally accounting for comorbidities increases the performance of the campaign in a context of scarce resources.
<b>Vie 2021</b> <sup>114</sup>	26-Mar-21	Not reported	arXiv [preprint]	Modelling	Globally	Community	N/A	Emergence of more contagious variants using genetic algorithms (GAs); policy measures	To examine the phenomenon of coevolution with COVID-19 variants and evaluate the impact of policy interventions over the evolution of the viruses	Alpha	Under coevolution, virus adaptation towards more infectious variants is considerably faster than when the virus evolves against a static policy. More contagious strains become dominant much faster in the virus population under coevolution. Seeing more infectious virus variants becoming dominant may signify that

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								aiming at minimizing infection rates in the population; how they competitively evolve			the policy measures are effective. Seeing more infectious virus variants becoming dominant may signify that the policy measures are effective.
<b>Zhang 2021</b> <sup>115</sup>	3-Sep-21	Not reported	medRxiv [preprint]	Modelling	USA	Schools (K - 12)	N/A	Number of infections	To estimate the number of new infections during one semester among a student population under different assumptions about mask usage, routine testing, and levels of incoming protection.	Delta	Without interventions in place (testing & masking), the vast majority of susceptible students ( $\geq 75\%$ ) will become infected through the semester. Universal masking can reduce student infections by 26-78% (dependent upon incoming protection), and biweekly testing along with masking reduces infections by another 50%.
<b>INCLUDED STUDIES FROM MAY 11 TO JULY 14, 2021 (N=31)</b>											
<b>Adeyinka 2021</b> <sup>116</sup>	05-Jul-21	Jan 3 <sup>rd</sup> to Feb 6 <sup>th</sup> 2020 & Jan 1 <sup>st</sup> to Jun 15 <sup>th</sup> 2021	medRxiv [preprint]	Modelling	CAD	Community	NR	Prevalence of VOC, vaccination data & public health measures	Examine clustering patterns of COVID-19 public health efforts & cluster differences in prevalence of VOC in Canada	Alpha, Beta, Gamma & Delta	Public health measures varied greatly across provinces, indicating the importance for increasing the number of fully vaccinated individuals
<b>Aubrey 2021</b> <sup>117</sup>	21-Jun-21	July 15 <sup>th</sup> 2020 to Feb 15 <sup>th</sup> 2021	medRxiv [preprint]	Surveillance	PYF	Community	59,490 individual self-collected samples	Number of positive SARS-CoV-2 cases	Reduce the importation of SARS COV-2 into French Polynesia through travel	Alpha	Self-collection & pooling proved to be a low resource-intensive approach to testing, while still effectively detecting VOC
<b>Berec 2021</b> <sup>118</sup>	05-Jul-21	Aug 31 <sup>st</sup> 2020 to Jun 30 <sup>th</sup> 2021	medRxiv [preprint]	Modelling	CZE	Community	N/A	COVID-19 related deaths	Determine whether delaying the 2 <sup>nd</sup> vaccine dose from 21 to 42 days is advantageous	Alpha	A 2 <sup>nd</sup> dose at 21 days is advantageous when vaccine supply is sufficient & epidemic is mild, while a 2 <sup>nd</sup> dose at 42 days is advantageous when vaccine supply is insufficient & epidemic is severe

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<b>Betti 2021</b> <sup>119</sup>	03-Jun-21	Dec 12 <sup>th</sup> 2020 to May 7 <sup>th</sup> 2021	Vaccines	Modelling	CAD	Community	N/A	Number of positive SARS-CoV-2 cases	Predict when new variants overtake the wildtype during an outbreak	Alpha	Due to current underreporting of COVID-19 cases, it is estimated that a VOC wouldn't become dominant until March/April 2021. Therefore, NPIs should be maintained in ON along with vaccination to prevent further outbreaks.
<b>Bilinski 2021</b> <sup>120</sup>	10-Aug-21	N/A	medRxiv [preprint]	Modelling	USA	Schools	N/A	30-day cumulative incidence of SARS-CoV-2 infection; proportion of cases detected; proportion of planned and unplanned days out of school; cost of testing programs and childcare costs	Identify the costs and benefits of testing strategies to reduce the infection risks of full-time in-person K-8 education at different levels of community incidence	Delta	"Test to stay" policies and/or screening tests can facilitate consistent in-person school attendance with low transmission risk across a range of community incidence. Surveillance may be a useful reduced-cost option for detecting outbreaks and identifying school environments that may benefit from increased mitigation.
<b>Borchering 2021</b> <sup>121</sup>	14-May-21	Mar 27 <sup>th</sup> 2021	CDC MMWR	Modelling	USA	Community	n/a	Weekly reported cases, hospitalizations & deaths	Provide COVID-19 projections in the US over 6 months	Alpha	High vaccination coverage & moderate NPI adherence would allow hospitalizations & deaths to remain low, with a projected decline in cases by July 2021. Lower NPI adherence would lead to increases in severe COVID-19 outcomes, even with enhanced vaccination coverage.
<b>Bowie 2021</b> <sup>122</sup>	10-Jun-21	Jun 1 <sup>st</sup> 2021	medRxiv [preprint]	Modelling	UK	Community	n/a	Incidence, death rate & reproductive ratio	Determine whether an effective find, test, trace, isolate & support (FTTIS) system would be helpful in the UK with low case numbers, moderate	Delta	An improved FTTIS system could help prevent a 3 <sup>rd</sup> wave caused by VOC



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									immunization levels & a circulating VOC		
<b>Braun 2021</b> <sup>123</sup>	15-Jun-21	Jan to Mar 2021	International Journal of Clinical Pharmacology & Therapeutics	Modelling	DEU	Community	N/A	Daily number of newly infectious persons, total number of infected persons & occupancy of ICU	Model the epidemiological effect of vaccination in relation to the presence of Alpha in Germany	Alpha	Daily number of new infections, total number of infections & ICU occupancy is directly related to the speed of vaccine rollout amongst the population
<b>Chen 2021</b> <sup>124</sup>	15-Jun-21	Nov 1 <sup>st</sup> 2020 to Jan 20 <sup>th</sup> 2021	SSRN The Lancet [preprint]	Observational	UK	Community	41,341 type 1 groups comprising 160,600 backward events available for analysis	SGTF prevalence (proxy for Alpha)	Estimate COVID-19 transmission risk, including Alpha, across community settings in Engl&	Alpha	Highest risk of transmission associated with personal services (e.g. hairdressers), visiting friends/relatives & daycare/educational settings. Transmission risk depends on environmental factors with higher risk in certain settings likely associated with single source transmission or indoor environments.
<b>Conn 2021</b> <sup>125</sup>	22-May-21	3 data-sets: Jun 12 <sup>th</sup> to Nov 13 <sup>th</sup> 2020; Nov 14 <sup>th</sup> 2020 to Mar 24 <sup>th</sup> 2021; & Mar 2020 to May 12 <sup>th</sup> 2021	medRxiv [preprint]	Modelling	UK	Community	N/A	Reproduction number, daily infections & daily deaths	Estimate reproduction numbers & transmission rate of Alpha to assess the UK's re-opening plan in relation to vaccine rollout	Alpha	Number of daily cases are predicted to increase as NPIs are lifted in May & Jun 2021. A further significant increase in cases is predicted with a reduced uptake of vaccination by eligible individuals.
<b>Domenico 2021</b> <sup>126</sup>	16-May-21	Mar 2020 to Apr 2021	medRxiv [preprint]	Modelling	FRA	Community	N/A	Number of cases of SARS-CoV-2	Compare various intervention scenarios to examine adherence to &	Alpha	An estimated increase in cases predicted for May & Jun 2021 as NPIs are lifted. Moderate NPIs should be in place for extended time to achieve

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									sustainability of epidemic control		similar results as high intensity lockdowns. Short & strict lockdowns perform better than longer moderate lockdowns due to waning adherence of lockdown measures.
<b>Dimeglio 2021</b> <sup>48</sup>	12-May-21	Feb 5 <sup>th</sup> to 12 <sup>th</sup> 2021 & Mar 5 <sup>th</sup> to 12 <sup>th</sup> 2021	Viruses	Modelling	FRA	Community	N/A	Number of new daily SARS-CoV-2 cases	Estimate transmission dynamics of SARS-CoV-2 in Toulouse, France in the presence of VOC & in relation to public health measures, including vaccination rollout .	Alpha	Alpha became dominant in Feb 2021, which indicates its capacity to adapt to new hosts. Its transmission dynamics suggest that the public health measures are effective against Alpha in contrast to some reports
<b>Du 2021</b> <sup>128</sup>	01-Jul-21	NA	SSRN The Lancet [preprint]	Modelling	USA	Community	N/A	Testing strategies & number of positive SARS-CoV-2 cases	Assess the economic impact of proactive testing strategies versus different transmission scenarios of SARS-CoV-2	Alpha, Beta, Gamma & Delta	Modelling suggests daily testing is needed for confirmed cases when population immunity is low & weekly testing when immunity is high. As transmission rate increases in the population, testing becomes more economical.
<b>Jaya-sundara 2021</b> <sup>129</sup>	07-Jul-21	N/A	medRxiv [preprint]	Modelling	MYS	Community	N/A	Number of SARS-CoV-2 cases	Predict the impact of vaccine rollout on controlling the spread of SARS-CoV-2 in relation to various public health response scenarios in Malaysia	Alpha, Beta & Delta	Under current vaccination rollout, lifting all NPIs would lead to a surge in cases. VOC are estimated to be responsible for the current resurgence in case numbers & therefore, rapid vaccine rollout is necessary to mitigate the spread of SARS-CoV-2, along with continuation of NPIs
<b>Lane 2021</b> <sup>130</sup>	09-Jul-21	Jan 25 <sup>th</sup> 2020 to Jan 31 <sup>st</sup> 2021	Lancet Public Health	Observational	AUS	Community	20 451 cases of COVID-19	Genomic analyses & associated case clusters	Explore the role of genomic epidemiology in mitigating COVID-19 outbreaks in Australia	Alpha	Swift & comprehensive quarantine & public health measures are effective at mitigating COVID-19 outbreaks, even with high viral growth rates. Real-time genomic analysis surveillance is a useful public health tool
<b>Li 2021</b> <sup>131</sup>	27-Jun-21	Mar 1 <sup>st</sup> 2020 to May 31 <sup>st</sup> 2021 & Dec 13 <sup>th</sup> 2020 to May 31 <sup>st</sup> 2021	medRxiv [preprint]	Modelling	USA	Community	N/A	Number of wildtype & Alpha cases	Estimate the transmission dynamics of wildtype & VOC SARS-CoV-2 in	Alpha	Current vaccines are effective against the alpha variant, & 70% coverage would be sufficient protection, to allow for social activities to resume

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									relation to vaccine coverage in the US		
<b>Loenenbach 2021</b> <sup>132</sup>	2027-05-21	Jan to Feb 2021	Euro-surveillance	Observational	DEU	Childcare centres	3 outbreaks	Secondary attack rate	Investigate childcare center outbreaks & assess secondary attack rate within centers & associated households	Alpha	Evidence supports a higher transmissibility rate of alpha variant, & there are indications that it affects children at a higher rate. This highlights the need for NPIs
<b>Maison 2021</b> <sup>133</sup>	09-Jun-21	Apr 2 <sup>nd</sup> 2021	Research Square [preprint]	Observational	USA	Community	Alpha & Beta	Prevalence & origin of VOC in Hawai'i	Demonstrate a method to defining COVID-19 variants' lineages	Alpha, Beta, Gamma	Quarantine prevented VOC from entering Hawai'i. There would be benefit from a collective quarantine across various states rather than individual state quarantines
<b>Mancuso 2021</b> <sup>134</sup>	13-Jul-21	Jan 22 <sup>nd</sup> , 2020 to Mar 6 <sup>th</sup> , 2021	medRxiv [preprint]	Modelling	USA	Community	N/A	Vaccine effectiveness	Assess the impact of vaccination & vaccine-induced cross-protection against COVID-19 & the alpha variant	Alpha	Wide-scale vaccination & vaccine-induced cross protection is imperative to slowing the spread of COVID-19
<b>Moghadas 2021</b> <sup>135</sup>	08-Jul-21	Dec 12 <sup>th</sup> 2020 to Jun 28 <sup>th</sup> 2021	medRxiv [preprint]	Modelling	USA	Community	N/A	Case data in areas with different vaccination progress	Quantify impact of vaccination on cases	Alpha, Gamma & Delta	Vaccination program is highly effective in preventing COVID-19 cases. The speed of vaccination can have a very large impact on outbreak prevention, & increasing vaccination rates in areas which are underserved should be a priority
<b>Neuberger 2021</b> <sup>136</sup>	03-Jul-21	Aug 31 <sup>st</sup> 2020 to May 31 <sup>st</sup> 2021 & Ongoing	medRxiv [preprint]	Observational	DEU	Childcare centres	8,500 ECEC managers	Reported infections	Define risk determinants & understand difference in risk between children & adults	Alpha	Centers with children with lower socioeconomic status have a higher risk of infection, strict contact restrictions have shown to prevent infection
<b>Nielson 2021</b> <sup>137</sup>	06-Jul-21	NR	medRxiv [preprint]	Modelling	N/A	Community	N/A	Overdispersion & mean infectiousness of variants	Determine how overdispersion will affect the variant	Alpha	Overdispersion is evolutionarily unstable, & variants could become dominant
<b>Quilty 2021</b> <sup>138</sup>	14-Jun-21	NR	medRxiv [preprint]	Modelling	Global	Community	N/A	Proportion of infected travelers	Assess the effectiveness of quarantine & testing strategies for travelers	Alpha	Quarantine & strategic testing are effective methods in preventing transmission due to traveling

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<b>Quinonez 2021</b> <sup>139</sup>	17-May-21	Dec 2019 to Apr 2021	Viruses	Modelling	NA	Community	N/A	Estimates of VOC infection	Forecast the variant behaviour due to selective pressure	Alpha, Beta, Gamma & Delta	B.1.351, B.1.617, & P.1 variants have shown to escape vaccine induced immunity, indicating the potential need for a third dose of vaccination
<b>Sachak-Patwa 2021</b> <sup>140</sup>	02-Jun-21	Mar 12 <sup>th</sup> to Apr 11 <sup>th</sup> 2021 & Mar 22 <sup>nd</sup> to April 21 <sup>st</sup> 2021	Research Square [preprint]	Modelling	IMN & ISR	Community	N/A	Viral transmission	Assess the risk of virus outbreak upon the removal of NPIs & travel restrictions	Alpha	Upon lifting travel restrictions, surveillance of incoming passengers will be crucial to preventing outbreaks
<b>Salvatore 2021</b> <sup>141</sup>	30-June-21	March & April 2021	medRxiv [preprint]	Modelling	IND	Community	N/A	Number of deaths and case counts	To compare the second and first waves, nationally and across states and union territories, in terms of public health metric. Then, to investigate the extent to which the emergence and altered epidemiological properties of the SARS-CoV-2 Delta variant might have driven the surge in the observed case and death counts in the 2nd wave in India. Finally, to estimate the number of deaths that could have been averted through an early nationwide intervention (like a lockdown) at various time points in March and April 2021 during the onset of the second wave.	Delta	Using an extended SIR model accounting for reinfections and waning immunity, we produce evidence in support of how early public interventions in March 2021 would have helped to control transmission in the country. We argue that enhanced genomic surveillance along with constant assessment of risk associated with increased transmission is critical for pandemic responsiveness. [...] To summarize, had action taken place at any time in March, it is plausible that more than 90% of observed cases and deaths between March 1-May 15 could potentially be avoided under both strong and moderate intervention scenarios.
<b>Sanz-Leon 2021</b> <sup>142</sup>	08-Jul-21	Mar to May 2020 & Feb to Mar 2021	medRxiv [preprint]	Modelling	AUS	Community	N/A	Estimated transmission	Assess the risk of continued transmission with the	Alpha	A small group of people infected with variants with increased transmissibility could result in larger &

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								n of COVID-19	presence more transmissible variants		longer community transmission outbreaks
<b>Turner 2021</b> <sup>143</sup>	Jun-2021	Jan 2020 to May 2021	CESifo Working Papers	Modelling	OECD countries	Community	N/A	Reproduction number	Analyze the impact of a set of policies, & the importance of vaccination in relation to variants	Alpha, Beta, Gamma, Delta	Increased vaccination rates would provide economic relief due to fewer containment policies & lower infection rates
<b>Van Egeren 2021</b> <sup>144</sup>	18-May-21	N/A	medRxiv [preprint]	Modelling	USA	Community	N/A	Estimated transmission rates of VOC in presence of vaccines	To model the impact of vaccine-evading variants on the course of the COVID-19 pandemic in the presence of vaccines	Alpha, Beta, Gamma	Variants that are already present within the population may be capable of quickly defeating the vaccines as a public health intervention, a fatal flaw in strategies that emphasize rapid reopening before achieving control of SARS-CoV-2
<b>Yang 2021</b> <sup>145</sup>	25-Jun-21	Mar 2020 to May 2021	medRxiv [preprint]	Modelling	IND	Community	N/A	Number of infections, reported cases, & reported deaths	Understand the epidemiological characteristics & impact of the Delta variant	Delta	Case decline was most likely due to NPIs & weather conditions which negatively impacted SARS-CoV-2 transmission, rather than high population immunity
<b>Zou 2021</b> <sup>146</sup>	07-Jul-21	Jan 25 <sup>th</sup> 2020 to Mar 12 <sup>th</sup> 2021	medRxiv [preprint]	Modelling	AUS	Community	N/A	Effective reproduction number	Create a model to inform decision makers on suitable timing for public health measure implementation	Alpha, Delta	The number of cases which were reported on the day of public health measure implementation predicted the size of case outbreaks
<b>INCLUDED STUDIES FROM EARLIER RAPID REVIEW<sup>147</sup> (N=20)</b>											
<b>Ahn 2021</b> <sup>148</sup>	05-May-21	N/A	SSRN The Lancet [preprint]	Modelling	USA	Community	Not reported	Policies	To propose a multi-model optimization (MMO) framework that identifies policies that perform well across structurally distinct models, and we apply this to design 12-month COVID-19 containment strategies	Alpha	Considering the heterogeneity across states, we have determined the MMO policies for all 50 US states over a one-year period and estimated the associated outcomes. Under our optimal policy, we show that some states can be on the trajectory to the halfway normal or minimal response policies for most 2021, while we recommend a few states to spend a significant portion of the year in more restrictive interventions. We also find that the prevalence of highly infectious variants (e.g., Alpha) can

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											significantly increase the 12- month cost, which strongly supports the case for aggressive work to contain variants.
<b>Borges 2021</b> <sup>149</sup>	11-Mar-21	Dec 2020 to Feb 5, 2021	Eurosurveillance	Modelling	PRT	Community	3367 positive SGTF tests (proxy for Alpha) from Portuguese National Institute of Health	SGTF & SGTL test	To investigate the proportion of SGTF cases to gain insight on Alpha frequency and spread in Portugal	Alpha	After implementing public health measures, a decelerating trend was observed in proportion of SGTF/SGTL remaining below 50% in week 7 of 2021
<b>Bosetti 2021</b> <sup>150</sup>	23-Feb-21	N/A	HAL Archives	Modelling	FRA	Community	N/A	Hospitalization	To develop mathematical models and explore scenarios that help understand how the interplay of the key drivers of the pandemic (the variants, the vaccines and the control measures) will shape its dynamics for the coming months	Alpha	The current curfew and conditions appear sufficient to control the spread of the historical virus but not that of Alpha. With vaccination targeting those at higher risk of hospitalization, the burden on hospitals could quickly be alleviated. However, our assessment suggests that this effect may not be sufficient to compensate for the increased transmissibility of Alpha.
<b>Buchan 2021</b> <sup>151</sup>	05-Apr-21	Feb 7-27, 2021	medRxiv [preprint]	Observational	CAD	Community	5617 index cases and 3397 secondary cases	Household secondary attack rate 1-14 days after index case	To compare household secondary attack rates in those with VOC versus non-VOC index cases in Ontario	Alpha	Secondary attack rate 1.31 higher in VOC vs non-VOC in same household, further accentuated in asymptomatic (RR=1.91) and pre-symptomatic (RR=3.41) cases. Findings suggest need for aggressive public health measures physical distancing, masking, testing and contact tracing

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<b>Chudasma 2021</b> <sup>152</sup>	10-May-21	Oct 1 to Dec 15, 2020	Journal of Infection	Observational	UK	Community	57,382	Household outbreak	A comparative analysis of household clustering to provide a rapid assessment of transmissibility of this variant against other sequenced cases	Alpha	Analysis of national data has shown that Alpha cases were almost twice as likely to give rise to household clusters compared with wild type cases. Household exposures are high risk with passive surveillance demonstrating high attack rates, providing an important indicator of transmissibility as household exposures are unlikely to differ between cases infected with different variants and their contacts.
<b>Domenico 2021</b> <sup>153</sup>	14-Apr-21	Jan 7-8, 2021	medRxiv [preprint]	Modelling	FRA	Community	N/A	Estimated # cases of historical strain and VOC based on various social distancing measures using data from a large-scale genome sequencing initiative conducted in France	To assess the impact of implemented measures on two COVID strains (i.e., Alpha and wild type) through modeling	Alpha	Social distancing implemented in Jan 2021 would bring down the R of historical strain, however VOC would continue to increase. School holidays also slowed down dynamics. Accelerating vaccinations will help but won't be sufficient to stop the spread of the VOC, even with optimistic vaccination rates
<b>Giordano 2021</b> <sup>154</sup>	16-Apr-21	February 24, 2020, through March 26, 2021	Nature Medicine	Modelling	ITA	Community	N/A	Health care costs, death	To compare different vaccines campaign scenarios, varying SARS-CoV-2 profiles and NPI restriction	Alpha, Beta	Findings strongly advocate for NPI to remain in place during vaccine roll out until sufficient population immunity is reached. Pre-emptive NPI actions (close then open at low case #s) could drastically reduce hospitalizations and deaths
<b>Gurbaxani 2021</b> <sup>155</sup>	27-Apr-21	N/A	medRxiv [preprint]	Modelling	USA	Community	N/A	Effectiveness of mask wearing	To extend the model of Worby and Chang to use age-stratified social contact patterns for the general U.S.	Alpha	Showed the potential for substantial reduction in SARS-CoV-2 transmission, even with moderately effective masks, when they are worn consistently correctly (over the chin and covering nose and mouth) and/or per

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									population, and we analyzed the model both employing the measured face mask efficacy parameters for a variety of specific types of masks and for efficacy estimates that can act as benchmarks for evaluating these products		manufacturers' specifications by a large portion of the population.
<b>Kim 2021</b> <sup>156</sup>	13-Apr-21	Dec 14, 2020, to Mar 2, 2021	medRxiv [preprint]	Modelling	USA	Community	N/A	Evaluate the impact of each vaccine type using infection attack rate (IAR) as the main health outcome	To evaluate the trade-offs between speed of distribution vs. efficacy of multiple vaccines when variants emerge	Alpha, Beta	The speed of the vaccine distribution is a key factor to achieve low IAR levels, even though the vaccine may have high efficacy both before and after the variants emerge.
<b>Kühn 2021</b> <sup>157</sup>	26-Apr-21	N/A	medRxiv [preprint]	Modelling	DEU	Community	N/A	Effectiveness of lockdowns, measured by number of new cases	To provide viable strategies of careful opening of facilities in low-incidence regions without being affected by neighboring regions of substantially higher incidence.	Alpha	In order to keep the spread of the virus under control, strict regional lockdowns with minimum delay and commuter testing of at least twice a week are advisable.
<b>Linka 2021</b> <sup>158</sup>	27-Apr-21	N/A	medRxiv [preprint]	Modelling	USA	University campus	N/A	Effective reproduction number	To perform a retrospective study to evaluate the risks that would have been associated with the reopening of Stanford University in the spring, summer, and fall of 2020, and winter of 2021; and	Alpha, Beta	With no additional countermeasures, during the most affected quarter, the fall of 2020, there would have been 203 cases under baseline reproduction, compared to 4727 and 4256 cases for the Alpha and Beta variants. The results suggest that population mixing presents an increased risk for local outbreaks, especially with new and more



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									to explore the possible effect of variants on the overall disease dynamics		infectious variants emerging across the globe. Tight outbreak control through mandatory quarantine and test-trace-isolate strategies will be critical in successfully managing these local outbreak dynamics
<b>Meister 2021</b> <sup>159</sup>	16-May-21	N/A	Journal of Infectious Diseases	Laboratory	DEU	Community	N/A	Viral stability over 48hr (for testing different surfaces); viral infectivity (for testing effect of soap/ethanol); reduction of viral titers by end point dilution to calculate TCID50 values (to test susceptibility to heat)	To compare the surface stability of 3 SARS-CoV-2 strains, the preexisting variant (wild type) and the currently emerging Alpha and Beta variants on different surfaces and their sensitivity to heat, soap and ethanol	Alpha, Beta	The currently circulating VOC did not exhibit enhanced surface stability or differences in disinfection profiles indicating that current hygiene measures are sufficient and appropriate...Overall, our data support the application of currently recommended hygiene concepts to minimize the risk of Alpha and Beta transmission
<b>Munitz 2021</b> <sup>160</sup>	18-May-21	Dec 6, 2020, to Feb 10, 2021	Cell Reports Medicine	Modelling	ISR	Community; Nursing homes	N/A	SGTF data, reproduction number (Rt) & cycle threshold	To explore the transmission dynamics of the variant B.1.1.7 and to estimate the success of the above operations to mitigate the risk in the general population and in the elderly	Alpha	Israel's national vaccine program which initially targeted the elderly (60+ years) resulted in containment of Alpha in that population. By Jan 14th, 2021 when 50% of the 60+ were 2 weeks beyond their first dose of Pfizer vaccine, a striking decline was observed in the incidence of Alpha in the 60+ age group compared with 0-19 or 20-59 years of age (r=0.075, p=0.74; r=-0.005, p=0.98, respectively)
<b>Pageaud 2021</b> <sup>161</sup>	20-Mar-21	Santé publique	medRxiv [preprint]	Modelling	FRA	Community	N/A	# of individuals	To model the expected dynamics of	Alpha, Beta,	While rapid vaccination of the whole population within 6 months provides

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		France data from Jan 8 to 27, 2021, and Feb 18, 2021						recovered, # of in hospital deaths, ICU resource use	COVID-19 with variant strains applying protective measures and several vaccine strategies	Gamma	the best outcome, a one-year vaccination campaign with extended non-pharmaceutical interventions (i.e., public health measures) would limit the number of deaths and avoid ICU resource saturation
<b>Piantham 2021</b> <sup>162</sup>	30-Mar-21	Sep 1, 2020 to Feb 19, 2021	medRxiv [preprint]	Modelling	UK	Community	71692 Alpha strains and 65850 non-Alpha strains	Time from illness onset in a primary case to illness onset in secondary case (using serial interval distribution)	To propose a method to estimate selective advantage of mutant strain over previous strains	Alpha	Alpha has an estimated reproduction advantage of 33.7% over non-VOC, suggesting control measures need to be strengthened by 33.7%
<b>Sah 2021</b> <sup>163</sup>	07-Apr-21	N/A	Eclinical Medicine	Modelling	USA	Community	N/A	Transmission probability; Hospitalization (non-ICU and ICU)	To evaluate the impact of accelerated vaccine distribution on curbing the disease burden of novel SARS-CoV-2 variants	Alpha	The current pace of vaccine rollout is insufficient to prevent the exacerbation of the pandemic that will be attributable to the novel, more contagious SARS-CoV-2 variants. Accelerating the vaccination rate should be a public health priority for averting the expected surge in COVID-19 hospitalizations and deaths that would be associated with widespread dissemination of the SGTF variants.
<b>Scherbina 2021</b> <sup>164</sup>	20-Feb-21	N/A	SSRN The Lancet [preprint]	Modelling	USA	Community	N/A	Estimated future monetary cost of the pandemic	To estimate the benefits of a lockdown in the US similar to those imposed in Europe	Alpha	Modeling suggests strict lockdown could reduce R by 76%, or R0: 0.933. A less restrictive lockdown would lead to R0:1.66. Optimal lockdown time of 6-7 weeks is needed to achieve high-dQALY outcomes, or 4-5 weeks to meet low-dQALY outcomes
<b>Tokuda 2021</b> <sup>165</sup>	07-May-21	Jan 14 to Apr 20, 2021	medRxiv [preprint]	Modelling	JPN	Community	N/A	Number of new infections per day	To construct the COVID-19 epidemic curve to examine effect of vaccination schedules and need for restrictions (lockdown)	Alpha	If the vaccination pace could not be quadrupled from the current pace, Japan could not achieve Zero Covid status, which is reflected by a low COVID-19 death rate and less economic damage.

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<b>Victoria 2021</b> <sup>166</sup>	30-Apr-21	Weeks 1-14, 2021	medRxiv [preprint]	Observational	BRA	Community	370,000 registered deaths in Brazil	Mortality rate ratios over two-weekly periods in between Jan 3rd, 2021 and Apr 22nd, 2021 for individuals aged 80+ and 90+ years	To evaluate the real-life effectiveness of the vaccination campaign among the elderly in Brazil	Gamma	Rapid scale up of vaccination among elderly Brazilians in early 2021 was associated with a decline in relative mortality compared to younger individuals
<b>Zimmerman 2021</b> <sup>167</sup>	11-Mar-21	Jun 1, 2020 to Jan 10, 2021	Cureus	Modelling	BRA	Community	773 genomic sequence samples	Social isolation index (SII), which is based on percentage of individuals who stayed within 450m of their home	To assess whether social isolation into small families or groups is associated with the emergence of new variants	Gamma	In the state of Amazonas, where household sizes are large, there was a positive correlation between SII and the prevalence of Gamma when SII was above 40%. Authors hypothesize that forced prolonged cohabitation may boost viral mutation and increased infectivity.

ARG: Argentina; AUS: Australia; AUT: Austria; Brazil: BRA; CAD: Canada; CDC: Centres for Disease Control & Prevention; CHL: Chile; CHN: China; CZE: Czech Republic; DEU: Germany; FRA: France; HKG: Hong Kong; IND: India; ISR: Israel; IMN: Isle of Man; ITA: Italy; JPN: Japan; KOR: Korea; MMWR: morbidity & mortality weekly report; MYS: Malaysia; NA: North America; N/A: Not available; NPI: non-pharmaceutical intervention; PRT: Portugal; PRY: Paraguay; PYF: French Polynesia; SGP: Singapore; THA: Thailand; TWN: Taiwan; URY: Uruguay; USA: United States of America; UK: United Kingdom; VNM: Vietnam; VOC: variant/s of concern

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**Supplementary Table 2.** Critical appraisal results of included studies

Author, Year	Source	Preprint or Peer Review	Adjusted score for PP	Total Score (%)	Overall Quality
Cohort Studies Appraised with NOS Tool <sup>a</sup>					
Buchan, 2021 <sup>151</sup>	MedRxiv	PP	-2	6 (67)	Medium
Chudasama, 2021 <sup>152</sup>	Journal of Infection	PR	N/A	8 (89)	High
Cross-sectional Studies Appraised with NOS Tool <sup>b</sup>					
Victoria, 2021 <sup>166</sup>	MedRxiv	PP	-2	6 (60)	Medium
Cohort Studies Appraised with JBI Tool <sup>d</sup>					
Amirthalingam, 2021 <sup>87</sup>	MedRxiv	PP	-2	9 (81.8)	High
Atyeo, 2021 <sup>2</sup>	MedRxiv	PP	-2	7.5 (68.2)	High
Eyre, 2021 <sup>56</sup>	MedRxiv	PP	-2	7 (63.6)	Medium
Havervall, 2021 <sup>18</sup>	MedRxiv	PP	-2	8 (72.7)	High
Hillus, 2021 <sup>101</sup>	The Lancet: Respiratory Medicine	PR	N/A	11 (100)	High
Karaba, 2021 <sup>102</sup>	MedRxiv	PP	-2	7 (63.6)	Medium
Levine-Tiefenbrun, 2021 <sup>22</sup>	Nature Medicine	PR	N/A	9 (81.8)	High
Lv 2021 <sup>26</sup>	Journal of Travel Medicine	PR	N/A	5 (45.5)	Medium
Mahasirimongkol, 2021 <sup>27</sup>	MedRxiv	PP	-2	8.5 (77.3)	High
Naranbhai 2021 <sup>31</sup>	MedRxiv	PP	-2	8 (72.7)	High
Nordstrom, 2021 <sup>32</sup>	The Lancet Regional Health: Europe	PR	N/A	11 (100)	High
Payne, 2021 <sup>33</sup>	Cell	PR	N/A	11 (100)	High
Siedner, 2021 <sup>38</sup>	MedRxiv	PP	-2	6.5 (59.1)	Medium
Urbanowicz, 2021 <sup>79</sup>	Science Translational Medicine	PR	N/A	8 (72.7)	High

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Yinon, 2021 <sup>84</sup>	MedRxiv	PP	-2	8 (72.7)	High
Yorsaeng 2021 <sup>85</sup>	MedRxiv	PP	-2	4 (36.4)	Medium
Cross-sectional Studies Appraised with JBI Tool <sup>c</sup>					
Adenaiye, 2021 <sup>86</sup>	MedRxiv	PP	-2	3 (37.5)	Medium
Chen, 2021 <sup>8</sup>	Risk Management and Healthcare Policy	PR	N/A	5 (62.5)	Medium
Cheng 2021 <sup>9</sup>	The Lancet Regional Health: Western Pacific	PR	N/A	7 (87.5)	High
Neuberger, 2021 <sup>136</sup>	MedRxiv	PP	-2	3 (37.5)	Medium
Si, 2021 <sup>111</sup>	Frontiers in Public Health	PR	N/A	5 (62.5)	Medium
Yue, 2021 <sup>44</sup>	Emerging Microbes & Infections	PR	N/A	3.5 (43.8)	Medium
Prevalence Studies Appraised with JBI Tool <sup>a</sup>					
Gorji, 2021 <sup>99</sup>	MedRxiv	PP	-2	6 (66.6)	High
Lane, 2021 <sup>130</sup>	Lancet Public Health	PR	N/A	9 (100)	High
Loenenbach, 2021 <sup>132</sup>	Eurosurveillance	PR	N/A	9 (100)	High
Case Series Studies Appraised with JBI Tool <sup>c</sup>					
Ademoski, 2021 <sup>168</sup>	MedRxiv	PP	-2	2 (25)	Low
Doyle 2021 <sup>55</sup>	MMWR	PR*	-1	4 (44.4)	Medium
Hagan 2021 <sup>59</sup>	MMWR	PR*	-1	6 (66.6)	High
Lam-Hine 2021 <sup>61</sup>	MMWR	PR*	-1	4 (44.4)	Medium
Maison, 2021 <sup>133</sup>	Research Square	PP	-2	2 (25)	Low
Case Control Studies Appraised with JBI Tool <sup>b</sup>					
Abu-Raddad, 2021 <sup>45</sup>	Journal of Travel Medicine	PR	N/A	8 (80)	High
Barda 2021 <sup>3</sup>	The Lancet	PR	N/A	10 (100)	High
Patalon, 2021 <sup>71</sup>	MedRxiv	PP	-2	6 (60)	Medium
Skowronski 2021 <sup>39</sup>	MedRxiv	PP	-2	7.5 (75)	High

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Randomized Controlled Trial Studies Appraised with JBI Tool					
Atmar 2021 <sup>1</sup>	MedRxiv	PP	-2	4.5 (34.6)	Medium
Chu 2021 <sup>11</sup>	MedRxiv	PP	-2	10 (77)	High
Li 2021 <sup>25</sup>	MedRxiv	PP	-2	6.5 (50)	Medium
Mok 2021 <sup>30</sup>	MedRxiv	PP	-2	3.5 (27)	Low

<sup>a</sup>Total scores calculated out of 9; <sup>b</sup>Total score calculated out of 10; <sup>c</sup>Total score calculated out of 8; <sup>d</sup>Total score calculated out of 11; \*sources are not peer reviewed journal articles but have undergone some level of peer review

## Search Strategies

All searches last executed on August 25, 2021.

### MEDLINE (Ovid MEDLINE All)

COVID-19 search filter: CADTH <https://covid.cadth.ca/literature-searching-tools/cadth-covid-19-search-strings/>

1	(coronavirus/ or betacoronavirus/ or coronavirus infections/) & (disease outbreaks/ or epidemics/ or p&emics/)
2	(ncov* or 2019ncov or 19ncov or covid19* or covid or sars-cov-2 or sarscov-2 or sarscov2 or severe acute respiratory syndrome coronavirus 2 or severe acute respiratory syndrome corona virus 2).ti,ab,kf,nm,ot,ox,rx,px.
3	((new or novel or "19" or "2019" or wuhan or hubei or china or chinese) adj3 (coronavirus* or corona virus* or betacoronavirus* or CoV or HCoV)).ti,ab,kf,ot.
4	((coronavirus* or corona virus* or betacoronavirus*) adj3 (p&emic* or epidemic* or outbreak* or crisis)).ti,ab,kf,ot.
5	((wuhan or hubei) adj5 pneumonia).ti,ab,kf,ot.
6	or/1-5 [CADTH COVID-19 filter, no date limit]
7	((uk or united kingdom or engl& or english or britain or british or kent) adj3 (variant* or voc or vui)) or "b117" or "20i 501yv1" or "variant of concern 202012 01" or "voc 202012 01" or "variant under investigation in december 2020" or "variant under investigation 202012 01" or "vui 202012 01").ti,ab,kw,kf.
8	((south africa* or sa) adj3 (variant* or voc or vui)) or "b1351" or "501v2" or "501yv2" or "20h 501yv2" or "20c 501yv2").ti,ab,kw,kf.
9	((brazil* adj3 (variant* or voc or vui)) or "p1" or "b11281" or ((mutation* or spike*) adj3 (k417t or e484k or n501y))).ti,ab,kw,kf.
10	((mutation* or spike*) adj3 d614g).ti,ab,kw,kf.
11	((india* adj3 (variant* or voc or vui)) or "b1617*" or "g 452v3" or "voc 21apr" or "vui 21apr" or double mutation or double mutant or double variant or triple mutation or triple mutant or triple variant or ((mutation* or spike*) adj3 (e484q or l452r or p681r))).ti,ab,kw,kf.

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12	((alpha or beta or Gam-ma or delta) adj3 variant*).ti,ab,kw,kf.
13	or/7-12
14	6 & 13

### Embase (Elsevier Embase.com)

COVID-19 search filter: CADTH adapted to Embase.com format; line 1 exploded

1	'SARS-related coronavirus'/exp
2	('coronavirinae'/de OR 'betacoronavirus'/de OR 'coronavirus infection'/de) & ('epidemic'/de OR 'p&emic'/de)
3	(ncov* OR 2019ncov OR 19ncov OR covid19* OR covid OR 'sars-cov-2' OR 'sarscov-2' OR 'sars-cov2' OR sarscov2 OR 'severe acute respiratory syndrome coronavirus 2' OR 'severe acute respiratory syndrome corona virus 2'):ti,ab,kw,de,tt,oa,ok
4	((new OR novel OR '19' OR '2019' OR wuhan OR hubei OR china OR chinese) NEAR/3 (coronavirus* OR 'corona virus*' OR betacoronavirus* OR cov OR hcov)):ti,ab,kw,de,tt,oa,ok
5	((coronavirus* OR 'corona virus*' OR betacoronavirus*) NEAR/3 (p&emic* OR epidemic* OR outbreak* OR crisis)):ti,ab,kw,tt,oa,ok
6	((wuhan OR hubei) NEAR/5 pneumonia):ti,ab,kw,tt,oa,ok
7	#1 OR #2 OR #3 OR #4 OR #5 OR #6
8	((uk OR 'united kingdom' OR engl& OR english OR britain OR british OR kent) NEAR/3 (variant* OR voc OR vui)) OR 'b.1.1.7' OR b117 OR '20i 501y.v1' OR 'variant of concern 202012 01' OR 'voc 202012 01' OR 'variant under investigation in december 2020' OR 'variant under investigation 202012 01' OR 'vui 202012 01'):ti,ab,kw
9	((('south africa*' OR sa) NEAR/3 (variant* OR voc OR vui)) OR 'b.1.351' OR b1351 OR '501.v2' OR '501y.v2' OR '20h 501y.v2' OR '20c 501y.v2'):ti,ab,kw
10	((brazil* NEAR/3 (variant* OR voc OR vui)) OR 'p.1' OR p1 OR 'b.1.1.28.1' OR b11281 OR ((mutation* OR spike*) NEAR/3 (k417t OR e484k OR n501y))):ti,ab,kw
11	((mutation* OR spike*) NEAR/3 d614g):ti,ab,kw
12	((india* NEAR/3 (variant* OR voc OR vui)) OR 'b.1.617*' OR b1617* OR 'g 452.v3' OR 'voc 21apr' OR 'vui 21apr' OR 'double mutation' OR 'double mutant' OR 'double variant' OR 'triple mutation' OR 'triple mutant' OR 'triple variant' OR ((mutation* OR spike*) NEAR/3 (e484q OR I452r OR p681r))):ti,ab,kw
13	((alpha OR beta OR Gam-ma OR delta) NEAR/3 variant*):ti,ab,kw
14	#8 OR #9 OR #10 OR #11 OR #12 OR #13
15	#7 & #14

### Cochrane Database of Systematic Reviews & Cochrane CENTRAL (Cochrane Library, Wiley)

1	MeSH descriptor: [Coronavirus] this term only
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2	MeSH descriptor: [Betacoronavirus] this term only
3	MeSH descriptor: [Coronavirus Infections] this term only
4	{or #1-#3}
5	MeSH descriptor: [Disease Outbreaks] this term only
6	MeSH descriptor: [Epidemics] this term only
7	MeSH descriptor: [P&emics] this term only
8	{or #5-#7}
9	#4 & #8
10	(ncov* or 2019ncov or 19ncov or covid19* or covid or "sars-cov-2" or "sarscov-2" or sarscov2 or "severe acute respiratory syndrome coronavirus 2" or "severe acute respiratory syndrome corona virus 2"):ti,ab,kw
11	((new or novel or "19" or "2019" or wuhan or hubei or china or chinese) near/3 (coronavirus* or "corona virus*" or betacoronavirus* or cov or hcov)):ti,ab,kw
12	((coronavirus* or "corona virus*" or betacoronavirus*) near/3 (p&emic* or epidemic* or outbreak* or crisis)):ti,ab,kw
13	((wuhan or hubei) near/5 pneumonia):ti,ab,kw
14	{or #9-#13}
15	(variant* or voc or vui or mutation* or spike):ti,ab
16	#14 & #15

### Epistemonikos Living Overview of the Evidence (LOVE) for COVID-19

Basic search of the following terms within the LOVE:

variant\* OR voc OR vui OR "B.1.1.7" OR "20I/501Y.V1" OR "202012/01" OR "B.1.351" OR "501.V2" OR "501Y.V2" OR "20H/501Y.V2" OR "20C/501Y.V2" OR "P.1" OR "B.1.1.28.1" OR "K417T" OR "E484K" OR "N501Y" OR "D614G" OR "B.1.617" OR "B.1.617.1" OR "B.1.617.2" OR "B.1.617.3" OR "G/452.V3" OR "VOC-21APR" OR "VUI-21APR" OR "double mutation" OR "double mutant" OR "triple mutation" OR "triple mutant" OR "E484Q" OR "L452R" OR "P681R"

### medRxiv / bioRxiv

medRxiv & bioRxiv simultaneous search; Date limit changed for each search update (this update: May 11 - July 14, 2021); Title & Abstract search; All words (unless otherwise specified); 50 per page; Best Match; export first 50 results only

Searches:

alpha variant
beta variant



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Gam-ma variant  
delta variant  
uk variant  
united kingdom variant  
engl& variant  
english variant  
britain variant  
british variant  
kent variant  
south africa variant  
brazil variant  
variant of concern (*phrase search*)  
variants of concern (*phrase search*)  
B.1.1.7  
20I/501Y.V1  
202012/01  
B.1.351  
501.V2  
501Y.V2  
20H/501Y.V2  
20C/501Y.V2  
P.1  
B.1.1.28.1  
K417T  
E484K  
N501Y  
D614G  
india variant  
B.1.617  
B.1.617.1  
B.1.617.2  
B.1.617.3  
G/452.V3  
VOC-21APR  
VUI-21APR  
E484Q  
L452R  
P681R

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