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COVID-19

COVID Vaccine Certification - Evidence Paper

September 2021

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Contents

1. Background

This paper summarises the range of evidence available on vaccination certification schemes. It adopts a four harms approach covering the direct harms of COVID-19, the indirect health harms, the social and economic harms. Evidence is drawn from clinical and scientific literature, from public opinion and from international experience. The methodology adopted is outlined in **Annex A.**

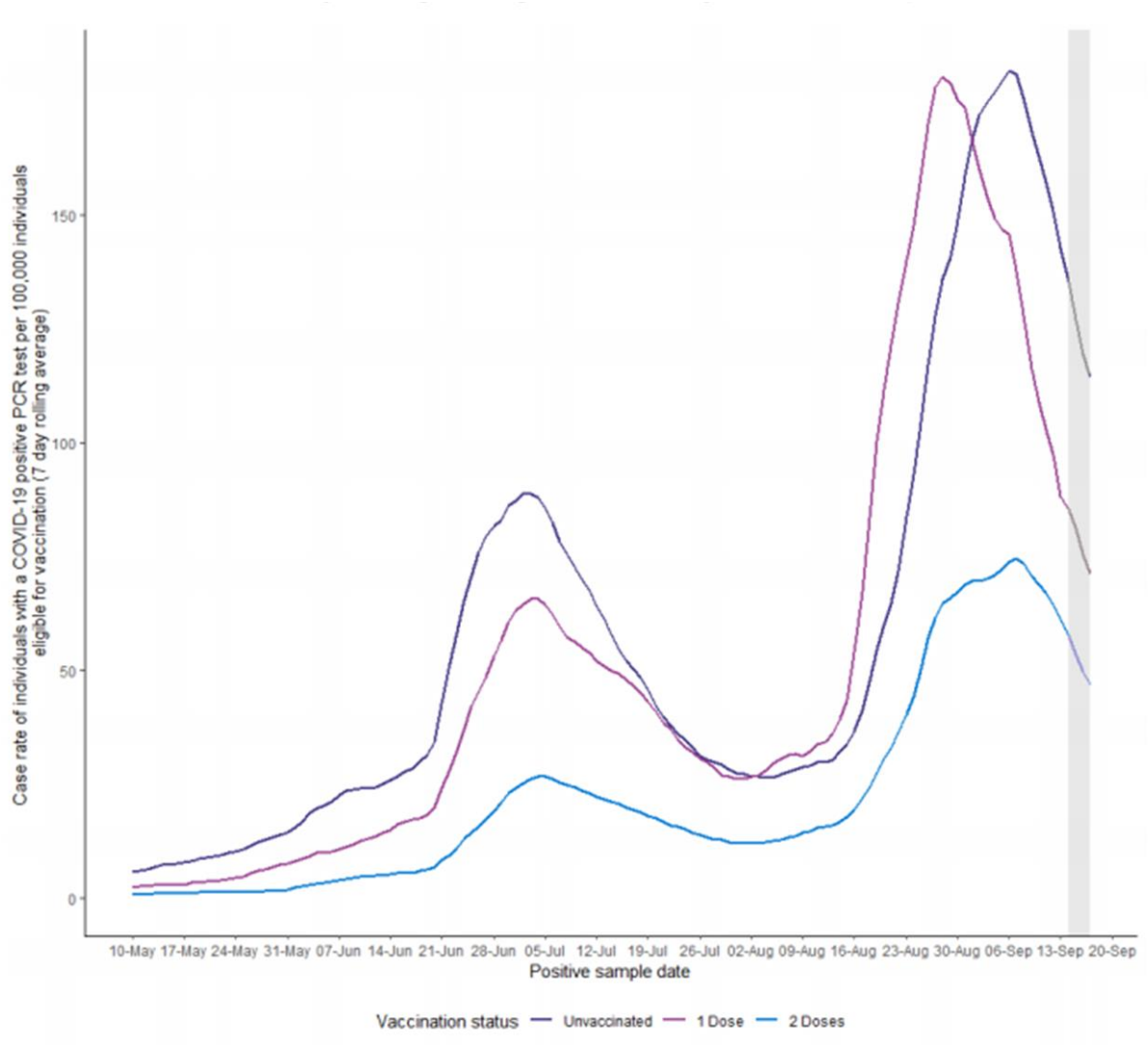
2. The current state of the epidemic.

2.1 Cases, hospitalisations and deaths

In late August 2021, COVID-19 cases reached a higher peak than the last wave of cases in July 2021. Cases are currently decreasing but remain high across most local authorities[1]. Case rates are lower in fully vaccinated individuals, than unvaccinated and partially vaccinated individuals (Figure 1).

[1] COVID-19 Daily Dashboard | Tableau Public accessed on 27 September, data relate to 26 September

Figure 1: COVID-19 rate per 100,000 individuals eligible for vaccination by vaccination status, 7-day rolling average from 10 May 2021 to 17 September.



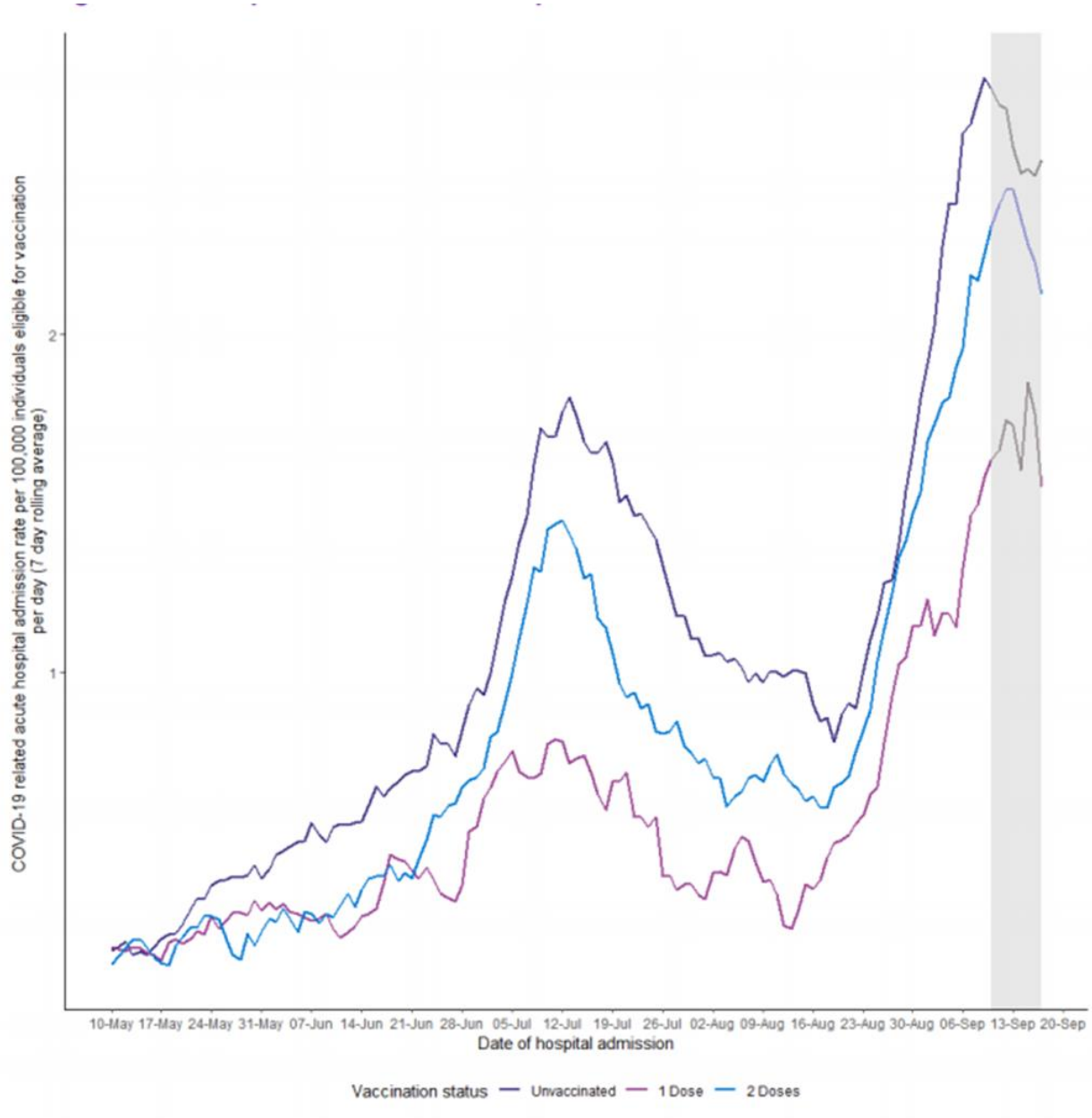
Vaccination status is determined as at the date of PCR specimen date according to the definitions described in Appendix 9. The data displayed within the greyed-out section (3 days) are considered preliminary and are subject to change as more data is updated. The denominators have been updated to include under 16s denominators from NRS mid-2020 population estimates.

Source: Public Health Scotland COVID-19 Statistical Report 22 September 2021

COVID-19 related acute hospital admissions have also increased over the past month but are now decreasing[2]. Hospitalisation rates are higher among unvaccinated individuals (Figure 2).

[2] Source: Daily COVID-19 Cases in Scotland - Daily Case Trends By Health Board - Scottish Health and Social Care Open Data (nhs.scot) Accessed 28 September 2021 with data up to 24 September 2021.

Figure 2: Rate of acute hospital admissions where individual had a COVID-19 positive PCR test 14 days prior, on admission or during their stay in hospital, per 100,000 individuals eligible for COVID-19 vaccination by vaccination status, seven-day rolling average from 01 September 2020 to 17 September 2021.



Vaccination status is determined as at the date of PCR specimen date according to the definitions described in Appendix 9. The data displayed within the greyed-out section (1 week) are considered preliminary and are subject to change as more data is updated. The denominators have been updated to include under 16s denominators from NRS mid-2020 population estimates..

Source: Public Health Scotland COVID-19 Statistical Report 22 September 2021

Of those individuals that have been fully vaccinated, from 29 December to 10 September, 0.01% have died with COVID-19 recorded as an underlying or contributory cause of death[3].

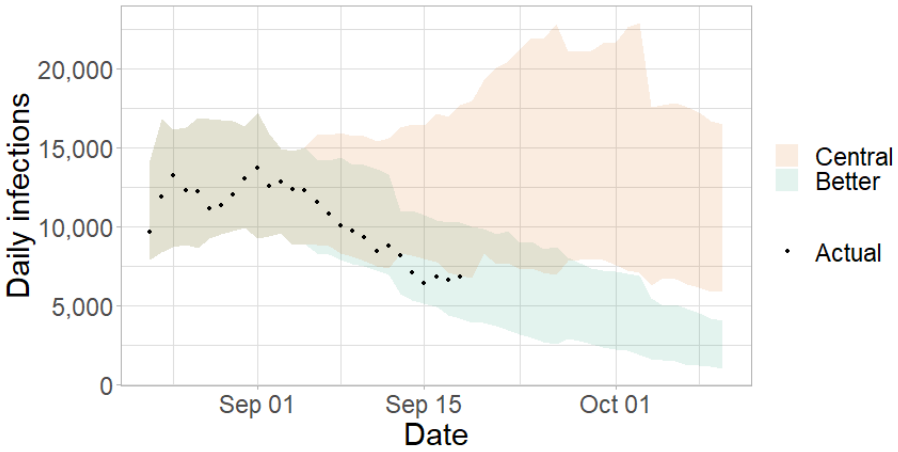
[3] Public Health Scotland COVID-19 Statistical Report 22 September 2021

More information on the current situation as of 24th September in Scotland can be found in the State of the Epidemic report which is updated and published on a weekly basis[4].

2.2 Forecasts for the medium term

Predictions of the impact of COVID-19, in terms of estimated number of infections, hospitalisations and ICU, on the NHS over the coming weeks are modelled by Scottish Government analysts (Figures 3, 4 & 5) and show two projections over the three weeks to 10th October. 'Central' assumes that infections have plateaued. 'Better' assumes that infections continue to fall[5].

Figure 3: Medium term projections of modelled total new daily infections, adjusting positive tests[6] to account for asymptomatic and undetected infections, from Scottish Government modelling, based on positive test data reported up to 20th September.



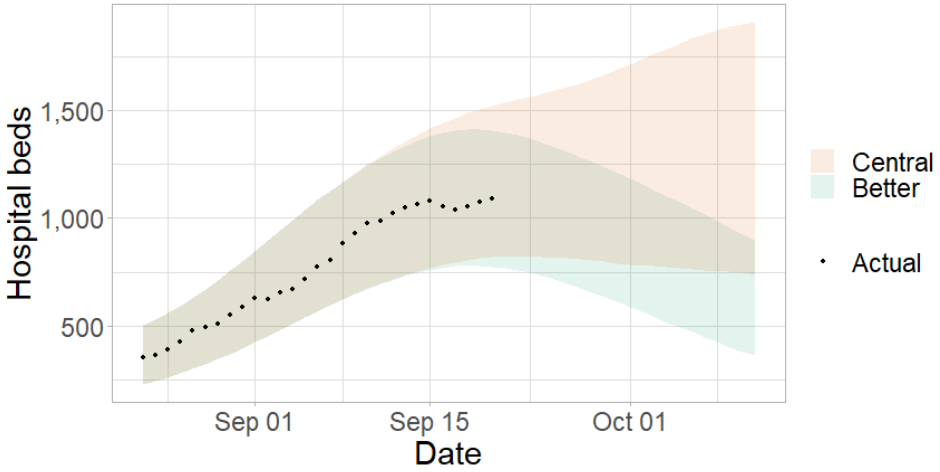
Source: Coronavirus (COVID-19): modelling the epidemic (issue no. 70) - gov.scot (www.gov.scot)

There is uncertainty as to how much infections will increase or decrease in coming weeks.

Figure 4 shows the impact of the projections on the number of people in hospital. The modelling includes all hospital stays, whereas the actuals only include stays up to 28 days duration that are linked to COVID-19. Hospital and ICU occupancies have plateaued. The scale of any future increase or decrease in hospital occupancy and intensive care use is highly uncertain, and depends on the number of infections.

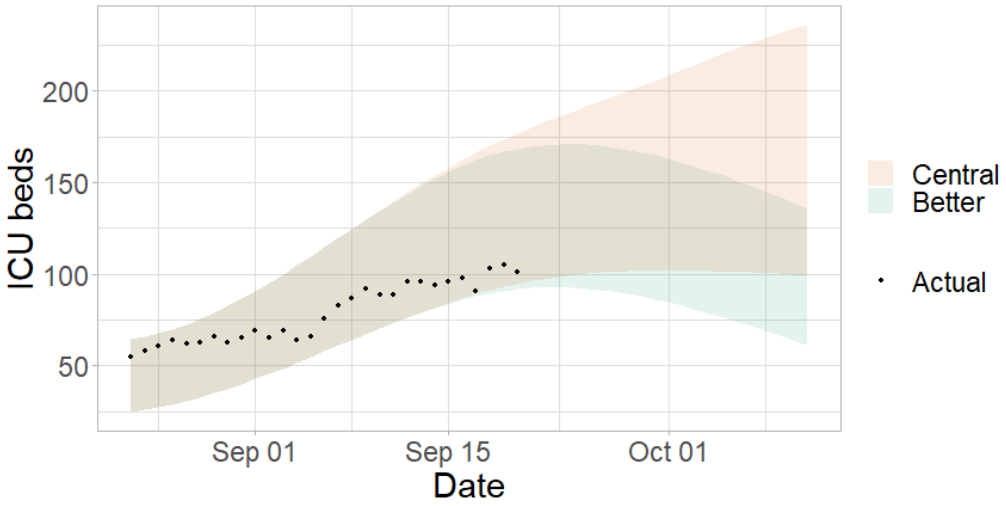
[4] Coronavirus (COVID-19): state of the epidemic - gov.scot (www.gov.scot)
[5] All scenarios are based on current vaccine roll-out plans and efficacy assumptions. Data to 20th September.
[6] The actual positive tests are adjusted to coincide with the estimated day of infection.

Figure 4: Medium term projections of modelled hospital bed demand, from Scottish Government modelling, based on positive test data reported up to 20th September.



Source: Coronavirus (COVID-19): modelling the epidemic (issue no. 70) - gov.scot (www.gov.scot)

Figure 5: Medium term projections of modelled ICU bed demand, from Scottish Government modelling[7], based on positive test data reported up to 20th September.



Source: Coronavirus (COVID-19): modelling the epidemic (issue no. 70) - gov.scot (www.gov.scot)

More information on Scottish Government modelling can be found in the Coronavirus (COVID-19): modelling the epidemic in Scotland report which is updated and published on a weekly basis[8].

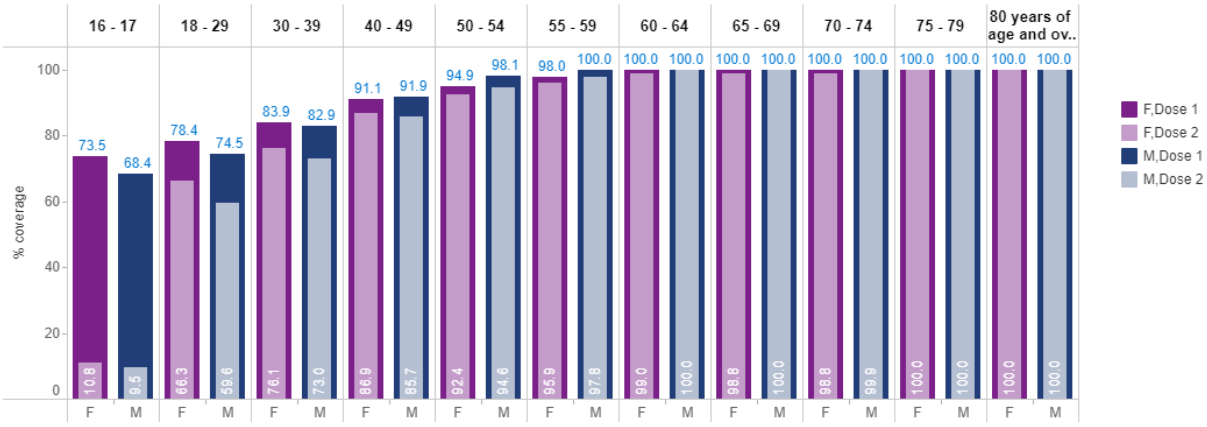
What the above predictions tell us is that there is still a degree of uncertainty about the future and we cannot be assured that the current positive position will continue.

[7] Actual data does not include full numbers of CPAP. ICU bed actuals include all ICU patients being treated for Covid-19 including those over 28 days.
[8] Coronavirus (COVID-19): modelling the epidemic - gov.scot (www.gov.scot)

2.3 Vaccination progress

Vaccine uptake has progressed extremely well in the Scottish adult population with approximately 76% of 18 to 29 year olds and 71% of 16 to 17 year olds having received the first dose of the vaccine. Around 96% of people aged 40 and over have received two doses of the vaccine[9] [10], see Figure 6. This puts Scotland in a different position to a number of other countries where vaccination rates were much lower on the introduction of certification, see section 5.3.

Figure 6: Total % coverage by age group and sex in Scotland



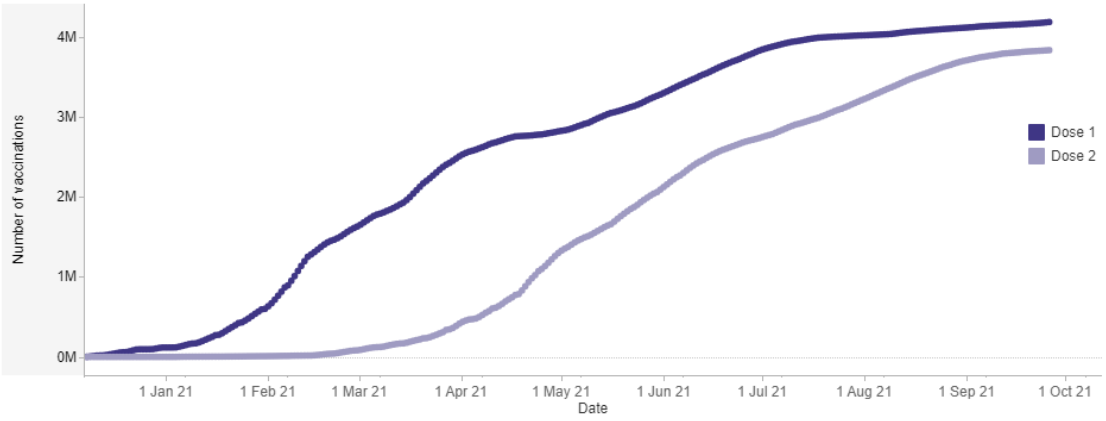
Source: [COVID-19 Daily Dashboard | Tableau Public.](#) Updated 27th September 2021, data related to 26th Sept

[9] [COVID-19 Daily Dashboard | Tableau Public](#) accessed on 27 September, data relate to 26 September

[10] [COVID-19 Vaccination in Scotland - Daily Trend of Vaccinations by Age Group and Sex - Scottish Health and Social Care Open Data (nhs.scot)](#) accessed on 28 September, data relate to 26 September

In recent months the rate of first doses of vaccination has been slowing, see Figure 7. On 26 September 91.3% of those aged 16+ had received a first dose of the vaccination, there has been an increase of 1.2 percentage points in the latest 4 weeks compared to an increase of 11.1 percentage points in the 4 weeks leading up to 1 July. In recent weeks the rate of second doses of vaccination has been slowing, on 26 September 84.2% of those aged 16+ had received a second dose of the vaccination, there has been an increase of 3.5 percentage points in the latest 4 weeks compared to 12.4 percentage points in the 4 weeks leading up to 1 July[11]. It was announced on 4 August that 16-17 year olds would be offered the vaccine from 6 August. The proportion of people aged over 16+ that had received a first dose increased from 72.4% to 81.6% in the first four weeks of 16-17 years olds being offered the vaccine.

Figure 7: Cumulative total number of vaccinations by dose in Scotland



Source: COVID-19 Daily Dashboard | Tableau Public. Updated 27th September 2021, data related to 26th Sept

Forecasting suggests a second dose coverage of the 16+ population of between 83.9% and 86%, with a central estimate of 84.3% by 30 September. Trend analysis suggests that first dose coverage of 16 and 17 year olds may reach between 73.1% and 78% (central estimate: 76.1%) by 30 September. Applying forecasting to 18 to 29 year olds indicates a second dose coverage of between 62.6% and 66.4% by 30 September. Similarly, for 30 to 39 year olds, second dose coverage is estimated to reach between 74.6% and 76.2% by 30 September.

2.4 The impact on the Health service

The COVID-19 pandemic is having an impact on our health and social care in Scotland in a number of ways. This includes the impact on our health and social care services, how people are using those services, and how this impacts on health. As we prepare for autumn and winter our primary and secondary health and social care services face significant and increasing pressures and demands. The rapid rise in COVID-19 cases and hospitalisations in Scotland over recent weeks illustrates the

[11] COVID-19 Daily Dashboard | Tableau Public accessed on 27 September, data relate to 26 September

need to take action to reduce transmission in high risk settings in order to reduce the risk of serious illness and death and alleviate pressures on the NHS.

For example, elective inpatient and day case activity reduced by 46.8% during April 20 - June 21(circa 164,000 surgical procedures), compared to pre-pandemic (April 18 – June 19). Elective inpatient and day case activity for quarter ending June 2020 was at 20.7% of pre-COVID-19 activity when compared to June 2019. For quarter ending June 2021, inpatient and day case activity was at 72.8% of pre-COVID-19 activity (June 2019).

There is uncertainty as to how much infections will increase or decrease in coming weeks. Hospital and ICU occupancies appear to be plateauing but the scale of any future change in hospital occupancy and intensive care use is highly uncertain, and depends on the number of infections[12].

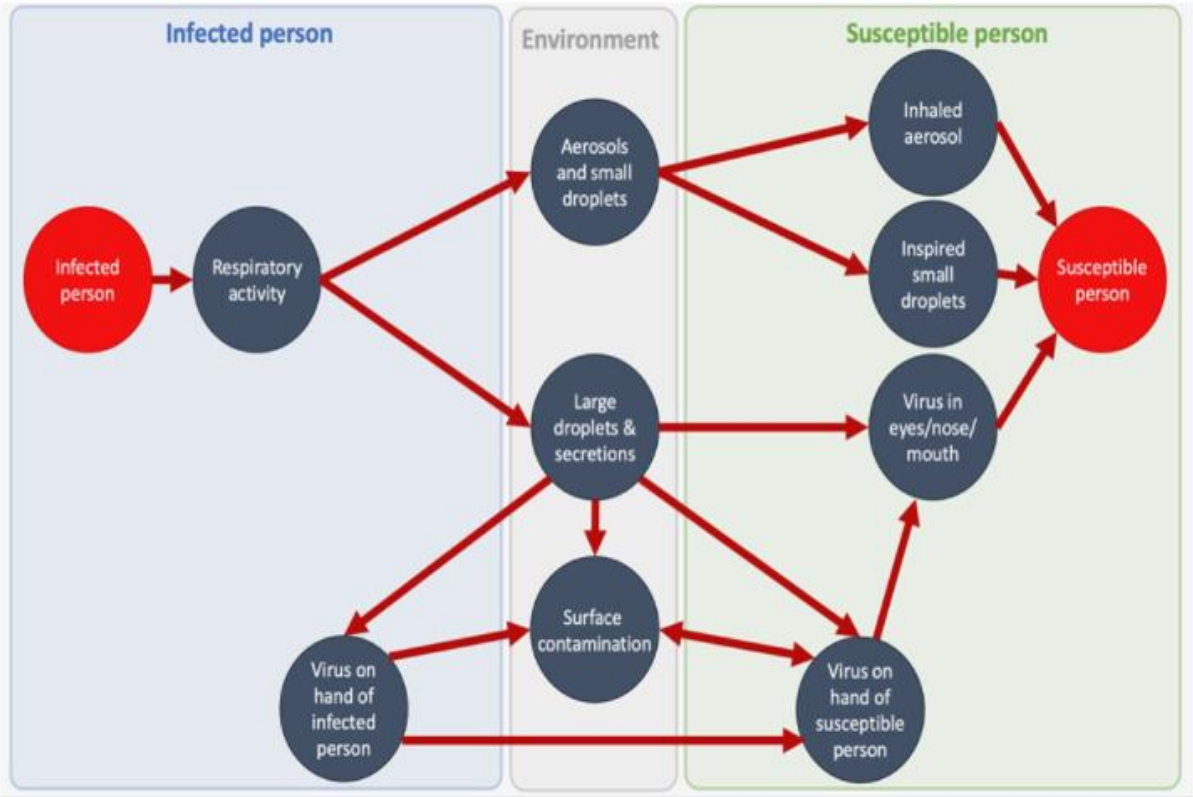
3. Transmission in a vaccinated society

3.1 The science of transmission in a range of settings

SARS-CoV-2 can be transmitted by three main routes: close-range respiratory droplets and aerosols, longer range respiratory aerosols, and direct contact with surfaces contaminated with virus[13]. Figure 8 shows the main transmission routes.

Figure 8: Infographic showing transmission routes of SARS-CoV-2

[12] Coronavirus (COVID-19): modelling the epidemic - gov.scot (www.gov.scot)
[13] Coronavirus disease (COVID-19): How is it transmitted? (who.int)



Source: [Events Research Programme: Phase I findings - GOV.UK (www.gov.uk)]

The PHE Transmission Group indicate that

"Transmission of the virus can take place in any setting….. It is the human behaviour, activities and interactions that occur within a setting that influence transmission. However, some settings facilitate greater transmission due to a combination of risk factors.

This may be that the setting enables particular activities or behaviours that are more risky (e.g. singing, aerobic activity, close interactions), in a place where people spend a long period of time (e.g. homes, workplaces, education), or that a setting does not apply certain mitigation measures (e.g. no use of face coverings in some settings)."[14]

High-risk settings, tend to have the following characteristics[15] [16]:

- close proximity with people from other households
- settings where individuals stay for prolonged periods of time
- high frequency of contacts
- confined shared environments
- poor ventilation

[14] PHE: Factors contributing to risk of SARS-CoV2 transmission in various settings, 26 November 2020 - GOV.UK (www.gov.uk)
[15] Coronavirus disease (COVID-19): How is it transmitted? (who.int)
[16] EMG Transmission Group: Insights on transmission of COVID-19 with a focus on the hospitality, retail and leisure sector, 8 April 2021 - GOV.UK (www.gov.uk)

Activities such as dancing, singing and exercise where more particles are breathed out increase the risk of transmission[17].

The Environmental and Modelling Group (EMG) of Scientific Advisory Group for Emergencies (SAGE) have high confidence that the highest risks of transmission are associated with poorly ventilated and crowded indoor settings[18].

3.2 High risk settings

There are a number of higher risk settings currently suggested to be included in the vaccination certifications scheme[19]:

- Late night venues with music, alcohol and dancing
- Live events: indoors unseated 500+ in the audience
- Live events: outdoors unseated 4,000+ in the audience
- All live events: 10,000+ in the audience

Late night venues and live indoor events are considered high risk due to the high likelihood of aerosol emission and low probability of physical distancing and face coverings being worn. These are places where people come together from different households to spend prolonged periods of time (more than 15 minutes) in close proximity, enabling the virus to spread easily from person to person. Risks are further compounded by speaking loudly and the effects of alcohol consumption[20]. Depending on the venue, issues of ventilation (with recirculation of air being particularly problematic), crowding (where it is hard to regulate the distance between people), and pinch points (at areas such as toilets) all contribute to risk. Keeping surfaces clean and regulating movement throughout the setting is a further challenge.

Large outdoor events are considered a risk as even though transmission risk is lower outdoors in general, the risk will be higher where close interactions happen such as in crowded pinch points[21]. Other risks are due to large numbers of people travelling to and from events, leading to crowded public transport and crowded local hospitality venues.

The UK Events Research Programme (ERP) aims to assess the risk of transmission of COVID-19 associated with attending large events as well as to look at whether testing and other measures (non-pharmaceutical interventions) can be used so that people can attend events safely[22]. Information on the outcomes of the programme is in section 5.5 of this report.

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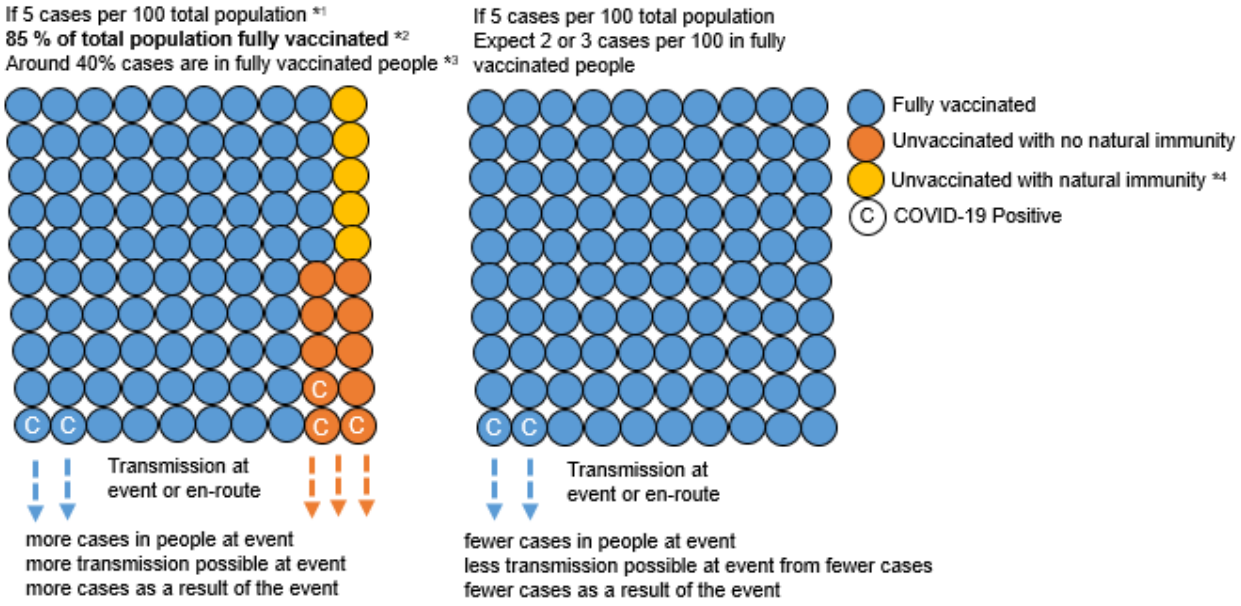
[17] Coronavirus disease (COVID-19): How is it transmitted? (who.int)
[18] EMG Transmission Group: Insights on transmission of COVID-19 with a focus on the hospitality, retail and leisure sector, 8 April 2021 - GOV.UK (www.gov.uk)
[19] Coronavirus (COVID-19): vaccine certification update - 23 September 2021 - gov.scot (www.gov.scot)
[20] Re-opening of hospitality - alcohol-specific risks and possible mitigation, University of Stirling, June 2020 - Institute for Social Marketing | Publications | About | University of Stirling
[21] PHE: Factors contributing to risk of SARS-CoV2 transmission in various settings, 26 November 2020 - GOV.UK (www.gov.uk)
[22] Information on the Events Research Programme - GOV.UK (www.gov.uk)

3.3 The impact of vaccination

3.3.1 Vaccinated individuals are less likely to catch the virus

Vaccines help prevent transmission of the virus as vaccinated people are less likely to become infected and ill than unvaccinated people (and only infected people can transmit the virus). A diagram to show how vaccines help prevent infections in a group of people is in Figure 9 below.

Figure 9: Infographic to explain that groups of fully vaccinated people lead to fewer cases compared to a mix of vaccinated and non-vaccinated people.



Assumptions from:
*1 Estimated average ratio of the population that had COVID-19 in week ending 3 September 2021 - 1/45 for Scotland Coronavirus (COVID-19) Infection Survey, UK - Office for National Statistics
*2 Data up to 15 September COVID-19 Daily Dashboard - PHS COVID-19 | Tableau Public
*3 As on 6 September COVID-19 Statistical Report - 8 September 2021 - COVID-19 statistical report - Publications - Public Health Scotland
*4 As of 1 September - **5%** have natural immunity and not vaccinated (assumption based on 85% adults are vaccinated and 90% have antibodies) Coronavirus (COVID-19) Infection Survey, antibody and vaccination data, UK - Office for National Statistics

The UK Vaccine Effectiveness Expert Panel (VEEP) is a group of scientific and analytical specialists from academia and government in the UK who provide a consensus view on vaccine effectiveness, split by variant, vaccine and dose. They have recently published estimates for vaccine effectiveness based on an assessment of the evidence at the time of writing and as new evidence or data emerges, SAGE will update its advice[23]. The current estimates are described in **Annex B**. For a summary, see Table 1 below[24].

[23] VEEP: Vaccine effectiveness table, 27 August 2021 - GOV.UK (www.gov.uk)
[24] VEEP: Vaccine effectiveness table, 27 August 2021 - GOV.UK (www.gov.uk)

Table 1. Summary of vaccine effectiveness.			
	Infection	Symptomatic disease	Hospitalisation
Oxford AstraZeneca	65% (two dose)	70% (two dose)	80% (one dose), 95% second dose
Pfizer/BioNTech	75% (two dose)	85%(two dose)	80% (one dose), 95% second dose
Moderna	85% (two dose)	75% (one dose)	Not included

Source: Vaccine Effectiveness Expert Panel - consensus narrative, 27 August 2021[25]

Vaccine effectiveness is estimated by comparing rates of disease in vaccinated individuals to rates in unvaccinated individuals and is generally measured as the percent reduction in the frequency of COVID-19 among vaccinated people compared to people not vaccinated. More analysis can be found in a number of large studies including EAVE-II (Early Pandemic Evaluation and Enhanced Surveillance of COVID-19) in Scotland[26] [27], REal-time Assessment of Community Transmission (REACT-1) in England[28] [29] [30] and the Office for National Statistics (ONS) COVID-19 Infection Survey ONS study[31] [32] [33], which are described in **Annex B**.

A death involving COVID-19 occurring in someone who has received both vaccine doses, and had a first positive PCR test at least 14 days after the second vaccination dose, is known as a “breakthrough death”. In total, there were 256 breakthrough deaths in England between 2 January and 2 July 2021[34]. In people who received their second dose at least 21 days before their date of death, 0.8% of all deaths involved COVID-19. Over one-third (37.4%) of all deaths in unvaccinated people involved COVID-19[35].

Therefore, we have strong evidence that vaccines are effective at preventing disease, hospitalisations and deaths. However, vaccine effectiveness decreases

[25] VEEP: Vaccine effectiveness table, 27 August 2021 - GOV.UK (www.gov.uk)
[26] SARS-CoV-2 Delta VOC in Scotland: demographics, risk of hospital admission, and vaccine effectiveness - The Lancet
[27] EAVE II | The University of Edinburgh
[28] REACT-1 round 13 interim report: acceleration of SARS-CoV-2 Delta epidemic in the community in England during late June and early July 2021 | medRxiv
[29] Coronavirus infections three times lower in double vaccinated people - REACT | Imperial News | Imperial College London
[30] The REACT 1 programme | Faculty of Medicine | Imperial College London
[31] Coronavirus (COVID-19) Infection Survey, UK - Office for National Statistics
[32] Impact of Delta on viral burden and vaccine effectiveness against new SARS-CoV-2 infections in the UK | medRxiv
[33] Delta Variant and vaccine effectiveness; what can the CIS tell us? | National Statistical (ons.gov.uk)
[34] Deaths involving COVID-19 by vaccination status, England - Office for National Statistics
[35] Coronavirus (COVID-19) latest insights - Office for National Statistics (ons.gov.uk)

over time for both Pfizer-BioNTech and Oxford-AstraZeneca vaccines due to waning immunity[36] [37] [38].

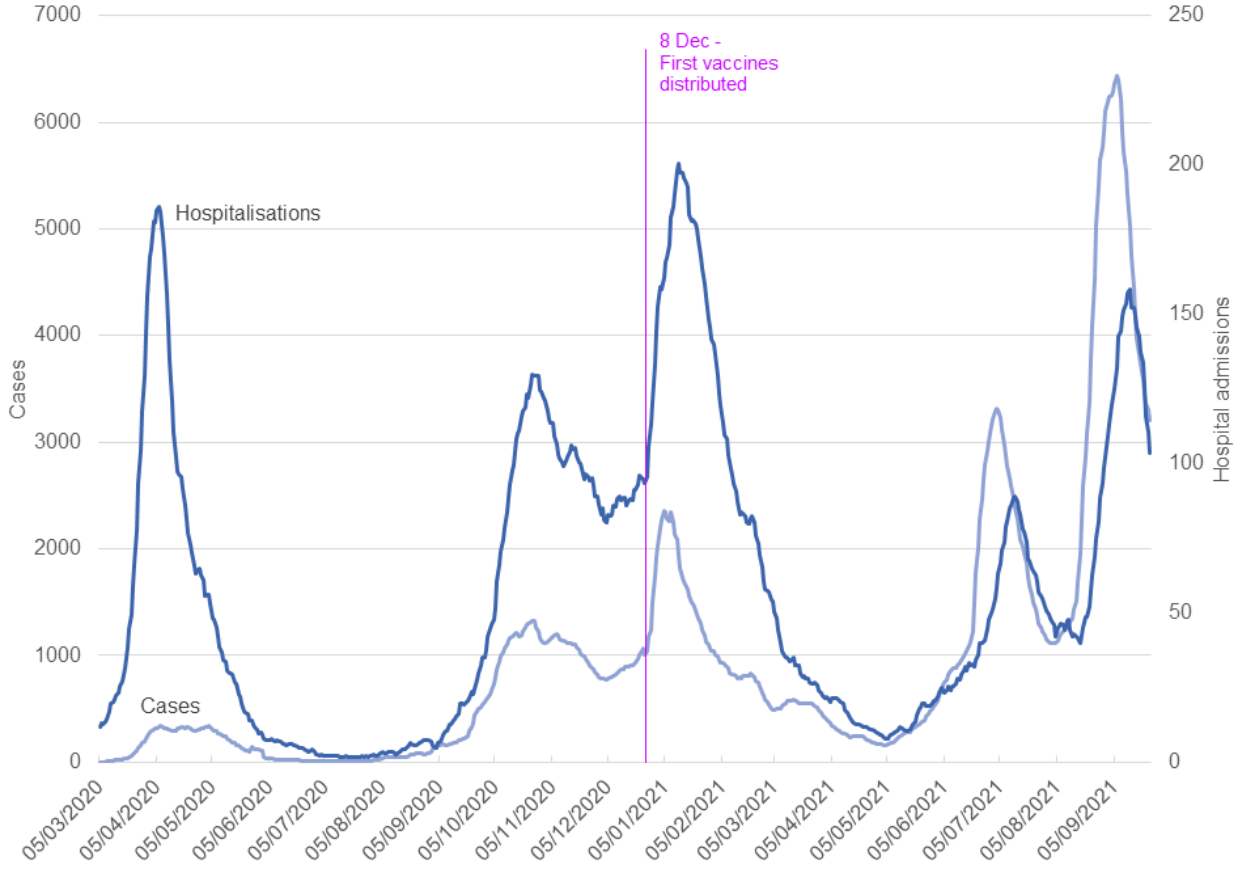
The latest estimates included in COVID-19 vaccine surveillance report (Week 38) indicate that in England as a result of the COVID-19 vaccination programme, 230,800 hospitalisations have been prevented, and between 119,500 and 126,800 deaths and 23.7 to 24.1 million infections have been prevented, up to 17 September[39].

3.3.2 Vaccination prevents hospitalisations

We can observe in real data from Scotland the pivotal effect vaccination has had in preventing hospitalisations.

[36] Impact of Delta on viral burden and vaccine effectiveness against new SARS-CoV-2 infections in the UK
[37] Is COVID vaccine protection fading? (joinzoe.com)
[38] PHE: Duration of protection of COVID-19 vaccines against clinical disease, 9 September 2021 - GOV.UK (www.gov.uk)
[39] COVID-19 vaccine surveillance reports - GOV.UK (www.gov.uk)

Figure 10: 7 day average cases and daily hospital admissions in Scotland over time.



Note: It takes 21 days for protection to develop after the first dose
Source: Daily COVID-19 Cases in Scotland - Daily Case Trends By Health Board - Scottish Health and Social Care Open Data (nhs.scot). Updated 28 September 2021 with data up to 24 September 2021.

Figure 10 above shows that, prior to the deployment of vaccinations, a spike in cases resulted in a steep surge in hospitalisations. At the start of the year, daily reported cases peaked at around 2,600 and at that time (pre-vaccines) around 13% of cases ended up in hospital. In the current wave, daily cases peaked at 7,521 on 2 September resulting in around 2-3% of cases being hospitalised[40].

Public Health Scotland data shows that, in the four weeks from 21 August to 17 September, 34.1**%** of COVID-19 related acute hospital admissions were unvaccinated individuals[41]. For context, 91.8% of adults aged 18+ have had at least one dose of the vaccine and vaccinated figures include the elderly and vulnerable groups. Overall, individuals in the oldest age groups were most likely to be hospitalised. In all age groups, the rate of admissions per 100,000 was higher in unvaccinated individuals compared to fully vaccinated individuals in the week to 17 September. Unvaccinated individuals were 3 to 4 times more likely to be in hospital with Covid-19[42].

[40] Coronavirus (COVID-19) update: First Minister's statement – 1 September 2021 - gov.scot (www.gov.scot)
[41] All releases - Publications - Public Health Scotland
[42] Public Health Scotland COVID-19 Statistical Report

3.3.3 Vaccinated people who are infected can transmit the virus

Once infected a person may transmit the virus, even if they are vaccinated. However, evidence is limited for whether vaccinated people that test positive are less infectious or infectious for a shorter period of time compared to non-vaccinated people.

The most recent consensus view of The Vaccine Effectiveness Expert Panel (VEEP) was considered at SAGE 95 on 9 September 2021[43].

> VEEP say that "for the Alpha variant, there is ~40% reduction in onward transmission from vaccinated but infected people after one dose of the AstraZeneca vaccine, and ~45% for the Pfizer vaccine"[44].

Data from Scotland has also shown that household contacts of vaccinated healthcare workers are at reduced risk of becoming a case, at a time when Alpha variant was dominant[45]. Data from Israel also indicate vaccine helped prevent transmission in breakthrough cases at a time when Alpha variant was circulating[46] [47].

VEEP state that there is no direct evidence available for vaccine effectiveness against transmission for the Delta variant[48].

However, there is some indirect evidence discussed below and in **Annex B** to suggest vaccine effectiveness against transmission may be lower for Delta than for the Alpha variant. Delta infection is thought to result in more infectious viral particles than the original wild type and alpha strain (reflected by a lower Ct value in PCR testing) and is more transmissible[49] [50] [51] [52] [53] [54] [55] [56].

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[43] VEEP: Vaccine effectiveness table, 27 August 2021 - GOV.UK (www.gov.uk)
[44] VEEP: Vaccine effectiveness table, 27 August 2021 - GOV.UK (www.gov.uk)
[45] Effect of vaccination on transmission of COVID-19: an observational study in healthcare workers and their households | medRxiv
[46] Impact of BNT162b2 vaccination and isolation on SARS-CoV-2 transmission in Israeli households: an observational study | medRxiv
[47] Vaccination with BNT162b2 reduces transmission of SARS-CoV-2 to household contacts in Israel | medRxiv
[48] VEEP: Vaccine effectiveness table, 27 August 2021 - GOV.UK (www.gov.uk)
[49] Viral infection and transmission in a large, well-traced outbreak caused by the SARS-CoV-2 Delta variant | medRxiv
[50] Delta variants of SARS-CoV-2 cause significantly increased vaccine breakthrough COVID-19 cases in Houston, Texas | medRxiv
[51] Infection with the SARS-CoV-2 Delta Variant is Associated with Higher Infectious Virus Loads Compared to the Alpha Variant in both Unvaccinated and Vaccinated Individuals (nih.gov)
[52] Impact of Delta on viral burden and vaccine effectiveness against new SARS-CoV-2 infections in the UK (medrxiv.org)
[53] Spiral: REACT-1 round 13 final report: exponential growth, high prevalence of SARS-CoV-2 and vaccine effectiveness associated with Delta variant in England during May to July 2021 (imperial.ac.uk)
[54] SARS-CoV-2 B.1.617.2 Delta variant emergence and vaccine breakthrough | Research Square
[55] Investigation of SARS-CoV-2 variants of concern: variant risk assessments - GOV.UK (www.gov.uk)
[56] COVID vaccines slash viral spread – but Delta is an unknown (nature.com)

A number of studies comparing Ct values (giving an indication of viral load and infectiousness) in vaccinated versus unvaccinated people are outlined in **Annex B**. Looking at the limited evidence available, some studies show that fully vaccinated people with Delta variant breakthrough infections have similar levels of viral RNA as unvaccinated people at the time of testing, such as the larger studies from the ONS COVID-19 infection survey[57] [58] [59] and PHE study[60] as well as other studies[61] [62] [63] [64] [65].

However, the level of viral RNA may decrease quicker in fully vaccinated people, meaning that they could spread the virus for a shorter period than unvaccinated people[66] [67]. Also the large UK REACT-1 study found a difference in viral load between vaccinated and non-vaccinated people with a positive PCR test, but the difference between median Ct values for vaccinated and unvaccinated individuals became smaller when only stronger positives were included in the analysis[68].

4. The use of baseline measures

A number of baseline measures are still in place in Scotland including:

- Wearing face coverings in public indoor settings including public transport
- Providing your contact details when you go to places like pubs, cafes and restaurants
- International travel – testing and quarantine requirements[69]

In addition guidance is still in place recommending working from home if possible.

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[57] Impact of Delta on viral burden and vaccine effectiveness against new SARS-CoV-2 infections in the UK | medRxiv
[58] New studies — Nuffield Department of Medicine (ox.ac.uk)
[59] Covid-19: Fully vaccinated people can carry as much delta virus as unvaccinated people, data indicate | The BMJ
[60] Investigation of SARS-CoV-2 variants of concern: technical briefings - GOV.UK (www.gov.uk)
[61] Shedding of Infectious SARS-CoV-2 Despite Vaccination | medRxiv
[62] Outbreak of SARS-CoV-2 Infections, Including COVID-19 Vaccine Breakthrough Infections, Associated with Large Public Gatherings - Barnstable County, Massachusetts, July 2021 - PubMed (nih.gov)
[63] Delta variants of SARS-CoV-2 cause significantly increased vaccine breakthrough COVID-19 cases in Houston, Texas | medRxiv
[64] SARS-CoV-2 Infections and Hospitalizations Among Persons Aged ≥16 Years, by Vaccination Status — Los Angeles County, California, May 1–July 25, 2021 (nih.gov)
[65] Infection with the SARS-CoV-2 Delta Variant is Associated with Higher Infectious Virus Loads Compared to the Alpha Variant in both Unvaccinated and Vaccinated Individuals (nih.gov)
[66] Longitudinal analysis of SARS-CoV-2 vaccine breakthrough infections reveal limited infectious virus shedding and restricted tissue distribution | medRxiv
[67] Virological and serological kinetics of SARS-CoV-2 Delta variant vaccine-breakthrough infections: a multi-center cohort study | medRxiv
[68] Spiral: REACT-1 round 13 final report: exponential growth, high prevalence of SARS-CoV-2 and vaccine effectiveness associated with Delta variant in England during May to July 2021 (imperial.ac.uk)
[69] Coronavirus (COVID-19): staying safe and protecting others - gov.scot (www.gov.scot)

These baseline measures aim to reduce the likelihood of infected people mixing with others and infecting them. Wearing face coverings helps reduce the risk from a potentially infectious person in any given setting.

Detailed guidance is available for all sectors of the economy and society on how to operate with lower risk. In addition organisers of outdoor events of more than 5,000 and indoor events of more than 2,000 have to apply for permission and provide the local authority with a risk assessment.

Sage noted in April 2021 that:

> "there are three main ways in which baseline measures can reduce transmission (from most to least effective)"[70]:

1. Reducing the likelihood that people who are infectious mix with others.

   The most effective baseline measures are likely to be ones which reduce infected people mixing, such as an effective test, trace and isolation system (high confidence)[71].

2. For those potentially infectious people who are not isolated, reducing the likelihood that they enter higher risk settings or situations.

   EMG SPI-M advises that the next most effective baseline measures aim to eliminate or substitute some of the higher risk situations where transmission could occur. This could be by using a certification scheme based on negative testing, vaccination, or proof of prior infection[72]. Other important ways would be by minimising the frequency and duration of exposure such as encouraging outdoor interactions, working from home, and generally reducing the number, size, and duration of interactions[73].

3. Decreasing the transmission risk from a potentially infectious person in any given environment[74] [75].

   EMG SPI-M advises that to decrease the risk of transmission from an infectious person the following non pharmaceutical interventions (NPIs) should be considered:[76]

[70] SAGE 87 minutes: Coronavirus (COVID-19) response, 22 April 2021 - GOV.UK (www.gov.uk)
[71] EMG, SPI-M and SPI-B: Considerations in implementing long-term 'baseline' NPIs, 22 April 2021 - GOV.UK (www.gov.uk)
[72] EMG, SPI-M and SPI-B: Considerations in implementing long-term 'baseline' NPIs, 22 April 2021 - GOV.UK (www.gov.uk)
[73] EMG, SPI-M and SPI-B: Considerations in implementing long-term 'baseline' NPIs, 22 April 2021 - GOV.UK (www.gov.uk)
[74] SAGE 87 minutes: Coronavirus (COVID-19) response, 22 April 2021 - GOV.UK (www.gov.uk)
[75] EMG, SPI-M and SPI-B: Considerations in implementing long-term 'baseline' NPIs, 22 April 2021 - GOV.UK (www.gov.uk)
[76] EMG, SPI-M and SPI-B: Considerations in implementing long-term 'baseline' NPIs, 22 April 2021 - GOV.UK (www.gov.uk)

- Physical distancing (to reduce risk from respiratory droplets and short-range aerosols)[77] [78] [79]
- Ventilation (to reduce risk from long duration exposure and far-fields aerosol transmission)[80] [81] [82]
- Face coverings (to reduce emission of virus and exposure to droplets and larger aerosols)[83]. Other forms of barriers (e.g. Perspex screens) may provide some protection from droplets in some circumstances though consideration needs to be given to airflows, as in some cases they may increase risk of aerosol transmission.
- Hand hygiene and surface cleaning (to reduce risk from fomites)[84].

These mitigating measures interact with each other and as such it is difficult to estimate the effectiveness of each baseline measure. However, for example, EMG SPI-M advises that theoretical effectiveness for a good quality face covering is likely to be around 50-90% for smaller aerosols and greater for large droplets[85]. A number of large-scale studies and reviews from data in other countries suggest the impact on transmission of wearing a face masks is typically in 6-15% range, but potentially up to 45%[86].

A complex set of factors interlink to determine the exact impact that various baseline measures have on reducing transmission; including level of compliance, quality of face covering or mechanical air ventilation systems and the physical environment etc. In addition, the effectiveness of each baseline measure or package of baseline measures will also vary depending on the demographic of people in attendance and their attitudes towards compliance.

SAGE suggest that:

[77]SAGE 40 https://www.gov.uk/government/publications/transmission-of-sars-cov-2-and-mitigating-measures-update-4-june-2020
[78] SAGE 51 https://www.gov.uk/government/publications/pheemg-aerosol-and-droplet-generation-from-singing-wind-instruments-and-performance-activities-13-august-2020
[79]SAGE 76 https://www.gov.uk/government/publications/emg-application-of-physical-distancing-and-fabric-face-coverings-in-mitigating-the-b117-variant-sars-cov-2-virus-in-public-workplace-and-community, 13 January 2021.
[80]SAGE 76 https://www.gov.uk/government/publications/emg-application-of-physical-distancing-and-fabric-face-coverings-in-mitigating-the-b117-variant-sars-cov-2-virus-in-public-workplace-and-community, 13 January 2021.
[81]SAGE 60 https://www.gov.uk/government/publications/sage-60-minutes-coronavirus-covid-19-response-1-october-2020
[82]SAGE 60 https://www.gov.uk/government/publications/emg-role-of-ventilation-in-controlling-sars-cov-2-transmission-30-september-2020
[83]SAGE 76 https://www.gov.uk/government/publications/emg-application-of-physical-distancing-and-fabric-face-coverings-in-mitigating-the-b117-variant-sars-cov-2-virus-in-public-workplace-and-community, 13 January 2021
[84] EMG, SPI-M and SPI-B: Considerations in implementing long-term 'baseline' NPIs, 22 April 2021 - GOV.UK (www.gov.uk)
[85] EMG, SPI-M and SPI-B: Considerations in implementing long-term 'baseline' NPIs, 22 April 2021 - GOV.UK (www.gov.uk)
[86] EMG: Application of physical distancing and fabric face coverings in mitigating the B117 variant SARS-CoV-2 virus in public, workplace and community, 13 January 2021 - GOV.UK (www.gov.uk)

"It is highly likely that transmission will increase in autumn and winter"[87].

The reasons for this are due to people interacting with others inside rather than outside, and closing doors when the weather gets colder as well as seasonal social activities related to mid-term breaks and holidays. For this reason SAGE suggest that stronger measures may be beneficial in the autumn and winter[88].

The vaccine certification scheme as proposed for Scotland is targeted towards higher risk settings or events and will be used in conjunction with the NPIs listed above[89] to further enhance the overall preventative impact. As part of this package of mitigation measures, a vaccine certification scheme should ensure that only fully vaccinated individuals are present at these events reducing the risk of infection and severe illness leading to hospitalisation amongst the attendees.

SAGE considered with a medium confidence that a certification scheme could potentially have medium effectiveness[90]. However they also warned that "certificates should also not be used to replace other measures to protect high-risk individuals"[91].

Notably SAGE has suggested that "the prevalence of infection in the community will have an important impact on the level of risk and effectiveness of certification which may be very effective when prevalence is low, but less effective at high prevalence"[92]

5. Introducing vaccine certification

5.1 The basis of certification

The COVID-19 vaccination certification scheme in Scotland aims to[93] [94] [95] [96]

- Reduce the risk of transmission (harm 1);
- Reduce the risk of serious illness and death and in doing so alleviate current and future pressure on the healthcare system (harm 1 and 2);
- Allow higher risk settings to continue to operate as an alternative to closure or more restrictive measures (harms 3 & 4); and
- Increase vaccine uptake (harm 1 and 2)

[87] EMG, SPI-M and SPI-B: Considerations in implementing long-term 'baseline' NPIs, 22 April 2021 - GOV.UK (www.gov.uk)
[88] EMG, SPI-M and SPI-B: Considerations in implementing long-term 'baseline' NPIs, 22 April 2021 - GOV.UK (www.gov.uk)
[89] Coronavirus (COVID-19) vaccine certification scheme debate: Deputy First Minister's statement - 9 September 2021 - gov.scot (www.gov.scot)
[90] EMG, SPI-M and SPI-B: Considerations in implementing long-term 'baseline' NPIs, 22 April 2021 - GOV.UK (www.gov.uk)
[91] SAGE 79 minutes: Coronavirus (COVID-19) response, 4 February 2021 - GOV.UK (www.gov.uk)
[92] SAGE 79 minutes: Coronavirus (COVID-19) response, 4 February 2021 - GOV.UK (www.gov.uk)
[93] Coronavirus (COVID-19): mandatory vaccine certification - gov.scot (www.gov.scot)
[94] Coronavirus (COVID-19) vaccine certification scheme debate: Deputy First Minister's statement - 9 September 2021 - gov.scot (www.gov.scot)
[95] Vaccine certification plans approved by Scottish Parliament - gov.scot (www.gov.scot)
[96] Coronavirus (COVID-19) update: First Minister's statement – 14 September 2021 - gov.scot (www.gov.scot)

Scotland's COVID-19 vaccine certification scheme will act as proof that an individual has had both doses of a COVID-19 vaccine. The certificate will allow access to restricted higher risk settings. Certificates will be available as a QR code through the Scotland COVID-19 Status App or requested through a paper record of vaccination[97].

Scotland will be the only European country that will adopt a vaccine only certification scheme with no option to provide a negative PCR or antigen test result or proof of recovery from a previous COVID-19 infection within a predetermined time period.

In Scotland, an individual must have been "vaccinated with a Medicines and Healthcare products Regulatory Agency (MHRA) recognised vaccine in line with the MHRA recommended number of doses for the vaccine used and two weeks has passed for the vaccine to take effect"[98].

However, it should be noted that the UK Government have stated in their report 'COVID-19 Response: Autumn and Winter Plan' that a contingency 'Plan B' may be implemented that would include a vaccine certification scheme without the option to test negative or to provide proof of recovery from a previous COVID-19 infection within a predetermined time period[99].

Certain provinces in Canada have recently launched vaccine only certification schemes[100] [101] [102]. The vaccine only certification schemes allow access to high risk locations, such as indoor events, hospital, nightclubs and gyms. They do not provide the option of a recent negative test or proof of previous infection. Provinces include Quebec, Manitoba, British Columbia and Ontario all of which launched their schemes in September 2021[103] [104] [105] [106]. As these schemes only recently launched started, it is too early to say if they have been successful in reducing transmission or case numbers.

A variety of different criteria are used for COVID-19 status certification across the countries with schemes in place, see Table 2 for COVID-19 certification validity in Scotland and comparator countries.

[97] Coronavirus (COVID-19) vaccine certification scheme debate: Deputy First Minister's statement - 9 September 2021 - gov.scot (www.gov.scot)
[98] Coronavirus (COVID-19): mandatory vaccine certification - gov.scot (www.gov.scot)
[99] COVID-19 Response: Autumn and Winter Plan 2021 - GOV.UK (www.gov.uk)
[100] Proof of vaccination and the BC Vaccine Card - Province of British Columbia (gov.bc.ca)
[101] P210 emergency order (covid-19 prevention) (manitoba.ca)
[102] COVID-19 vaccination passport | Gouvernement du Québec (quebec.ca)
[103] Proof of vaccination and the BC Vaccine Card - Province of British Columbia (gov.bc.ca)
[104] P210 emergency order (covid-19 prevention) (manitoba.ca)
[105] Proof of Vaccination Guidance for Businesses and Organizations under the Reopening Ontario Act (gov.on.ca)
[106] COVID-19 vaccination passport | Gouvernement du Québec (quebec.ca)

Table 2: COVID-19 certification validity in Scotland and comparator countries. Correct as of 23 September 2021					
Country	Certification Name	Certification Validity			
		Vaccination	PCR test	Rapid Antigen Test	Recovery
Scotland [107]	COVID-19 vaccination certification scheme	Full +14 days	Not included	Not included	Not included
Austria[108]	Gruner Pass (Green Pass)	Full (+22 days for J&J)	72h (Vienna 48h)	24h (Vienna certified only)	180 days
Belgium [109]	COVID Safe Ticket	Full +14 days	72h	48h	180 days
France[110]	Pass sanitaire	Full (+7 days or +28 for J&J)	48h	48h	6 months
Germany [111]	CovPass/ Corona Warn App	Full +14 days	48h	24h	6 months
Iceland[112]	N/A – Testing scheme	Not included	Not included	48hr (Certified only)	Not included
Ireland[113]	COVID-19 certification scheme	Full (+ additional days depending on vaccine)	Not included	Not included	6 months
Israel[114]	Green Pass	Full (currently updating to include booster)	72h	24h	6 months
Italy[115]	Certificazione verde (Green Pass)	Full or partial	48h	48h	6 months
Netherlands[116]	Corona Check	Full +14 days (+28 days for J&J)	24h	24h	6 months

[107] Vaccine certification plans approved by Scottish Parliament - gov.scot (www.gov.scot)
[108] Safe travels in times of Coronavirus: How Austria's entry tests work
[109] Covidsafe | Frequently Asked Questions
[110] Coronavirus Covid 19 – English | Gouvernement.fr
[111] Coronavirus vaccination: protection for everyone – Federal Government (bundesregierung.de)
[112] covid19
[113] COVID-19 restrictions in Ireland (citizensinformation.ie)
[114] What is the Green Pass Scheme? - Corona Traffic Light Model (Ramzor) Website (health.gov.il)
[115] Home - COVID-19 Green Certification (dgc.gov.it)
[116] Steps for getting a COVID Certificate for travel or events using CoronaCheck | Coronavirus COVID-19 | Government.nl

Norway [117]	COVID-19 certificate	Full or partial +3 weeks	24h	24h	6 months
Wales[118]	(From 11 October)	Full	Not included in announcement	48h	Not included in announcement

[117] COVID-19 certificate - helsenorge.no
[118] COVID Pass for events and nightclubs announced | GOV.WALES

The strictness of vaccination status eligibility ranges from partial vaccination in Italy, to fully vaccinated with additional waiting time in Germany and Belgium[119] [120] [121]. Other countries certification schemes also accept negative PCR or rapid antigen tests as proof of negative COVID-19 status.

Duration of certification based on negative COVID-19 status is more limited compared to vaccination status, with negative PCR test validity ranging from 24 hours in the Netherlands and Norway, 48 hours in France, Germany and Italy, and up to 72 hours in Austria, Belgium and Israel[122] [123] [124] [125] [126] [127] [128] [129].

Other countries also accept proof of COVID-19 recovery as a means to demonstrate COVID-19 secure status. For example, France's certificate (pass sanitaire) includes individuals who had previously tested positive through rapid antigen testing or PCR testing, provided the test is more than 15 days old but less than 6 months old[130].

EMG/SPI-M/SPI-B have noted that certification based on vaccination status or prior infection would indirectly reduce the likelihood of an infected person being present as they would demonstrate some level of immunity. Certification to prove vaccination or prior infection can reduce the risk of severe illness but is not yet certain whether it will reduce transmission of infected people. EMG/SPI-M/SPI-B note that certification based on negative test results could reduce the likelihood of an infected person being present but would depend on the quality of the test and when the test was taken in relation to the event. They note that the practical and ethical issues need to be considered[131].

There are no real life studies directly comparing certification schemes based on testing only, vaccination (or previous infection) only, or both. LFD testing is effective at identifying people with the virus when they are at their most infectious and have high viral loads[132]. A large study in England found that the sensitivity at high viral loads was the same (88%) whether administered by experienced or inexperienced users[133]. A consensus view of vaccines effectiveness against infection or symptomatic disease in fully vaccinated people is between 60-90%, depending on the vaccine[134]. Evidence is not available on which type of certification scheme

[119] Home - COVID-19 Green Certification (dgc.gov.it)
[120] What you need to know about Germany's new "3G" Covid health pass rules - Worldakkam
[121] Covidsafe | Frequently Asked Questions
[122] Steps for getting a COVID Certificate for travel or events using CoronaCheck | Coronavirus COVID-19 | Government.nl
[123] COVID-19 certificate - helsenorge.no
[124] Coronavirus Covid 19 – English | Gouvernement.fr
[125] What you need to know about Germany's new "3G" Covid health pass rules - Worldakkam
[126] Home - COVID-19 Green Certification (dgc.gov.it)
[127] Safe travels in times of Coronavirus: How Austria's entry tests work
[128] Covidsafe | Frequently Asked Questions
[129] What is the Green Pass Scheme? - Corona Traffic Light Model (Ramzor) Website (health.gov.il)
[130] Coronavirus Covid 19 – English | Gouvernement.fr
[131] EMG, SPI-M and SPI-B: Considerations in implementing long-term 'baseline' NPIs, 22 April 2021 - GOV.UK (www.gov.uk)
[132] Asymptomatic testing backed by new research studies - GOV.UK (www.gov.uk).
[133] Asymptomatic testing for SARS-CoV-2 using antigen-detecting lateral flow devices: evidence from performance data October 2020 – May 2021 (publishing.service.gov.uk)
[134] VEEP: Vaccine effectiveness table, 27 August 2021 - GOV.UK (www.gov.uk)

(testing or vaccination) would be most effective at reducing the likelihood of infected people being present at an event.

5.2 Activities requiring certification

COVID-19 certification is in widespread use in European countries such as Austria, France, Germany, Israel and Italy where restricted settings include indoor hospitality, leisure facilities and gyms.

See Table 3 for restricted activities requiring COVID-19 certification in Scotland and comparator countries.

Table 3: Restricted activities requiring COVID-19 certification in Scotland and comparator countries. Correct as of 23 September 2021										
Country	Certification Name	Restricted activities								
		Indoor hospitality	Leisure facilities	Contact professions	Indoor events	Outdoor Events	Nightclubs	Gyms	Hospitals	Domestic travel
Scotland[135]	COVID-19 vaccination certification scheme				Y	Y	Y (late night venues)			
Austria[136]	Gruner Pass (Green Pass)	Y	Y	Y	Y	Y	Y	Y		
Belgium[137]	COVID Safe Ticket	(From 1 October 2021)[138]			Y	Y	Shut			
France[139]	Pass sanitaire	Y	Y	Y	Y	Y	Y	Y	Y	Y
Germany[140]	CovPass/ Corona Warn App	Y	Y	Y	Y	Y	Y	Y	Y	
Iceland[141]	N/A – Testing scheme				Y	Y				
Ireland[142]	COVID-19 certification scheme	Y	Y		Y	Y	Shut	Y		
Israel[143]	Green Pass	Y	Y		Y	Y	Y	Y		
Italy[144]	Certificazione verde (Green Pass)	Y	Y		Y	Y	Shut	Y	Y	Y
Netherlands[145]	Corona Check	Y	Y		Y	Y	Shut			
Norway[146]	COVID-19 certificate				Y	Y				
Wales[147]	(From 11 October)				Y	Y	Y			

[135] Vaccine certification plans approved by Scottish Parliament - gov.scot (www.gov.scot)
[136] Safe travels in times of Coronavirus: How Austria's entry tests work
[137] Covidsafe | Frequently Asked Questions
[138] Brussels to require coronavirus passports in bars from October – POLITICO
[139] Coronavirus Covid 19 – English | Gouvernement.fr
[140] Coronavirus vaccination: protection for everyone – Federal Government (bundesregierung.de)
[141] covid19
[142] COVID-19 restrictions in Ireland (citizensinformation.ie)
[143] What is the Green Pass Scheme? - Corona Traffic Light Model (Ramzor) Website (health.gov.il)
[144] Home - COVID-19 Green Certification (dgc.gov.it)
[145] Steps for getting a COVID Certificate for travel or events using CoronaCheck | Coronavirus COVID-19 | Government.nl
[146] COVID-19 certificate - helsenorge.no
[147] COVID Pass for events and nightclubs announced | GOV.WALES

EU countries with certification include events (indoor and/or outdoor) of varying sizes within their certification schemes, ranging for up to 1000 indoor in the Czech Republic to 75,000 in Belgium[148] [149] [150] [151] [152] [153] [154] [155] [156] [157] [158] [159] [160] [161] [162] [163] [164] [165] [166]. In Ireland, since 20 September 2021, when multiple cohorts have mixed immunity status at indoor events, uncertified individuals are allowed to enter in 'pods' of 6, with social distancing protective measures in place[167]. In Iceland, both indoor and outdoor events are allowed up to 500 with no certification and up to 1500 with certification[168].

In France and Italy domestic certification is also used for domestic travel, while in France and Germany it is used to enter hospital settings and in France public facing employees must be fully vaccinated or provide proof of a negative antigen test within a defined period of time.

5.3 The impact of certification on vaccine uptake

There have been a range of reasons for the introduction of COVID-19 certification in other countries[169]. France, Belgium and Germany introduced certification in response to increasing case numbers. Belgium aimed to use the certificates to avoid the reinstatement of social restrictions[170]. France and Israel introduced certification

[148] Safe travels in times of Coronavirus: How Austria's entry tests work
[149] Covidsafe | Frequently Asked Questions
[150] Covid putovnica - Naslovna (eudigitalnacovidpotvrda.hr)
[151] 03062021_safepassindoorEN.pdf (pio.gov.cy)
[152] COVID-19: What You Should Know before You Come · #VisitCzechRepublic
[153] Social events · Covid Portál (gov.cz)
[154] COVID-19 certificate | COVID-19 crisis webpage (kriis.ee)
[155] Coronavirus Covid 19 – English | Gouvernement.fr
[156] What you need to know about Germany's new "3G" Covid health pass rules - Worldakkam
[157] Update on COVID-19 - 13/09/2021| Info before you Travel | Discover Greece
[158] Hungary's late launch of the EU Digital COVID Certificate (covidpasscertificate.com)
[159] COVID-19 restrictions in Ireland (citizensinformation.ie)
[160] Home - COVID-19 Green Certification (dgc.gov.it)
[161] Covid-19 control measures | Covid-19 (covid19.gov.lv)
[162] National Certificate | Ministry of the Economy and Innovation of the Republic of Lithuania (lrv.lt)
[163] CovidCheck Certificates - Coronavirus - Official information - Luxembourg (public.lu)
[164] Steps for getting a COVID Certificate for travel or events using CoronaCheck | Coronavirus COVID-19 | Government.nl
[165] COVID-19 | Visit Lisboa
[166] Measures to contain the spread of COVID-19 infections | GOV.SI
[167] gov.ie - Public health measures that will come into place in September (www.gov.ie)
[168] covid19
[169] World Health Organization meeting on smart vaccination certificates WHO/Europe | Digital health - WHO European Region Member State meeting on Smart Vaccination Certificates (2021)
[170] Brussels could decide on Covid Safe Tickets in nightlife in September (brusselstimes.com)

to drive vaccine uptake, hoping that by restricting access to desirable events more people would take up the vaccine[171] [172] [173].

The impact of vaccine certification in Israel is unclear, as announcements were followed by protests and confusion; however, case rates declined allowing Israel's economy to begin reopening[174]. In Denmark the main stated goal was to encourage regular testing among unvaccinated people and certification was linked to the overall health situation rather than vaccine uptake. In the week beginning 16 April 2021, following the launch of certification on the 14 April, a record 1 million people were tested, roughly 1 in 4 adults, many getting tested several times a week[175]. The high rates of testing peaked on 12 May 2021 with 33.70 per 1000 but drastically dropped since then, averaging 6.27 per 1000 on 19 September 2021[176]. From 10 September, Denmark discontinued the use of their mandatory domestic COVID-19 vaccine certificate scheme, Coronapas with around 77% of all adults over 12 fully vaccinated they consider the epidemic to be currently under control[177] (weekly case rates in Denmark up to 16 September were 48.77 per 100k compared to 530.6 per 100k in Scotland)[178].

In Spain certification has not been introduced, Spain's central government cited its relatively high vaccine uptake for not requiring a certification scheme and instead prioritises vaccination as the key strategy to tackle COVID-19[179]. However, regional governments have started to consider the use of COVID-19 certifications. In Galicia, following a favourable Supreme Court ruling, the implementation of a scheme for hospitality and late night venues will now proceed[180]. In Catalonia, the government is exploring the possibility of introducing the scheme as a way of reopening indoor hospitality and late night venues[181]. The Valencian Government will initiate a dialogue with the hospitality and event sectors with a view of introducing a scheme from 9 October[182].

The percentage of the total population that was vaccinated when certification schemes were announced also varies significantly between countries, ranging from 3% of the total population in Denmark to 68% in Belgium[183].

In Scotland 75% of the total population (90% of adult population) had received at least one dose of a vaccine on 1 September when the announcement of vaccine

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171 Macron tells critics: vaccine passport will protect all our freedoms | France | The Guardian
172 Israeli health minister says vaccine passport system doesn't have 'medical justification' in some cases – leaked footage — RT World News
173 Incentivizing Vaccination Uptake: The "Green Pass" Proposal in Israel | Global Health | JAMA | JAMA Network
174 Covid passports | The Institute for Government
175 'Stark contrast': how Covid pass is helping Denmark open up | Denmark | The Guardian
176 Coronavirus (COVID-19) Testing - Statistics and Research - Our World in Data
177 Corona passport in Denmark - where and when? (coronasmitte.dk)
178 Our World in Data
179 https://www.thelocal.es/20210819/why-has-the-covid-health-pass-for-daily-affairs-been-rejected-in-spain-and-not-elsewhere-in-europe/
180 Orde do DOG nº 177-Bis do 2021/9/14 - Xunta de Galicia
181 El Govern proposa ampliar l'horari de l'oci ... - Govern.cat
182 GVA.ES: Ximo Puig avanza 'una nueva etapa de apertura progresiva' a partir del próximo lunes con la vacunación del 90% de la población
183 Coronavirus (COVID-19) Vaccinations - Statistics and Research - Our World in Data

certification scheme was made[184] [185]. Significant uptake of a first dose of vaccine was noted immediately after the Scottish Government announced their intention to introduce a vaccine certification scheme in the 16-17 age groups respectively, as seen in Table 4. In the five days after the announcement, an increase was seen in first dose uptake, peaking at an 81.3% increase on day 4 compared to the day of the announcement. Total vaccination uptake hasn't seen the same level of increase. With the total vaccination uptake in the 7 days after the announcement being at 75% of the 7 days prior. However, Scotland is starting at a higher vaccine level than comparator countries[186] [187].

Table 4: Vaccination rates in Scotland[Error! Bookmark not defined.]

Dose 1

Age group	1 September	17 September	Change (percentage points)
16-17	50.9%	66.4%	15.5
18-29	74.5%	75.9%	1.4
30-39	82.4%	83.1%	0.7
40-49	91.0%	91.4%	0.4
Under 40s	76.4%	78.4%	2.0

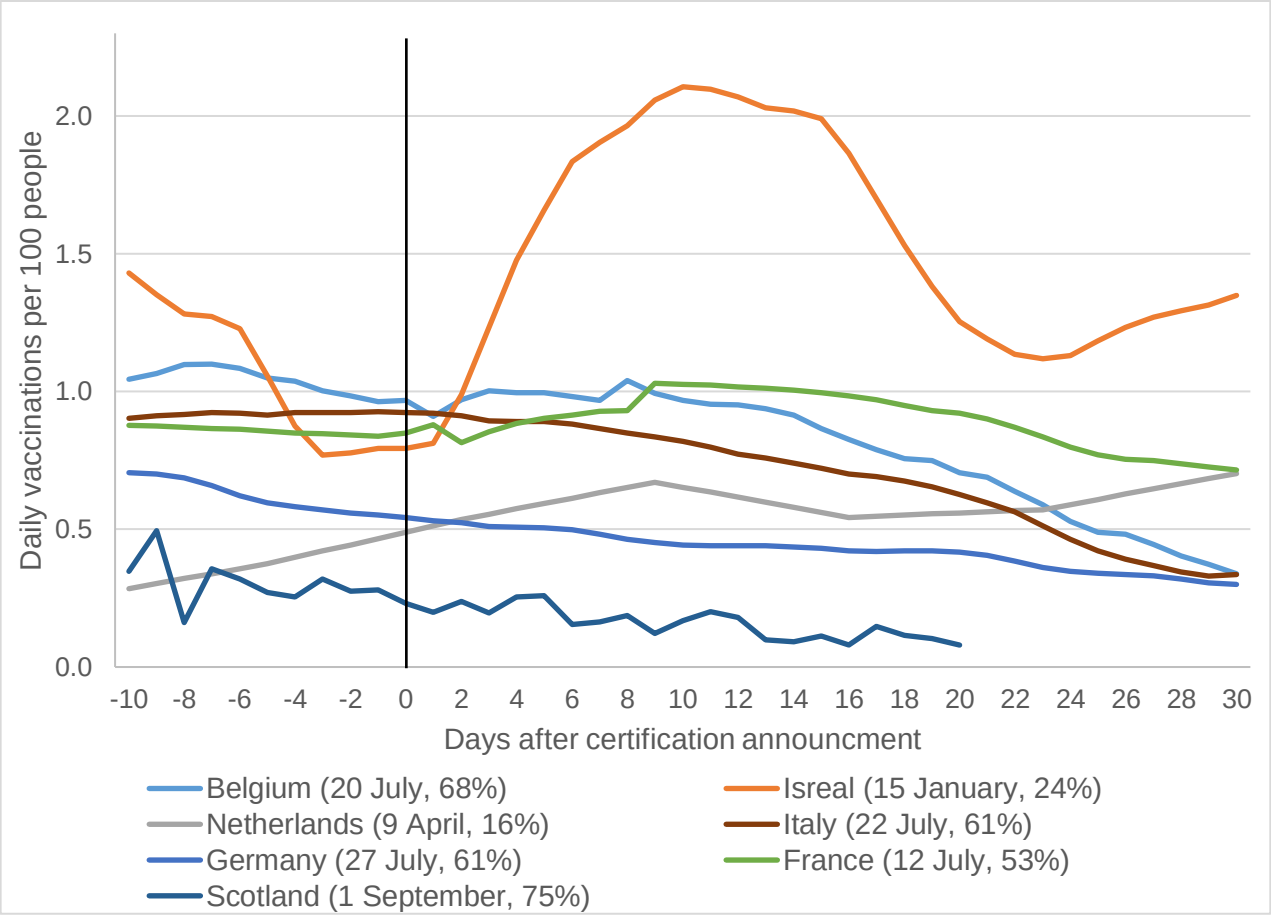
Dose 2

Age group	1 September	17 September	Change (percentage points)
16-17	8.6%	9.4%	0.8
18-29	52.6%	61.1%	8.5
30-39	71.3%	73.7%	2.4
40-49	84.9%	85.9%	1.0
Under 40s	57.9%	63.2%	5.3

COVID-19 certification schemes, including vaccine certification have been implemented in different countries, with a mixed response on vaccine uptake (Figure 11).

[184] COVID-19 Daily Dashboard | Tableau Public
[185] Coronavirus (COVID-19) update: First Minister's statement – 1 September 2021 - gov.scot (www.gov.scot)
[186] COVID-19 Daily Dashboard | Tableau Public
[187] Coronavirus (COVID-19) Vaccinations - Statistics and Research - Our World in Data

Figure 11: Daily vaccinations administered per 100 people, 10 days prior and 30 days after the initial announcement of COVID-19 certification.



Sources for dates of announcement for France[188], Italy[189], Scotland[190], rest from ICJU (unpublished). % of population vaccinated at time of announcement given[191]
From: Coronavirus (COVID-19) Vaccinations - Statistics and Research - Our World in Data. COVID-19 Daily Dashboard | Tableau Public Updated 21 September 2021.

Israel announced that they would be introducing a COVID-19 certification pass on 15 January. On that day, the number of people vaccinated against COVID-19 was 2.11 million (24% of the 18+ population), this increased to 2.72 million (32%) 10 days after the announcement on 25 January. Daily vaccine doses administered per 100 people over this period were 0.79 on 15 January and 2.11 on 25 January. Therefore a 100% increase was observed in daily doses administered over the 10 day period after the announcement was made, however this is a correlation, rather than proof of effectiveness of the scheme. The proportion of people vaccinated against COVID-19 with at least one dose of vaccine over 10 days period after the announcement day rose from a low level of 24% to 31%[192].

[188] https://www.connexionfrance.com/French-news/Health-pass-extended-more-vaccination-Macron-s-anti-Covid-measures
[189] What is it - COVID-19 Green Certification (dgc.gov.it)
[190] Coronavirus (COVID-19) update: First Minister's statement – 1 September 2021 - gov.scot (www.gov.scot)
[191] Coronavirus (COVID-19) Vaccinations - Statistics and Research - Our World in Data
[192] Coronavirus (COVID-19) Vaccinations - Statistics and Research - Our World in Data

Appointments in Italy increased by 200% in some regions in the following months after the announcement[193].

In Ontario where a vaccine only certificate was introduced, “The proof of vaccination policy has resulted in a marked increase in vaccination rates. Between September 1 and September 8, 2021, the seven-day average for first doses administered increased by more than 29 per cent, from over 11,400 doses to over 14,700 doses. During that time, more than 90,000 first doses and 102,000 second doses were administered in Ontario to individuals aged 18 to 59”[194].

Comparator countries first announced certification at different stages of their vaccination rollout and epidemic. Belgium, Germany and Netherlands have seen little to no change in vaccination uptake rates after announcements. A range of other factors such as vaccine supply and cohort eligibility are also likely to affect situation differently in each comparator country.

France introduced certification to drive vaccine uptake by restricting access to desirable events[195]. In the first few weeks after the introduction of vaccine/immunity certificates in France an increase in vaccination rates was reported, with 4 million being vaccinated in the 2 weeks after the announcement[196]. Vaccination rates per 100 people increased from 0.85 on July 12 2021 to 1.03 on 21 July 2021[197]. Since this initial peak, daily vaccination rates have dropped to 0.34 per 100 people on 15 September 2021[198]. There have also been numerous demonstrations against vaccine certification since the announcement was made[199] [200].

Notably France introduced an update to their certification scheme on 30 August whereby all staff with face to face interactions with the general public are required to be fully vaccinated or have tested negative for the virus in the last 72 hours. This is thought to affect around 1.8 million workers[201].

Italy have also announced the introduction of certification to public and private work from the 15 October 2021. This includes all staff of public administrations, holders of elective offices and institutional offices, those who work in the private sector and administrative staff and magistrates with judicial offices[202].

[193] Italy’s ‘green pass’ boosts vaccine uptake while the right grumbles – POLITICO
[194] Ontario Releasing Guidance to Support Proof of Vaccination Policy | Ontario Newsroom
[195] France enforces vaccine passports for over-18s visiting museums and cultural venues | The Art Newspaper
[196] Four million French get vaccinated in two weeks since Macron's announcement on health passports - The Local
[197] Coronavirus (COVID-19) Vaccinations - Statistics and Research - Our World in Data
[198] Coronavirus (COVID-19) Vaccinations - Statistics and Research - Our World in Data
[199] Protests in France against COVID-19 'health pass' rules | Reuters
[200] France braces for widespread demonstrations against Covid-19 health pass (rfi.fr)
[201] French health pass mandatory for 1.8 million workers from today (connexionfrance.com)
[202] FAQ - COVID-19 Green Certification (dgc.gov.it)

5.4 The impact of certification on transmission risk

As described in Section 3, vaccinated people are less likely to become infected and so less likely to infect others, therefore vaccination prevents transmission at large events by reducing the likelihood of infected people being present.

There is limited evidence to date that vaccine certificates alone result in a reduction in transmission at events given the difficulties in linking specific cases to specific venues. However by encouraging more people who attend higher risk venues to become vaccinated the transmission risk will be reduced. This is particularly important in the absence of other mitigations in such venues, for example physical distancing or the wearing of face masks, which would be alternative ways of reducing transmission.

There is some evidence that COVID-19 certification based on test results as well as vaccination status can be open to manipulation. The Netherlands implemented COVID-19 certification for nightclub entry on 26 June, 2021. Despite attempts to prevent unauthorised access unvaccinated and untested individuals were still able to gain entry due to end-user errors and oversight[203]. Subsequent rises in cases led to the closure of nightclubs again[204]. However, the government is currently developing support measures for nightclubs and discos to try to reopen[205].

Media reports increasingly note the problem of fake certificates[206] [207] [208]. Some countries have implemented fines and prosecution for individuals found using counterfeit certificates and for businesses found not to be checking certificates[209] [210].

5.5 The interaction of certification and event capacity

The UK Government's Events Research Programme, set up to examine the risk of transmission of COVID-19 from attendance at mass events, has completed the 3 phases of the research. Details can be found at Information on the Events Research Programme - GOV.UK (www.gov.uk)

During Phase I of the programme all attendees were required to provide a negative lateral flow (rapid) test before they could enter each event. They were also asked to take a voluntary PCR test before and after the event, however there was a low return rate of 15%). At the time, virus prevalence was low and together with the low rate of testing before and after events, it was not possible to draw conclusions on the effectiveness of the testing scheme[211].

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[203] False results and hacking: reopening of Dutch clubs proves to be problematic – DutchReview
[204] Netherlands lifted COVID restrictions too soon, PM apologizes | News | DW | 12.07.2021
[205] Netherlands to reopen further with coronavirus entry passes | News item | Government.nl
[206] Fake Covid vaccine and test certificate market is growing, researchers say | Coronavirus | The Guardian
[207] Can the US crack down on fake vaccination cards? - BBC News
[208] Fake COVID vaccine certificates sold on dark web for €150 | Euronews
[209] France forced to soften rules after coronavirus green pass backlash – POLITICO
[210] Proof of Vaccination Guidance for Businesses and Organizations under the Reopening Ontario Act (gov.on.ca)
[211] Events Research Programme: Phase I findings - GOV.UK (www.gov.uk)

Results from the Phase III showed that the highest percentage of all the infections connected to various mass events came from the eight European Football Championship EURO 2020 games involved (June – July 2021). Researchers concluded that;

> "Whilst some of this may be attributed to a set of circumstances which are unlikely to be replicated for the forthcoming sporting season, other aspects may be important to consider including mitigations for spectators to consider such as face coverings when travelling to and from events and minimising crowding in poorly ventilated indoors spaces such as bars and pubs where people may congregate to watch events"[212].

Another risk mitigating measure recommended was promoting vaccination during high community prevalence as this reduces the number of people who are potentially infectious or at risk when entering the venue without the necessity to limit the attendance.

Four events have been associated with higher numbers of cases (over 1,000). These are the UEFA, European Football Championships 2020 final (Italy vs England, 11 July, 2021) and one of the semi-finals (England vs Denmark, 7 July, 2021), Latitude Music Festival and Tramlines Festival. These events all took place during a period of higher underlying community prevalence[213] [214]. The UK government's analysis of the Phase III findings concluded that mass events can take place safely as case numbers were largely in line with or below community infection rates, but fans are urged to remain cautious in crowds and encouraged to get vaccinated.

Preliminary findings have been reported from a study 'Limiting Virus Transmission during Sporting Mega Events (LIVE)' project by researchers from the University of Stirling and Loughborough University. They analysed COVID-19 mitigation measures and behaviours of fans that attended matches at Hampden Park, Glasgow or Wembley Stadium, London during the UEFA European Football Championships in June – July 2021 using trained supporters to collect data via structured observations. The study recommended that several improvements could be made to assist future large scale events including providing clearer instructions of the mitigation measures in place to attendees prior to the event[215]. They all suggested that proof of identification to be included as part of the protocol if testing or vaccination status was required, see **Annex D** for further details.

6. Public attitudes and societal impacts of vaccination.

A key objective of the vaccine certification scheme is to encourage vaccine take-up. For some vaccine hesitant people vaccine passports are perceived to be a reason

[212] Public Health Impact of Mass Sporting and Cultural Events in a rising COVID-19 prevalence in England (khub.net)
[213] Government data shows mass events can take place safely but fans urged to remain cautious in crowds and get vaccinated - GOV.UK (www.gov.uk)
[214] Events Research Programme Phases I, II and III data release - GOV.UK (www.gov.uk)
[215] Policy briefings | Research | University of Stirling

why they would get vaccinated in the future. However, for others, vaccine passports were seen as coercive measures to control the population and violate privacy[216] [217]. There are variations in views depending on socio-demographic status[218]. (See **Annex C** for further details). Research on the impact of COVID-19 vaccine certificates on issues of identity and control and its interaction with wider public health issues is evolving[219] and more evidence will become available.

A study examining the views of a large number of scientists across the world earlier on in the pandemic also found that a small majority favoured immunity certification but a large minority also expressed concerns about fairness and inequality[220]. From a survey of over 12,000 scientists the authors found that scientists perceive immunity certificates as favourable for public health (50.2%) and the state of the economy (54.4%) while one-fifth (19.1%) and one-sixth (15.4%) disagree. Scientists stipulate some concerns about fairness (36.5%) and inequality (22.4%) arising from implementation of immunity certification.

Research recommends that implementation will require clear, specific and delimited purpose, ethical justifications, and practical solutions that do not discriminate against the poor, the less technically literate, and people from low and middle income countries[221] [222] [223] [224] [225] [226] [227][228].

Research into public attitudes carried out by YouGov for the Scottish Government, on 24-25 August 2021, (n=1006 people in Scotland) highlighted attitudes towards the benefits and concerns of a certification scheme. Over half of respondents (55%) would download and use a mobile app to prove either vaccination or a negative test result, with just over one in five (23%) saying they would not use such an app. Around three quarters, (74%) would be happy to share their vaccination status or test results via a certification scheme to allow entry to a venue and 62% say that this would make them feel more comfortable if they were to go to a venue or an event (up from 58% in early June) There are worries about the vaccine passport scheme, with 62% questioning whether everyone will have immunity and 67% worrying that systems may not be fool-proof (down from 77% in early June).

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[216] Public attitudes to COVID-19 vaccines: A qualitative study | medRxiv
[217] Covid-19 vaccine passports and vaccine hesitancy: freedom or control? - The BMJ
[218] The potential impact of vaccine passports on inclination to accept COVID-19 vaccinations in the United Kingdom: evidence from a large cross-sectional survey and modelling study | medRxiv
[219] COVID-19 immunity (or vaccine) passports: a documentary overview and analysis of regimes of health verification within the coronavirus pandemic | Emerald Insight
[220] Scientists have favorable opinions on immunity certificates but raise concerns regarding fairness and inequality (nature.com)
[221] Checkpoints for vaccine passports | Ada Lovelace Institute
[222] "Vaccine Passport" Certification — Policy and Ethical Considerations | NEJM
[223] EU Covid-19 certificate (europa.eu)
[224] Covid-19 vaccine passports: access, equity, and ethics | The BMJ
[225] Behavioural responses to Covid-19 health certification: A rapid review (medrxiv.org)
[226] COVID-19 Immunity Passport to Ease Travel Restrictions? | Journal of Travel Medicine | Oxford Academic (oup.com)
[227] Nalubola, S (2021). Vaccine Passports and COVID-19: Ethical, Scientific, and Practical Considerations
[228] JAMA Health Forum – Health Policy, Health Care Reform, Health Affairs | JAMA Health Forum | JAMA Network

Research into public attitudes on the vaccine certification scheme, carried out by YouGov for the Scottish Government on 21-22 September 2021 (n=1005 people in Scotland) stated that 56% support its introduction and 26% oppose it. When asked about the effect of the vaccine certification scheme on likelihood of visiting a venue or event that require it, 30% would be 'much/slightly more' likely to visit and 45% agree they would like to see it rolled out to other types of venues and events. 52% agree that the scheme is a good way to help control the spread of the virus and 51% disagree that they don't think this type of scheme is fair on those who aren't vaccinated (See **Annex C** for further details on methodology and sample).

In terms of general support across time in the UK, latest polling conducted 28-29 July (YouGov Aug 9th) states that public opinion regarding vaccine passports has stayed much the same since March[229], with six in ten Britons (60%) supporting the introduction of vaccine passports during the vaccine rollout, including 30% who 'strongly' support their implementation[230]. However, support for their introduction decreases down the age groups.

The UK generally shows a positive disposition towards vaccination certification compared to other countries, according to an Ipsos survey carried out for The World Economic Forum (April 2021) which suggested that Great Britain has comparatively high support for certification compared to comparator countries[231] [232].

The Scottish Government is committed to ensuring that human rights, children's rights and equality are embedded in everything we do and are central to our response to the pandemic. The Framework for Decision Making recognises that harms caused by the pandemic do not impact everyone equally and that we must work to advance equality and protect human rights. An Equality Impact Assessment (EQIA) to analyse the potential impacts, of the use of COVID-19 Status Certification domestically for each protected characteristic under the Equality Act 2010 has been produced. Where there are potential negative impacts, mitigating actions have been identified. The document also assesses the impact of the policy on the Scottish Government's obligations under the Public Sector Equality Duty (PSED) to advance equality of opportunity, eliminate unlawful discrimination and to foster good community relations.

The Scottish Government has also developed a Children's Rights and Wellbeing Impact Assessment (CRWIA) to analyse the potential impact, both positive and negative, of the domestic use of COVID-19 Status Certification on the promotion of children's rights and wellbeing. As with the EQIA, where potential negative impacts have be found, mitigating actions have been identified.

Both of these documents will be published shortly and should be read in conjunction with this evidence paper.

[229] Most Britons support a COVID-19 vaccine passport system | YouGov
[230] Britons still broadly support COVID-19 vaccine passports | YouGov
[231] Présentation PowerPoint (ipsos.com)
[232] Garrett, P (2021). Public attitudes to immunity passports | Pursuit by The University of Melbourne (unimelb.edu.au)

7. The economic impact of vaccination certification

7.1 Businesses and sectors affected

The introduction of certification is considered against the alternative of not introducing a certification scheme, although the latter option is not likely to have any immediate financial implications for businesses. However, if the state of the epidemic requires further more restrictive measures such as closures to be considered, the negative economic impact on these sectors is likely to be significant.

The introduction of certification would allow specific high-risk settings, which have either been closed for long periods of time throughout the last 18 months or operating at reduced capacity, to remain open and to provide a safe experience for customers and to allow businesses to continue to operate.

The Business Regulatory Impact Assessment sets out the relative costs and benefits of certification options and will be published shortly.

7.1.1 Sectors, businesses and individuals affected

The certification system as described in section 3.2 will potentially affect:

- Late night venues, their workforces and customers;
- Indoor cultural performance venues associated with live events, particularly larger venues that stage unseated performances;
- Outdoor venues associated with large cultural or sporting gatherings, such as larger sports stadia and racecourses;
- Conference centres, in instances where staging large scale seated or unseated live events, trade fairs, markets or exhibitions;
- Businesses involved in the organization and staging of live events, such as performers, event promoters, staging and production businesses, associated supply chain businesses;
- Ancillary businesses dependent on live events (e.g. food and drink sales, merchandising).
- Prospective attendees at live events.

7.1.2 The number of businesses potentially affected

<u>Events industry</u>
The industry association “2020 UK Events Report” reported direct spend of £70 billion in the events sector in the UK in 2019. Visit Scotland has estimated 9% of the UK total can be attributed to Scotland, representing £6 billion of direct spend to the Scottish economy and also accounting for approximately half of the country’s total visitor spend.

Direct and indirect impacts on the Events Industry arising from certification would accrue to venue operators, but also potentially on event organisers, performers, support businesses and ancillary businesses, operating across a range of event types, depending on audience numbers. It is not currently possible to indicate the

full range of individual events that would be impacted by the regulations, or the associated number of wider businesses affected. The following data therefore presents a summary of data on businesses associated with staging and supporting of events in Scotland overall.

It is estimated, based on the Inter-Departmental Business Register 2020 and 2019 Business Register and Employment Survey that there are 3,785 Events Industry businesses in Scotland. Event catering businesses, performing arts, activities of sports clubs and activities of exhibition and fair organisers are such businesses in Scotland that fall under this classification[233]. These businesses operate across 4,625 sites (as some businesses may have more than one site) and are estimated to employ around 56,000 people. Not all of these businesses would be in scope, however, we currently have no specific data on supply chains for these businesses. It is likely that most of these are based in cities and larger towns although it is not possible to obtain detailed data at this time.

Based on the Annual Business Survey 2018, the events industry had an estimated Turnover of £1,927 million in 2018 (0.8% of Scotland's non-financial business economy Turnover in 2018) and an estimated Gross Value Added (GVA[234]) of £978 million in 2018 (1.0% of Scotland's non-financial business economy GVA in 2018). The local authority areas contributing most to total GVA within the events sector in 2018 were Glasgow City (17%), City of Edinburgh (15%) and Fife (9%).

Small businesses form the majority part of the sector. Figures from the Inter Departmental Business Register indicate that in 2020, 96% of businesses in the Events Sector had fewer than 50 employees, 3% had between 50 and 249 employees and 1% had more than 250 employees. Similarly, 50% had a turnover of between £100,000 and £499,000 and 8% had a turnover in excess of £1 million (IDBR, 2020).

Only around 17% of events businesses have a turnover of £500,000 or more. Approximately 1,265 had a turnover of less than £100,000. Of the 655 businesses operating with a turnover of £500,000 or more, 120 (14%) were present in Edinburgh

[233] Events Industry defined here using the following SIC2007 codes: UK SIC 2007 - Office for National Statistics (ons.gov.uk)
5621 : Event catering activities
9001 : Performing arts
9002 : Support activities to performing arts
9004 : Operation of arts facilities
9311 : Operation of sports facilities
9312 : Activities of sport clubs
68202 : Letting and operating of conference and exhibition centres
74209 : Other photographic activities (not including portrait and other specialist photography and film processing)
79909 : Other reservation service activities (not including activities of tourist guides)
82301 : Activities of exhibition and fair organizers
82302 : Activities of conference organizers
93199 : Other sports activities (not including activities of racehorse owners)

[234] Gross value added (GVA) represents the amount that individual businesses, industries or sectors contribute to the economy. It is the value of an industry's outputs less the value of intermediate inputs used in the production process.

and 85 (12%) in Glasgow. The figure is 7% for Fife, 7% for Highland and 5% in South Lanarkshire (IDBR, 2020).

The Business Register and Employment Survey 2019 indicates that, overall, more than 50% of employees in the sector work part-time (54,000 employees, of which 25,000 are full-time).

Approximately 6,300 (11.1%) of workers in the events industry were self-employed. This is a slightly lower proportion than for the workforce as a whole (12.4%). The proportion of women working in the events industry is similar to the proportion in the overall workforce – 46.6% and 48.8% respectively. However, for Events Catering Activities, women make up 55.4% of the workforce and for Other Reservation Service and Related Activities they make up 72.9% of the workforce. Source: Annual Population Survey, Jan-Dec 2019, ONS.

Sports

For the sports sector, certification will impact on Scottish Rugby home internationals, Scottish Football home internationals, and the home fixtures for all of Rangers, Celtic, Aberdeen, Hearts and Hibernian. The two Dundee clubs may occasionally be affected too. Scottish Rugby have 4 home fixtures over October and November and the Scottish football team have 2. However, for domestic games one of the Glasgow and Edinburgh clubs will have a home fixture each week and there will be additional domestic and European cup matches where certification is required.

Late night venues with music, alcohol and dancing

It is estimated, based on the Inter-Departmental Business Register 2020 and 2019 Business Register and Employment Survey that there are 120 businesses under the heading non-charity licensed clubs. Nightclubs and sexual entertainment[235] businesses in Scotland fall under this classification. These businesses operate across 145 sites (as some businesses may have more than one site) and are estimated to employ around 2,500 people. It is not possible to separate out sexual entertainment venues from this, though it is understood less than 20 operate in Scotland as of 2015. The vast majority of nightclub and sexual entertainment businesses are small (employing less than 50 people). We currently have no specific data on supply chains for these businesses. It is likely that most of these are based in cities and larger towns although it is not possible to obtain detailed data at this time.

- Based on the Annual Business Survey 2018, nightclub businesses had an estimated Turnover of £84 million in 2018 (0.03% of Scotland's non-financial business economy Turnover in 2018).

[235] As per previous work for Nightclub related BRIAs (e.g. p54-71: The Health Protection (Coronavirus) (Restrictions and Requirements) (Local Levels) (Scotland) Regulations 2020 (legislation.gov.uk) – Nightclub businesses are defined here as non-charity licensed clubs (within Standard Industrial Classification code 56.103). Nightclubs and sexual entertainment businesses in Scotland fall under this classification. The SIC code definition of nightclubs used here does not align perfectly with the definition of nightclubs used in certification regulations. These statistics therefore represent a best estimate.

- Based on the Annual Business Survey 2018, nightclub businesses had an estimated Gross Value Added[236] of £44.6 million in 2018 (0.05% of Scotland's non-financial business economy GVA in 2018).
- Based on the Inter-Departmental Business Register 2020, it is estimated that there are 120 nightclub Businesses in Scotland. These businesses operate across 145 Sites (as some businesses may have more than one site).
- Based on the Business Register and Employment Survey (BRES) 2019, it is estimated that nightclub businesses provide 2,500 Jobs across Scotland (0.1% of Scotland's Jobs in 2019).

Late Night Venues – Hybrid Venues

There are potentially premises that might be classed as pubs or restaurants in official statistics that could fall within scope of the regulations.

Stakeholder estimates suggest that there may be around 300-400 premises across Scotland that operate as 'hybrid' venues (e.g. as pubs or restaurants during the day, and late night venues with music, alcohol and dancing at night). Stakeholders have also suggested there may potentially be up to 1,500 premises that may operate with some of the late night venues with music, alcohol and dancing characteristics (e.g. late opening, dancefloors, loud music).[237] However, it is not currently clear the extent to which all or some of these premises would fall within scope of the regulations.

7.2 Nature and scale of economic impacts

7.2.1 Context

The sectors impacted by certification are also those that have been hard hit by the impact of the pandemic as a result of restrictions that have required long periods of closures and limits on their operating capacity.

Over the course of the pandemic, businesses in Accommodation & Food and Arts, Entertainment & Recreation sectors have consistently been more likely to report decreased turnover than businesses across all sectors – 44.0% and 56.1% respectively, compared to 27.1% of businesses across all sectors in the period 23 Aug to 5 Sept 2021. In this latest period, 11.6% of businesses in the Accommodation & sector, and 17.9% of businesses in the Arts, Entertainment & Recreation sectors reported their turnover had decreased by more than 50% compared to what would normally be expected, compared to 4.4% of businesses across all sectors.

The sustained losses incurred by many businesses in worst affected sectors will likely have a significant impact on resilience. It follows that borrowing will have increased, and cash reserves will have been depleted for many businesses. Even as profitability approaches pre-COVID-19 levels in the worst affected sectors, businesses in these sectors could be vulnerable to any further restrictions, particularly as key support packages such as furlough scheme are withdrawn.

[236] Gross value added (GVA) represents the amount that individual businesses, industries or sectors contribute to the economy. It is the value of an industry's outputs less the value of intermediate inputs used in the production process.

[237] Night Time Industries Association (2021), Covid Status Certification: NTIA Scotland Briefing Paper

7.2.2 Impact on costs

Certification will increase administration costs for businesses and administration difficulties at a time when businesses in the sectors have weak cash flow. For example, the Night Time Industry Association reports that night time businesses that were closed until 9 August are carrying on average a debt burden of £150k, which now needs repaid. Consequently, many will no longer be suitable for further lending thus their resilience to cope with further impacts is significantly diminished.

Costs will include

- Additional resource for staff to check certification.
- Dedicated hardware to scan or read certification (mobiles/tablets) and/or install technology to check QR codes at automatic entry barriers.
- Cancellation of tickets and refunds
- Additional policing costs arising if there are scenes of disorder at sports stadia due to long queues caused by certification checks.
- For business events, additional complexity of exempting one element of the programme (e.g. standing receptions), with associated cost and reputational risk of denying delegates who are attending this and all other elements in a work capacity. Business event professionals have shared that the majority of high value business events in Scotland encompass receptions that would be in scope (500+).
- Loss in revenue if customers choose to visit venues and events which do not require certification (see next section of impact on footfall).

The extent of these costs would likely vary across businesses, depending on the scope to integrate them into existing staff functions, use existing IT infrastructure, or physical infrastructure. These costs may be higher for businesses which have not delivered a similar function historically, such as venues which have previously not had a need for door staff and will now require staff to check certification at the point of entry.

Staff costs represent a large component of the overall running costs of businesses in these sectors. For example, in Accommodation and Food Services sector staff costs account for 42% of total costs and in Arts, Culture and Entertainment sector staff costs account for 18% of total costs (compared to 25% across all sectors)[238].

Overall impacts on staff costs would likely vary across businesses depending on several factors, particularly whether the regulations' requirements could be accommodated within existing staff responsibilities or would require additional staff. If the latter were required, costs would be influenced by factors such as numbers of staff required, and number of hours required each week. It is not currently possible to give an estimate of the overall magnitude of additional staff costs for the reasons set out above. However, hourly and weekly gross wage costs for occupational

[238] Scottish Annual Business Survey, Scottish Annual Business Statistics (SABS) 2018, Scottish Annual Business Statistics 2018 - gov.scot (www.gov.scot). Note that SABS excludes financial sector & parts of agriculture and the public sector.

groups that would be affected by the regulations are set out the Table 1 below. It should be noted that these statistics do not include non-wage labour costs, such as Employers' NIC and pension contributions:

Table 5: Gross Mean Hourly and Weekly Pay, Selected Occupations, 2019

	Mean Gross Hourly Pay, £			Mean Gross Weekly Pay, £		
	All	Part-Time	Full-Time	All	Part-Time	Full-Time
Security Guards & Related Occupations (SOC 9231)	£11.09	£12.50	£10.91	£409.30	£216.20	£467.60
Bar Staff (SOC 9265)	£8.37	£8.38	£8.36	£151.90	£123.30	£303.40

Source: ONS, Annual Survey of Hours and Earnings 2019, Tables 15.1a, 15.5a: Earnings and hours worked, region by occupation by four-digit SOC: ASHE Table 15 - Office for National Statistics (ons.gov.uk)

It is noted that there is a widely reported difficulty in securing sufficient numbers of stewarding staff at present, due to labour shortages, which could be exacerbated during COP26. There is also evidence of continued strong growth in vacancies in hospitality staff[239]. Both of these could create challenges for affected businesses in recruitment of numbers of staff required as a result of regulations. However, it is possible that more people could be encouraged to return to the industry if they perceived the workplace venues as less risky.

The magnitude of these costs will be closely linked to the level of enforcement expected from businesses, the footprint of venues and flow of customers at venues and events. Regulations would impose a legal requirement on the person operating the business or premises to 'take all reasonable measures' to ensure that only those fully vaccinated or exempt are admitted, with guidance used to set out what reasonable measures may be in different settings. The Scottish Government has proposed that reasonable measures will include enabling businesses to check vaccine certificates initially either visually or by scanning the QR code with a view that the number being scanned increased over time. For late night venues, and for smaller events, the expectation would be that this would transition over the first month of operation to a 100% check on entry, given the option for a visual check. For large events, the Scottish Government has proposed that what is reasonable should be assessed by business on a venue by venue basis.

It has been indicated by businesses that a 20% visual check at sporting events may be achieved with minimal additional resource, however the Scottish Football's COVID-19 Joint Response Group estimates that the cost of creating and staffing an outer cordon in sports stadia could cost upwards to £5,000 per game, and that is before technological infrastructure costs.

[239] For instance, the RBS Markit Report on Jobs, September 2021 reported continued strong growth in August in temporary and permanent Hotel & Catering staff vacancies in Scotland, albeit after unprecedented declines in Spring 2020.

The technology investment may be a one-off expenditure for businesses, with requirements to issue staff with dedicated hardware to read certification such as mobile phones or tablets.

Scottish Rugby have indicated that providing scanning technology to stewarding staff to check QR codes, if it were a requirement, could cost in the region of £35,000. This provides an indication of potential similar costs at comparable sized stadia in Glasgow, of which there are three. The costs to SPFL football clubs in Edinburgh and Aberdeen could be in the region of a third of this each.

Alternatives to staff checking certification in person are being considered, with Scottish football clubs exploring the potential to pre-load vaccine certification on to season ticket databases to minimise costs and disruption on match days due to the high proportion of season ticket holders attending matches. The development of such capabilities would require an initial investment and ongoing administrative costs to operate. It is not clear what the cost of this infrastructure would be at this time.

This option has further financial impact on events which run over a prolonged period of time such as trade fairs and exhibitions which often run over a number of days. The combination of extended event times and changeover in attendees would require consistent staffing capacity to check certification.

There may be additional costs associated with enforcement and subsequent policing due to Certification. Given the limited scope of the certification scheme we would anticipate these being absorbed as part of the work of EHOs and Police Scotland relating to enforcement and adherence at larger events

It is noted that businesses engaged with through stakeholder engagement noted that there is a significant risk to the reputation of businesses based in Scotland or those holding events in Scotland that cannot be quantified. But this could also be used to demonstrate that Scotland is a safer place for events to take place.

Businesses involved in the organisation and staging of live events and ancillary businesses dependent on live events (e.g. food and drink sales, merchandising) may experience knock on effects from the impacts experienced by venues and events

The impact on business profitability has been raised consistently with many sectors highlighting that their members are already running with high levels of debt due to closures during the pandemic and therefore a reduction in customers or an interruption to normal trading will put some business premises in a more difficult financial position
There are concerns about having enough staff to implement the new scheme, given shortages of personnel, businesses have concerns about having to check all customers, as this would cause unacceptable delays for them to enter venues, potentially leading to crowd compression and therefore greater risk of transmission.

Further details on costs of options are set out in the Business Regulatory Impact Assessment that will be published imminently.

7.2.3 Impact on footfall

Certification may also impact footfall result which in turn could result in a loss of trade and revenue for participating venues, with consequent pressures on individual businesses' viability.

Footfall could be impacted in the following ways:

- Those without certification would be refused entry (which in turn depends on numbers vaccinated)
- Others may be reluctant to attend if non-certificated friends were unable to attend
- Entry delays could deter customers if onerous.

On the other hand, custom could increase if customers feel safer, particularly amongst higher spending older customers.

If capacity limits are maintained at events than certification can only increase revenues if the number of events that go ahead increases. However if certification is accompanied by lifting capacity limits then the costs of obtaining local authority approval will be removed and revenues may rise as more people are able to attend.

7.2.4 Wider impact on consumer choice and market impacts

Certification will potentially restrict some consumers' ability to attend nightclubs, AEVs and live scale events, and potential displacement to less regulated alternative venues and settings. This may place increased pressure on businesses involved in these activities through reduced footfall and turnover, with consequent pressures on business viability. This pressure may encourage business exit if sufficiently severe and long-lasting; however, it will also be influenced by consumers' decisions around vaccine uptake, and the duration and severity of the wider pandemic.

There is potential for displacement to other less regulated settings (e.g. pubs) or greater competition for events providers and venues from other geographies. This may strengthen suppliers' incentives to compete across different markets.

Further details on wider impacts are set out in the Business Regulatory Impact Assessment that will be published imminently.

7.2.5 Impacts of closure

However, if the state of the epidemic requires further more restrictive measures such as closures to be considered, the negative economic impact on these sectors is likely to be significant.

COVID-19, and previous restrictions introduced to control the virus, have had a substantial impact on these sectors. Estimates of direct impacts on GDP are not available from official statistics for nightclubs and live events venues as a standalone part of the economy, rather they are contained within the following sections of the economy who have experienced significant impacts. For instance, during the first lockdown output fell significantly over the month of April 2020: by 77.0% in

Accommodation and Food Services and by 42.6% in Arts, Culture and Recreation sector. When further restrictions were imposed on Accommodation and Food Services in 2021 output fell 30.5% over the month of January 2021. These figures highlights the potential order of magnitude of loss in economic output that could arise from closure[240].

Relative impacts of the pandemic on sector viability have varied between sectors and business size bands, with sectors more seriously affected by restrictions for longer periods have endured longer periods of lack of viability (e.g. Accommodation & Food Services, Arts, and Entertainment & Recreation). Over the course of the pandemic, businesses in Accommodation & Food and Arts, Entertainment & Recreation sectors have consistently been more likely to report decreased turnover than businesses across all sectors – 44.0% and 56.1% respectively, compared to 27.1% of businesses across all sectors in the period 23 Aug to 5 Sept 2021. In this latest period, 11.6% of businesses in the Accommodation & Food services sector, and 17.9% of businesses in the Arts, Entertainment & Recreation sectors reported their turnover had decreased by more than 50% compared to what would normally be expected, compared to 4.4% of businesses across all sectors[241].

The sustained losses incurred by many businesses in worst affected sectors will likely have a significant impact on resilience. It follows that borrowing will have increased, and cash reserves will have been depleted for many businesses. Even as profitability approaches pre-COVID-19 levels in the worst affected sectors, businesses in these sectors could be vulnerable to any further restrictions, particularly as key support packages such as job retention scheme are withdrawn. It should be noted that, unlike the first and subsequent lockdowns, the support schemes in place in future will be different with, for example, the furlough scheme ending in September 2021. This would exacerbate the economic impact of closure for businesses in these sectors.

8. Conclusion

To continue to manage the epidemic at this point in time requires additional measures to be put in place to help reduce infection and subsequent hospitalisations as we move into the winter season. Vaccine certification could assist as a package of measures along with other non-pharmaceutical interventions (NPIs). Vaccine certification is a far less restrictive measure than re-introducing capacity limits on venues, early closure times or complete closure of events.

Vaccines help prevent transmission as vaccinated people are less likely to catch the virus and only infected people can infect others. Vaccinated people who catch the virus are less likely to become seriously ill than unvaccinated people. However people infected with the Delta variant who are fully vaccinated can contract symptomatic breakthrough infections and transmit the virus onwards. There is insufficient data to conclude whether people who have symptomatic infections are as infectious as unvaccinated people, or whether fully vaccinated people with

[240] See https://www.gov.scot/publications/monthly-gdp-july-2021/
[241] BICS weighted Scotland estimates: data to wave 38 - gov.scot (www.gov.scot)

asymptomatic breakthrough infections can transmit SARS-CoV-2. The impact of vaccine waning on transmission is not yet clear.

Vaccination certification reduces the likelihood of infected people being present at events. Evidence from the UK Events Research Programme (section 5.5) together with evidence on the science of transmission (section 3.1) suggests that mitigation measures to reduce the risk of transmission should be considered and implemented as a part of a package, certification alone is not enough.

Different countries introduced their certification schemes with varying aims depending on the current state of the epidemic and the level of vaccination in place at the time of introduction. The main difference of the certification system proposed for Scotland compared to other European countries is that it takes into account vaccination status only, not testing results, or previous infection. The proposed vaccination certification scheme in Scotland is also narrower in scope compared to most comparator countries and the level of vaccination within the Scottish population is also higher than was the case in most other comparator countries when they introduced their certification schemes.

Some initial increase in vaccine uptake was noted in Scotland when the scheme was initially announced but given these differences and the variety of schemes in place elsewhere it is difficult to draw clear trends and conclusions between implementation of vaccine certificates and vaccine uptake. Certification is unlikely to convince the most vaccine hesitant to be vaccinated, however, it may convince those who are currently indifferent.

It is acknowledged that the COVID-19 Status Certification system is likely to increase administrative costs for the businesses it affects, and that these businesses have already been badly affected by the pandemic. The extent of additional cost depends in part on how it is introduced. However, if COVID-19 cases keep rising, the alternative would be to require those businesses to close which would exacerbate economic harm. The COVID-19 Status Certification system allows higher risk settings to remain open safely and to continue to trade and may therefore provide a more sustainable basis for these businesses to continue to operate safely in the long run.

The Scottish Government is putting in place monitoring and evaluation to assess the extent that the COVID-19 Status Certification system achieves its four objectives. This will enable us to keep the evidence base up to date and to respond to new findings.

Annex A - Methodology note

The data for this report were gathered through an elaborate and collaborative process including input from the SG Library services, colleagues from the COVID Ready Society Division and colleagues from the Reporting, Societal Impact and Wellbeing, and Evidence Team of the C-19 Analysis Division.

A search of the Knowledge Exchange database was conducted by the SG library team using search terms including, but not limited to: “coronavirus”; “covid-19”; certificate*; passport; documentation . The Knowledge Exchange database includes following databases:

- Idox – a UK information service for government and the public sector.
- KandE (Knowledge and Evidence) – single search across a range of quality databases selected by the librarians.
- Knowledge Network – the national knowledge management platform for health and social care in Scotland.
- Policy Commons – community platform for objective, fact-based research from the world’s leading policy experts, nonpartisan think tanks, IGO’s and NGOs.
- ProQuest – a collection of social science abstracts and index databases.
- OCLC First Search – search for articles books and conference papers across a range of databases including ArticleFirst and WorldCat
- British Library Catalogue – the main catalogue for digital ad print books, journals, newspapers, maps and scores, in the Library’s collection.

An additional searches were conducted online, Google Advanced and Google Scholar, and some relevant scientific papers have been also included. However it should be noted that not all are peer reviewed, even those published in academic journals, such is the desire for speed around research in this area. Most of the resources included consider vaccine or negative coronavirus certification in a UK context, however there are some examples of EU and other international schemes as points of comparison.

Publications from SAGE, PHS, PHE and ONS were collated and assessed by the C-19 Evidence Team analysts and used as a primary source of information based on the credibility of the source and fact the data were prepared by a panel of experts. A scientific literature review carried out by the Scottish Government Central Library generated around 130 articles related to COVID-19 certification. The most relevant search results were used by policy colleagues in their Impact Assessments and incorporated in this publication. Information from scientific literature was used to address gaps in areas not covered by official governmental publications and to reinforce the evidence base where necessary. Google searches were performed to gather international evidence on certification schemes. Those searches were guided by international assessments produced by the UK Government International Comparators Joint Unit (ICJU). The state of the epidemic is evolving constantly in both the UK and internationally therefore the most recent publications were used where possible.

Other sources of material researched and analysed by Scottish Government policy colleagues and analysts include:

- Papers from Scientific Advisory Group for Emergencies (SAGE)
- Publications from the Scottish Government
- Publications from the World Health Organisation (WHO)
- Publications from the International Comparators Joint Unit (ICJU)
- Publications from the Public Health Scotland (PHS)
- Publications from the Public Health England (PHE)
- Publications from the Office for National Statistics (ONS)
- Data from Our World in Data website
- YouGov polling data

Annex B – Vaccine effectiveness

Vaccine effectiveness against Delta in UK

- **Vaccine Effectiveness Expert Panel (VEEP**), published on 14 September 2021 the consensus view of vaccine effectiveness for different vaccines and doses and outcomes, which was reached on 27 August 2021[242]. The values presented in the table below are the consensus judgement of the Vaccine Effectiveness Expert Panel for Delta, they also published a table for Alpha (not shown here). The panel considers a wide range of domestic and international data, and draws a conclusion as to the most accurate values, given the data. Green shows high confidence (Evidence from studies is consistent and comprehensive), Orange shows medium confidence (Evidence is emerging but may be inconsistent requires further analysis) and Red shows low confidence (Little evidence is available at present and results are inconclusive).

Vaccine Product	Dose Regime	Delta			
		Real World Data			
		Infection	Symptomatic	Severe	Transmission**
Oxford/ AstraZeneca (Non-replicating viral vector) AZD1222	1st Dose	40% (30-50%)	45% (40-55%)	80% (75-85%) (hospitalisation) 80% (75-85%) (mortality)	Insufficient / no data
	2nd Dose	65% (60-70%)*	70% (60-75%)	95% (80-99%) (hospitalisation) 95% (80-99%) (mortality)	Insufficient / no data
Pfizer-BioNTech (RNA) BNT162b2	1st Dose	55% (40-70%)	55% (50-65%)	80% (75-85%) (hospitalisation) 80% (75-85%) (mortality)	Insufficient / no data
	2nd Dose	75% (65-85%)	85% (80-90%)	95% (90-99%) (hospitalisation) 95% (80-99%) (mortality)	Insufficient / no data
Moderna (RNA) mRNA-1273	1st Dose	75% (60-90%)	75% (60-90%)	Insufficient / no data	Insufficient / no data
	2nd Dose	85% (80-90%)	Insufficient / no data	Insufficient / no data	Insufficient / no data

- **REal-time Assessment of Community Transmission (REACT-1)** - the UK study analysed swabs taken by nearly 100,000 people in England between 24

[242] VEEP: Vaccine effectiveness table, 27 August 2021 - GOV.UK (www.gov.uk)

June 2021 and 12 July 2021, 100% of which were Delta variant. Based on the findings the researchers estimated that "fully vaccinated people in this testing round had between around 50% to 60% reduced risk of infection, including asymptomatic infection, compared to unvaccinated people. In addition, double vaccinated people were less likely than unvaccinated people to test positive after coming into contact with someone who had COVID-19 (3.84% vs 7.23%)"[243] [244].

- **Office for National Statistics COVID-19 Infection Survey** is a large survey of randomly selected private households across the UK, where RT-PCR tests were performed following a schedule, irrespective of symptoms, vaccination and prior infection. It found a lower risk of new PCR-positive infections in those vaccinated with two doses of Pfizer/BioNTech or Oxford/AstraZeneca vaccines. Two doses of either kind of vaccine offers at least as good protection as those who have built natural immunity following a previous COVID-19 infection and have not been vaccinated. However, reported vaccine effectiveness against the Delta variant was reduced in comparison with the Alpha variant (Pfizer/BioNTech 88% for Delta versus 94% for Alpha and for Oxford/AstraZeneca 67% versus 75%, respectively)[245] [246].
- **The EAVE II study** undertook cohort analysis of the population in Scotland and reported 'Risk of COVID-19 hospital admission was approximately doubled in those with the Delta VOC when compared to the Alpha VOC, with risk of admission particularly increased in those with five or more relevant comorbidities. Both the Oxford–AstraZeneca and Pfizer–BioNTech COVID-19 vaccines were effective in reducing the risk of SARS-CoV-2 infection and COVID-19 hospitalisation in people with the Delta VOC, but these effects on infection appeared to be diminished when compared to those with the Alpha VOC'[247].
- Greater risk of disease (8 fold increase), hospitalisation (25 fold increase) and death (25 fold increase) between unvaccinated in comparison with vaccinated Americans was also reported by the Centers for Disease Control and Prevention (CDC)[248]. The study also showed that breakthrough cases of Delta have roughly 10 fold increase in viral load compared to Alpha and other lineages.

Vaccine effectiveness against transmission of Delta.

As shown in the section above on vaccine effectiveness against Delta in the UK there are no direct studies looking at how effective vaccination is at reducing transmission of Delta in breakthrough infections or from people infected but without symptoms. Ct values are a measure of viral load, where the lower the Ct value, the

[243] REACT-1 round 13 interim report: acceleration of SARS-CoV-2 Delta epidemic in the community in England during late June and early July 2021 | medRxiv
[244] Coronavirus infections three times lower in double vaccinated people - REACT | Imperial News | Imperial College London
[245] Impact of Delta on viral burden and vaccine effectiveness against new SARS-CoV-2 infections in the UK | medRxiv
[246] Delta Variant and vaccine effectiveness; what can the CIS tell us? | National Statistical (ons.gov.uk)
[247] SARS-CoV-2 Delta VOC in Scotland: demographics, risk of hospital admission, and vaccine effectiveness - The Lancet
[248] Improving communications around vaccine breakthrough and vaccine effectiveness, CDC, 29 July 2021

higher the viral load and therefore Ct values can be an indication of how infectious a person is and how likely transmission could occur. Delta cases have a higher viral load compared to alpha[249] [250] [251] [252] [253] [254] and Delta is more transmissible than Alpha[255].

Vaccination reduced the rate of transmission of the Alpha variant[256] [257] [258] [259] [260] [261]. However, it is important not to generalize what has been seen in other variants to Delta, as vaccination may not have the same protective effect against transmission[262]. Some studies are summarised below that compare Ct value in vaccinated versus unvaccinated people, as a proxy for viral load and infectiousness:

- **Office for National Statistics COVID-19 Infection Survey** found that with Delta, infections occurring following two vaccinations had similar peak viral burden to those in unvaccinated individuals[263] [264] . Sarah Walker, professor of medical statistics and epidemiology at the University of Oxford and chief investigator of the study, "We don't yet know how much transmission can happen from people who get COVID-19 after being vaccinated—for example, they may have high levels of virus for shorter periods of time". "But the fact that they can have high levels of virus suggests that people who aren't yet vaccinated may not be as protected from the Delta variant as we hoped. This means it is essential for as many people as possible to get vaccinated—both in the UK and worldwide."[265]
- **REACT-1 study** found a difference in viral load between vaccinated and non-vaccinated people with a positive PCR test, with a median Ct value in vaccinated participants at 27.6 (25.5, 29.7) compared with unvaccinated at 23.1 (20.3, 25.8). However, when the Ct threshold for positivity was reduced, representing strong positives with greater infectiousness, the difference between medians for vaccinated and unvaccinated individuals became smaller. The REACT-1 study

[249] Impact of Delta on viral burden and vaccine effectiveness against new SARS-CoV-2 infections in the UK (medrxiv.org)
[250] REACT-1 round 13 final report: exponential growth, high prevalence of SARS-CoV-2 and vaccine effectiveness associated with Delta variant in England during May to July 2021 (medrxiv.org)
[251] SARS-CoV-2 B.1.617.2 Delta variant emergence and vaccine breakthrough | Research Square
[252] Viral infection and transmission in a large, well-traced outbreak caused by the SARS-CoV-2 Delta variant | medRxiv
[253] Delta variants of SARS-CoV-2 cause significantly increased vaccine breakthrough COVID-19 cases in Houston, Texas | medRxiv
[254] Infection with the SARS-CoV-2 Delta Variant is Associated with Higher Infectious Virus Loads Compared to the Alpha Variant in both Unvaccinated and Vaccinated Individuals (nih.gov)
[255] Risk assessment for SARS-CoV-2 variant: VOC-21APR-02 (B.1.617.2) (publishing.service.gov.uk)
[256] VEEP: Vaccine effectiveness table, 27 August 2021 - GOV.UK (www.gov.uk)
[257] Effect of vaccination on transmission of COVID-19: an observational study in healthcare workers and their households | medRxiv
[258] COVID-19 vaccine surveillance report - week 35 (publishing.service.gov.uk)
[259] Impact of vaccination on household transmission of SARS-COV-2 Harris et al
[260] Impact of BNT162b2 vaccination and isolation on SARS-CoV-2 transmission in Israeli households: an observational study | medRxiv
[261] Vaccination with BNT162b2 reduces transmission of SARS-CoV-2 to household contacts in Israel | medRxiv
[262] COVID vaccines slash viral spread – but Delta is an unknown (nature.com)
[263] Impact of Delta on viral burden and vaccine effectiveness against new SARS-CoV-2 infections in the UK | medRxiv
[264] New studies — Nuffield Department of Medicine (ox.ac.uk)
[265] Covid-19: Fully vaccinated people can carry as much delta virus as unvaccinated people, data indicate | The BMJ

analysed swab-positivity data from round 12 (between 20 May and 7 June 2021) and round 13 (between 24 June and 12 July 2021) with swabs sent to non-overlapping random samples of the population ages 5 years and over in England[266].

- **A PHE study** found similar Ct values in unvaccinated and vaccinated people for all cases with Delta, where Ct data was available, since the 14 June 2021. The study uses NHS tests and trace data[267]. The majority of cases would be symptomatic at the time of testing.
- **Luo *et al.*,** "Infection with the SARS-CoV-2 Delta Variant is Associated with Higher Infectious Virus Loads Compared to the Alpha Variant in both Unvaccinated and Vaccinated Individuals" found no significant differences in Ct value between vaccinated and unvaccinated people for both alpha and Delta variant in cases from the National Capital Region, USA. However, Alpha variant breakthrough vaccinated individuals had higher viral loads at the start of the infection than later (a mean Ct value of 20.75 within the first 5 days vs 26.45 after 5 days). A similar analysis was not possible for the Delta variant breakthrough infections due to the infrequent positives after 5 days of symptoms in the study[268].
- **Griffin et al**, "SARS-CoV-2 Infections and Hospitalizations Among Persons Aged ≥16 Years, by Vaccination Status - Los Angeles County, California, USA, from May 1 to July 25, 2021" found that by July, when Delta was dominant, there were no differences in median Ct values detected among specimens from fully vaccinated, partially vaccinated, and unvaccinated persons by gene targets[269].
- **A US Centers for Disease Control and Prevention (CDC) report**, detailed that following large public gatherings in a town in Massachusetts, nearly three-quarters of the 469 new COVID-19 cases were in vaccinated people. Both vaccinated and unvaccinated individuals had comparably low PCR Ct values, indicating high viral loads, and of the 133 samples sequenced, 90% were identified as Delta[270].
- **Riemersma *et al*.,** compared RT-PCR cycle threshold (Ct) data from 699 swab specimens collected in Wisconsin USA, from 29 June to .31 July 2021. They found low Ct values (<25) in both vaccinated (68%) and non-vaccinated (63%) individuals, regardless of symptoms[271].
- **Chia *et al***., report a small study of 218 with delta infection in Singapore and found that Ct values were similar between both vaccinated and unvaccinated groups at diagnosis, but viral loads decreased faster in vaccinated individuals[272].
- **Christensen *et al***., sequenced the genomes of 12,221 SARS-CoV-2 from samples acquired March 15, 2021 through August 26, 2021 in Houston and found a similar

[266] REACT-1 round 13 final report: exponential growth, high prevalence of SARS-CoV-2 and vaccine effectiveness associated with Delta variant in England during May to July 2021 (medrxiv.org)
[267] SARS-CoV-2 variants of concern and variants under investigation (publishing.service.gov.uk)
[268] Infection with the SARS-CoV-2 Delta Variant is Associated with Higher Infectious Virus Loads Compared to the Alpha Variant in both Unvaccinated and Vaccinated Individuals (nih.gov)
[269] SARS-CoV-2 Infections and Hospitalizations Among Persons Aged ≥16 Years, by Vaccination Status — Los Angeles County, California, May 1–July 25, 2021 (nih.gov)
[270] Outbreak of SARS-CoV-2 Infections, Including COVID-19 Vaccine Breakthrough Infections, Associated with Large Public Gatherings - Barnstable County, Massachusetts, July 2021 - PubMed (nih.gov)
[271] Shedding of Infectious SARS-CoV-2 Despite Vaccination | medRxiv
[272] Virological and serological kinetics of SARS-CoV-2 Delta variant vaccine-breakthrough infections: a multi-center cohort study | medRxiv

median Ct value for vaccinated and unvaccinated patients with COVID-19 caused by Delta variants[273].

- **Ke *et al.,*** found that in a small study of SARS-CoV-2 infection in 23 individuals the duration of virus shedding and symptoms was shorter in vaccinated people compared to unvaccinated people[**274**].

[273] Delta variants of SARS-CoV-2 cause significantly increased vaccine breakthrough COVID-19 cases in Houston, Texas | medRxiv
[274] Longitudinal analysis of SARS-CoV-2 vaccine breakthrough infections reveal limited infectious virus shedding and restricted tissue distribution | medRxiv

Annex C - Societal views

Certification and vaccination

Considering the relationship between vaccine uptake and certification, some studies have shown that for some 'delayers', vaccine passports were perceived to be a reason why they would get vaccinated in the future. For others vaccine passports were controversial, and were seen as coercive measures of the global vaccination plan to control the population and violate privacy[275] [276].

For example, research suggests that control measures, such as domestic vaccine passports, may have detrimental effects on people's autonomy, motivation, and willingness to get vaccinated. The decrease is larger if passports were required for domestic use rather than for facilitating international travel[277] [278] [279] [280] [281]. Further, the introduction of certification for leisure venues does not appear to increase willingness to be vaccinated amongst the most vaccine hesitant, with a decrease seen if certification is required for recreational settings[282].

An important dimension of a certification scheme is how it affects vaccine take-up in hesitant groups and it is recognised there is balance to be struck between it being an incentive for busy people ('delayers') but also something which may cause anxiety in those who distrust the vaccination or the government[283] [284] [285] [286]. Related to this researchers have also considered the 'unintended effects' of certification schemes[287].

Further, several studies have concluded that successful vaccine rollout will only be achieved by ensuring community engagement: involving trusted community leaders,

[275] Public attitudes to COVID-19 vaccines: A qualitative study | medRxiv
[276] Covid-19 vaccine passports and vaccine hesitancy: freedom or control? - The BMJ
[277] "Vaccine Passports" May Backfire: Findings from a Cross-Sectional Study in the UK and Israel on Willingness to Get Vaccinated against COVID-19
[278] The potential impact of vaccine passports on inclination to accept COVID-19 vaccinations in the United Kingdom: evidence from a large cross-sectional survey and modelling study | medRxiv
[279] How to lose friends and alienate people? On the problems of vaccine passports - The BMJ
[280] The potential impact of vaccine passports on inclination to accept COVID-19 vaccinations in the United Kingdom: evidence from a large cross-sectional survey and modelling study | medRxiv
[281] Radic, A et al., (2021). Intention to take COVID-19 Vaccination as a Precondition for International Travel: Application of Extended Norm Activation
[282] COVID-19 behaviour tracker | Institute of Global Health Innovation | Imperial College London
[283] Checkpoints for vaccine passports | Ada Lovelace Institute
[284] SPI-B: Health status certification in relation to COVID-19, behavioural and social considerations, 9 December 2020 - GOV.UK (www.gov.uk)
[285] Garrett, P. M et al., (2021). Papers please: Predictive factors for the uptake of national and international COVID-19 immunity and vaccination passports. PsyArXiv Preprint. 10.31234/osf.io/fxemq
[286] Porat, T et al., (2021). "Vaccine Passports" May Backfire: Findings from a Cross-Sectional Study in the UK and Israel on Willingness to Get Vaccinated against COVID-19. Vaccines
[287] Ricky, G et al., (2021). A call for caution regarding infection-acquired COVID-19 immunity: The potentially unintended effects of 'immunity passports' and how to mitigate them

overcoming cultural, socioeconomic, and political barriers that lead to mistrust and hinder uptake of vaccines [288] [289] [290].

Public attitudes – polling and academic literature

Research[291] reports the results of two large surveys in the United Kingdom, that uncover people's attitudes towards various tracking technologies. The results show that in the main, there is widespread acceptance for co-location tracking and immunity passports although around 20% of the public strongly oppose passports. Further research has described public attitudes towards certification, and its possible impact on uptake of testing and vaccination and protective behaviours[292].

YouGov polling 7-8 April 'Would you support or oppose the following places requiring people to provide a COVID certificate to visit them so they can remove social distancing restrictions?' Survey results

YouGov polling 28-29 July 'Some people have suggested introducing a system of "vaccine passports". This system would involve giving everyone a vaccine passport once they have received their COVID-19 vaccines, and allowing services and venues to reopen so long as they only serve those who have already been vaccinated (i.e. those who can show their vaccine passport). In principle, would you support or oppose introducing such a system' Survey results

- Over half of 25-49 year olds (53%), and seven in ten of those 50 and over (70%) would support their introduction[293] while 38% of 18-24 years old are supportive. In that age group 14% is undecided and 48% 'somewhat' or 'strongly oppose' the idea.

YouGov polling 28-29 July 'Once everyone has been offered a COVID-19 vaccine, do you think each of the following places should or should not require people to provide a "vaccine passport" to visit them?' Survey results

- Two thirds of people (67%) think that care homes should require people to provide a 'vaccine passport' for visitors. Around half of people also think that pubs and bars (54%), gyms (53%) and cinemas (52%) should require people to show a vaccine passport before being allowed to enter.

Data tables and methodology for Scotland sample 24-25th August 2021

Methodology**:** This survey has been conducted using an online interview administered to members of the YouGov Plc UK panel of 800,000+ individuals who have agreed to take part in surveys. Emails are sent to panellists selected at random

[288] Public attitudes to COVID-19 vaccines: A qualitative study | medRxiv
[289] The COVID-19 vaccines rush: participatory community engagement matters more than ever - The Lancet
[290] Vaccine hesitancy due to vaccine country of origin, vaccine technology, and certification | SpringerLink
[291] Lewandowsky, S et al., (2021). Public acceptance of privacy encroaching policies to address the COVID-19 pandemic in the United Kingdom.
[292] Drury, J et al., (2021). Behavioural responses to Covid-19 health certification: A rapid review
[293] Britons still broadly support COVID-19 vaccine passports | YouGov

from the base sample. The e-mail invites them to take part in a survey and provides a generic survey link. Once a panel member clicks on the link they are sent to the survey that they are most required for, according to the sample definition and quotas. (The sample definition could be "GB adult population" or a subset such as "GB adult females"). Invitations to surveys don't expire and respondents can be sent to any available survey. The responding sample is weighted to the profile of the sample definition to provide a representative reporting sample. The profile is normally derived from census data or, if not available from the census, from industry accepted data. The figures have been weighted and are representative of all Scottish adults (aged 18+).

Question text 'One possible approach to allow entry to venues such as stadiums, arenas and nightclubs is to introduce a Covid certification scheme. The exact details of this would need to be confirmed but an example may involve showing a certificate that proves you have been fully vaccinated or tested negative in the last 48 hours. To what extent do you agree or disagree with these statements about using covid certification to allow entry to certain venues?'
Base: All excluding those who would not normally attend this type of event
(n = c.800)

In future there may be an app which could offer proof in digital form of Covid vaccination and/or outcome of a recent PCR Test. This could enable entry to certain venues, allow participation in certain activities or allow international travel. If this app becomes available, how likely will you be to download and use it?		If I wanted to go to a venue or event, having this scheme in place would make me feel more comfortable doing this		I would be happy to share my vaccination and testing status by using a certificate if it means things can resume		Even if vaccinated I would prefer that everyone do a test beforehand, rather than needing to prove and share vaccination status		This sounds like more trouble than it's worth to attend an event at the moment	
Unweighted base	1007	Unweighted base	1007	Unweighted base	1007	Unweighted base	1007	Unweighted base	1007
Base: All Scottish Adults	1007	Base: All Scottish Adults	1007	Base: All Scottish Adults	1007	Base: All Scottish Adults	1007	Base: All Scottish Adults	1007
Definitely will	32%	Strongly agree	23%	Strongly agree	32%	Strongly agree	16%	Strongly agree	13%
Probably will	23%	Tend to agree	26%	Tend to agree	28%	Tend to agree	25%	Tend to agree	14%
May or may not	14%	Neither agree nor disagree	15%	Neither agree nor disagree	10%	Neither agree nor disagree	19%	Neither agree nor disagree	19%
Probably will not	9%	Tend to disagree	7%	Tend to disagree	4%	Tend to disagree	13%	Tend to disagree	19%

Definitely will not	14%	Strongly disagree	9%	Strongly disagree	7%	Strongly disagree	9%	Strongly disagree	18%
Don't know	8%	Not applicable – I wouldn't normally attend this type of venue or event	20%	Not applicable – I wouldn't normally attend this type of venue or event	20%	Not applicable – I wouldn't normally attend this type of venue or event	18%	Not applicable – I wouldn't normally attend this type of venue or event	17%

I worry that although people have been vaccinated not everyone will have immunity after one dose		I worry that this system is not fool proof – people may not do the rapid flow test themselves or not do it properly	
Unweighted base	1007	Unweighted base	1007
Base: All Scottish Adults	1007	Base: All Scottish Adults	1007
Strongly agree	19%	Strongly agree	26%
Tend to agree	32%	Tend to agree	31%
Neither agree nor disagree	21%	Neither agree nor disagree	18%
Tend to disagree	6%	Tend to disagree	7%
Strongly disagree	4%	Strongly disagree	2%
Not applicable – I wouldn't normally attend this type of venue or event	17%	Not applicable – I wouldn't normally attend this type of venue or event	15%

How likely or unlikely are you to be vaccinated for COVID-19 when a vaccine becomes available to you? (Please select a number between 0 and 10, where 0 means 'extremely unlikely' and 10 means 'extremely likely') If you have already received your first vaccination, please tell us how likely or unlikely you are to have your second.			
Unweighted base	80	Unweighted base	40
Base: All Scottish adults who are awaiting either their 1st or their 2nd vaccination	112	Base: Not yet received vaccination	46
0 - Extremely unlikely	20%		39%
1	-		-
2	4%		10%
3	3%		4%
4	5%		7%
5	4%		-
6	5%		10%
7	5%		3%
8	5%		2%
9	1%		-
10 - Extremely likely	32%		4%
Don't know	12%		20%
Prefer not to say	3%		-

Data tables and methodology for Scotland sample 21-22 Sep 2021

Methodology**:** This survey has been conducted using an online interview administered to members of the YouGov Plc UK panel of 800,000+ individuals who have agreed to take part in surveys. Emails are sent to panellists selected at random from the base sample. The e-mail invites them to take part in a survey and provides a generic survey link. Once a panel member clicks on the link they are sent to the survey that they are most required for, according to the sample definition and quotas. (The sample definition could be "GB adult population" or a subset such as "GB adult females"). Invitations to surveys don't expire and respondents can be sent to any available survey. The responding sample is weighted to the profile of the sample definition to provide a representative reporting sample. The profile is normally derived from census data or, if not available from the census, from industry accepted data. The figures have been weighted and are representative of all Scottish adults (aged 18+).

Question text 'From 1 October, the Scottish Government intends to introduce a vaccine certification scheme for entry to nightclubs and similar settings and large events (that is unseated indoor live events with more than 500 people in the audience, unseated outdoor live events with more than 4,000 people in the audience, and any event that has more than 10,000 people in attendance). People visiting these venues or attending events of this size will have to show proof that they are fully vaccinated or exempt from vaccination before entering. The easiest way of doing this will be to show a QR code on the new Covid Status app, but you can also download a certificate or obtain a letter by visiting nhsinform.scot'

Still thinking about the vaccine certification scheme planned to start in Scotland in October…To what extent do you support or oppose the introduction of this scheme?		Will the introduction of the covid vaccine certification scheme make you more or less likely to visit a venue or attend an event that requires such a vaccine certificate for entry?		I believe that the covid vaccine certification scheme is a good way to help control the spread of the virus		I would like to see the scheme rolled out to other types of venue and events		I don't think this type of scheme is fair on those who aren't vaccinated	
Unweighted Base	1005	Unweighted Base	1005	Unweighted Base	1005	Unweighted Base	1005	Unweighted Base	1005
Base All Scottish adults	1005	Base: All Scottish adults	1005	Base: All Scottish Adults	1005	Base: All Scottish Adults	1005	Base: All Scottish Adults	1005
Strongly Support	33%	Much more likely	9%	Strongly agree	19%	Strongly agree	19%	Strongly agree	14%
Tend to Support	23%	Slightly more likely	14%	Tend to agree	33%	Tend to agree	26%	Tend to agree	14%
Neither support nor oppose	15%	Neither more or less likely	35%	Neither agree or disagree	21%	Neither agree nor disagree	27%	Neither agree nor disagree	20%
Tend to oppose	9%	Slightly less likely	4%	Tend to disagree	11%	Tend to disagree	11%	Tend to disagree	26%
Strongly oppose	17%	Much less likely	10%	Strongly disagree	16%	Strongly disagree	17%	Strongly disagree	26%
Don’t know	3%	Don’t know	4%						
		Not applicable - would never visit such a venue/attend such an event anyway	23%						

The World Economic Forum (April 2021)

- The survey on the requirement of vaccine passports between March 26 – April 9 2021, showed that in Great Britain there was 72% support for their use at large public events (vs 63% average comparators) and 55% support for use in retail and offices (vs 50% average comparators). Respondents levels of comfort with allowing the government to access personal health and vaccination information was at 60% and at 37% for a private company. In the UK, 22% of respondents thought that certification should not be required for domestic travel, international travel or workplaces, compared to 20% in comparators.

Annex D Bibliography[294]

Ada Lovelace Institute (2021) Report here: Checkpoints for vaccine passports | Ada Lovelace Institute.

Aranzales, I., et al. Scientists have favourable opinions on immunity certificates but raise concerns regarding fairness and inequality. (2021) *Scientific reports*. Scientists have favourable opinions on immunity certificates but raise concerns regarding fairness and inequality (nature.com)

Baisheng, L., Viral infection and transmission in a large, well-traced outbreak caused by the SARS-CoV-2 Delta variant. (2021) *medRxiv Preprint*. Viral infection and transmission in a large, well-traced outbreak caused by the SARS-CoV-2 Delta variant | medRxiv

Brown, C.M, et al., Outbreak of SARS-CoV-2 infections, including COVID-19 vaccine breakthrough infections, associated with large public gatherings—Barnstable County, Massachusetts, July 2021. (2021) *Morbidity and Mortality Weekly Report*, Outbreak of SARS-CoV-2 Infections, Including COVID-19 Vaccine Breakthrough Infections, Associated with Large Public Gatherings - Barnstable County, Massachusetts, July 2021 - PubMed (nih.gov)

Burgess, R.A., et al. The COVID-19 vaccines rush: participatory community engagement matters more than ever. (2021) *The Lancet*, The COVID-19 vaccines rush: participatory community engagement matters more than ever - The Lancet

Centers for Disease Control and Prevention (CDC). Improving communications around vaccine breakthrough and vaccine effectiveness 29 July 2021 Presentation here: Improving communications around vaccine breakthrough and vaccine effectiveness, CDC, 29 July 2021

Chief Economist Directorate. GDP Monthly Estimate: July 2021 (22 September 2021) Report here: https://www.gov.scot/publications/monthly-gdp-july-2021/

Chief Economist Directorate. BICS weighted Scotland estimates: data to wave 38 (17 September 2021) Report here: BICS weighted Scotland estimates: data to wave 38 - gov.scot (www.gov.scot)

Chen, L.H., et al. COVID-19 immunity passport to ease travel restrictions?. (2020) *Journal of travel medicine*, COVID-19 Immunity Passport to Ease Travel Restrictions? | Journal of Travel Medicine | Oxford Academic (oup.com)

Chia, P.Y., et al. Virological and serological kinetics of SARS-CoV-2 Delta variant vaccine-breakthrough infections: a multi-center cohort study. (2021) *medRxiv Preprint*. Virological and serological kinetics of SARS-CoV-2 Delta variant vaccine-breakthrough infections: a multi-center cohort study | medRxiv

[294] This list contains references from the main body of the evidence paper

Christensen, P.A., Delta variants of SARS-CoV-2 cause significantly increased vaccine breakthrough COVID-19 cases in Houston, Texas. (2021) *medRxiv Preprint*. Delta variants of SARS-CoV-2 cause significantly increased vaccine breakthrough COVID-19 cases in Houston, Texas | medRxiv

De Figueiredo, A., et al. The potential impact of vaccine passports on inclination to accept COVID-19 vaccinations in the United Kingdom: evidence from a large cross-sectional survey and modelling study. (2021) *medRxiv Preprint*. The potential impact of vaccine passports on inclination to accept COVID-19 vaccinations in the United Kingdom: evidence from a large cross-sectional survey and modelling study | medRxiv

Department for Digital, Culture, Media & Sport. Events Research Programme Phases I, II and III data release. Reports here: Events Research Programme Phases I, II and III data release - GOV.UK (www.gov.uk)

Department of Health and Social Care. Asymptomatic testing for SARS-CoV-2 using antigen-detecting lateral flow devices (7 July 2021). Report here: Asymptomatic testing for SARS-CoV-2 using antigen-detecting lateral flow devices: evidence from performance data October 2020 – May 2021 (publishing.service.gov.uk)

Dror et al., Vaccine hesitancy due to vaccine country of origin, vaccine technology, and certification. (2021) *European Journal of Epidemiology,* Vaccine hesitancy due to vaccine country of origin, vaccine technology, and certification | SpringerLink

Drury, J et al. Behavioural responses to Covid-19 health certification: A rapid review. (2021) *BMC Public Health*, Behavioural responses to Covid-19 health certification: a rapid review | SpringerLink

Dumbrava, C and de Groot, D., EU Covid-19 certificate. A tool to help restore the free movement of people across the European Union (2021) EU Covid-19 certificate (europa.eu)

Elliot, P., REACT-1 round 13 final report: exponential growth, high prevalence of SARS-CoV-2 and vaccine effectiveness associated with Delta variant in England during May to July 2021. (2021) *Imperial College London*. Spiral: REACT-1 round 13 final report: exponential growth, high prevalence of SARS-CoV-2 and vaccine effectiveness associated with Delta variant in England during May to July 2021 (imperial.ac.uk)

Environmental Modelling Group (EMG), Public Health England (PHE). Aerosol and Droplet Generation from Singing, Wind Instruments (SWI) and Performance Activities. (2020). Report here: PHE/EMG: Aerosol and droplet generation from singing, wind instruments and performance activities, 13 August 2020 - GOV.UK (www.gov.uk)

Environmental Modelling Group (EMG). Application of physical distancing and fabric face coverings in mitigating the B117 variant SARS-CoV-2 virus in public, workplace and community, 13 January 2021. (2021) Report here: EMG: Application of physical

distancing and fabric face coverings in mitigating the B117 variant SARS-CoV-2 virus in public, workplace and community, 13 January 2021 - GOV.UK (www.gov.uk)

Environmental Modelling Group (EMG), Scientific Pandemic Influenza Group on Modelling (SPI-M), Scientific Pandemic Insights Group on Behaviours (SPI-B). Considerations in implementing long-term 'baseline' Non-Pharmaceutical Interventions. (2021) Report here: EMG, SPI-M and SPI-B: Considerations in implementing long-term 'baseline' NPIs, 22 April 2021 - GOV.UK (www.gov.uk)

Environmental Modelling Group, Transmission Group Report. Insights on transmission of COVID-19 with a focus on the hospitality, retail and leisure sector (8 April 2021). Report here: EMG Transmission Group: Insights on transmission of COVID-19 with a focus on the hospitality, retail and leisure sector, 8 April 2021 - GOV.UK (www.gov.uk)

Environmental Modelling Group (EMG). Role of ventilation in controlling SARS-CoV-2 transmission, 30 September 2020. (2020) Report here: EMG: Role of ventilation in controlling SARS-CoV-2 transmission, 30 September 2020 - GOV.UK (www.gov.uk)

Environmental Modelling Group (EMG). Transmission of SARS-CoV-2 and Mitigating Measures. (2021) Report here: Transmission of SARS-CoV-2 and Mitigating Measures - update, 4 June 2020 - GOV.UK (www.gov.uk)

Garrett, P. M., et al. Papers please: Predictive factors for the uptake of national and international COVID-19 immunity and vaccination passports. (2021) PsyArXiv Preprint

Garrett, P (2021). Public attitudes to immunity passports | Pursuit by The University of Melbourne (unimelb.edu.au)

Griffin, J.B., et al. SARS-CoV-2 infections and hospitalizations among persons aged≥ 16 years, by vaccination status—Los Angeles County, California, May 1–July 25, 2021. (2021) *Morbidity and Mortality Weekly Report*, SARS-CoV-2 Infections and Hospitalizations Among Persons Aged ≥16 Years, by Vaccination Status — Los Angeles County, California, May 1–July 25, 2021 (nih.gov)

Griffin, S., Covid-19: Fully vaccinated people can carry as much delta virus as unvaccinated people, data indicate. (2021) *BMJ* Covid-19: Fully vaccinated people can carry as much delta virus as unvaccinated people, data indicate | The BMJ

Hall, M.A. and Studdert, D.M., "Vaccine Passport" Certification—Policy and Ethical Considerations. (2021) *New England Journal of Medicine*. "Vaccine Passport" Certification — Policy and Ethical Considerations | NEJM

Harris, R.J., et al. Impact of vaccination on household transmission of SARS-COV-2 in England. (2021) *medRxiv*, Impact of vaccination on household transmission of SARS-COV-2 Harris et al

HM Government. Covid-19 response: Autumn and winter plan. (2021) Report here: COVID-19 Response: Autumn and Winter Plan 2021 - GOV.UK (www.gov.uk)

Ipsos. Global views on personal health data and vaccine passports. (2021) Presentation here: Présentation PowerPoint (ipsos.com)

Ke, R., et al., Longitudinal analysis of SARS-CoV-2 vaccine breakthrough infections reveal limited infectious virus shedding and restricted tissue distribution. (2021) *medRxiv Preprint*. Longitudinal analysis of SARS-CoV-2 vaccine breakthrough infections reveal limited infectious virus shedding and restricted tissue distribution | medRxiv

Kosciejew, M.R.H., COVID-19 immunity (or vaccine) passports: a documentary overview and analysis of regimes of health verification within the coronavirus pandemic. (2021) *Journal of Documentation*. COVID-19 immunity (or vaccine) passports: a documentary overview and analysis of regimes of health verification within the coronavirus pandemic | Emerald Insight

Layan, M., et al. Impact of BNT162b2 vaccination and isolation on SARS-CoV-2 transmission in Israeli households: an observational study. (2021) m*edRxiv Preprint*. Impact of BNT162b2 vaccination and isolation on SARS-CoV-2 transmission in Israeli households: an observational study | medRxiv

Lewandowsky, S., et al. Public acceptance of privacy encroaching policies to address the COVID-19 pandemic in the United Kingdom. (2021) *Plos one*, Public acceptance of privacy-encroaching policies to address the COVID-19 pandemic in the United Kingdom (plos.org)

Li, B., et al. Viral infection and transmission in a large well-traced outbreak caused by the Delta SARS-CoV-2 variant. (2021) *medRxiv Preprint.* Viral infection and transmission in a large, well-traced outbreak caused by the SARS-CoV-2 Delta variant | medRxiv

Luo, C.H., Infection with the SARS-CoV-2 Delta Variant is Associated with Higher Infectious Virus Loads Compared to the Alpha Variant in both Unvaccinated and Vaccinated Individuals. (2021) *medRxiv Preprint*. Infection with the SARS-CoV-2 Delta Variant is Associated with Higher Infectious Virus Loads Compared to the Alpha Variant in both Unvaccinated and Vaccinated Individuals (nih.gov)

Mlcochova, P., SARS-CoV-2 B.1.617.2 Delta variant emergence and vaccine breakthrough. (2021) *NaturePortfolio In Review.* SARS-CoV-2 B.1.617.2 Delta variant emergence and vaccine breakthrough | Research Square

Musser, J.M., et al. Delta variants of SARS-CoV-2 cause significantly increased vaccine breakthrough COVID-19 cases in Houston, Texas. (2021) *medRxiv Preprint*. Delta variants of SARS-CoV-2 cause significantly increased vaccine breakthrough COVID-19 cases in Houston, Texas | medRxiv

Nalubola, S., Vaccine Passports and COVID-19: Ethical, Scientific, and Practical Considerations. (2021) *Roundtable J. Health Policy*, Vaccine Passports and COVID-19: Ethical, Scientific, and Practical Considerations – The Roundtable Journal on Health Policy

Osama, T., et al. Covid-19 vaccine passports: access, equity, and ethics. (2021) BMJ Covid-19 vaccine passports: access, equity, and ethics | The BMJ

Porat, T et al. “Vaccine Passports” May Backfire: Findings from a Cross-Sectional Study in the UK and Israel on Willingness to Get Vaccinated against COVID-19. (2021) *Vaccines* Vaccines | Free Full-Text | “Vaccine Passports” May Backfire: Findings from a Cross-Sectional Study in the UK and Israel on Willingness to Get Vaccinated against COVID-19 | HTML (mdpi.com)

Pouwels, K., et al. Impact of Delta on viral burden and vaccine effectiveness against new SARS-CoV-2 infections in the UK. (2021) *medRxiv.* Impact of Delta on viral burden and vaccine effectiveness against new SARS-CoV-2 infections in the UK (medrxiv.org)

Prunas, O., Vaccination with BNT162b2 reduces transmission of SARS-CoV-2 to household contacts in Israel. (2021) *medRxiv Preprint*. Vaccination with BNT162b2 reduces transmission of SARS-CoV-2 to household contacts in Israel | medRxiv

Public Health England, COVID-19 vaccine surveillance report (2021). Weekly reports here: COVID-19 vaccine surveillance reports - GOV.UK (www.gov.uk)

Public Health England, for the Scientific Advisory Group for Emergencies (SAGE). Duration of protection of COVID-19 vaccines against clinical disease (9 September 2021). Report here: PHE: Duration of protection of COVID-19 vaccines against clinical disease, 9 September 2021 - GOV.UK (www.gov.uk)

Public Health England. Risk assessment for SARS-CoV-2 variant Delta: 8 July 2021. (2021) Report here: Investigation of SARS-CoV-2 variants of concern: variant risk assessments - GOV.UK (www.gov.uk)

Public Health England. SARS-CoV-2 variants of concern and variants under investigation in England: technical briefing. (2021) Reports here: Investigation of SARS-CoV-2 variants of concern: technical briefings - GOV.UK (www.gov.uk)

Public Health England. Investigation of SARS-CoV-2 variants of concern: variant risk assessments. Reports here: Investigation of SARS-CoV-2 variants of concern: variant risk assessments - GOV.UK (www.gov.uk)

Public Health England, Transmission Group. Factors contributing to risk of SARS-CoV2 transmission in various settings (26 November 2020). Report here: PHE: Factors contributing to risk of SARS-CoV2 transmission in various settings, 26 November 2020 - GOV.UK (www.gov.uk)

Public Health Scotland. Covid-19 Statistical Report (2021). Weekly reports here: Show all releases - Publications - Public Health Scotland

Radic, A., et al. Intention to take COVID-19 Vaccination as a Precondition for International Travel: Application of Extended Norm-Activation model, (2021) *International Journal of Environmental Research and Public Health* IJERPH | Free

Full-Text | Intention to Take COVID-19 Vaccine as a Precondition for International Travel: Application of Extended Norm-Activation Model | HTML (mdpi.com)

Reicher S and Drury J, How to lose friends and alienate people? On the problems of vaccine passports (2021) *BMJ* How to lose friends and alienate people? On the problems of vaccine passports - The BMJ

Ricky, G et al. A call for caution regarding infection-acquired COVID-19 immunity: The potentially unintended effects of 'immunity passports' and how to mitigate them. (2021) *Journal of Applied Social Psychology* A call for caution regarding infection-acquired COVID-19 immunity: The potentially unintended effects of "immunity passports" and how to mitigate them - Green - 2021 - Journal of Applied Social Psychology - Wiley Online Library

Riemersma, K.K., et al. Shedding of Infectious SARS-CoV-2 Despite Vaccination when the Delta Variant is Prevalent-Wisconsin, July 2021. (2021) *medRxiv Preprint*, Shedding of Infectious SARS-CoV-2 Despite Vaccination when the Delta Variant is Prevalent - Wisconsin, July 2021 | medRxiv (contiamoci.eu)

Riley, S,. et al. REACT-1 round 13 interim report: acceleration of SARS-CoV-2 Delta epidemic in the community in England during late June and early July 2021. (2021) *medRxiv Preprint.* REACT-1 round 13 interim report: acceleration of SARS-CoV-2 Delta epidemic in the community in England during late June and early July 2021 | medRxiv

Ruian Ke, P., Longitudinal analysis of SARS-CoV-2 vaccine breakthrough infections reveal limited infectious virus shedding and restricted tissue distribution. (2021) *medRxiv Preprint*, Longitudinal analysis of SARS-CoV-2 vaccine breakthrough infections reveal limited infectious virus shedding and restricted tissue distribution | medRxiv

Scientific Advisory Group for Emergencies (SAGE). Sixtieth SAGE meeting on COVID-19 – 1 October 2020. (2020) Report here: SAGE 60 minutes: Coronavirus (COVID-19) response, 1 October 2020 - GOV.UK (www.gov.uk)

Scientific Advisory Group for Emergencies (SAGE). SAGE 79 minutes: Coronavirus (COVID-19) response, 4 February 2021. (2021). Report here: SAGE 79 minutes: Coronavirus (COVID-19) response, 4 February 2021 - GOV.UK (www.gov.uk)

Scientific Advisory Group for Emergencies (SAGE), Vaccine Effectiveness Expert Panel (VEEP). VEEP: Vaccine effectiveness table (27 August 2021). Report here: VEEP: Vaccine effectiveness table, 27 August 2021 - GOV.UK (www.gov.uk)

Scottish Annual Business Survey, Scottish Annual Business Statistics (SABS). (2018) Report here: Scottish Annual Business Statistics 2018 - gov.scot (www.gov.scot).

Scottish Government Riaghaltas na h-Alba. Coronavirus (COVID-19): modelling the epidemic in Scotland (2021). Weekly reports here: Coronavirus (COVID-19): modelling the epidemic - gov.scot (www.gov.scot)

Scottish Government Riaghaltas na h-Alba. Coronavirus (COVID-19): state of the epidemic. (2021). Weekly reports here: Coronavirus (COVID-19): state of the epidemic - gov.scot (www.gov.scot)

Sesa G, et al., Covid-19 vaccine passports and vaccine hesitancy: freedom or control? (2021) *BMJ* Covid-19 vaccine passports and vaccine hesitancy: freedom or control? - The BMJ

Shah, A.S, et al. Effect of vaccination on transmission of COVID-19: an observational study in healthcare workers and their households. (2021) *medRxiv*. Effect of vaccination on transmission of COVID-19: an observational study in healthcare workers and their households | medRxiv

Sheikh, A., et al. SARS-CoV-2 Delta VOC in Scotland: demographics, risk of hospital admission, and vaccine effectiveness. (2021) *The Lancet*. SARS-CoV-2 Delta VOC in Scotland: demographics, risk of hospital admission, and vaccine effectiveness - The Lancet

Smith J.A.E., et al. Public health impact of mass sporting and cultural events in a rising COVID-19 prevalence in England (2021) Public Health Impact of Mass Sporting and Cultural Events in a rising COVID-19 prevalence in England (khub.net)

Tanner, R & Flood, C. M. Vaccine Passports Done Equitably. (2021) *JAMA Health Forum* JAMA Health Forum – Health Policy, Health Care Reform, Health Affairs | JAMA Health Forum | JAMA Network

University of Stirling. Alcohol Focus Scotland and University of Stirling Briefing: Re-opening of hospitality - alcohol-specific risks and possible mitigation (2020). Report here: Institute for Social Marketing | Publications | About | University of Stirling

Wilf-Miron, R., Incentivizing Vaccination Uptake The “Green Pass” Proposal in Israel. (2021) *Jama Network*. Incentivizing Vaccination Uptake: The “Green Pass” Proposal in Israel | Global Health | JAMA | JAMA Network

Williams, S.N. and Dienes, K.A., Public attitudes to COVID-19 vaccines: A qualitative study. (2021) *medRxiv Preprint*. Public attitudes to COVID-19 vaccines: A qualitative study | medRxiv

World Health Organization. WHO European Region Member State meeting on Smart Vaccination Certificate. (2021) Report here: WHO/Europe | Digital health - WHO European Region Member State meeting on Smart Vaccination Certificates (2021)

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