


The unintended consequences of COVID-19 vaccine policy: why mandates, passports and restrictions may cause more harm than good

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ABSTRACT

Vaccination policies have shifted dramatically during COVID-19 with the rapid emergence of population-wide vaccine mandates, domestic vaccine passports and differential restrictions based on vaccination status. While these policies have prompted ethical, scientific, practical, legal and political debate, there has been limited evaluation of their potential unintended consequences. Here, we outline a comprehensive set of hypotheses for why these policies may ultimately be counterproductive and harmful. Our framework considers four domains: (1) behavioural psychology, (2) politics and law, (3) socioeconomics, and (4) the integrity of science and public health. While current vaccines appear to have had a significant impact on decreasing COVID-19-related morbidity and mortality burdens, we argue that current mandatory vaccine policies are scientifically questionable and are likely to cause more societal harm than good. Restricting people's access to work, education, public transport and social life based on COVID-19 vaccination status impinges on human rights, promotes stigma and social polarisation, and adversely affects health and well-being. Current policies may lead to a widening of health and economic inequalities, detrimental long-term impacts on trust in government and scientific institutions, and reduce the uptake of future public health measures, including COVID-19 vaccines as well as routine immunisations. Mandating vaccination is one of the most powerful interventions in public health and should be used sparingly and carefully to uphold ethical norms and trust in institutions. We argue that current COVID-19 vaccine policies should be re-evaluated in light of the negative consequences that we outline. Leveraging empowering strategies based on trust and public consultation, and improving healthcare services and infrastructure, represent a more sustainable approach to optimising COVID-19 vaccination programmes and, more broadly, the health and well-being of the public.

INTRODUCTION

Since 2021, mandatory proof-of-vaccination policies have been implemented and justified by governments and the scientific community

SUMMARY BOX

- ⇒ Mandatory COVID-19 vaccine policies have been used around the world during the COVID-19 pandemic to increase vaccination rates. But these policies have provoked considerable social and political resistance, suggesting that they have unintended harmful consequences and may not be ethical, scientifically justified, and effective.
- ⇒ We outline a comprehensive set of hypotheses for why current COVID-19 vaccine policies may prove to be both counterproductive and damaging to public health. Our framework synthesizes insights from behavioural psychology (reactance, cognitive dissonance, stigma, and distrust), politics and law (effects on civil liberties, polarization, and global governance), socio-economics (effects on inequality, health system capacity and social wellbeing) and the integrity of science and public health (the erosion of public health ethics and regulatory oversight).
- ⇒ Our analysis strongly suggests that mandatory COVID-19 vaccine policies have had damaging effects on public trust, vaccine confidence, political polarization, human rights, inequities and social wellbeing. We question the effectiveness and consequences of coercive vaccination policy in pandemic response and urge the public health community and policymakers to return to non-discriminatory, trust-based public health approaches.

to control COVID-19. These policies, initiated across the political spectrum, including in most liberal democracies, have spread globally and have involved: workplace mandates (eg, a 'no jab, no job' US federal mandate); green passes/vaccine passports that limit access to social activities and travel (eg, Israel, Australia, Canada, New Zealand and most European countries); school-based mandates (eg, most North American universities); differential lockdowns for the unvaccinated (eg, Austria and Australia); the use of vaccine



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Table 1 The global turn towards mandatory COVID-19 proof-of-vaccination policies*

Policy/intervention	Countries
'No jab, no job' mandates (eg, government employees, key workers, public and private sector)	Australia, Canada, China, Costa Rica, Croatia, Czech Republic, Denmark, Egypt, Fiji, France, Ghana, Hungary, Italy, Kazakhstan, Latvia, Lebanon, New Zealand, Oman, Poland, Philippines, Russia, Saudi Arabia, Tunisia, Turkey, Ukraine, USA
Healthcare worker mandates	Australia, Britain, Canada, Croatia, Czech Republic, England, Finland, France, Germany, Greece, Hungary, Lebanon, New Zealand, Poland, USA (some states)
Internal vaccine passports to attend social events, restaurants, bars, nightclubs, fitness facilities, entertainment venues and for bus/train/airport travel	Australia, Austria, Britain, Bulgaria, Canada, Czech Republic, Denmark, Egypt, France, Germany, Italy, Israel, Kenya, Lebanon, Morocco, Netherlands, Romania, Serbia, Singapore, Switzerland, South Korea, Ukraine, USA (some states)
School-based mandates	Canada (several provinces), Costa Rica, Lithuania and USA (some states)
Full country mandatory vaccination	Austria, Ecuador, Germany, Indonesia, Micronesia, Turkmenistan, Tajikistan
Full population mandate for the elderly	Czech Republic, Greece, Malaysia, Russia

*This is not a comprehensive list of policies, which are rapidly changing in early 2022. This list excludes the use of segregated lockdowns of the unvaccinated (eg, Austria, Germany, Australia), entry requirements for international travel, fines and penalties (including restricted access to social services and medical care, business capacity restrictions and threats of imprisonment) and the use of vaccine metrics to inform other restrictions. There is a significant variation in how countries recognise infection-derived immunity, allow religious, philosophical and/or medical exemptions and incorporate testing as an alternative to vaccination. In addition, some countries have implemented a combination of policies and interventions, so each is not mutually exclusive. As of March 2022, some countries also shifted course and decided to not implement these policies due to changing epidemiological circumstances and sociopolitical resistance. Adapted from Reuters.¹³⁶

metrics in lifting lockdowns and other restrictions (eg, Australia, Canada and New Zealand); differential access to medical insurance and healthcare (eg, Singapore); and mandatory population-wide vaccination with taxes, fines, and imprisonment for the unvaccinated (eg, the Philippines, Austria, Greece) (see [table 1](#)).

The publicly communicated rationale for implementing such policies has shifted over time. Early messaging around COVID-19 vaccination as a public health response measure focused on protecting the most vulnerable. This quickly shifted to vaccination thresholds to reach herd immunity and 'end the pandemic' and 'get back to normal' once sufficient vaccine supply was available.^{1 2} In late summer of 2021, this pivoted again to a universal vaccination recommendation to reduce hospital/intensive care unit (ICU) burden in Europe and North America, to address the 'pandemic of the unvaccinated'.

COVID-19 vaccines have represented a critical intervention during the pandemic given consistent data of vaccine effectiveness averting COVID-19-related morbidity and mortality.³⁻⁶ However, the scientific rationale for blanket mandatory vaccine policies has been increasingly challenged due to waning sterilising immunity and emerging variants of concern.⁷ A growing body of evidence shows significant waning effectiveness against infection (and transmission) at 12-16 weeks, with both Delta and Omicron variants,⁸⁻¹³ including with third-dose shots.^{14 15} Since early reports of post-vaccination transmission in mid-2021, it has become clear that vaccinated and unvaccinated individuals, once infected, transmit to

others at similar rates.¹⁶ Vaccine effectiveness may also be lower in younger age groups.¹⁷ While higher rates of hospitalisation and COVID-19-associated morbidity and mortality can indeed be observed among the unvaccinated across all age groups,³⁻⁶ broad-stroke passport and mandate policies do not seem to recognise the extreme risk differential across populations (benefits are greatest in older adults), are often justified on the basis of reducing transmission and, in many countries, ignore the protective role of prior infection.^{18 19}

Mandate and passport policies have provoked community and political resistance including energetic mass street protests.^{20 21} Much of the media and civil debates in liberal democracies have framed this as a consequence of 'anti-science' and 'right-wing' forces, repeating simplistic narratives about complex public perceptions and responses. While vaccine mandates for other diseases exist in some settings (eg, schools, travel (eg, yellow fever) and, in some instances, for healthcare workers (HCWs)),²² population-wide adult mandates, passports, and segregated restrictions are unprecedented and have never before been implemented on this scale. These vaccine policies have largely been framed as offering 'benefits' (freedoms) for those with a full COVID-19 vaccination series,^{23 24} but a sizeable proportion of people view conditioning access to health, work, travel and social activities on COVID-19 vaccination status as inherently punitive, discriminatory and coercive.^{20 21 25-28} There are also worrying signs that current vaccine policies, rather than being science-based, are being driven by sociopolitical attitudes that reinforce segregation, stigmatisation

Potential Unintended Consequences of COVID-19 vaccine policies

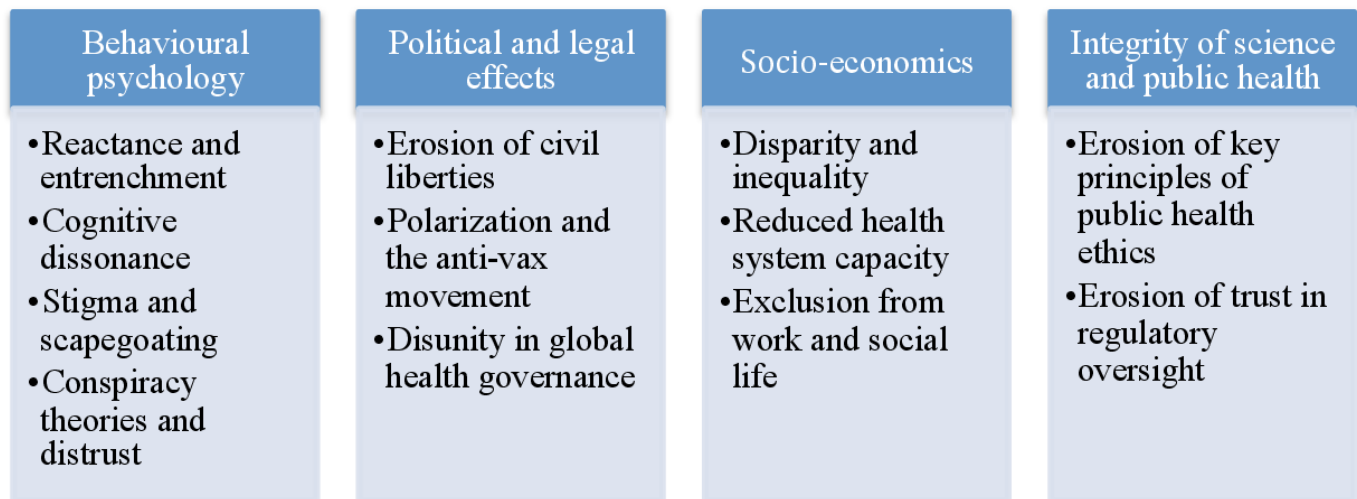


Figure 1 Conceptual framework. We consider a broad conceptual framework spanning core aspects of behavioral psychology, politics and the law, the socio-demographic drivers of health inequality and the integrity of science and public health.

and polarisation, further eroding the social contract in many countries. Evaluating the potential societal harms of COVID-19 pandemic restrictions is essential to ensuring that public health and pandemic policy is effective, proportionate, equitable and legally justified.^{29 30} The complexity of public responses to these new vaccine policies, implemented within the unique sociopolitical context of the pandemic, demands assessment.

In this paper, we reflect on current COVID-19 vaccine policies and outline a comprehensive set of hypotheses for why they may have far-reaching unintended consequences that prove to be both counterproductive and damaging to public health, especially within some sociodemographic groups. Our framework considers four domains: (1) behavioural psychology, (2) politics and law, (3) socioeconomic, and (4) the integrity of science and public health (see figure 1). Our aim is not to provide a comprehensive overview or to fully recapitulate the broad ethical and legal arguments against (or for) COVID-19 vaccine mandates and passports. These have been comprehensively discussed by others.^{31–33} A full review of the contribution of mandates and passports to COVID-19 morbidity and mortality reductions is not yet possible, although some existing studies on vaccine uptake are cited below. Rather, our aim is to add to these existing arguments by outlining an interdisciplinary social science framework for how researchers, policy-makers, civil society groups and public health authorities can approach the issue of unintended social harm from these policies, including on public trust, vaccine confidence, political polarisation, human rights, inequities and social well-being. We believe this perspective is urgently needed to inform current and future pandemic policies. Mandatory population-wide vaccine policies have become a normative part of pandemic governance

and biosecurity response in many countries. We question whether this has come at the expense of local community and risk group adaptations based on deliberative democratic engagement and non-discriminatory, trust-based public health approaches.

WHAT CAN WE LEARN FROM THE BEHAVIOURAL SCIENCES?

Reactance, entrenchment and vaccine uptake

Apart from mandatory vaccination of the elderly (planned in Czech Republic, Greece, Malaysia and Russia), most policies do not specify individuals at higher risk of severe COVID-19 outcomes—among whom COVID-19 vaccine uptake rates, and vaccine confidence, are very high.^{34 35}

Although studies suggest that current policies are likely to increase population-level vaccination rates to some degree,^{36–39} gains were largest in those under 30 years old (a very low-risk group) and in countries with below average uptake.³⁶ Moreover, insights from behavioural psychology suggest that these policies are likely to entrench distrust and provoke *reactance*—a motivation to counter an unreasonable threat to one’s freedom. Literature reviewed by Drury *et al*,⁴⁰ including a survey by Porat *et al*⁴¹ in the UK and Israel, found that compulsory COVID-19 vaccination would likely increase levels of anger, especially in those who are already mistrustful of authorities, and do little to persuade the already reluctant. Two experiments in Germany and the USA found that a new COVID-19 vaccine mandate would likely energise anti-vaccination activism, reduce compliance with other public health measures, and decrease acceptance to future voluntary influenza or varicella (chickenpox) vaccines.^{42 43} A third experiment found that selective mandates increased reactance when herd immunity targets were not clearly explained⁴⁴—which

most governments failed to communicate adequately and convincingly as they shifted their rationale from herd immunity to hospital/ICU admission metrics. De Figueiredo *et al*⁴⁵ found that vaccine passports in the UK would induce a net *decrease* in inclination to get vaccinated among those who had not received a full vaccination dose, while Bell *et al*⁴⁶ found that UK HCWs who felt pressured to get vaccinated were more likely to have declined the COVID-19 vaccine. Jørgensen *et al*⁴⁷ found that the reintroduction of vaccine passports in late 2021 in Denmark increased distrust among the unvaccinated. Finally, recent evidence from France suggests that the *passé sanitaire* was associated with increased vaccination but that it did so to a lower extent among the most vulnerable, may have contributed to increased nocebo effects and did not reduce vaccine hesitancy itself; the authors concluded: “Mandatory vaccination for COVID-19 runs the risk of politicising vaccination further and reinforcing distrust of vaccines.”⁴⁸

Cognitive dissonance

The public interpretation of these policies has occurred within the context of the rapidly changing pandemic. Oftentimes, public announcements and media coverage have oversimplified, struggled to communicate potential adverse events (including a potentially higher risk in the convalescent)⁴⁹ and overstated vaccine efficacy on transmission. Significant public concerns about safety signals and pharmacovigilance have been furthered by the lack of full transparency in COVID-19 clinical trial data^{50 51} as well as shifting data on adverse effects, such as blood-clotting events,⁵² myocarditis⁵³ and altered menstrual periods.⁵⁴ These changes have been associated with changes to vaccination guidelines in terms of eligibility for different vaccines in some countries. Mandates, passports and segregated restrictions create an environment where reactance effects are enhanced because people with low vaccine confidence see contradictory information as validating their suspicions and concerns. The pressure to vaccinate and the consequences of refusal heighten people’s scrutiny of information and demand for clarity and transparency. Current policies have likely facilitated various layers of *cognitive dissonance*—a psychological stress precipitated by the perception of contradictory information.

Citing the potential for backlash and resistance, in December 2020, the director of the WHO’s immunisation department stated: “I don’t think we envision any countries creating a mandate for [COVID-19] vaccination.”⁵⁵ Many governments originally followed with similar public statements, only to shift positions, often suddenly, in mid or late 2021 during the Delta or Omicron surge, including in Austria (the first country to announce a full population-wide mandate).^{56 57} Cognitive dissonance may have been compounded by the changing rationale provided for vaccine mandate policies, which originally focused on achieving herd immunity to stop viral transmission and included public messaging that vaccinated

people could not get or spread COVID-19. Policies often lacked clear communication, justification and transparency, contributing to persistent ambiguities and public concerns about their rationale and proportionality.⁵⁸ In late 2021, however, the re-introduction of onerous non-pharmaceutical interventions in countries with mandates and passports perpetuated cognitive dissonance, since governments had made promises that vaccination would ensure a ‘return to normal’ and many people (especially younger people) had vaccinated based on these announcements.^{36 48}

When mandate rules are perceived to lack a strong scientific basis, the likelihood for public scrutiny and long-term damage to trust in scientific institutions and regulatory bodies is much higher. A good example is the lack of recognition of infection-derived immunity in employer-based vaccine mandates and passports in North America, including most universities and colleges.⁵⁹ Despite clear evidence that infection-derived immunity provides significant protection from severe disease on par with vaccination,^{18 31} prior infection status has consistently been underplayed. Many individuals with post-infection immunity have been suspended or fired from their jobs (or pushed to leave) or been unable to travel or participate in society^{31 56–59} while transmission continued among vaccinated individuals in the workplace. This inconsistency was widely covered in American conservative and libertarian-leaning media in ways that reinforced distrust not only about the scientific basis of vaccine policies but also the entire public health establishment, including the US Centers for Disease Control and Prevention (CDC).

Stigma as a public health strategy

Since 2021, public and political discourse has normalised stigma against people who remain unvaccinated, often woven into the tone and framing of media articles.⁶⁰ Political leaders singled out the unvaccinated, blaming them for: the continuation of the pandemic; stress on hospital capacity; the emergence of new variants; driving transmission to vaccinated individuals; and the necessity of ongoing lockdowns, masks, school closures and other restrictive measures (see [table 2](#)). Political rhetoric descended into moralising, scapegoating, and blaming using pejorative terms and actively promoting stigma and discrimination as tools to increase vaccination. This became socially acceptable among pro-vaccine groups, the media and the public at large, who viewed full vaccination as a moral obligation and part of the social contract.⁶¹ The effect, however, has been to further polarise society—physically and psychologically—with limited discussion of specific strategies to increase uptake especially in communities where there would be disproportionately larger individual and societal benefits. There is rarely a discussion of *who* and *why* people remain unvaccinated. Vaccine policy appears to have driven social attitudes towards an us/them dynamic rather than adaptive strategies for different communities and risk groups.

Table 2 Political rhetoric regarding the unvaccinated

Country leader	Statement
Emmanuel Macron, PM of France	"[It is] only a very small minority who are resisting. How do we reduce that minority? We reduce it by pissing them off even more...When my freedoms threaten those of others, I become someone irresponsible. Someone irresponsible is not a citizen." ¹¹⁷
Justin Trudeau, PM of Canada	"When people are seeing cancer treatments and elective surgeries put off because beds are filled with people who chose not to get vaccinated, they're frustrated...When people see that we are in lockdowns or serious public health restrictions right now because of the risk posed to all of us by unvaccinated people, people get angry." "They are extremists who don't believe in science, they're often misogynists, also often racists...It's a small group that muscles in, and we have to make a choice, as a leader and as a country: Do we tolerate these people?" ¹³⁷
Joe Biden, President of the USA	"This is a pandemic of the unvaccinated. And it's caused by the fact that despite America having an unprecedented and successful vaccination program, despite the fact that for almost five months free vaccines have been available in 80 000 different locations, we still have nearly 80 million Americans who have failed to get the shot." ¹³⁸ "For the unvaccinated, you're looking at a winter of severe illness and death for yourselves, your families, and the hospitals you may soon overwhelm." ¹³⁹
Naftali Bennett, PM of Israel	"Dear citizens, those who refuse vaccines are endangering their health, those around them and the freedom of every Israeli citizen. They are endangering our freedom to work, the freedom of our children to learn and the freedom to hold celebrations with the family. Those who refuse vaccines hurt us all because if all of us were vaccinated, we would all be able to maintain daily life. But if one million Israelis continue to not get vaccinated, this will oblige the eight million others to shut themselves in their homes." ¹⁴⁰
Michael Gunner, Northern Territories Chief Minister, Australia	"If you are anti-mandate, you are absolutely anti-vax, I don't care what your personal vaccination status is. If you support, champion, give a green light, give comfort to [or] support anybody who argues against the vaccine, you are an anti-vaxxer, absolutely. Your personal vaccination status is not relevant. If you campaign against the mandate...If you say 'pro-persuasion', stuff it, shove it. You are anti-vax." ¹⁴¹
Jacinda Ardern, PM of New Zealand,	"If you are still unvaccinated, not only will you be more at risk of catching COVID-19, but many of the freedoms others enjoy will be out of reach.... we have managed very high vaccination rates, generally, without the use of certificates but what has become clear to me is that they are not only a tool to drive up vaccines; they are a tool for confidence. People who are vaccinated will want to know that they are around other vaccinated people...it is a tool for business." ¹⁴²
Tony Blair, former UK PM	"We need to target the unvaccinated. Frankly if you are unvaccinated at the moment and you're eligible and have no health reason for being unvaccinated, you're not only irresponsible but you're an idiot. I am sorry but truthfully you are. With this Omicron variant...you will get it and this will put a lot of strain on the health service." ¹⁴³
Rodrigo Duterte, President of the Philippines	"I'm now giving orders to village leaders to look for those persons who are not vaccinated and request them to stay put [in their house]...If they refuse to vaccinate, or continue to leave their home, the village leaders are empowered to arrest them...." ¹⁴⁴
PM, Prime Minister.	

Leveraging stigma as a public health strategy, regardless of whether or not individuals are opposed to vaccines, is likely to be ineffective at promoting vaccine uptake.⁶² Unvaccinated or partially vaccinated individuals often have concerns that are based in some form of evidence (eg, prior COVID-19 infection, data on age-based risk, historical/current trust issues with public health and governments, including structural racism), personal experiences (eg, direct or indirect experience of adverse drug reactions or iatrogenic injuries, unrelated trauma, issues with access to care to address adverse events, etc) and concerns about the democratic process (eg, belief that governments have abused their power by invoking a constant state of emergency, eschewing public consultation and over-relying

on pharmaceutical company-produced data) that may prevent or delay vaccination.^{45 46 63-66} Inflammatory rhetoric runs against the pre-pandemic societal consensus that health behaviours (including those linked to known risk factors for severe COVID-19, for example, smoking and obesity) do not impact the way medical, cultural or legal institutions treat individuals seeking care. Some governments discussed or imposed medical insurance fines or premiums on the unvaccinated, while hospital administrators considered using vaccination status as a triage protocol criterion. The American Medical Association released a statement decrying the refusal to treat unvaccinated patients⁶⁷ but this has not prevented the ongoing narrative of shaming and scapegoating people choosing not to get vaccinated.

Trust, power and conspiracy theories

Trust is one of the most important predictors of vaccine acceptance globally,^{68 69} including confidence in COVID-19 vaccines.^{63 70 71} Data show that being transparent about negative vaccine information increases trust and Petersen *et al*⁷² found that when health authorities are not transparent, it can increase receptivity to alternate explanations.

COVID-19 vaccine policies have the potential to erode vaccine confidence, trust and the social contract in the particular context of the pandemic, which has exacerbated social anxieties, frustrations, anger and uncertainty. By the time COVID-19 vaccine mandates were introduced, many communities had struggled under lockdowns and other severe public health restrictions, undergone a succession of pandemic waves with changing rules that stretched public confidence in government, had their economic security and livelihoods negatively impacted and been exposed to a media-induced culture of fear perpetuated by an abundance of conflicting and confusing information. All of this occurred within the broader global trend of increasing inequities between North and South, rich and poor, as well as the erosion of trust in institutions and experts.

It is likely that many of the alternative explanations of the pandemic, often called conspiracy theories, were further entrenched when vaccine policies were forcefully implemented in 2021, creating a strong confirmation bias that governments and corporate powers were acting in an authoritarian manner. Those who resist vaccine mandates and passports are more likely to have low trust in government and scientific institutions,^{25–28 63 64} and these beliefs and distrust have likely grown due to the propensity of policies to justify social segregation, creating new forms of activism. Furthermore, multiple social perceptions and logics about science, technology and corporate and government power have been grafted onto the public discussion about COVID-19 vaccines, specifically related to authoritarian biosurveillance capabilities.⁷³ These include concerns about the adoption of implantable tracking devices (including microchips), digital IDs, the rise of social credit systems and the censorship of online information by technology companies and state security agencies. The COVID-19 pandemic happens to coincide with far-reaching technological advances that do provide the capability for new forms of mass state surveillance.^{74 75} For example, emerging biocompatible intradermal devices can be used to hold vaccine records,⁷⁶ while multifunction implantable microchips (that can regulate building access and financial payments, much like cellphones) are now available on the market.⁷⁷ Aspects of vaccine passport policies (dependent on QR codes) combined with these innovations—as well as censorship by social media companies of vaccine clinical trial and safety issues from reputable sources like the BMJ⁷⁸—have likely reinforced and exacerbated suspicion and distrust about the impartiality of public health guidance and vaccines.⁷⁹ It is highly likely

that reactance effects generated by current vaccine policies have increased the view that public health is influenced by powerful sociopolitical forces acting in the private interest, which may damage future social trust in pandemic response.

THE POLITICAL AND LEGAL EFFECTS OF VACCINE MANDATES, PASSPORTS AND RESTRICTIONS

The erosion of civil liberties

The COVID-19 vaccine policies that we have outlined represent a broad interference with the rights of unvaccinated people. While some governments introduced mandates and passports through the democratic process (eg, Switzerland, Austria, France), many policies were imposed as *regulations, decrees, orders* or *directions* under states of emergency and implemented in ways that allowed ad hoc juridical decisions and irregular and over-permissive private sector rules, with limited accountability or legal recourse to address rights violations.⁵⁸

Vaccine passports risk enshrining discrimination based on *perceived* health status into law, undermining many rights of healthy individuals: indeed, unvaccinated but previously infected people may generally be at *less* risk of infection (and severe outcomes) than doubly vaccinated but infection-naïve individuals.⁸⁰ A weekly negative SARS-CoV-2 test is often seen as a compromise in lieu of full vaccination status, but this places additional burdens (including financial) on the unvaccinated while also risking reputational damage. Employer-imposed mandates that do not provide reasonable accommodation (eg, testing, relocation or reassignment of duties) or that require people to be vaccinated following prior infection even where employees can work remotely, arguably constitute a disproportionate imposition of a health intervention without workplace-related justification.⁸¹ Many countries have also tightened the ability to seek religious, medical or philosophical exemptions, open to unclear decision-making and political interference.⁸² Perhaps the most high-profile case to date involves the deportation of the top-ranked men's tennis player, Novak Djokovic, at the Australian Open 2022, despite having been granted a medical exemption on the basis of documented prior infection.⁸³ While media outlets were quick at hinting about problems in his official submission, the Minister of Immigration accepted that he had a valid test result and that he posed only a 'very low' risk to the health of Australians.⁸⁴ Yet, the court ruled that it was reasonable for the Minister to conclude that Mr Djokovic's presence could 'foster anti-vaccination sentiment' and thus have a negative impact on vaccination and boosters.⁸⁴ It endorsed Mr Djokovic characterisation as a threat to Australian 'civil order and public health'.^{83 84} The case underlines concerns of vaccine mandates and passports as a tool for disproportionate policy that circumvents normative civil liberties and process.

There are also significant privacy issues with passports, which involve sharing medical information with strangers.

Having set these population-wide passport precedents, it is conceivable that they could be expanded in the near future to include other personal health data including genetic tests and mental health records, which would create additional rights violations and discrimination based on biological status for employers, law enforcement, insurance companies, governments and tech companies. COVID-19 vaccine passports have normalised the use of QR codes as a regulated entry requirement into social life; in France and Israel, double-vaccinated citizens lost their ‘status’ when passports required a booster dose in 2021/2022.^{85 86} Technology companies interested in biosurveillance using artificial intelligence and facial recognition technology have obtained large contracts to implement vaccine passports and now have a financial interest in maintaining and expanding them.⁸⁷

Political polarisation

COVID-19 vaccine policies have generated intense political debate, mass street protests and energised new populist movements with varied political views.^{20 21 25–28 56} Studies show that while many support these policies, others view them as inherently coercive, discriminatory, disproportionate and counter to liberal values of bodily autonomy, freedom of choice and informed consent.^{25–28} It is clear that current policies are divisive and unpopular with many, even vaccinated people, and that they have become a source for collective rage and anger, notably for those who have been fired from their jobs or isolated and barred from social life.

COVID-19 vaccine policies may influence upcoming elections. For instance, right-wing and populist parties in Germany (the Alternative for Germany), Canada (People’s Party) and Austria (Freedom Party) have come out strongly against medical segregation. After implementing the world’s first population-wide mandatory vaccine policy in February 2022, Austria suspended it 6 days before police would impose fines (max €3600), partially due to legal concerns, mass street protests and the fact that the rate of vaccination had not significantly improved (20% of adults remain unvaccinated).^{56 88} In 2022, the US Supreme Court struck down the Biden administration’s federal vaccine mandate as unconstitutional,⁸⁹ just as it came into effect for 80 million workers (although upholding the mandate for HCWs); republicans had long criticised the mandates.^{90 91} In Martinique and Guadalupe, vaccine passports have led to months of political unrest and violent protests that threaten the stability of the French government.⁴⁸ Pottinger⁹² argued that mandates and passports could trigger insurrection and civil war in South Africa.

Just as the smallpox vaccination mandates in 1850s Britain created the first ‘anti-vax’ movement,⁹³ the backlash against COVID-19 policies is energising a global network connected by modern communication technology against these measures. These backlashes may contribute to increased distrust of other vaccines and foster new forms of radicalisation and protest. While

mainstream news outlets have voiced concern about the rising ‘anti-vaccination fervour’ among the far-right, and potential for violence,⁹⁴ centre and left politicians have also used this rhetoric for their own agenda. In Canada, Prime Minister Trudeau used majority support for mandatory vaccination and passports to divide the conservative opposition in the 2021 federal election. The end to exemptions for unvaccinated truckers crossing the US–Canadian border precipitated the trucker ‘freedom convoy’ protests in early 2022 in Canada, which led to weeks of protesters occupying streets outside parliament. The protest ended with the unprecedented invoking of the Emergencies Act, equivalent to martial law, which was heavily criticised by civil liberty organisations and included the freezing of protester bank accounts.^{95 96} In the USA, California and New York (Democrat-controlled states) have implemented COVID-19 vaccine passports for children while Florida, Georgia and Texas (Republican-controlled) are introducing legislation to remove childhood school vaccine mandates in general. Some medical freedom and anti-vaccination groups have made increasingly false and inflammatory claims, and business owners and employees requiring QR codes for entry have been targeted for abuse, in some cases. In turn, pro-vaccine advocates have equated anti-mandate social groups as ‘anti-vaxxers’ and even domestic terrorists, calling for government agencies and social media companies to strengthen censorship laws. Echo chambers have skewed the reasonableness of risk assessment of some pro-mandate individuals, who now fear that unvaccinated people are ‘unsafe’—physically but also culturally—despite the scientific evidence. Political polarisation and radicalisation—both anti-mandate and pro-mandate—will increase if punitive vaccine policies continue.

Disunity in global health governance

Current vaccine policies risk furthering disunity in global health governance. Despite the WHO stating in early 2022 that boosters would prolong the pandemic by contributing to vaccine hoarding and low supply,⁹⁷ universities (including some global health departments) in wealthy countries have mandated boosters for low-risk healthy students and faculty,⁵⁹ when vaccination rates remained low in many low/middle-income countries (LMICs).⁹⁸ Efforts to pressure pharmaceutical companies (who developed vaccines with the support of publicly funded research money) to remove patent protections have proven unsuccessful.^{99 100} Pharmaceutical companies have ensured that the costs of adverse effects are borne by governments¹⁰¹; in turn, the world’s tens of millions of migrants and asylum-seekers may be denied COVID-19 vaccines because of legal liability issues.¹⁰² Simultaneously, some scientists are calling the unvaccinated (as a homogeneous group) the source of future variants (‘variant factories’) fuelling inflammatory rhetoric¹⁰³ that may have contributed to the heavily criticised reaction to close international borders to southern Africa during the spread of Omicron in late 2021. International

travellers, especially from the global south, have been barred from travelling to high-income countries based on the type of received vaccine.

The rollout of vaccine passports and mandates is financially costly and diverts resources and focus away from other interventions. In Canada, \$1 billion was pledged by the Trudeau government for vaccine passports¹⁰⁴ and in New York State, the Excelsior Pass App-system developed by IBM will cost more than \$27 million.⁸⁷ Importantly, focus on ‘the unvaccinated’ as the cause of health system collapse diverts public attention away from global equity failures and deep structural challenges facing public health capacity in many countries. It absolves governments of attending to other strategies for opening schools and keeping public spaces safe, including improved ventilation and paid sick leave. The indiscriminate global adoption of current COVID-19 vaccine policies may also compromise national sovereignty by skewing health priorities in LMICs, taking budgets away from other important health priorities and disregarding public opinion—a new form of vaccine colonialism. Perhaps more significantly, it is possible that vaccination metrics become tied to international financial agreements and development loans and that pharmaceutical and technology companies influence the global adoption of passport systems and mandate policies for the current but also future pandemics.

SOCIOECONOMIC IMPACTS

Increasing disparity and inequality

Historically, marginalised groups—those facing economic challenges and racial and minority groups—tend to have less confidence in vaccination programmes and are more likely to be distrustful.^{63–66 68–71} This raises the possibility that current vaccine policies may fuel existing inequity.¹⁰⁵ A rapid policy briefing by the Nuffield Council on Bioethics¹⁰⁶ emphasised that immunity passports could ‘create coercive and stigmatising work environments’ and are ‘more likely to compound than redress...structural disadvantages and...social stigmatisation’.¹⁰⁶ It is highly likely that mandates and passports have been implemented in ways that discriminate against disadvantaged groups including immigrants, the homeless, isolated elderly people, those with mental illness, specific cultural and religious groups, those in precarious living circumstances, and people with certain political views and values. Moreover, communities who have historically been subject to state surveillance, segregation, structural racism, trauma or violence may be more likely to resist medical mandates. In Israel, reports suggest that Bedouin and Palestinian communities in the Occupied Palestinian Territory have faced major barriers to vaccine access, with more distrust of vaccination and bureaucratic barriers to accessing and using green passes even when vaccinated.⁵⁸ Similar challenges have been raised among Europe’s Roma and in black communities in the UK and USA.^{45 66 107} Altogether, rather than enhancing human

agency and strengthening communities and social cohesion, many current vaccine policies—including monthly fines for non-compliance (eg, Greece and Austria)—may work to disempower individuals and contribute to long-term psychosocial stress and disharmony.

Reduced health system capacity

The pandemic has created immense strain on health systems, contributing to disruptions in global immunisation programmes¹⁰⁸ and burnout in healthcare and social care workers that risk worsening clinical outcomes for all patients. These trends may be exaggerated by the current policy push towards mandatory COVID-19 vaccination of healthcare/social care workers and firing of unvaccinated staff. The ethical arguments against these policies have been outlined by others.^{31 33 109}

Despite these considerations, many countries may lose frontline staff due to mandates. By December 2021, despite the forthcoming imposition of a (later rescinded) vaccine mandate for patient-facing National Health Service (NHS) workers, 8% of medical practitioners in the UK (73 000 people) remained unvaccinated.¹¹⁰ In late 2021, Quebec (Canada) dropped its proposed mandate for HCWs, citing the devastating labour shortage it would cause in hospital systems (3% of staff, or 14 000, were unvaccinated).¹¹¹ Both cases created immense stress on already overburdened health staff and administrators, and were decried for their lack of clarity and clumpy policy process.¹¹²

Exclusion from work and social life

COVID-19 vaccination policies that disproportionately restrict people’s access to work, education, public transport and social life can be considered a violation of constitutional and human rights.¹¹³ The economic effects of restricting access to work may also have indirect implications for dependents of the unvaccinated. A survey in October 2021 in the USA found that 37% of unvaccinated participants (5% of participants overall) would leave their job if their employer required them to get a vaccine or get tested weekly; this rose to 70% of unvaccinated participants (9% of all participants) if weekly testing was not an option.¹¹⁴ Economic deprivation and parental stress resulting from restricted access to work and exclusion from social life may have long-term psychological and livelihood consequences on individuals, families and especially children.³⁰ Commentators have also highlighted the potential impact of mandates in creating supply chain bottlenecks in certain commodities and with cross-border trade and argued that changing vaccine rules and regulations threaten to negatively impact overall economic recovery in some sectors of the economy including tourism.¹¹⁵

THE INTEGRITY OF SCIENCE AND PUBLIC HEALTH

Erosion of key principles of public health ethics and law

Current vaccine policies may erode core principles of public health ethics. As some of those supporting

mandates recognise,^{113 116} and contrary to the media portrayal that ‘the unvaccinated are entirely free to decline’, many COVID-19 vaccine policies clearly limit choice and the normal operation of informed consent. This has placed medical professionals in an awkward position, blurring the lines between voluntary and involuntary vaccination. It is clear that many who are vaccinated did so because of the serious consequences of refusal, such as loss of employment and livelihood or access to social events and travel. We should pause to consider the extent to which current policies, and how they are implemented in clinical settings, sets a precedent for the erosion of informed consent into the future and impact the attitude of the medical profession to those who are reticent to undergo a specific medical procedure.

According to public health ethics, the principle of proportionality requires that the benefits of a public health intervention must be expected to *outweigh* the liberty restrictions and associated burdens.³² It would violate the proportionality principle to impose significant liberty restrictions (and/or harms) in exchange for trivial public health benefits, particularly when other options are available. Evidence shows that the efficacy of current COVID-19 vaccines on reducing transmission is limited and temporary,⁷⁻¹⁶ likely lower in younger age groups targeted for vaccine mandates and passports³⁶ and that prior infection provides, roughly speaking, comparable benefit.^{18 31 80} The effectiveness of vaccine mandates in reducing transmission is likely to be smaller than many might have expected or have hoped for, and decrease over time. These issues have been widely discussed in the public arena, raising the idea that many current vaccine policies are no longer being guided by the best science but are rather being used to punish individuals who remain unvaccinated and to shape public opinion and compliance. Some governments have publicly admitted this much; in the words of French President Emmanuel Macron, the aim is to ‘piss off [the unvaccinated] ...to the end. This is the strategy.’¹¹⁷ Mandating a third dose for young boys to attend college or university in America has been widely discussed in the US media despite the lack of evidence for substantial clinical benefit,^{59 118} and with evidence of small but still significant risk of myocarditis that compounds with each dose.¹¹⁹⁻¹²¹ Scandinavian countries have taken a precautionary and voluntary approach in their recommendations to the vaccination of children, with Swedish authorities stating that ‘[because of] a low risk for serious disease for kids, we don’t see any clear benefit with vaccinating them’.¹²² This furthers the perception that current COVID-19 school vaccine mandates (eg, in California) are disproportionate, especially as safety studies in young children remain relatively sparse.¹²³

Proportionality is also a key condition from a constitutional and human rights perspective.^{113 124 125} The formal requirements of legal proportionality tests, which differ slightly depending on jurisdiction and context, generally reflect a balancing similar to the one in public health

ethics. In part because of legally required restraint when it comes to assessing the reasonableness of complex policy interventions, several courts, human rights tribunals and committees, and labour arbitrators have upheld mandates as proportionate or made statements as to their legitimacy.¹¹³ This appears to have led to a broad presumption that mandates are legally unproblematic. But a common requirement of legal proportionality is that no other, less rights-restricting measures are available that can reasonably achieve the key public health goal. Accommodation of the workplace, or alternatives to vaccination such as testing, should be and have often been identified by courts, tribunals and arbitrators, as being a core element of the legality of mandates.^{81 113 124 126} Mandates imposing unconditional vaccination, those ignoring the role of prior infection, and those ignoring a shifting risk/benefit balance depending on specific populations, should be considered suspect from a legal proportionality perspective.

When members of the public perceive mandates to be ethically and legally problematic and in violation of established norms of informed consent and proportionality, this will erode trust in public health and scientific institutions and even courts that endorsed or actively promoted such policies. This presents a challenging paradox for experts and authorities: will pro-mandate scientists and organisations come to acknowledge that mandates and passports were disproportionate policy responses? One key aspect of building trust in science and public health involves the open acknowledgement of when experts are wrong and when policies were misguided; however, it appears that many officials have doubled down in their narratives. This may undermine key ethical and legal criteria for policy and have damaging effects on the integrity of public health itself.

Erosion of trust in regulatory oversight

COVID-19 vaccines were developed in record time to meet an urgent public health need and have been accepted by billions of people, preventing deaths, severe hospitalisation and long-term sequelae from SARS-CoV-2.³⁻⁶ COVID-19 vaccines have also generated at least \$100 billion profit for pharmaceutical companies, especially Pfizer.¹²⁷ Has the acceptance of mandates and passports—and the rhetoric around ‘anti-vaxxers’—contributed to a cultural shift in norms of scientific and corporate transparency and accountability?

Governments have refused to disclose the details of contracts with manufacturers, including for additional doses or ‘next-generation’ vaccines.⁹⁹ Vaccines are typically not approved until 2 years of follow-up data are gathered,² but given the urgency of the COVID-19 pandemic and international harmonisation of new agile regulations, the novel mRNA COVID-19 vaccines were placed into emergency use in Europe and North America in late 2020.¹²⁸ There is concern that, in the fog of crisis, vaccine policy is being driven by vaccine manufacturers rather than independent scientific and regulatory review. For

example, in April 2021, Moderna informed their investors that they were expecting a robust 'variant booster market' as a source of profits. Similarly, Pfizer CEO Albert Bourla suggested that a fourth dose of vaccine would be necessary, without any clinical trial data or independent evaluation that the benefits of subsequent doses outweigh any risks, nor consideration of the changing clinical dynamics with the Omicron variant.¹¹⁸ This only adds to distrust over decision-making around vaccine use and ensuing mandates. The public is aware of the history of corporate pharmaceutical malfeasance and criminal and civil settlements in the billions of dollars, including with Pfizer, in part resulting from marketing practices and misrepresentation of safety and efficacy of medicines.^{50 51 129}

The nature of mandates, passports and restrictions has increased public demands for scientific accountability and transparency—shown to be fundamental to building long-term confidence in vaccination.¹³⁰ This has increased the need to diligently track all safety signals for adverse effects in specific demographics¹³¹ and explore trends in overall population mortality and potential non-specific effects.¹³² However, the original clinical trial data remain unavailable for independent scientific scrutiny^{50 51}; a whistleblower raised important concerns about data integrity and regulatory oversight practices at a contract company helping with Pfizer's clinical trials in the USA.¹³³ After a Freedom of Information Act (FOIA) request by a civil society group (see: <https://phmpt.org>), the US Food and Drug Administration (FDA) requested (ultimately denied by a federal judge) 75 years to fully release internal documents and communications related to the regulatory process between FDA and Pfizer. In September 2021, an FDA advisory committee voted 16–2 against boosting healthy young adults in the USA but was over-riden by the White House and CDC, leading to the resignation of two top FDA vaccine experts.¹¹⁸ Such efforts have only increased the perception that regulatory agencies are 'captured' by industry and would conveniently ignore a higher than usual adverse effect ratio to control the pandemic. Concerns have been raised about the lack of due process in vaccine injury compensation claims for the COVID-19 vaccines,¹⁰⁰ which are to be borne by governments and not pharmaceutical companies. A video of a US congressional roundtable on COVID-19 vaccine adverse events with medically confirmed vaccine-injured individuals from the original clinical trials, a US military clinician and Peter Doshi (senior editor of the BMJ) was permanently removed by YouTube.¹³⁴ These practices do not reinforce confidence that authorities are being transparent or applying optimal standards for regulatory safety, efficacy and quality for these novel vaccines—standards which should arguably be more stringent given the legal precedent for mandates and passports.

CONCLUSION

The adoption of new vaccination policies has provoked backlash, resistance and polarisation. It is important to emphasise that these policies are not viewed as 'incentives' or 'nudges' by substantial proportions of populations^{25–28 41 45} especially in marginalised, underserved or low COVID-19-risk groups. Denying individuals education, livelihoods, medical care or social life unless they get vaccinated—especially in light of the limitations with the current vaccines—is arguably in tension with constitutional and bioethical principles, especially in liberal democracies.^{30–33} While public support consolidated behind these policies in many countries, we should acknowledge that ethical frameworks were designed to ensure that rights and liberties are respected even during public health emergencies.

Vaccination policies can be an important tool in the promotion of the right to health, but they need to be proportionate and designed to achieve a clearly defined goal. Some of those supporting current restrictions based on vaccination status¹¹⁶ seem to accept too easily that these measures are indeed proportionate; that they are not more restrictive than necessary; that they are effective in preventing transmission and protecting the healthcare system from collapse; and that there are no options available other than punitive mandates, passports and segregated restrictions. As illustrated above, we believe that current vaccine policies have failed on these fronts and are no longer fit for purpose.

We encourage social and behavioural scientists, bioethicists, epidemiologists, legal scholars, and others to assess the benefits and harms of COVID-19 vaccination policies, along with wider open multidisciplinary discussion and debate. Empirical assessments may or may not validate the concerns presented in this paper—but their generation is critical in engagement with politicians, scientists, and organisations to reconsider current policies affecting those who remain unvaccinated as well as those who vaccinated due to threats and pressure. COVID-19 will not be the last public health emergency and it remains critical that we understand the reasons these approaches were adopted and provide robust evidence to improve future policymaking in times of health emergencies.¹³⁵ If not, the proclivity for mandates, passports, restrictions, fines and punishments is likely to become an accepted policy response for the next pandemic irrespective of whether such policies are truly effective, ethical and socially harmful.

If current policies are to continue, public health-associated bureaucracies and society will have to increase coercion to address current and future resistance and, in the process, come to leverage strategies more consistent with policing than public health. We may also see political forces double down and use people who have chosen not to get vaccinated as a collective, psychological and political tool to scapegoat and reinforce a false notion of safety among vaccinated people as they yearn to resume social and economic life. Policymakers should

reflect on the necessity of enforcing what is essentially a new two-tier, segregated social system and how this will affect different social groups now and into the future—behaviourally, politically and socioeconomically—as well as the impact of such policies on the integrity of science and public health itself.

There are other options to address the pandemic and it is not too late to return to non-coercive public health measures, including pro-social language and community leadership for vaccination, especially to protect high-risk groups.⁷ Future investments in public health capacity, especially health providers who build relationships of trust working in communities, will be essential to engage in positive reforms. Improving data transparency, media independence and broad public debate and scrutiny about COVID-19 vaccine policies will also be essential to maintain population trust, help people better understand the risks and benefits of the continued use of current vaccines, and to inform research on improvements and future policies.

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REFERENCES

- Schaffer DeRoo S, Pudalov NJ, Fu LY. Planning for a COVID-19 vaccination program. *JAMA* 2020;323:2458–9.
- Rosenbaum L. Escaping Catch-22 - Overcoming Covid Vaccine Hesitancy. *N Engl J Med* 2021;384:1367–71.
- León TM, Dorabawila V, Nelson L, et al. COVID-19 Cases and Hospitalizations by COVID-19 Vaccination Status and Previous COVID-19 Diagnosis - California and New York, May–November 2021. *MMWR Morb Mortal Wkly Rep* 2022;71:125–31.
- Andrews N, Tessier E, Stowe J, et al. Duration of protection against mild and severe disease by Covid-19 vaccines. *N Engl J Med* 2022;399:340–50.
- Nordström P, Ballin M, Nordström A. Risk of infection, hospitalisation, and death up to 9 months after a second dose of COVID-19 vaccine: a retrospective, total population cohort study in Sweden. *Lancet* 2022;399:814–23.
- Rotshild V, Hirsh-Racah B, Miskin I, et al. Comparing the clinical efficacy of COVID-19 vaccines: a systematic review and network meta-analysis. *Sci Rep* 2021;11:1–9.
- McIntyre PB, Aggarwal R, Jani I, et al. COVID-19 vaccine strategies must focus on severe disease and global equity. *Lancet* 2022;399:406–10.
- Chemaitelly H, Tang P, Hasan MR, et al. Waning of BNT162b2 vaccine protection against SARS-CoV-2 infection in Qatar. *N Engl J Med* 2021;385:e83.
- Eyre DW, Taylor D, Purver M, et al. Effect of Covid-19 vaccination on transmission of alpha and delta variants. *N Engl J Med* 2022;386:744–56.
- Goldberg Y, Mandel M, Bar-On YM, et al. Waning immunity after the BNT162b2 vaccine in Israel. *N Engl J Med* 2021;385:e85.
- Kissler SM, Fauver JR, Mack C, et al. Viral dynamics of SARS-CoV-2 variants in vaccinated and unvaccinated persons. *N Engl J Med* 2021;385:2489–91.
- Levin EG, Lustig Y, Cohen C, et al. Waning immune humoral response to BNT162b2 Covid-19 vaccine over 6 months. *N Engl J Med* 2021;385:e84.
- Fabiani M, Puopolo M, Morciano C, et al. Effectiveness of mRNA vaccines and waning of protection against SARS-CoV-2 infection and severe covid-19 during predominant circulation of the delta variant in Italy: retrospective cohort study. *BMJ* 2022;376:e069052.
- Ferdinands JM, Rao S, Dixon BE, et al. Waning 2-Dose and 3-Dose Effectiveness of mRNA Vaccines Against COVID-19-Associated Emergency Department and Urgent Care Encounters and Hospitalizations Among Adults During Periods of Delta and Omicron Variant Predominance - VISION Network, 10 States, August 2021–January 2022. *MMWR Morb Mortal Wkly Rep* 2022;71:255.
- Levine-Tiefenbrun M, Yelin I, Alapi H, et al. Waning of SARS-CoV-2 booster viral-load reduction effectiveness. *Nat Commun* 2022;13:1–4.
- Singanayagam A, Hakki S, Dunning J, et al. Community transmission and viral load kinetics of the SARS-CoV-2 delta (B.1.617.2) variant in vaccinated and unvaccinated individuals in the UK: a prospective, longitudinal, cohort study. *Lancet Infect Dis* 2022;22:183–95.
- Fowlkes AL, Yoon SK, Lutrick K, et al. Effectiveness of 2-Dose BNT162b2 (Pfizer BioNTech) mRNA Vaccine in Preventing SARS-CoV-2 Infection Among Children Aged 5–11 Years and Adolescents Aged 12–15 Years - PROTECT Cohort, July 2021–February 2022. *MMWR Morb Mortal Wkly Rep* 2022;71:422.
- Kojima N, Klausner JD. Protective immunity after recovery from SARS-CoV-2 infection. *Lancet Infect Dis* 2022;22:12–14.
- Block J. Vaccinating people who have had covid-19: why doesn't natural immunity count in the US? *BMJ* 2021;374:n2101.
- Paterlini M. Covid-19: Italy sees protests against mandatory health passports for workplaces. *BMJ* 2021;375:n2575.
- Dyer O. Covid-19: Ottawa declares emergency as truckers' protest continues. *BMJ* 2022;376:o352.

- 22 Omer SB, Betsch C, Leask J. Mandate vaccination with care. *Nature* 2019;571:469–72.
- 23 The Guardian. Macron tells critics: vaccine passport will protect all our freedoms, 2022. Available: <https://www.theguardian.com/world/2021/aug/08/macron-tells-critics-vaccine-passport-will-protect-all-our-freedoms> [Accessed 27 Jan 2022].
- 24 NSW Government. New freedoms for vaccinated first step on state roadmap out of COVID, 2021. Available: https://www.health.nsw.gov.au/news/Pages/20210826_01.aspx [Accessed 26 Aug 2021].
- 25 Juen CM, Jankowski M, Huber RA. Who wants COVID-19 vaccination to be compulsory? the impact of Party cues, left-right ideology, and populism. *politics* 2021.
- 26 Graeber D, Schmidt-Petri C, Schröder C. Attitudes on voluntary and mandatory vaccination against COVID-19: evidence from Germany. *PLoS One* 2021;16:e0248372.
- 27 Gagneux-Brunon A, Botelho-Nevers E, Bonneton M, et al. Public opinion on a mandatory COVID-19 vaccination policy in France: a cross-sectional survey. *Clin Microbiol Infect* 2022;28:433–9.
- 28 Smith DT, Attwell K, Evers U. Support for a COVID-19 vaccine mandate in the face of safety concerns and political affiliations: an Australian study. *Politics* 2021;026339572110090.
- 29 Turcotte-Tremblay A-M, Gali Gali IA, Ridde V. The unintended consequences of COVID-19 mitigation measures matter: practical guidance for investigating them. *BMC Med Res Methodol* 2021;21:1–17.
- 30 Bavli I, Sutton B, Galea S. Harms of public health interventions against covid-19 must not be ignored. *BMJ* 2020;371:m4074 <https://www.bmj.com/content/371/bmj.m4074>
- 31 Pugh J, Wilkinson D, Brown RCH. The unnaturalistic fallacy: COVID-19 vaccine mandates should not discriminate against natural immunity. *Journal of medical ethics* 2022.
- 32 Williams BM. The ethics of selective mandatory vaccination for COVID-19. *Public Health Ethics* 2021;383:phab028.
- 33 Rodger D, Blackshaw BP. *COVID-19 vaccination should not be mandatory for health and social care workers*. The New Bioethics, 2022: 1–13.
- 34 de Figueiredo A, Karafillakis E, Larson HJ. State of vaccine confidence in the EU and UK, 2020. Available: https://heatinformatics.com/sites/default/files/images-videosFileContent/2020_confidence_rep_en.pdf
- 35 Ritchie H, Mathieu E, Rodés-Guirao L, et al. Coronavirus pandemic (COVID-19). Available: <https://ourworldindata.org/covid-vaccinations>
- 36 Mills MC, Rüttenauer T. The effect of mandatory COVID-19 certificates on vaccine uptake: synthetic-control modelling of six countries. *Lancet Public Health* 2022;7:e15–22.
- 37 Albarracín D, Jung H, Song W, et al. Rather than inducing psychological reactance, requiring vaccination strengthens intentions to vaccinate in US populations. *Sci Rep* 2021;11:1–9.
- 38 Karaivanov A, Kim D, Lu SE. *COVID-19 vaccination mandates and vaccine uptake*. Cambridge, MA, USA: National Bureau of Economic Research, 2021.
- 39 Walkowiak MP, Walkowiak JB, Walkowiak D. COVID-19 Passport as a factor determining the success of national vaccination campaigns: does it work? the case of Lithuania vs. Poland. *Vaccines* 2021;9:1498.
- 40 Drury J, Mao G, John A, et al. Behavioural responses to Covid-19 health certification: a rapid review. *BMC Public Health* 2021;21:1–16.
- 41 Porat T, Burnell R, Calvo RA, 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. *Vaccines* 2021;9:902.
- 42 Sprengel P, Felgendreff L, Böhm R, et al. Vaccination policy reactance: predictors, consequences, and countermeasures. *J Health Psychol* 2022;27:1394–407.
- 43 Sprengel P, Betsch C, Böhm R. Reactance revisited: consequences of mandatory and scarce vaccination in the case of COVID-19. *Applied Psychology: Health and Well-Being* 2021;13:986–95.
- 44 Sprengel P, Betsch C. Herd immunity communication counters detrimental effects of selective vaccination mandates: experimental evidence. *EClinicalMedicine* 2020;22:100352.
- 45 de Figueiredo A, Larson HJ, Reicher SD. 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 modeling study. *EClinicalMedicine* 2021;40:101109.
- 46 Bell S, Clarke R, Mounier-Jack S, et al. Parents' and guardians' views on the acceptability of a future COVID-19 vaccine: a multi-methods study in England. *Vaccine* 2020;38:7789–98.
- 47 Jørgensen FJ, Bor A, Petersen MB. Increased pressure leads to decreased trust among the unvaccinated: effects of the announcement of the re-introduction of Covid passports in Denmark. *PsyArXiv2021*. not peer reviewed.
- 48 Ward JK, Gauna F, Gagneux-Brunon A, et al. The French health pass holds lessons for mandatory COVID-19 vaccination. *Nat Med* 2022;28:232–5.
- 49 Beatty AL, Peyser ND, Butcher XE, et al. Analysis of COVID-19 vaccine type and adverse effects following vaccination. *JAMA Netw Open* 2021;4:e2140364.
- 50 Doshi P, Godlee F, Abbasi K. Covid-19 vaccines and treatments: we must have RAW data, now. *BMJ* 2022;376:o102.
- 51 Tanveer S, Rowhani-Farid A, Hong K, et al. Transparency of COVID-19 vaccine trials: decisions without data. *BMJ Evid Based Med* 2021. doi:10.1136/bmjebm-2021-111735. [Epub ahead of print: 09 Aug 2021].
- 52 Ledford H. COVID vaccines and blood clots: five key questions. *Nature* 2021;592:495–6.
- 53 Munro C. Covid-19: boys are more at risk of myocarditis after vaccination than of hospital admission for covid. *BMJ* 2021;374:n2251.
- 54 Male V. Menstrual changes after covid-19 vaccination. *BMJ* 2021;374:n2211.
- 55 Reuters. Who against making coronavirus vaccine mandatory, 2020. Available: <https://www.reuters.com/business/healthcarepharmaceuticals/who-does-not-engage-covid-19-vaccines-being-made-mandatory-2020-12-11/>
- 56 Druml C, Czech H. A pandemic is no private matter: the COVID-19 vaccine mandate in Austria. *Lancet Respir Med* 2022;10:S2213–600.
- 57 Burki T. COVID-19 vaccine mandates in Europe. *Lancet Infect Dis* 2022;22:27–8.
- 58 Luster T, Albin E, Gross A, et al. Promoting Vaccination from a Human Rights and Equity Perspective: Lessons from the Israeli "Green Pass". *European Journal of Risk Regulation* 2021;12:308–20.
- 59 Block J. US college covid-19 vaccine mandates don't consider immunity or pregnancy, and may run foul of the law. *BMJ* 2021;373:n1397.
- 60 Savulescu J, Giubilini A. Shaming unvaccinated has got to stop. We've turned into an angry mob and it's getting ugly. The Conversation, 2021. Available: <https://theconversation.com/shaming-unvaccinated-people-has-to-stop-weve-turned-into-an-angry-mob-and-its-getting-ugly-173137>
- 61 Korn L, Böhm R, Meier NW, et al. Vaccination as a social contract. *Proc Natl Acad Sci U S A* 2020;117:14890–9.
- 62 Kampf G. COVID-19: stigmatising the unvaccinated is not justified. *The Lancet* 2021;398:1871.
- 63 Miyachi T, Takita M, Senoo Y, et al. Lower trust in national government links to NO history of vaccination. *Lancet* 2020;395:31–2.
- 64 Cook EJ, Elliott E, Gaitan A, et al. Vaccination against COVID-19: factors that influence vaccine hesitancy among an ethnically diverse community in the UK. *Vaccines* 2022;10:106.
- 65 Razai MS, Osama T, McKechnie DGJ, et al. Covid-19 vaccine hesitancy among ethnic minority groups. *BMJ* 2021;372:n513.
- 66 Kamal A, Hodson A, Pearce JM. A rapid systematic review of factors influencing COVID-19 vaccination uptake in minority ethnic groups in the UK. *Vaccines* 2021;9:1121.
- 67 American Medical Association. Can physicians decline unvaccinated patients? 2021. Available: <https://www.ama-assn.org/delivering-care/ethics/can-physicians-decline-unvaccinated-patients>
- 68 Larson HJ, Clarke RM, Jarrett C, et al. Measuring trust in vaccination: a systematic review. *Hum Vaccin Immunother* 2018;14:1599–609.
- 69 Lazarus JV, Ratzan SC, Palayew A, et al. A global survey of potential acceptance of a COVID-19 vaccine. *Nat Med* 2021;27:225–8.
- 70 de Figueiredo A, Larson HJ. Exploratory study of the global intent to accept COVID-19 vaccinations. *Commun Med* 2021;1:1–10.
- 71 Hotez P, Batista C, Ergonul O, et al. Correcting COVID-19 vaccine misinformation: Lancet Commission on COVID-19 vaccines and therapeutics Task force members. *EClinicalMedicine* 2021;33:100780.
- 72 Petersen MB, Bor A, Jørgensen F, et al. Transparent communication about negative features of COVID-19 vaccines decreases acceptance but increases trust. *Proc Natl Acad Sci U S A* 2021;118:e2024597118.

- 73 Sturm T, Albrecht T. 'Constituent Covid-19 apocalypses: contagious conspiracism, 5G, and viral vaccinations'. *Anthropol Med* 2021;28:122–39.
- 74 Schwab K. *The fourth industrial revolution*. Geneva: World Economic Forum, 2016.
- 75 Zuboff S. *The age of surveillance capitalism: the fight for a human future at the new frontier of power*. New York: Public Affairs, 2019.
- 76 McHugh KJ, Jing L, Severt SY, et al. Biocompatible near-infrared quantum dots delivered to the skin by microneedle patches record vaccination. *Sci Transl Med* 2019;11:eayy7162.
- 77 Teh C. A Swedish company has created a microchip that allows users to carry their COVID vaccine passport under their skin. *Insider*, 2021. Available: <https://www.insider.com/swedish-firm-under-skin-microchip-for-covid-19-passes-2021-12>
- 78 Coombes R, Davies M. Facebook versus *The BMJ*: when fact checking goes wrong. *BMJ* 2022;376:o95.
- 79 The Royal Society. The online information environment: Understanding how the internet shapes people's engagement with scientific information, 2021. Available: <http://ti-health.org/wp-content/uploads/2021/05/For-Whose-Benefit-Transparency-International.pdf>
- 80 Gazit S, Shlezinger R, Perez G, et al. SARS-CoV-2 naturally acquired immunity vs. vaccine-induced immunity, reinfections versus breakthrough infections: a retrospective cohort study. *Clin Infect Dis* 2022:ciac262.
- 81 Bogg A, Contouris N. Mandatory vaccinations in the workplace: constitutionalizing the managerial prerogative [Internet] Blog Symposium on Mandatory Vaccination Lex-Atlas: Covid-19, 2021. Available: <https://lexatlas-c19.org/mandatory-vaccinations-in-the-workplace-constitutionalising-the-managerial-prerogative/>
- 82 Reuters. Maine can bar religious exemptions to COVID-19 vaccine mandate, judge rules, 2021. Available: <https://www.reuters.com/world/us/maine-can-bar-religious-exemptions-covid-vaccine-mandate-judge-rules-2021-10-13/>
- 83 Le Grand C. Australia declares Djokovic a risk to civil order and public health [Internet]. *The Age*, 2022. Available: <https://www.theage.com.au/sport/australia-declares-djokovic-a-risk-to-civil-order-and-public-health-20220114-p59oex.html>
- 84 Djokovic V Minister for immigration, citizenship, migrant services and multicultural Affairs, 2022. Available: <https://www.judgments.fedcourt.gov.au/judgments/Judgments/fca/full/2022/2022fcafc0003>
- 85 Politico, 2022. Available: <https://www.politico.eu/article/france-toughens-its-coronavirus-measures-extends-third-shot-to-all-adults/>
- 86 New York times, 2021. Available: <https://www.nytimes.com/2021/10/03/world/israel-covid-booster.html>
- 87 Levine J. Vaccine Passports are here to stay. Why worry? the intercept., 2022. Available: <https://theintercept.com/2022/01/01/covid-vaccine-passports-surveillance/>
- 88 New York Times. Austria does a U-turn on mandatory vaccinations, Citing milder variant cases, 2022. Available: <https://www.nytimes.com/2022/03/09/world/europe/austria-covid-vaccine-mandate.html>
- 89 National Federation of independent business V department of labor, occupational safety and health administration, 1595 us __, no. 21A244 (January 13, 2022).
- 90 Rainey R. Federal court blocks Biden administration's mandate. *Politico*, 2021. Available: <https://www.npr.org/2022/01/21/1074815838/federal-court-blocks-bidens-vaccine-mandate-for-federal-workers>
- 91 Wise A. The political fight over vaccine mandates deepens despite their effectiveness. [Internet]. *NPR*, 2021. Available: <https://www.npr.org/2021/10/17/1046598351/the-political-fight-over-vaccine-mandates-deepens-despite-their-effectiveness>
- 92 Pottinger B. South Africa's Looming Vaccine Revolt. *Unherd*, 2021. Available: <https://unherd.com/2021/12/south-africas-looming-vaccine-revolt/>
- 93 Durbach N. *Bodily matters: the anti-vaccination movement in England, 1853–1907*. Duke University Press, 2005.
- 94 Orr C. Experts warn of violence as alarming demonstration ushers in new era of anti-vaccine fervour. *National observer*, 2022. Available: <https://www.nationalobserver.com/2022/01/12/analysis/experts-warn-violence-alarming-demonstration-ushers-new-era-anti-vaccine-fervour>
- 95 Alford R. The danger of Politicizing the policing of protests, 2022. Available: <https://macdonaldlaurier.ca/danger-politicizing-policing-protests-ryan-alford-inside-policy/>
- 96 Alford R. The emergencies act is far more dangerous than you think. *National post*, 2022. Available: <https://nationalpost.com/opinion/the-emergencies-act-is-far-more-dangerous-than-you-think-full-comment-with-anthony-furey>
- 97 Miao H. Who says Covid booster programs limit vaccine supply for poor countries, could prolong pandemic. *CNBC*, 2021. Available: <https://www.cnbc.com/2021/12/22/who-says-covid-vaccine-booster-programs-will-prolong-pandemic.html>
- 98 Leach M, MacGregor H, Akello G, et al. Vaccine anxieties, vaccine preparedness: perspectives from Africa in a Covid-19 era. *Soc Sci Med* 2022;298:114826.
- 99 Loftus P. Who invented Covid-19 vaccines? Drugmakers battle over patents. *The Washington post*, 2021. Available: <https://www.wsj.com/articles/who-invented-covid-vaccines-11640726776>
- 100 Rizvi Z. Pfizer's Power. *Public Citizen*, 2021. Available: <https://www.citizen.org/article/pfizers-power/?eType=EmailBlastContent&eId=9b708ddb-d34d-4dfa-95e4-d4d672a82a1b>
- 101 Allen A. Federal vaccine court hasn't helped those whose lives were altered by COVID-19 vaccines. *LA Times*, 2021. Available: <https://www.latimes.com/science/story/2021-08-17/severe-covid-vaccine-injuries-help-federal-vaccine-court>
- 102 Guarascio F, Wongcha-um P. Refugees lack COVID shots because drugmakers fear lawsuits, documents show. *Reuters*, 2021. Available: <https://www.reuters.com/world/refugees-lack-covid-shots-because-drugmakers-fear-lawsuits-documents-2021-12-16/>
- 103 Goldman E. How the unvaccinated threaten the vaccinated for COVID-19: a Darwinian perspective. *Proc Natl Acad Sci U S A* 2021;118:e2114279118.
- 104 Tasker J. Trudeau promises \$1B to help provinces pay for vaccine passports [Internet]. *CBC*, 2021. Available: <https://www.cbc.ca/news/politics/trudeau-promises-1b-vaccine-passports-1.6155618>
- 105 Arguedas-Ramirez G. Build that wall! vaccine certificates, passes and passports, the distribution of harms and decolonial global health justice. *J Glob Ethics* 2021;17:375–87.
- 106 Nuffield Council on Bioethics. New briefing: COVID-19 antibody testing and 'immunity certification', 2020. Available: <https://www.nuffieldbioethics.org/news/new-briefing-covid-19-antibody-testing-and-immunity-certification>
- 107 Milanović M. The compatibility of Covid passes with the Prohibition of discrimination. *Pravni zapisi* 2021;2:357–70.
- 108 Causey K, Fullman N, Sorensen RJD, et al. Estimating global and regional disruptions to routine childhood vaccine coverage during the COVID-19 pandemic in 2020: a modelling study. *Lancet* 2021;398:522–34.
- 109 Gur-Arie R, Jamrozik E, Kingori P. No Jab, no job? Ethical issues in mandatory COVID-19 vaccination of healthcare personnel. *BMJ Glob Health* 2021;6:e004877.
- 110 Faragher J. *Nhs vaccine mandate could cost 73,000 staff. personnel today*, 2021.
- 111 Maratta A. Quebec drops vaccination mandate for health-care workers. *global news*, 2021. Available: <https://globalnews.ca/news/8346947/quebec-drops-vaccine-mandate-among-health-care-workers/>
- 112 McKee M, van Schalkwyk MCI. England's U turn on covid-19 vaccine mandate for NHS staff. *BMJ* 2022;376:o353.
- 113 King J, Ferraz O. Legal, constitutional, and ethical principles for mandatory vaccination requirements for Covid-19, 2021. Available: <https://lexatlas-c19.org/vaccination-principles/>
- 114 Hamel L. KFF COVID-19 vaccine monitoring, October 2021, 2021. Available: <https://www.kff.org/coronavirus-covid-19/poll-finding/kff-covid-19-vaccine-monitor-october-2021/>
- 115 Sampson H. Vaccine mandates are mounting — and that's likely to affect your next trip [Internet]. *The Washington Post*, 2021. Available: <https://www.washingtonpost.com/travel/2021/08/17/vaccine-mandate-new-york-broadway-california/>
- 116 Gostin LO, Cohen IG, Shaw J. Digital Health Passes in the Age of COVID-19: Are "Vaccine Passports" Lawful and Ethical? *JAMA* 2021;325:1933–4.
- 117 The guardian, 2022. Available: <https://www.theguardian.com/world/2022/jan/04/macron-declares-his-covid-strategy-is-to-piss-off-the-unvaccinated>
- 118 Krause PR, Fleming TR, Peto R, et al. Considerations in boosting COVID-19 vaccine immune responses. *Lancet* 2021;398:1377–80.
- 119 Krug A, Stevenson J, Høeg TB. BNT162b2 vaccine-associated Myo/Pericarditis in adolescents: a stratified risk-benefit analysis. *Eur J Clin Invest* 2022;52:e13759.
- 120 Chua GT, Kwan MYW, Chui CSL, et al. Epidemiology of acute Myocarditis/Pericarditis in Hong Kong adolescents following Comirnaty vaccination. *Clinical Infectious Diseases* 2021;4:ab989.
- 121 Makary M. The dangerous push to give boosters to teens. *Wall Street Journal* 2021.
- 122 Shaheen M. Experts do not agree that Covid vaccines are necessary for children as young as five due to little risk they face from the virus and potential adverse effects of the Jab. *The daily mail*, 2022. Available: <https://www.dailymail.co.uk/health/article->

- 10452707/Not-experts-agree-Covid-vaccines-necessary-children-young-five.html
- 123 Rudan I, Adeloye D, Katikireddi V, *et al*. The COVID-19 pandemic in children and young people during 2020-2021: a complex discussion on vaccination. *J Glob Health* 2021;11:01011.
 - 124 Edwards L, Grieman E. 'No jab, no job'? Employment law and mandatory vaccination requirements in the UK. British Institute of International and Comparative Law, 2021. Available: https://binghamcentre.biiicl.org/documents/129_3.pdf
 - 125 Ontario Human Rights Commission. Actions consistent with a human rights-based approach to managing the COVID-19 pandemic, 2020. Available: <https://www.ohrc.on.ca/en/policy-statement-human-rights-based-approach-managing-covid-19-pandemic>
 - 126 Pohler D, Gomez R. Why vaccine mandates are in legal trouble. The line, 2021. Available: <https://theline.substack.com/p/dionne-pohler-and-rafael-gomez-why?s=r>
 - 127 Dransfield S, Rusu L, Thériault A. Pfizer, BioNTech and Moderna making \$1,000 profit every second while world's poorest countries remain largely unvaccinated [Internet]. Oxfam, 2021. Available: <https://www.oxfam.org/en/press-releases/pfizer-biontech-and-moderna-making-1000-profit-every-second-while-worlds-poorest>
 - 128 Eren Vural I, Herder M, Graham JE. From sandbox to pandemic: Agile reform of Canadian drug regulation. *Health Policy* 2021;125:1115–20.
 - 129 Lemmens T. Pharmaceutical knowledge governance: a human rights perspective. *J. Law. Med. Ethics* 2013;41:163–84.
 - 130 Goldenberg MJ. *Vaccine hesitancy: public trust, expertise, and the war on science*. University of Pittsburgh Press, 2021.
 - 131 Rosenblum HG, Gee J, Liu R, *et al*. Safety of mRNA vaccines administered during the initial 6 months of the US COVID-19 vaccination programme: an observational study of reports to the vaccine adverse event reporting system and v-safe. *Lancet Infect Dis* 2022. doi:10.1016/S1473-3099(22)00054-8. [Epub ahead of print: 07 Mar 2022].
 - 132 Benn CS, Fisker AB, Rieckmann A, *et al*. Vaccinology: time to change the paradigm? *Lancet Infect Dis* 2020;20:e274–83.
 - 133 Thacker PD. Covid-19: researcher blows the whistle on data integrity issues in Pfizer's vaccine trial. *BMJ* 2021;375:n2635.
 - 134 Stieber J. YouTube Temporarily Suspends Sen. Johnson's Channel Over Vaccine Injury Panel. The Epoch Times, 2021. Available: https://www.theepochtimes.com/youtube-temporarily-suspends-sen-johnsons-channel-over-vaccine-injury-panel_4102388.html
 - 135 Bardosh KL, de Vries DH, Abramowitz S, *et al*. Integrating the social sciences in epidemic preparedness and response: a strategic framework to strengthen capacities and improve global health security. *Global Health* 2020;16:1–18.
 - 136 Reuters, 2021. Available: <https://www.reuters.com/business/healthcare-pharmaceuticals/countries-making-covid-19-vaccines-mandatory-2021-08-16/> [Accessed 30 Dec 2021].
 - 137 Toronto sun, 2022. Available: <https://torontosun.com/opinion/columnists/warmington-opposition-shockingly-silent-on-prms-hatred-of-unvaccinated-canadians>
 - 138 The white house, 2021. Available: <https://www.whitehouse.gov/briefing-room/speeches-remarks/2021/09/09/remarks-by-president-biden-on-fighting-the-covid-19-pandemic-3/>
 - 139 The white house, 2021. Available: <https://www.whitehouse.gov/briefing-room/press-briefings/2021/12/17/press-briefing-by-white-house-covid-19-response-team-and-public-health-officials-74/>
 - 140 The Prime Minister's Office, PM Bennett, 2021. Available: https://www.gov.il/en/departments/news/event_statement22072
 - 141 Abc news, 2021. Available: <https://www.abc.net.au/news/2021-11-22/nt-covid-vaccine-mandate-opponents-anti-vaxxers-michael-gunner/100640656>
 - 142 The spectator, 2021. Available: <https://www.spectator.co.uk/article/saint-jacinda-backs-a-two-tier-society>
 - 143 The times, 2021. Available: <https://www.thetimes.co.uk/article/tony-blair-if-youre-eligible-and-refuse-the-covid-vaccine-youre-an-idiot-sz97xhkq>
 - 144 Health policy Watch, 2022. Available: <https://healthpolicy-watch.news/philippine-president-arrest-unvaccinated/>