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A health-pass programme in France sparked weeks of angry protest last year.

DID COVID VACCINE MANDATES WORK? WHAT THE DATA SAY

A measure of last resort got a major workout during the pandemic. Scientists are now trying to determine whether the benefits outweighed the potential damage to public trust.

By Liam Drew

For four weekends across July and August last year, around 200,000 protesters took to the streets and squares of France, united in opposition to President Emmanuel Macron's *pass sanitaire*. Soon, to enter cinemas, museums, cafés, trains and other shared public venues, people in France would have to present evidence that

they were fully vaccinated, had tested negative for a COVID-19 infection or had recovered from an infection within the previous four months. In Paris, protesters chanted "Freedom!" and "Macron, we don't want your pass!"

Such protests have a long history. After the British government introduced a nationwide vaccine mandate in 1853 – fining parents who did not immunize their children against

smallpox – localized opposition groups formed, and protests periodically flared. Then, as now, the firmest opponents of mandates argued that they violate personal liberty and bodily autonomy. When legal requirements for vaccination arise, opposition often follows.

Public-health researchers generally agree that the preferred way to achieve vaccine-coverage targets is through education, outreach, public engagement and well-organized infrastructure – mandates should serve as a last resort. But decades of experience with efforts to vaccinate children against communicable diseases have left researchers with differing opinions on whether and when to recommend mandatory vaccinations. Some argue that coercive measures can damage public trust, sow social division and entrench opposition to vaccination. Supporters say that mandates are intended to establish new social norms, not to punish people. And they increase vaccine uptake.

Emerging research indicates that for COVID-19 this has been the case: "The results are quite clear, and the sizes are really big," says Miquel Oliu-Barton, a mathematician at Paris-Dauphine University in France who ran one study. But not everywhere saw such large effects, and many researchers think efforts to carefully assess these policies' long-term consequences must continue.

“The thing about judging mandates is whether the cost is worth it,” says Jeremy Ward, a sociologist who studies vaccine acceptance at the National Institute of Health and Medical Research in Paris. Pre-pandemic, Ward was wary of mandates, but he came to support the *pass sanitaire* because the pandemic shifted the cost–benefit analysis. “There was an emergency. We were scared,” he says.

Now, if the world is to be better prepared for future pandemics – or future waves of this one – learning from this experience is essential, says Noni MacDonald, a paediatrician at Dalhousie University in Halifax, Canada, and a founding member of the Global Advisory Committee on Vaccine Safety at the World Health Organization (WHO). Some key questions, says MacDonald, are when is the best time to introduce mandates and which kind are most effective. “If you’re going to do this, in what setting is it most useful?”

Policy choices

France is one of dozens of countries that might offer some lessons. Most took approaches similar to the *pass sanitaire*, requiring that people get vaccinated to access shared public spaces. Some countries, such as Ecuador, introduced measures like these as soon as vaccines were available. Other countries brought them in as the Delta wave grew in mid-2021, and some introduced them much later. Some nations adjusted pass-related restrictions as the pandemic progressed.

Many governments also made vaccination a requirement for employment in health care or federal jobs – and numerous private-sector companies followed suit. A few countries focused their efforts on children (requiring vaccination for school entry, for example) or the elderly, issuing fines to unvaccinated people. Among the most punitive measures, Singapore made unvaccinated people pay for health care relating to COVID-19 infections.

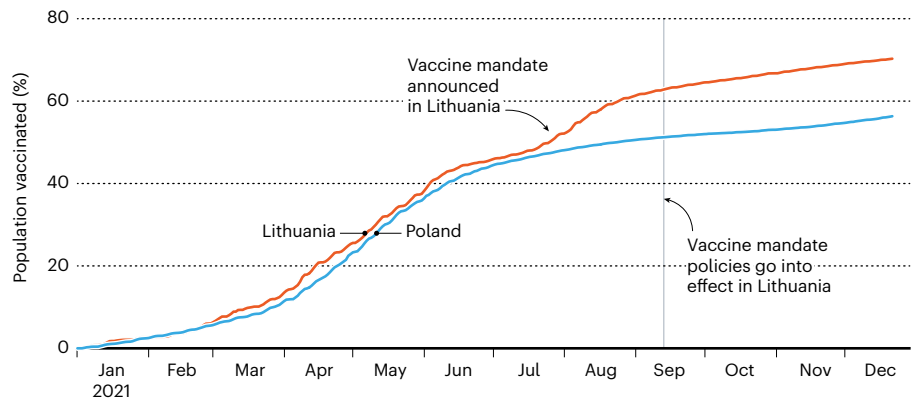
The most common legal interventions, variously termed health passes, green passes, vaccine passports or opportunity passports, often had a previously unseen feature: people could choose not to be vaccinated if they could prove that they had recovered from an infection, thereby acquiring some immunity to COVID-19, or if they could provide a recent negative test result.

Such options made health passes less restrictive than mandated vaccination and offered those unwilling to be vaccinated a way to participate in communal life. “It’s a good compromise in terms of social cost,” says Oliu-Barton.

Many of the policies, however, failed to clearly articulate their aims. Were they in place to make shared public spaces safer? To reduce overall viral transmission? Or to increase vaccination rates? “Those are very distinct goals,” says Maxwell Smith, a bioethicist at Western

COMPARING COUNTRIES

Lithuania announced tighter restrictions on access to public spaces for people without proof of immunization in late July 2021. Researchers have compared its vaccination rate to neighbouring Poland, which had no such policies.



University in Ontario, Canada, and lead author of the WHO’s ethics guidelines on mandating COVID-19 vaccination.

Ambiguous objectives can be problematic, Smith says. Clarity about policy choices fosters public trust and cooperation. And clearly stated goals are also essential for assessing whether an intervention is successful. Unfortunately, Smith says, “across the board, there really wasn’t clear explanation of what the objectives were”.

Researchers investigating the impact of policies, therefore, must choose what metrics to examine. So far, most have opted for a straightforward approach: did the passes increase vaccination rates?

But even answering this is challenging. “It’s basically a policy evaluation in the real world with very noisy data,” says Shih En Lu, an economist at Simon Fraser University in Burnaby,

“Just looking at the graphs of daily new vaccinations, you can see very big spikes.”

Canada. Studies must use counterfactual scenarios as a control to estimate what would have happened had a pass not been introduced.

Dariusz Walkowiak, a physician at Poznan University of Medical Sciences in Poland, used a case–control method to study the effects of vaccine mandates in neighbouring Lithuania¹. The Lithuanian government implemented an opportunity passport programme on 13 September 2021. Poland did not. “It’s not a scientific experiment, but we’ve got two countries – quite similar to one another,” says Walkowiak.

After the programme was introduced, Lithuania’s vaccination curve rose above Poland’s, resulting in a roughly 12% difference in vaccine coverage (see ‘Comparing countries’). The simplest explanation, Walkowiak says, is that this

gain was due to the passports.

In Canada, Lu and colleagues looked at certificate-based policies implemented across nine provinces from July to September of 2021, as the number of daily vaccines being administered was falling². Lu used a technique, regularly deployed in economics, called differences in differences. “It exploited the fact that different provinces introduced the policy at different times”, he says, meaning that for each implementation, data from the other eight provinces served as counterfactual controls.

To varying extents, announcing a mandate caused an increase in the number of people receiving a first vaccination in all provinces. “The average effect that we estimate is a 66% increase in the pace of vaccination,” says Lu, although the effect varied between 34% and 326%.

Starker increases were seen when the gap between announcement and implementation was shorter and when pre-policy vaccination rates were lower. Lu wonders whether this suggests that mandates overcome people’s vaccine hesitancy or their complacency about COVID, which had previously been reinforced by social norms.

In total, Lu and his colleagues estimated that the certificates accounted for an extra 979,000 people, roughly 2.9% of the eligible Canadian population, becoming vaccinated. “Just looking at the graphs of daily new vaccinations, you can see very big spikes,” he says.

In Europe, Melinda Mills and Tobias Rüttenauer, sociologists at the University of Oxford, UK, analysed the effects of health passes on vaccine uptake in Denmark, France, Germany, Israel, Italy and Switzerland³. Oliu-Barton and his colleagues also examined vaccination rates in France, Italy and Germany⁴. Each used so-called synthetic controls, whereby data from similar countries without mandates were combined to create comparable hypothetical countries.

Mills and Rüttenauer found that some countries saw pronounced spikes in uptake, most

strongly in France and Italy. In France, they looked across the 20 days between the policy's announcement and its implementation, as well as the subsequent 40 days. They estimated that an extra 8.6 million doses of vaccine were delivered as a result.

Oliu-Barton also saw the strong effects in France and Italy. He estimated that COVID certificates directly accounted for 13% of the French population and 9.7% of the Italian population getting vaccinated in 2021.

Across the studies, smaller increases were seen in Israel and Switzerland – with the bump being larger in Switzerland when a second policy introduced greater restrictions than the first. Mills and Rüttenauer found no significant increase in total doses when Germany and Denmark introduced their first certificates, although in Denmark, passports were introduced early, when the country was still struggling to acquire enough vaccines to meet demand. Oliu-Barton's analysis found a 6.2% jump in German vaccinations after passes were expanded, in November, to cover workplaces.

Consistent with Lu's observations in Canada, across these European countries, the more unvaccinated people there were when the policy was introduced, the greater its effect. Oliu-Barton also stresses that in France and Italy, there was clear, strong communication about the introduction of certificates, compared with less clear initial messaging in Germany (see 'Mandates measured').

Extrapolating from the observed upturns in vaccination by age group, Oliu-Barton's group estimated that introducing health passes averted nearly 4,000 deaths in France and more than 1,000 in both Italy and Germany. He also calculated that they boosted each country's gross domestic product by between 0.3% and 0.6%. Analysing pressure on hospital capacity, their study also suggested that the *pass sanitaire* prevented France from entering a third lock-down.

Another notable and consistent finding was that health passes most effectively lifted vaccination rates in younger groups. Oliu-Barton suspects that the type of venues that COVID certificates granted access to was important. Pointing to a previous survey of incentives for getting vaccinated, he says the data showed "if you can go to a bar, that's freedom. And liberties were much more influential for young people".

When it came to older, more vulnerable age groups, concerns of low coverage led Italy and Greece to introduce fines for being unvaccinated. In Italy, a €100 (US\$105) fine was set for the over-50 population. In Greece, a law passed in November 2021 meant unvaccinated people aged over 60 would, from January, have to pay a monthly €100 fine (until the policy was withdrawn in mid-April).

The impact in Italy is yet to be formally analysed. But Greece saw a major effect. When the policy was first announced, roughly 530,000

over-60s were still unvaccinated. By late December, around 42% of these had got their first jab.

No job, no job

Governments and private employers have also issued vaccine mandates to staff, making the shot a requirement for employment.

For health-care professionals, the ethical justification is widely considered strong – and follows years of precedent. Vaccination, if it reduces infection and transmission, protects patients. It also guards against staff absences in a crucial sector that has been under unprecedented stress. In non-health-care settings, the rationale ranges from the altruistic, such as creating safer workplaces or protecting clients, to the more self-interested, such as reducing staff leave, maintaining productivity and brand building (Springer Nature implemented a limited policy to comply with a New York City mandate).

In the United States, James Lee, an epidemiologist at the Centers for Disease Control and Prevention in Atlanta, Georgia, led a national phone survey of 12,875 health-care professionals who self-reported their vaccination status and the presence or absence of a workplace mandate⁵. Where mandates existed, 90.5% of respondents were vaccinated; where they did not, only 73.3% were.

The finding is consistent with mandates increasing vaccination rates, although Lee

“All of a sudden everyone who had an issue with government has an issue with vaccines.”

says, “our study is a cross-sectional survey, so we are not able to determine causality”. He notes that mandates are more likely to be implemented in regions where vaccine acceptance is higher.

When it comes to private-sector mandates, there are mainly isolated reports from the companies themselves. “You have lots and lots of cases,” says Ezekiel Emanuel, an ethicist at the University of Pennsylvania in Philadelphia, and a former member of US President Joe Biden's COVID-19 Transition Advisory Board.

Emanuel cites United Airlines and New York City's police, fire and sanitation departments as examples of mandates leading to high vaccination rates. United reported that it vaccinated more than 99% of its 67,000-strong workforce. “I think we've got a lot of evidence that when you put the mandate in, people will choose either working or not working,” says Emanuel. “They end up saying, ‘Alright, you know, a shot's not that bad a deal.’”

MacDonald stresses that a probable factor in these widely heralded successes was that the

companies “also made it really easy for people to get the vaccine”.

Improving access might be significant in accounting for a key observation made by Lee: in health-care settings where mandates existed, there was greater parity in vaccination rates between socio-economic groups. Where mandates were absent, there was a 26.7% gap (79.6% versus 52.9%) between the vaccination rate of staff earning more than US\$75,000 (for example, doctors and senior managers) versus staff earning below the federal poverty line (for example, cleaners and other manual labour workers). In mandated settings that gap fell to 11.9% – 92.7% versus 80.8%. This suggests mandates can help foster equity, Lee says.

But such mandates were not a success everywhere. In the United Kingdom, the Department of Health and Social Care first mandated that care-home workers must be vaccinated, then announced the same policy for National Health Service (NHS) employees.

Ahead of the policies' implementation, William Palmer, an analyst at the Nuffield Trust, an independent UK health-care think tank, advised that the government should prioritize clear and sympathetic communication with the two workforces, which had borne the brunt of the pandemic. “If you're going to do it, you need to do it right,” he says.

But this never materialized, Palmer says. Instead, the government's impact assessments and the rationale for the policies were buried in documents published at the last minute. A spokesperson for the Department of Health says, “There was full public consultation and engagement on the proposals at every point, which clearly set out the rationale and purpose.”

Between the policy's announcement in June and its implementation in November 2021, the number of directly employed care-home staff fell by 26,000, roughly 5%. And the NHS policy was withdrawn before taking effect after sustained protests.

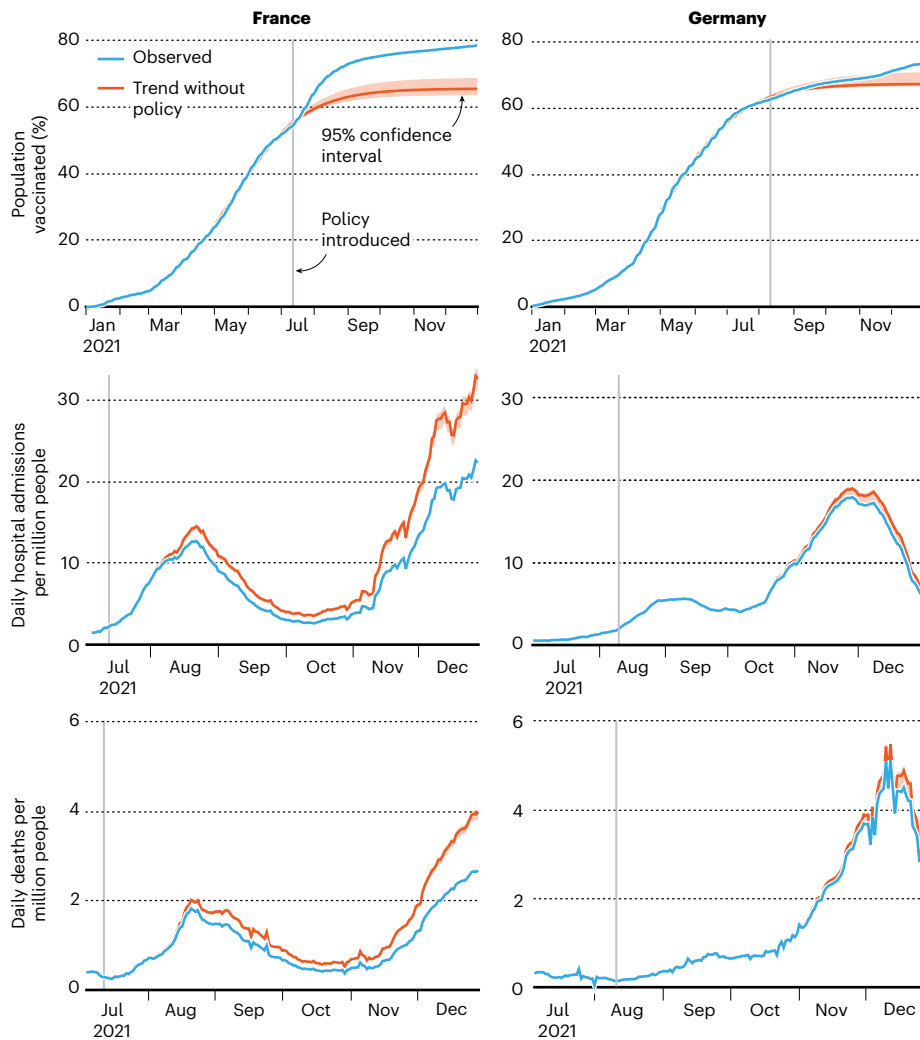
Employer mandates and their implementation warrant further analysis, although Lee warns, “as employer requirements are not collected systematically and enforcement varies, I anticipate this will be hard to study”.

At what cost?

Vaccine mandates do risk overly politicizing health policy, says MacDonald. But it is hard to accurately quantify the consequences such as social exclusion, loss of public trust or inequitable outcomes. Numerous other factors are at play, such as the way a government handled the pandemic overall, wider political campaigns against vaccination or mandates, or frustrations with the way that a mandate was implemented. Another crucial aspect of whether mandates are successful is the political skill and messaging used to introduce them.

MANDATES MEASURED

In France and Germany, laws requiring the presentation of a valid COVID-19 certificate increased the rate of vaccination compared with estimated trends without such policies. They also reduced estimated hospitalizations and could have saved thousands of lives.



SOURCE: REF. 4

Opposition to vaccines – and mandates – can also be a way of expressing displeasure with other aspects of civil society, says Heidi Larson, an anthropologist and founding director of the Vaccine Confidence Project at the London School of Hygiene & Tropical Medicine. “All of a sudden everyone who had an issue with government has an issue with vaccines,” she says. Oliu-Barton says that some mandates seem like a referendum: “Do you like the government? You can say, ‘no’, by not getting a shot.”

Ward has tried to gauge how the French public reacted to vaccination policies by using questionnaires. When asked if they felt relief, anger or regret when they got vaccinated, respondents who were vaccinated in early 2021 said they mostly felt relief. But most of those vaccinated later, especially after the government imposed health-pass requirements, reported anger or regret⁶. In a later poll conducted in March this year, more than 60% of respondents said they had felt at least somewhat ‘constrained’ to get vaccinated. Ward’s future work will further dissect why and how.

In Germany, Katrin Schmelz, a psychologist at the University of Konstanz, has led a unique series of surveys that tracked the evolving views of nearly 2,000 German residents over the course of the pandemic⁷.

Across all the surveys, the questionnaire showed that only around 3% of the population consistently opposed vaccination if it was voluntary. By contrast, 16.5% of people consistently opposed mandatory vaccination. Roughly half of all respondents changed their minds over time – and the shifting variables most closely tied to support for mandates were trust in government and belief in vaccine effectiveness.

“Mandates are an essential part of public health policies,” says Schmelz, but her work also suggests that it was a good decision to make vaccination a personal choice initially. Polling before vaccines were available showed that 73% of German adults were OK with getting vaccinated voluntarily⁸ – which corresponded almost exactly to the fraction who were vaccinated before mandates were introduced.

Schmelz says she believes that a sense of moral autonomy motivated these people to help battle the virus, and that mandating vaccination earlier would probably have reduced this motivation. “People respond to feeling distrusted by lowering their effort,” she says.

A major concern is that if a substantial proportion of society has lost trust in public institutions, this will make public-health policies harder to implement – in particular, other ongoing vaccine programmes. “Sentiments around vaccines are hugely tied to trust in government,” says Larson. “What’s the knock-on effect of this COVID experience on routine vaccination?”

Deciphering those longer trends might take time. Larson is awaiting the results of the Vaccine Confidence Project’s latest survey of overall attitudes to vaccines, which she thinks will be an indicator of how views have shifted.

Like so many aspects of the pandemic, decisions about mandates and their implementation have occurred at speed – amid a constantly shifting crisis. The legal requirements now being studied were introduced in the summer of 2021, when anxieties about the pandemic still ran deep, and such measures were more palatable. Available vaccines also offered protection against infection, not just against serious illness. With people becoming less afraid of COVID-19 and vaccines offering less protection against infection by Omicron variants, plans this spring to introduce new nationwide mandates in Austria and Germany, for example, were rejected or never enforced.

As concerns about the pandemic wane in many countries, researchers fear that research fatigue is setting in, too, not least when it comes to analysing the complex behavioural responses of people to the virus and mitigation strategies. Yet behavioural science is an essential part of the response to this pandemic and future ones. “People are tired,” MacDonald says, “I think everybody wants this done.” But what she’s more tired of is seeing governments not learning the lessons of previous public-health emergencies. “We need this analysis done.”

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Correction

This feature incorrectly implied that 16% of respondents to each of a series of three German surveys opposed mandatory vaccination, but that half of these individuals changed their minds over time. In fact, 16.5% was the proportion of respondents consistently opposed to vaccine mandates, and half of all respondents changed their minds over time.