

Balancing incentives and disincentives for vaccination in a pandemic

Mandates and incentives are being considered to increase uptake of vaccines against COVID-19, but payment for vaccination may be the fairest approach.

Julian Savulescu, Jonathan Pugh and Dominic Wilkinson

The COVID-19 pandemic has given rise to the fastest development and rollout of novel vaccines in human history. Initial clinical trials suggested that these vaccines were well tolerated and had a high degree of efficacy¹. Those results have since been confirmed by real-world data^{2,3}.

However, the vaccines have been associated with rare serious adverse events. Many countries suspended the use of the AstraZeneca vaccine due to rare cases of fatal blood clots and thrombocytopenia. There have also been concerns about an association between the mRNA vaccines and myocarditis and/or pericarditis⁴. At the time of this writing, The UK Joint Committee on Vaccination and Immunisation is not currently advising routine vaccination of children under the age of 16, outside of specified high-risk groups.

Many countries have seen high vaccine uptake. As of the middle of June 2021, approximately 45% of the UK and US population were fully vaccinated. However, in Australia, Japan and Malaysia, less than 5% of the population were fully vaccinated⁵. Somewhere between 70% and 90% of the population may need to be vaccinated to achieve herd immunity⁶.

Vaccine hesitancy is a considerable obstacle and varies widely between countries⁷. A UK study suggests hesitancy of 18% across the population⁸, whereas a US study suggests a level of 22.1% (ref. ⁹). However, vaccine hesitancy differs substantially between demographic subgroups. There has been particular concern about vaccine hesitancy among healthcare workers, with some UK National Health Service data suggesting lower rates of vaccination against COVID-19 among Black, Asian and minority ethnic healthcare workers¹⁰.

A number of strategies have been deployed to increase uptake, including community-engagement work, tailored communication to hesitant populations from trusted sources, and improving flexible access to vaccination¹¹. However, as viral variants emerge, some countries are

Table 1 | Examples of disincentives and incentives currently used for vaccination

Disincentives for COVID-19 vaccine refusal	Incentives for COVID-19 vaccination
<p>Fines</p> <p>People who refuse vaccination may be made liable to fines (e.g., in Indonesia)</p> <ul style="list-style-type: none"> • Non-COVID-19 example: €2,500 fine for parents who fail to vaccinate children against measles in Germany 	<p>Financial payment</p> <p>Citizens receive a lump sum in return for being vaccinated (e.g., Serbia paid citizens the equivalent of €25 to undergo vaccination)</p>
<p>Withholding state benefits</p> <p>People who refuse vaccination may have state benefits withheld or suspended (e.g., in Indonesia)</p> <ul style="list-style-type: none"> • Non-COVID-19 example: Australian 'No Jab, No Pay' scheme 	<p>Cash Lottery</p> <p>Vaccinated people are entered into a lottery for a substantial cash prize (e.g., in Ohio and Kentucky)</p>
<p>Vaccination as a condition of access to publicly accessible social goods</p> <p>Unvaccinated people may not be permitted to access certain goods, such as education (e.g., vaccination as a condition of entry to campus at some US colleges)</p> <ul style="list-style-type: none"> • Non-COVID-19 example: immunization as a condition for enrollment in public school in various US states 	<p>Investments</p> <p>People may be offered savings bonds if they get vaccinated (e.g., in West Virginia, people 16–35 years of age are offered a US\$100 savings bonds if they get vaccinated).</p>
<p>Vaccination as a condition of employment</p> <p>People may be prevented from entering or continuing in a professional role if they have not been vaccinated (e.g., staff in care homes in England, or service staff in Moscow)</p> <ul style="list-style-type: none"> • Non-COVID-19 example: vaccination against hepatitis B for healthcare workers 	<p>Payment in kind</p> <p>Vaccinated people are offered a non-financial payment (e.g., free beer in Connecticut, or guns in West Virginia)</p>

considering other strategies: disincentives or incentives (Table 1).

Disincentives and mandatory vaccination

It is a basic tenet of liberal societies that state restriction of liberty (coercion) is justified only to prevent harm to others. Harm to self is never a sufficient justification¹².

Vaccination generally offers a benefit and protection to those vaccinated. But it also affects others. Two key ethical features of pandemics are that people carrying an infection, even if asymptomatic, may pose a lethal threat to others, and second, that if large numbers of people fall ill simultaneously, this

may overburden health systems and prevent others from accessing healthcare.

It is on the basis that an individual person may harm others that coercive measures can be ethically justified in a pandemic. These can include various mandatory measures such as lockdown, quarantine, isolation, mask wearing, testing, and vaccination.

For vaccination, a variety of coercive measures could be deployed, ranging from requirements to attend education sessions, to withholding of benefits, fines, imprisonment and, in the extreme, compulsion (involuntary vaccination)¹³.

In choosing between different approaches, one commonly cited principle

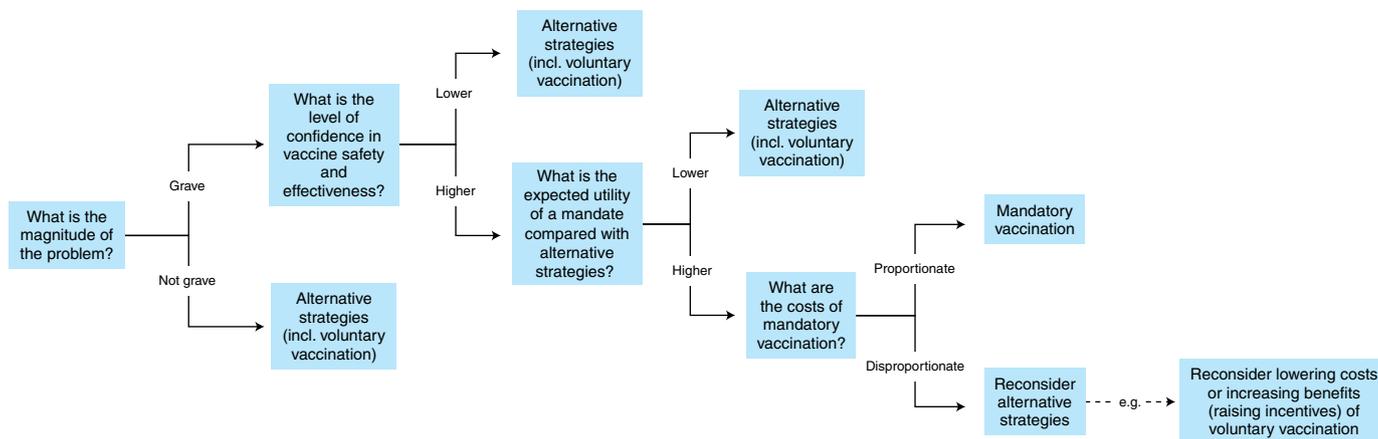


Fig. 1 | Algorithm for mandatory vaccination. An algorithm to determine if mandatory vaccination or other strategies are most appropriate, depending on the magnitude of the problem, costs of vaccination and other factors.

of public-health ethics is that the least restrictive alternative should be used. However, there are two problems with this principle as stated: first, the public-health goal may be vague (e.g., herd immunity, but achieved over what period?); second, greater restriction of liberty may provide greater public-health benefits.

A four-step decision aid has been proposed to unpack these decisions¹⁴ (Fig. 1).

Does the COVID-19 pandemic satisfy the criteria that must be met to justify mandatory vaccination? This raises difficult ethical issues.

Take proportionality first. Does the benefit achieved by the restriction outweigh the harms to the individual person? The principle of proportionality involves ethical value judgements. It can clearly be satisfied when vaccination poses small risks and thus represents a duty of easy rescue: a person should be prepared to take on a small risk to personal health for a large collective benefit¹⁵.

But when the risks are greater, vaccination may not represent an easy rescue. Ethical judgements must then be used to assess which values take precedence. Some ethical approaches take a simple, but very demanding, approach here.

Utilitarianism is the view that humans should act to create the greatest good for the greatest number. Utilitarians would require any level of sacrifice, provided the sum of those sacrifices is smaller than the collective benefits. However, other theories might instead claim that no amount of public-health benefit could be sufficient to outweigh certain rights.

Safety raises other complex value judgements. For older people, vaccination is not just an easy rescue; rather, it is a benefit to them. It is good for the individual person

and the collective. Proceeding down the age groups, the benefit to the individual person becomes smaller, until for children, it is questionable whether it is in their best interests. Moreover, SARS-CoV-2 is a new virus and these are new vaccines, with documented rare side effects.

It is therefore difficult to justify mandatory vaccination for all age groups. It would be easier to justify mandatory vaccination for older age groups, for which it is clearly in both the public interest and their interests. There may also be reasons to justify mandatory vaccination for care workers who have special obligations to protect the vulnerable patients in their care. This will apply in the UK from October 2021 (ref. ¹⁶).

Incentives for vaccination

A second approach to increasing vaccination rates is to incentivize vaccination (Table 1).

There are three ethical concerns raised against incentives. The first is that they will be coercive¹⁷. However, strictly speaking, the offer of payment cannot itself be coercive. Coercion involves limiting, not expanding, a person's options. Coercive threats (such as 'your money or your life') remove an existing desirable option. But if a person is free to refuse the offer without any penalty (as with vaccine payments), the offer cannot be coercive.

What some people refer to as coercion is more properly understood as undue inducement, whereby a person's judgement is compromised because of the size of an incentive. The person does not weigh the risks and benefits properly, and their decision to be vaccinated may not be sufficiently autonomous.

A final problem, opposite to the ones above, occurs if the payment is too small:

exploitation. Exploitation occurs because of background injustice that makes a person vulnerable. If a person is poor, they might accept a payment only because of their poverty. This is a problem of justice, rather than autonomy. There are two ways to prevent exploitation: correcting the background injustice (which will often be impractical in the short term), or paying people a fair and minimum price for the risks and labor involved in what they are being paid to do.

If vaccination is not in an individual person's interests (but is in others' interests) or if this is uncertain, vaccination can be considered paid labor, wherein the person is doing work for others. A payment model of vaccination requires that the person be paid for time, pain and discomfort; likely side effects; and risk of death. There should also be a compensation scheme for serious uncommon harms, such as rare vaccine side effects.

What would be a fair level of payment for being vaccinated? Because the risk of death is very low, a minimum wage for vaccination is also likely to be quite low, as shown in the algorithm for incentives for vaccination (Fig. 2). One challenge is that the appropriate minimum price may vary, since the risk/benefit ratio will also vary across the population. Paying people different amounts for being vaccinated is unlikely to be politically acceptable, and so the price may be fixed according to the level of the highest risk (to lowest benefit) segment of the population. Crucially, the kind and extent of payment justified depends on what would work.

Do incentives work?

If an incentive scheme involves substantial costs or harms without being effective in

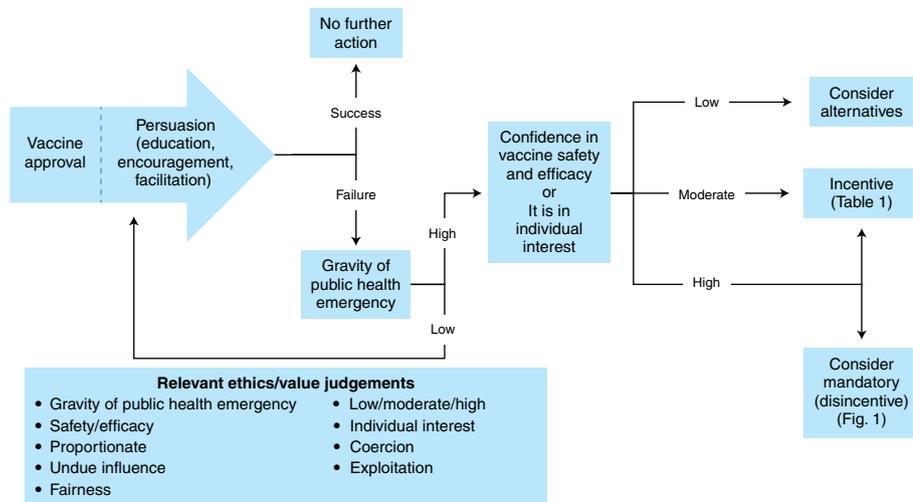


Fig. 2 | Incentives versus disincentives for vaccination. An algorithm to determine whether incentives or disincentives (mandatory measures) should be employed to promote vaccination if education, encouragement and facilitation fail to achieve sufficient levels of herd immunity.

increasing vaccine uptake, then it cannot be justified. Would incentive schemes increase COVID-19 vaccination rates or undermine solidarity? Outside the pandemic context, financial incentives have been found to be among the interventions that were most likely to positively affect vaccine uptake¹⁸. Evidence of the effectiveness of incentives schemes in the context of hepatitis B and influenza suggest that financial incentives could be helpful in promoting adherence to vaccines against COVID-19¹⁹. Similarly, Germany has moved to a paid system of plasma donation to increase rates and address shortage, with success²⁰. The UK must import blood products from the United States, where donors are paid, because the UK runs a purely altruistic system²¹.

However, a systematic review identified incentive-based interventions as among the least successful measures for increasing vaccine uptake²². Moreover, it is not clear that effectiveness in other contexts will transfer in a straightforward way to the use of incentives to increase uptake of a novel vaccine in a global pandemic. One survey study with 1,349 participants suggested that payments of up to €200 did not increase willingness to receive a vaccine against COVID-19²³. A recent study found no evidence that the Ohio vaccine lottery was associated with increased rates of adult vaccination against COVID-19²⁴.

Ultimately, the evidence on the effectiveness of vaccine payment schemes is somewhat limited, and the evidence that is available is mixed. Time will tell.

One concern is the affordability of such a scheme, but the costs of COVID-19 are astronomical, and many countries

are already providing economic stimulus packages. For example, Australia provided one to two payments of \$750 to certain benefit holders (pensioners, students, job seekers, etc.). The two payments will cost an estimated \$8.8 billion²⁵. That would have paid for a lottery in which people had chance of about a 1/200 of winning \$100,000, or around \$500 each to pay about 20 million people to receive the vaccine. These payments would stimulate the economy by encouraging spending and would allow lockdown to be ended, providing a ‘win-win’ situation.

Vaccine passports

We have described the ‘carrot’ (vaccine incentives) and ‘stick’ (vaccine mandates) alternatives to reducing vaccine hesitancy. Another alternative is vaccine passports (VPs).

VPs allow those who have been vaccinated to enjoy greater freedom of movement—for example, travel or association, such as going to pubs or restaurants²⁶. Israel and Denmark have introduced VP schemes.

VPs are sometimes described as an incentive to vaccination or as a disincentive to vaccine refusal. In part, this is simply a question of framing. However, which description is accurate depends on how the ethics of liberty restriction are understood. The only justification for overriding a person’s right to freedom of movement in the name of public health is that they pose a risk to other people—i.e., of transmitting the virus. If vaccines reduce transmission to a low level, then VPs may be morally required (provided they pass tests analogous to those

outlined in Fig. 1), since it will no longer be justifiable to restrict a vaccinated person’s liberty²⁶. That is independent of any question about the impact of VP on vaccine uptake.

If vaccination is only partly effective in reducing transmission, some justification for restricting the liberty of vaccinated people will remain—but VPs could still function as an incentive. And if lockdown is not justified independently (perhaps because rates of infection and/or mortality are low in a particular country), restrictions of liberty could function as a disincentive to vaccine refusal.

VPs would be unethical if the vaccine posed unreasonable risks or restrictions of liberty were unnecessary to deal with the public-health threat. VPs would also be unethical if they allowed freedom of movement only to people who were vaccinated but not to others who posed a low risk of transmission—for example, if natural immunity reduced transmission to a similar degree.

The ‘free-riding’ problem

The general ethical problem for vaccination is that it can be in each person’s self-interest for everyone else to be vaccinated, but for them personally to forgo the risks of vaccination. This is a classic ‘tragedy of the commons’ (or ‘free-riding’) problem. It is part of what causes climate change and antimicrobial resistance. It is a social coordination problem. For vaccination, this problem is particularly apparent where there are relatively high levels of vaccination, or a low incidence of infection. This free-riding problem may thus make it difficult for herd immunity to be achieved.

The main way humans have effectively dealt with such free-riding and coordination problems is through regulation and laws that align self-interest with the socially desired outcome (e.g., speed restrictions for drivers). It may be that achieving herd immunity requires incentives or disincentives. Mandatory vaccination may be ethical in some subgroups or in some circumstances (e.g., healthcare workers), but it is more problematic when applied to a whole population. For achieving high population levels of vaccine uptake, a payment-for-risk model, with a minimum fair level of incentive set in proportion to the risks and burdens incurred (along with compensation for injury) may be the fairest approach if education, encouragement and facilitation fail. □

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Published online: 6 September 2021

<https://doi.org/10.1038/s41591-021-01466-8>

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Acknowledgements

This research was funded in whole, or in part, by the Arts and Humanities Research Council as part of the UK Research and Innovation Pandemic Ethics accelerator (<https://ukpandemicethics.org/AH/V013947/1>). This research was also funded in whole, or in part, by the Wellcome Trust (grant numbers WT203132 and WT104848). For the purpose of open access, the authors have applied a CC BY public copyright license to any Author Accepted Manuscript version arising from this submission. J.S., through his involvement with the Murdoch Children's Research Institute, received funding through from the Victorian State Government through the Operational Infrastructure Support Program.

Author contributions

J.S. drafted the paper. J.P. and D.W. revised the paper, including substantial intellectual content. All authors participated in revision and approved the final version of the manuscript.

Competing interests

J.S. is a Partner Investigator on an Australian Research Council Linkage award (LP190100841) which involves industry partnership from Illumina, but does not personally receive any funds from Illumina.



Melding microbiome and nutritional science with early child development

Programs for treating malnutrition in children should consider how food formulations affect postnatal gut microbiome development.

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The pressing need to improve nutritional status globally is reflected in the United Nation's top three Sustainable Development Goals: no poverty; zero hunger; and good health and well-being¹. Currently, one in three children under 5 years of age is either undernourished (wasted and/or stunted) or manifests their malnutrition as overweight². Part of the problem and part of the solution may come from the vast collections of microbes that establish themselves in the gastrointestinal tract beginning at birth.

30 million children worldwide suffer from moderate acute malnutrition, defined as a weight-for-length measurement 2–3 standard deviations below the median (weight-for-length z-score, –2 to –3) of a multinational reference cohort of 8,500 children³. DNA-sequencing technologies

now allow comprehensive inventorying of the microbes present in the gut communities of infants and children. Application of these culture-independent methods to serially collected fecal samples from healthy members of birth cohorts uncovered a shared program of community assembly that is largely completed by the end of the second postnatal year. This program is perturbed in children with moderate acute malnutrition and is perturbed even more in severely malnourished children⁴. Preclinical studies suggested that disrepair of the microbial community is a contributing cause, not simply an effect, of malnutrition. This observation prompted a search for foods containing ingredients that could not only increase the abundance of underrepresented growth-promoting bacterial species but also reduce the proportion of bacteria that are

inappropriately prominent⁵. In a recently reported randomized controlled trial, children with moderate acute malnutrition whose diets were supplemented with one such microbiota-directed complementary food (MDCF) formulation (called 'MDCF-2' in that study) exhibited faster rates of weight gain, an increased abundance of plasma-protein mediators of various facets of growth, and more-complete repair of their gut communities than that of children who received a standard ready-to-use supplementary food⁶.

These findings add to a growing body of evidence indicating that the nutritional value of food extends beyond those macro-nutrients and micro-nutrients that are directly absorbed by the host⁷ and highlight a need to better understand how interactions between the gut microbiome