Who should receive the Covid-19 vaccine first?

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Abstract

There is a threat that richer countries may seek to be the first to vaccinate their populations against Covid-19 whereas, to have maximum effect, vaccines need to be rolled out simultaneously across all parts of the world. A set of principles to achieve this and to combat the danger of vaccine nationalism was published recently in the prestigious US journal *Science* and discussed at an on-line seminar hosted by Oxford University together with Beijing Normal University. The principles are critically evaluated in this article which concludes that, being difficult to fully implement, their principal value is as an evaluative tool against which to assess how well the world responds to the existential threat posed by the SARS-CoV-2 virus.

Living in China it is hard to imagine the fear stalking people elsewhere in the world. Covid-19 is taking away lives and livelihoods on a scale not seen for 100 years. The warmth of the summer months in the Northern hemisphere, when infections were comparatively low, has given way to darkness and despair as a second wave of infections threatens to overtake even the advanced healthcare systems previously enjoyed by Europeans. The only hope is that the vaccines that have been developed will be distributed as soon as possible in 2021. Normality is deferred until then; life is lived under threat of lockdown, some fearing death, others poverty and yet others social unrest.

In contrast, life in China has effectively returned to normal, the legacy of Covid-19 seen only in temperature checks, face-masks and mobile phone apps designed to record contacts with people who might carry the SARS-CoV-2 virus. But normality is made possible only because of the erection of a second Great Wall of China with intense bureaucratic vigilance at China's borders, quarantining global travellers, and surveillance of imported goods to prevent infection taking hold once more. In effect, China is self-isolating, cut off from normal interchange and, like the rest of the world, awaiting a vaccine that will enable the new Great Wall to be lowered.

As of 29th October 2020, nearly 160 vaccines were under development with 45 undergoing clinical trials including nine, four Chinese, that had reached Phase 3 which, beyond testing safety, is designed to establish effectiveness in protecting recipients against catching Covid-19, showing symptoms and being infectious. Two vaccines have been approved for use by Russia without completing Phase 3 trials. However, it is widely recognised that many of these vaccines will prove to be ineffective; the European Union has announced that it would approve vaccines with less than 50 per cent efficiency. Moreover, despite considerable investment in manufacturing capacity being in place even ahead of vaccine approval, demand for the first vaccines is likely to outstrip global supply and, more so, global need.

China's self-enforced isolation illustrates that no country can escape vulnerability to the threat from the SARS-CoV-2 virus and underlines the need for global cooperation in restricting its spread. In this regard, China's President Xi Jinping has stated that any Chinese vaccine developed will be a 'global public good', and contribute to 'ensuring accessibility and affordability in developing countries'.[1]

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However, this is not a universal response. Many countries have entered into bilateral purchasing agreements, legally binding contracts that ensure that specific governments are assured a supply of vaccine at a fixed price should the vaccine be successfully licensed. Canada, for example, has announced agreements to purchase 358 million doses for a population of 38 million[2]. Similarly, by August 2020, Britain had secured options on 340 million doses for its 67 million population.[3] The United States has through a somewhat different mechanism, a public-private initiative called Operation Warp Speed, selected to invest in eight companies, and has options on at least 600 million doses.[4]

Unlike Britain, Canada and China, the United States has not joined the COVID-19 Vaccine Global Access (COVAX) Facility, a global procurement mechanism that is, essentially, a multi-lateral purchasing agreement involving over 180 countries with a portfolio of nine vaccines under development with the aim of producing produce two billion doses of vaccine by the end of 2021.[5] Within the COVAX scheme, 92 low- and middle-income countries should be able to secure doses of COVID-19 vaccines at the same time as wealthier nations under the Advance Market Commitment (AMC), provided US$ two billion of up-front commitments are secured from rich countries by the end of 2020.[6] While COVAX might seem to be an effective antidote to vaccine nationalism, that is rich countries using their economic power and global influence to vaccinate their populations ahead of others, it represents only a partial solution. To attract rich nations, COVAX allows them to retain bilateral purchasing agreements, thereby reducing the collective resources and purchasing power of COVAX while creating competition with individual governments as to which should receive vaccine from manufacturers first. Moreover, a vaccine, once it becomes available, will be distributed by COVAX based on population size rather than according to any more precise measure of need. Furthermore, some commentators have expressed grave doubt that nationalistic pressures will be resisted by political leaders conscious of pending elections. Vaccine lawyer Clint Hermes, for example, opines that while 'it may not be fair… I don't think anyone expects the US to send vaccine to Angola before it gets to Arkansas'.[7]

Cognizant of this situation in which nationalist intent is not only patently unfair but likely to undermine the goal of building the global immunity that will allow normality to return, 19 philosophers offered an ethical framework for global vaccine allocation that was published in *Science* on 11th September 2020.[8] One of the authors, Cécile Fabre, Professor of Political Philosophy and Senior Research Fellow at All Souls College, Oxford, explained the proposal in an on-line conversation jointly organised by Beijing Normal University and the University of Oxford on 23rd October. While being an important contribution to the global debate, the framework is not without its limitations.

Fundamental values

The Fair Priority Model described in the *Science* article suggests allocating vaccine between countries based on three fundamental values: benefitting people and limiting harm; prioritising the disadvantaged; and equal moral concern. The first is the most straightforward and perhaps the least contentious. A vaccine should directly benefit people who receive it, preventing them from contracting COVID-19 with the consequent morbidity, risk of long-term complications and possibility of premature death. It would bring further indirect benefits including increased herd immunity that should prevent the spread of the virus, reduce pressure on hospitals and avoid the need for lock-down with its detrimental effect on economic activity, incomes and mental-well-being. Harm should be minimal provided that safety issues have not been downplayed to ensure early availability and

the vaccine has been thoroughly tested. However, an implication of this first value is that benefits should be maximised and harm minimised and there could be a trade-offs between these competing elements: for example, a vaccine that is very effective in preventing the acquisition of COVID-19 might have more than the normally acceptable level of side effects. Moreover, the vaccine could be more effective among some groups than others while countries may vary in their capacity to deliver the vaccine efficiently to their populations. To make fair allocations of vaccine in these circumstances requires the benefits and harms to be precisely specified and accurately measured. The approach to measurement suggested by the 19 philosophers is sophisticated and discussed below.

The second value, prioritising the disadvantaged, is according to the authors of the *Science* article, 'a fundamental value in ethics and global health'. However, the authors say little about its purpose in the context of a Covid-19 vaccine. Vaccination cannot be expected to compensate for all the structural wrongs that disadvantage people. May be, therefore, the intention is affirmative action on the grounds that the structural factors that create disadvantage might ordinarily deny disadvantaged individuals early access to vaccine. The authors do acknowledge, though, that different types of disadvantage will need to be considered and assessed. They ask (p.1310): 'Are the worst-off countries those experiencing the greatest poverty? Those where people have the lowest life expectancies?'.

The lack of detail on this second value speaks to intractability of the judgements required if this principle is to be operationalised. For example, although there are strong grounds for mainstreaming poverty, that is making the reduction of poverty an objective of all policy, this is equally true of other forms of disadvantage, be they individual characteristics such as gender, ethnicity, physical or mental disability and low educational attainment or communal ones such as living with pollution, lacking adequate infrastructure or subject to war or social conflict. However, in the context of distributing a vaccine against COVID-19, this amounts to favouring one person's life over another's. While cost-benefit analyses used in resource allocation and planning decisions do often put a price on human life, it is not self-evident that it is preferable when vaccinating against COVID-19 to protect the life of person in poverty but not that of a rich person, or to save a woman in preference to a man albeit this is the traditional code adopted at sea. In sum, there need to be clear criteria for determining what forms of disadvantage should be considered.

Equally, there must be criteria for prioritising different forms of disadvantage. As an illustration, it might initially appear obvious that preventing death is more important than alleviating poverty. However, global research that has taken seriously the voices of people experiencing poverty emphasises the depth of the associated suffering.[9] Even in urban China, research reports elderly people longing for an early death that would enable them to escape from poverty.[10] A successful vaccine would keep such people alive, prolonging the agony caused by their material and social circumstances. While no government, even given this evidence, is likely to seek to reduce poverty by denying vaccine to people experiencing poverty, the trade-offs between other forms of disadvantage might present governments with invidious choices.

Indeed, prioritising some forms of disadvantage could run counter to the third value underpinning the fair allocation framework: equal moral concern which requires that there should be no discrimination 'on the basis of morally irrelevant differences, such as sex, race, and religion'. The authors offer a qualification to this rule suggesting that 'distributing different quantities of vaccine to different countries is not discriminatory if it effectively benefits people while prioritizing the disadvantaged'. However, this poses a further challenge in determining when empirical differences become morally relevant. While men and women are equally likely to catch COVID-19, men are more likely to become seriously ill and die. Evidence from both the USA and Britain indicates that

people of colour are both more likely to become infected with COVID-19 and then to die from it although it is unclear whether this is attributable to race, ethnic behaviour, socio-economic disadvantage or discrimination either separately or in combination. Determining irrelevance, therefore, in seeking to operationalise the value of equal moral concern is far from straightforward.

While the authors in the article in *Science* posit three fundamental values, their detailed proposals pay most attention to securing benefits and avoiding harm. Given the reservations aired above, it might be preferable to construe the other two values as being operative passively rather than proactively or, perhaps, to view them as being simply instrumental in securing maximum benefit. By so doing, the sole goal becomes one of treating people equitably. Therefore, conditioned only by the principle of securing maximum benefit, the vaccine would need to be delivered, without prejudice, equitably to all persons irrespective of disadvantage. In achieving this, action might need to be taken to ensure that equal access to the vaccine was not prevented by disadvantage.

Phased response

In designing their ethical framework, the authors drop the distinction between benefits and harms highlighted in their first principle or value. They focus solely on harms caused directly or indirectly by COVID-19 that will be prevented through the distribution of a vaccine. This is understandable since, in preventing death, a vaccine is rectifying harm and bringing benefit to those who would otherwise have died and to the community to which they contributed.

Three phases of roll-out are proposed with separate allocations of vaccine being made to countries at each phase dependent on supplies becoming available (Table 1). It is envisaged that, in large measure, all countries will simultaneously transition from one stage to the next.

Table 1 The Fair Priority Model

DISTRIBUTION PHASE	PRIMARY AIM	METRIC TO DISTRIBUTE VACCINE DOSES	HOW THE METRIC FULFILLS VALUES	PRIORITIZATION
Reducing premature deaths	Reducing foreseeable premature deaths directly or indirectly caused by COVID-19.	Standard expected years of life lost (SEYLL) averted by administering vaccine.	Prevents substantial harms and gives priority to the worst-off by giving weight to premature deaths. Recognizes equal moral concern by valuing a life saved at a given age identically across countries.	Priority to countries that would reduce more SEYLL per dose of vaccine.
Reducing serious economic and social deprivations	Reducing serious economic, social, and fatal and nonfatal health harms caused by COVID-19.	SEYLL averted. Reduction in absolute poverty measured by poverty gap. Declines in gross national income (GNI) averted by administering vaccine.	Prevents harm by recognizing a wide range of economic, social, and health deficits. Gives priority to the worst-off by prioritizing people in poverty.	Priority to countries that would reduce more poverty, avert more loss of GNI, and avert more SEYLL per dose of vaccine.

Vaccine released in the first phase will be employed to reduce 'premature deaths and other irreversible direct and indirect health impacts'. The second phase will additionally aim to reduce 'serious economic and social deprivations, the closure of nonessential businesses and schools' thereby reducing unemployment, poverty and ill-health. Finally, phase three will seek to reduce community transmission and thereby, through stemming cross-border infection, bring the pandemic to an end, enabling the return of normal social and economic freedoms.

While this sequence is defensible both in terms of the finality of death and the vast volumes of vaccine required to prevent community transmission, the priorities implicit in the phasing place

individual health above economic and community well-being. In so doing, the framework is open to the criticism that it prioritises a Western model of individualism over a more socialised one when, on the basis of managing the pandemic to date, the latter has proved demonstrably more successful. This criticism might have less force if medical workers and others in key community roles were prioritised during the first phase of vaccination.

The sequencing of stages, given the differential mortality rates of COVID-19 by age, implicitly places the interests of the elderly, who will inevitably die in the comparatively short-term if only because of old age, above the life chances and economic well-being of younger people and children who have their whole lives ahead of them. There is a risk, therefore, that the allocation model will further erode the intergenerational solidity that has already been placed under threat by conditions that have denied younger generations the prospect of always being more prosperous than their predecessors.

As already noted, the three stages are envisaged as a convoy model in which all countries make similar progress in their response to the pandemic before further allocation of vaccine is made to enable countries to progress to later stages. It is unclear what, if any, accommodation will be made for countries that move ahead of the fleet, or curve, and those that fall behind. Given the very uneven spread of COVID-19 within and across countries to date, with only some of the variation clearly attributable to policies or infrastructure, some form of accommodation for differential progress would appear to be essential. What is made clear, however, is the basis for deciding when transition from one stage to the next should take place. For example, it is suggested that the transition from Phase 2 to Phase 3 might commence once the vaccine has reduced the poverty gap (the mean depth of poverty) to pre-pandemic levels (or when progress towards this goal was minimal). This criterion demands precise measurement based on reliable data as does the suggested procedure for determining the number of vaccine doses each country should receive and the order of receipt.

Prioritisation

The Fair Priority Model departs from the COVAX criterion of allocating vaccine to countries in proportion to their population, a procedure also suggested by the World Health Organisation.[11] Instead, it recommends determining the number vaccine doses to be allocated to each country at each stage based on the 'marginal improvement in ethically relevant metrics that each dose achieves'. So, for example, countries would be allocated vaccine according to the reduction in premature death likely to be achieved per dose of vaccine using the metric of Standard Expected Years of Life Lost (SEYLL).[12] 'SEYLL calculates life years lost compared to a standardized reference life table—that is, a person's life expectancy at each age as estimated on the basis of the lowest observed age-specific mortality rates anywhere in the world.'

The authors argue that using SEYLL has three major advantages. First, it incorporates equal moral concern 'by valuing a life saved at a given age identically across countries, regardless of pre-existing conditions or differences in national life expectancy'. Secondly, at the same time, while acknowledging the importance of any death, it accords earlier deaths greater priority and thereby prioritises the least advantaged, 'particularly because early deaths are more frequent in low-income countries and are a proxy for being disadvantaged overall'. Finally, SEYLL is the standard metric used in calculating the global burden of disease.

Two additional metrics are proposed for allocating vaccines in the second phase: projected absolute improvement in gross national income (GNI) per vaccine dose and 'projected reduction in the absolute size of the poverty gap per dose of vaccine, with the poverty line set at a uniform absolute level'. For Phase 3, countries with the highest transmission rates would initially be prioritised before ensuring that all countries receive enough vaccine to halt transmission.

The metrics are not only sophisticated but differ in kind with those appertaining to the first two phases focussed on efficiency with the virus transmission rate used for Phase 3 referencing need or, possibly, effectiveness. Viewed from a global perspective, the efficient use of a vaccine means that the maximum number of lives can be saved and at minimum cost. However, while the individual metrics would seem sensitive to disadvantage, in global terms this seems unlikely to be true. It appears that countries would compete by demonstrating that could save more lives than other countries through their delivery of the vaccine. Leave aside the challenge of estimating the number of lives to be saved per dose of vaccine, countries with poor administrative infrastructures, a surrogate for low national income and disadvantage, are least likely to be able to deliver vaccine efficiently.

The article in *Science* does not indicate how the impact of a dose of vaccine on mortality is to be calculated. It is presumably too simple to assume that each person vaccinated is a life saved given that the death rate varies by age, gender, health status and ethnicity as well as by country in complex ways that presumably reflect health provision, policies and a host of other determinants. Conceivably a vaccine might have most effect in countries with high Covid-19-related death-rates prior to vaccination which might reflect poor health infrastructures, arguably an index of disadvantage, although this would seem also to reward countries that have failed adequately to control diffusion of the virus by other means. More importantly, it seems unlikely that epidemiological models will be adequate to predict national differences in the effectiveness of a vaccine with an accuracy sufficient to justify different allocations of vaccine. This is suggested by the current situation in Europe (November 2020) in which the spread of Covid-19 infections is exceeding all but the most extreme epidemiological projections.

The allocation criteria set for the second phase are similarly extremely challenging technically to operationalise. The authors of the framework acknowledge that there is no single socioeconomic metric that integrates benefiting people and prioritizing the disadvantaged and, as noted above, propose improvement in gross national income and reductions in the absolute size of the poverty gap attributable to each dose of vaccine. It is far from clear that such metrics are technically feasible. For example, given that governments do not with any confidence know what reduces poverty beyond directly placing money into people's pockets and -very indirectly -by growing the economy, predicting the marginal effect of a vaccine will be very difficult and is not helped by the fact that estimates of poverty rates are seldom available until one or two years after the fact.

The metrics proposed for allocating vaccine between countries are chosen to be ethically relevant but are also justified in the *Science* article by a critique of alternatives. The COVAX Facility proposal to allocate vaccine based on population size is rejected because it does not reflect the 'markedly different levels of premature death and economic devastation from COVID-19'. The World Health Organization suggestion to allocate vaccine to countries according to risk, namely the number of frontline health care workers, the proportion of population over 65, and the number of people with comorbidities in the country, is also rejected. While acknowledging that the WHO strategy might reduce deaths while protecting health services, the authors opine that 'it is an empirical question whether this prioritisation optimally reduces death' suggesting that 'only data can determine which approach best fulfils the ethical value of reducing premature deaths'. While true, this criticism appears to be equally pertinent to the metrics supporting the Fair Priority Model.

Indeed, the focus on efficiency makes the Fair Priority Model not only reliant on data that may not be reliably available, but also on predictive modelling much dependent on assumptions that are likely to be contested on theoretical and, given that resources are involved, also on political grounds. It is not without coincidence, therefore, that most social policy resource allocation decisions are initially based on need and then, only with experience, modified to enhance efficiency in the light of evidence on effectiveness. While allocation according to population size, proposed by the COVAX Facility, is only a very crude index of need, this may reflect the politics involved in encouraging participation by self-financing partners. Likewise, while the WHO strategy employs readily available metrics of need, these cannot be criticised for favouring countries that have poorly managed the Covid-19 as might be the case had allocation been proposed based on the national infection reproduction number (R_0) or deaths attributable to Covid-19.

Current concerns

In this final section, it is appropriate to respond to concerns raised by participants in the on-line seminar at which the Fair Priority Model was presented by Cécile Fabre. One issue was vaccine nationalism which concerns the pressures on governments to place the health of their own populations ahead of the protection of others.

The Fair Priority Model is a direct response to the fear of vaccine nationalism which, as Tedros Adhanom Ghebreyesus, head of the WHO, has repeatedly warned is counterproductive; the most effective strategy is 'to vaccinate some people in all countries rather than all people in some countries' with the result that 'vaccine nationalism will prolong the pandemic, not shorten it'.[13] However, the Fair Priority Model prioritises ethical over political concerns and ignores the pressure on government to respond first to the needs of their citizens. An alternative points-based ethical framework offered by medical ethicists at Vanderbilt University includes reciprocity as one of three allocative principles. Nil points would be awarded to countries that 'hindered global efforts or attempted to obtain exclusive access' and the maximum of three points to those that 'participated in clinical trials, aided in surveillance efforts, donated viral samples'.[14] (The other two principles relate to the ability of countries to provide patients with medical care, reducing the immediate need for vaccine, and the ability to deliver a vaccine.)

The position adopted by COVAX is perhaps more practical than principled but policed by the court of global political opinion. Contributing countries have the right to vaccinate their populations through bilateral agreements irrespective of their membership of COVAX which consequentially helped fund the collective development and distribution of a target of 2 billion doses by the end of 2021, one billion to low and middle income countries. Governments arguably gain soft power because of joining COVAX, the contrast between China's membership and the failure of the USA (under President Trump) to do so being a case in point. China joining in October is the overt fulfilment of President Xi Jinping's commitment to make Chinese vaccine a global good.[15] Nevertheless, countries with vaccine to sell may equally gain political influence through bilateral agreements. Russia, which has not joined COVAX, is reputed to be negotiating to deliver its Sputnik V vaccine to 40 countries.[16]

For the vaccine to be effective, it needs to be delivered globally as soon as is practicable. Herd immunity is unlikely to be achieved with less than 60 per cent coverage of the population everywhere. This goal would be frustrated by vaccine nationalism and could similarly be put at risk by the growing resistance to vaccination expressed by vocal minorities in rich countries. This concern has attracted much attention focussed on the viral spread of conspiracy theories, although

conspiracy theorists, at least in the USA, account for only around a third of people saying that they would not vaccinate. Others are often hesitant, fearful that the vaccine may not be safe and confused by misinformation carried by social media, mostly uploaded, but not exclusively, by antivaccine influencers.[17] [18] A common characteristic of such people is that they distrust government and experts although there is evidence that this cynicism reflects, or generalises to, a social distrust and dislike of identifiable others.[19] In the USA, ignoring scientific advice has become a badge of honour among many political supporters of President Trump, while, in Britain, those most opposed to vaccination include groups most at risk: ethnic minorities and people on low income.[20]

Trust in government has been declining in many OECD countries with competence, reliability, responsiveness, integrity, and fairness being strong predictors of public trust.[21] Leaders knowingly lie, whereas in the past this would have resulted in impeachment or resignation.[22] [23]. Moreover, the lacklustre performance of many governments in responding to Covid-19 has further reduced trust; among the Group of Seven nations only the Japanese government avoided a fall in trust with Britain faring worst with an 18 per cent fall to 51 per cent between March and May in the proportion approving of how authorities had handled the pandemic.[24] By September, 56 percent of the British population were reporting 'no confidence' in the government's response to Covid-19.[25]

Trust and compliance are critical to the effectiveness of the vaccine as they have been in managing the pandemic to this point. Compliance with lock-down measures in countries is demonstrably greater in those European countries where populations have more trust in government.[26] Similarly, public assessment of the appropriateness and effectiveness of policies in the 19 most badly affected countries is positively correlated with prior trust in government.[27] This is most clearly evident in the three East Asian countries included in the study: China; Singapore; and South Korea. Governments in these countries were able to act early, employing large-scale testing campaigns, extensive contact tracing, and rigorous lockdown policies and compliance - indicated, for example, by the wearing of face-masks - was extremely high. It is probably no coincidence that trust in government was already high in each of these countries before the pandemic, permitting the implementation of robust and relatively successful policies that were in turn evaluated very positively by the national populations.

While these three East Asian countries have quite different political regimes, they share a Confucian legacy that both prioritises collective interests over individual ones and presumes that government naturally acts in the interests of the people. Therefore, China, where the SARS-CoV-2 virus was first identified and is now largely kept at bay, was able to act decisively, prioritising health by initially rigorously locking down the economy and population. It was able to demonstrate that policy to control Covid-19 need not be conceptualised as a zero-sum game in which protecting life destroys the economy and, as result, has achieved the highest satisfaction ratings of any government. [28]

While, China has demonstrated that it is possible, with great vigilance, to return to economic growth and for people to live an almost pre-pandemic life without access to a vaccine, it seems improbable that countries committed to combinations of capitalism, small government and individualism will ever be able to emulate such success. Therefore, the need for a vaccine is very real, to protect lives, the global economy and social well-being. The vaccine needs also to be fairly allocated to protect even the most disadvantaged and thereby to provide maximum global protection. The Fair Priority Model sets out an ethical framework which, if it is not adopted as an allocative procedure, still provides a datum against which the outcome of the COVAX mechanism and global politicking can be retrospectively assessed.

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