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Editorial article

Who should be vaccinated against COVID-19 first?☆

¿A quién habría que vacunar primero frente a la COVID-19?

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A few weeks ago, the media reported that the WHO had established a fundamental principle in the fight against COVID-19: the vaccines that prove to be safe and effective must be distributed in all countries in order to control the transmission of SARS-CoV-2. Poor countries should receive the needed vaccine doses coequally with rich countries; since the vaccine production will be staggered, it will be necessary to prioritise which population groups should be vaccinated first to maximise social benefit.

In order to ensure that this is fulfilled, a global collaboration was created for the development, manufacture and equitable distribution of COVID-19 vaccines, called COVAX. This is a partnership of countries, philanthropic foundations and pharmaceutical companies etc. COVAX is directed by the World Health Organization (WHO), *Global Alliance for Vaccines and Immunization* (GAVI) and *Coalition for Epidemic Preparedness Innovations* (CEPI). Its goal is to obtain two billion vaccine doses before the end of 2021, less than half of the possible world production,[1] to ensure delivery to countries that will either receive them for free or pay for them.[2] The latter countries can request amounts to cover between 10 and 50% of their population.[2] Poor countries will receive 1 billion doses for free.[1] 184 countries have joined the initiative,[3] including those of the EU and China, but not the US. The allocation of vaccine doses for each country will be proportional to their populations, with the exception that no country should receive doses that exceed 20% of its population until all have reached that percentage.[2]

Epidemiological and ethical criteria are used to achieve the objective that all countries receive sufficient doses of COVID-19 vaccines. According to epidemiology, as long as the transmission of SARS-CoV-2 is not controlled in the majority of countries and among the world's population, the pandemic will be present or may reappear. Therefore, thanks to the vaccine (and to a lesser extent, the infection), group immunity can be achieved and thereby break the chain of transmission. From an ethical point of view, equity and the maximisation of health and economic benefits should guide the case.

Assuming that vaccine production will be staggered and embracing the surrounding great uncertainty — how should the first available doses be distributed and to whom?

The COVID-19 vaccines are a global public good.[4] For the WHO, during the time that the vaccine production capacity is limited, the basic initial objectives are to reduce mortality and protect health systems.[5] The principles to consider are[5]: protect and promote human well-being; recognize the dignity of all people and treat them accordingly; ensure equity in access to vaccines; generate reciprocity with people and groups that present significant additional risks against SARS-CoV-2; and make global/national decisions on vaccine allocation in a transparent way, based on the best available evidence and taking into consideration the affected parties.

Under these premises, the WHO has identified which population groups should be prioritised to maximise the benefit of having to administer a limited number of vaccine doses, regardless of the seroprevalence achieved in each country: social health workers — because when caring for and treating patients with COVID-19 these workers are in close contact with them; and people over 65 and those with certain comorbidities — because they have a higher risk of dying from COVID-19.[6] In a first phase, all the countries should receive a quantity of vaccines proportional to their population: doses for 3% of the population make it possible to vaccinate the social health workers of each country; with additional doses to reach 20% of the population, those over 65 years of age and those under this age with comorbidities may be vaccinated. In addition, countries should receive sufficient amounts to attend humanitarian situations such as displaced persons and refugees.[6] Once these priority population groups have been vaccinated, countries can receive more doses to vaccinate the rest (>20%) of the priority population and, finally, include every person each country considers can benefit from vaccination. The prioritisation and quantification of the vaccine doses to be received in each allocation round should be based on the potential impact of COVID-19, according to epidemiological data (e.g. basic reproduction number,

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Ro), and on the vulnerability of the country's health system (e.g., occupation of hospital and ICU beds).[6]

The WHO proposal to use population-based proportionality for the allocation of vaccine doses has been questioned by those who support the Fair Priority Model.[7] As a fundamental ethical principle, this model defends benefiting people and limiting harm, prioritising those who are disadvantaged and recognising that all people have the same dignity. The model focuses on three types of harm caused directly or indirectly by COVID-19: death and permanent organ damage, health care system strain and stress (e.g., increased mortality rates from other pathologies) and economic destruction (e.g., increased unemployment, poverty and hunger).

The Fair Priority Model proposes three phases in which the priority is to prevent the most urgent harm.[7] Phase 1 aims to reduce premature death, something especially present in the poorest countries, and other irreversible direct and indirect health impacts. Premature death is measured using the *standard expected years of life lost*[8] (SEYLL) averted per dose of vaccine. SEYLL considers earlier deaths to be particularly important, and values a life saved at a given age identically across countries, regardless of differences in national life expectancy. In phase 2, in addition to irreversible harm to health, the proposal includes a reduction of economic and social deprivations. In this phase, the averted SEYLL is retained as a health measure, and the reduction of absolute poverty and *Gross National Income* (GNI) as measures of economic improvement. In phase 3 the objective is to reduce community transmission, which will facilitate economic and social activities to the pre-pandemic levels. For this model, countries with high Ro rates have priority. All countries should receive the number of doses of vaccines necessary to achieve group immunity. Three objections are raised regarding the Fair Priority Model[7]: (a) the misuse that some may make of vaccines due to lack of infrastructure or corruption; (b) negativity towards assigning vaccine doses to countries that have effectively known how to control the transmission of SARS-CoV-2 (Ro < 1) and (c) difficult to calculate assessment metrics (e.g., SEYLL).

However, from an ethical point of view, one has to be in agreement with the Fair Priority Model compared to that of the WHO, since the equitable distribution of a good such as vaccination must adhere to the principle of benefiting the least advantaged, as stated by Rawls's Difference Principle,[9] and not taking the population criterion as an allocation measure. Given the great inequalities that exist between countries, the only way to correct them is not by giving everyone the same, but by giving more to those who are worse off. Beyond ethics, Emanuel et al.[7] see other drawbacks in the WHO proposal; they think that it has not been empirically proven that vaccinating health workers and those most at risk of dying will optimally reduce mortality from COVID-19. At the opposite extreme, the models of Hogan et al.[10] show that the most efficient way to prevent mortality from COVID-19 is to assign vaccine doses in proportion to the population of each country. When doses are available to vaccinate less than 20% of the population, their models indicate the suitability of vaccinating those over 65 and those in high-risk groups. However, when a country has a sufficient number of doses, the best option would be to vaccinate people of working age, instead of those over 65, as group immunity would be achieved earlier,[10] something that is unlikely to happen given the staggered availability of anticipated vaccine doses.

If we stop thinking about assigning vaccine doses globally and focus on how to do it in developed countries, what should the criteria be? Three documents have addressed this issue.[11–13] The most extensive and detailed draft is the *National Academies of Sciences, Engineering and Medicine* from USA[13]; it explains that the objective of vaccine allocation is to reduce severe morbidity and mortality, and negative societal impact due to COVID-19. The proposed framework is based on three foundational ethical principles: maximise benefit, every person be considered and treated as having equal dignity, worth, and value, and the mitigation of health inequities.[13]

The allocation must be carried out taking into account three procedural principles[13]: fairness in prioritisation, transparency and being based on evidence. Taking into account four allocation criteria (risk of acquiring infection, risk of severe morbidity/mortality, risk of negative societal impact and risk of transmitting infection to others), four allocation phases are proposed. In phase 1a, vaccination would be for high-risk health, transportation and environmental services professionals (representing 5% of the US population); phase 1b includes high-risk patients (with at least two comorbidities such as cancer, severe cardiovascular disease, chronic obstructive pulmonary disease, obesity, type 2 diabetes) and those over 65 years of age who live with many people (e.g., elderly nursing homes, prisons), which represent 10% of the population. Phase 2 includes workers in schools, food services, public transport and other services, patients at moderately high risk (with only one comorbidity), adults who live with many people (e.g. residences for the disabled) and those over 65 years not included in phase 1 (they represent 30%–35% of the population). Phase 3 includes young adults, children, and industrial workers who are at moderate risk of exposure to SARS-CoV-2 (they account for 40%–45% of the population). Phase 4 would include everyone residing in the US who had not had access to the vaccine.

Spain's central and regional governments are agreeing on a plan to prioritise the distribution of vaccines,[14] and this must include to whom it will be allocated[15] and how it will be distributed, as the logistics are complex. It seems that the allocation to each autonomous community (CC.AA.) will be proportional to the population,[14] it should be taken into account that the presence of marginal groups (e.g., immigrants) and those at risk is uneven between the CC.AAs. People at higher risk and health professionals are likely to have priority.[14] Between December and the summer of 2021, Spain could have 31 million doses to vaccinate 15.5 million citizens.[16] Initially, three million doses are expected,[14] which would be enough to vaccinate the social health workers (there are about 900,000 health workers[17]) in the coming winter. Spanish society has the right to know about the remaining doses from the first shipment and to which risk groups they will be administered.

Whatever the answer is and due to the precarious situation we find ourselves in, the plan in question will require the collaboration of all those involved and (e.g., scientific societies) of the public.[5,13,18] It should be publicly available for the sake of transparency[5,13] and to avoid time-wasting discussions. Communication in this regard is essential for the population to know and understand the reasoning behind certain priorities regarding access to vaccination. At the same time, and given that 44% of the population state that they are not willing to be vaccinated within a few months of being able to do so,[19] it is important to report on the usefulness of the vaccine, when we have access to vaccines that, although they can reach only 50% efficacy,[20] will be essential to control COVID-19. Addressing the distribution of vaccines with transparency and a sense of responsibility is essential to ending successfully the social and health crisis in which we find ourselves.

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Conflict of interests

The authors declare that they have no conflict of interest.

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