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Geopolitical aspects of COVID-19 vaccines distribution

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ABSTRACT

In December 2019, the Wuhan Municipal Health Commission (China) reported to the World Health Organization (WHO) a cluster of pneumonia cases with unknown aetiology in Wuhan City, Province of Hubei, China. In March 2020, WHO declared a pandemic. So began the spread of Sars-Cov-2 and the race to possible countermeasures. This article analyses the commercial relationships of the sale and purchase of vaccines as a measure of influence between different regions of the world. Taking all vaccines with a degree of global diffusion into account (Sputnik V, Russia; Sinovac, China; Sinopharm, China; Covishield, Oxford/AstraZeneca formulation, India; Johnson & Johnson, USA; Oxford/AstraZeneca, UK; Pfizer/BioNTech, USA; and Moderna, USA), the article examines the specific regions of distribution. The paper has two aims: Firstly, to understand if the vaccines' distribution mirrors the geopolitical *status quo*. Secondly, to identify the territories potentially more capable of causing important, regional or global, geopolitical frictions. In order to do that, the article highlights regions with unipolar and multipolar geopolitical influences. Limitations and further possible developments of the work will be commented on in the conclusions.

Keywords: COVID-19, vaccines distribution, geopolitical influences, power, crisis

INTRODUCTION

A human being enters into a relationship with the outside world from the moment it exists in the maternal womb [1]. In fact, the nervous stimuli that a foetus receives are different from when it touches the uterus, its "external world", to when it touches itself. These two nervous stimuli are the precursors of the future concept of "Self" and "other-than-Self." Given this constant interaction, human beings are pushed from the very beginning to organize their way of relating to others. All existing scientific disciplines have been interested in the study of such modalities, even if at widely different end of the scale, going from single cells to international relations, and calling them with different names. In the economic and geopolitical sphere, the most used terms are those of relationships based on competition, or relationships based on cooperation [2-5]. The two polarities, in practice, are not clearly defined, but rather they constitute a *continuum* with which to describe and interpret international relations [6]. There is, in fact, a competitive ground in the vast majority of attempts at cooperation occurring between different countries around the world, which shows a willingness to be allied, as long as the counterpart does not question the leadership [7]. Cooperation and competition, therefore, are two constructs closely related to the search for power and the avoidance of the perceived danger coming from the external world [8-10]. The greater the perceived danger, the more intense the search for power, which in turn will result in cooperative and/or competitive behaviours aimed at gaining a controlling position and eliminating the perceived danger.

In fact, each relational *medium*, the tool that allows two or more individuals to be in a given relation, can be used for purposes of cooperation and/or competition, from the sword of the ancient Romans, which stimulated competition and cooperation in the world at that time, to the modern bilateral meetings, that can promote the competition and cooperation between two given countries. Vaccines are no exception: they represent the relational *medium* of choice if the world turns out to be in the middle of a pandemic. This article analyses the distribution of all the major vaccines on the global market as an index of geopolitical influence, and therefore of power, of one country over another.

The paper has two aims. Firstly, to understand if the vaccines' distribution mirrors the geopolitical *status quo*. Secondly, to identify the territories potentially more capable of causing important, regional or global, geopolitical frictions. In order to do that, the article highlights regions with unipolar and multipolar geopolitical influences. Limitations and further possible developments of the work will be commented on in the conclusions.

METHODS

To trace the distribution of the major vaccines on the global market, we have made use of the portal https://covid19.trackvaccines.org/, a project funded by McGill University, Montreal, which collects data from regional and global institutional sources used in various international scientific publications [11]. The reader can monitor the entire list of institutional sources at the following link https://covid19.trackvaccines.org/data-sources/. The lists of countries, where different types of vaccines have been distributed have been transformed into maps, using Tableau software version 2021.1. We took the distribution of the following vaccines into account: Sputnik V, Russia; Sinovac, China; Sinopharm, China; Covishield, Oxford/AstraZeneca formulation, India; Johnson & Johnson, USA; Oxford AstraZeneca, UK; Pfizer/BioNTech, USA; Moderna, USA. Furthermore, in order to analyse the unipolar or multipolar influence of each region of the globe, we have calculated the number of types of vaccines distributed within each country (given we have taken eight vaccines into account, the number may vary from one to eight). The higher the number of types of vaccines distributed within a given country, the more multipolar the influence will be. For this last analysis and related map, we have made use of MATLAB.

RESULTS

Firstly, we consider the doses of vaccines distributed per 100 inhabitants in different countries around the world (**Figure A1**, **Appendix A**). As can be observed in the African continent, the doses of vaccines distributed are significantly lower. Only some coastal nations of the continent manage to enter into the global vaccine market although they also show significantly small percentages of distribution compared to the average of countries from other continents. With regard to the global distribution of each type of vaccine, we find Oxford/AstraZeneca, UK, in first place with 177 countries in which it is distributed; followed by Pfizer/BioNTech, USA, with 146 countries; Sinopharm, China, with 88; Moderna, USA, with 81; Johnson & Johnson, USA with 81; Sputnik V, Russia, with 48; and Sinovac, China, with 44 (source: Our World in Data, January 24, 2022). Regarding the distribution of USA vaccines (**Figure A2**, **Appendix A**), we observe their clear prevalence in the regions of the world to which the USA is historically allied, such as Europe and regions of the Commonwealth, as well as Latin America, which has business relationships with Pfizer/BioNTech and Johnson & Johnson. The only exception in Latin America is represented by Maduro's Venezuela, which only has commercial relations with Sinopharm and Sputnik V. A very specific situation is that of Cuba in which only Sinopharm is distributed. This is because local Cuban companies have produced five vaccines independently. With the exceptions of India, Japan, Mongolia, and Pakistan, the distribution of USA vaccines is practically absent in the Asian continent and likewise in most African countries, with the exceptions being Nigeria, Libya, Kenya and South Africa.

The most widespread vaccine in the African continent is, in fact, Oxford/AstraZeneca, which is a collaboration between Oxford University and the company AstraZeneca that produces the active substance of the vaccine in at least 15 countries around the world, including the Serum Institute of India. The diffusion of Oxford/AstraZeneca covers practically all the countries of the African continent, obviously the whole Commonwealth, as well as Latin America. Most Asian countries and the USA do not have any commercial relations with the British company, except Japan, Mongolia, Pakistan, Tajikistan, and Uzbekistan (**Figure A3**, **Appendix A**). It should also be noted that, in the context of commercial frictions for the distribution of vaccines in Europe, following some thromboembolic events, which occurred subsequent to the inoculation of the Oxford/AstraZeneca vaccine, most European countries permanently suspended its use around July 2021. In an article published in January 2022 in the International Journal of Haematology [12], the authors compare 1,745,713 patients from Kuwait who received Pfizer/BioNTech with 1,025,715 patients receiving Oxford/AstraZeneca. The results report six cases of thrombosis after the first dose of Oxford/AstraZeneca, a ratio of one case: 123,000 patients, with no cases after the second dose, in comparison to four cases of thrombosis after the first dose of Pfizer/BioNTech, a ratio of one case: 257,000 patients, with seven cases after the second dose, a ratio of one case: 102,000 patients. Thus, the results evidence a null difference between the risks of administering the two vaccines. Furthermore, it is worth noting that the efficacy of the vaccines mentioned in this paper is largely comparable [13], excluding any relevant confounding factor leading to an apparent operational superiority of one vaccine over the other.

As for the Chinese vaccines (**Figure A4**, **Appendix A**), we can observe that in South America, they cover Cuba and Mexico, in Africa, South Africa and most of the countries of West Africa, plus the countries of Mediterranean Africa such as Algeria, Egypt, Morocco and Tunisia, some European countries such as Hungary, Montenegro, Serbia, and Ukraine, in the Middle East, Iran, Iraq, Jordan, and Turkey, and finally, the countries directly bordering on China.

Regarding the distribution of the Russian vaccine (**Figure A5**, **Appendix A**), we observe commercial trades in all the countries of Latin America, except Colombia and Peru, all the countries of Mediterranean Africa and most of West African countries, some European countries such as Albania, Belarus, Bosnia, Hungary, Moldova, Montenegro, San Marino, and Serbia, most of the Middle East and Asian countries except China, Japan, Saudi Arabia, and South Korea. It should be noted that Sputnik V has never been approved by the European Medicines Agency. On the other hand, from the data of the Institute for Social Security of San Marino, it emerges that the hospitalization rate in the population of San Marino is 0.102% for those vaccinated with Sputnik V and 0.162% for those vaccinated with Pfizer/BioNTech. While it is 5.19% in the unvaccinated population (50 times more), showing an attenuation of the risk of hospitalization absolutely comparable between the two vaccines. Furthermore, a recently published article [14], among at least 30 publications on the effectiveness of Sputnik V, the result of a combined effort between the researchers of the Spallanzani Institute of Rome and the Gamaleya Institute of Moscow, shows how the Russian vaccine produces a stronger antibody response than

Pfizer/BioNTech to the variant Omicron. In particular, the antibody response in people vaccinated with a double dose of Sputnik V decays twice as slowly as in those vaccinated with a double dose of Pfizer/BioNTech. In another study, published in November 2021 [15], the effectiveness of vaccines distributed in Hungary is compared. Sputnik V was ranked first for effectiveness of protection against mortality from COVID-19 (98%), Moderna was ranked second (94%), Pfizer/BioNTech third (91%), Oxford/AstraZeneca, and Sinopharm fourth (88%).

Finally, to investigate the regions of the globe with unipolar and multipolar influence, we have calculated the number of types of vaccines distributed within each country. Given we have taken eight vaccines into consideration, this number may vary from one to eight (**Figure A6**, **Appendix A**). The countries in blue have a markedly unipolar influence, countries in red a markedly multipolar influence. In particular, the countries where seven vaccines out of the eight are distributed are: Argentina, Bangladesh, Brazil, Hungary, Indonesia, Mexico, Nigeria, Philippines, and Sri Lanka. The countries, where six vaccines are distributed are: Egypt, Kenya, Malaysia, Maldives, Pakistan, Thailand, Tunisia, and Vietnam. The countries where five vaccines are distributed are: Bahrain, Bolivia, Canada, Chile, Colombia, Ghana, India, Libya, Mongolia, Paraguay, Saint Vincent, the Grenadines, and the United Arab Emirates.

CONCLUSIONS

China, Russia, and the USA are the three countries that exclusively use vaccines from their own production. Canada has trade ties with the UK and USA vaccines, historically allies. Even Greenland, although a Danish territory, has commercial relations only with USA vaccines, conceivably for geographical convenience. Mexico has commercial relations with all the main international players, a territory with a markedly multipolar influence. For geographical reasons, in fact, it can potentially constitute an important outpost of geographically very distant players, such as China and Russia. *Cuba*, as previously mentioned, has an autonomous production of vaccines. It is for this reason that only a Chinese firm, Sinopharm, distributes its vaccine in the country. In geopolitical terms, it is very interesting to observe the situation in South America, which includes many territories with a markedly multipolar influence (Argentina, Brazil, Bolivia, Chile, Colombia, and Paraguay) as these they are not only rich in natural resources but also very stimulating for the international players geographically distant from the USA. An interesting exception in South America is Maduro's *Venezuela*, which has commercial ties only with vaccines produced in China and Russia. In fact, it is not by chance that recent geopolitical frictions have taken place in Venezuela among the international supporters of a government led by Guaidò and those of Maduro. To date, Russia is Venezuela's main partner, both from the point of view of military cooperation and energy. Neighbouring Guyana also excludes the USA as a commercial partner, relying on British, Chinese, and Russian vaccines.

Europe shows itself as a faithful ally of the USA, preferring, in the long term, Pfizer/BioNTech and Moderna more than Oxford/AstraZeneca, except for some territories of Eastern Europe. Orbán's Hungary distributes vaccines produced in all the four international players: China, Russia, the UK, and the USA. *Belarus* has commercial relations only with China and Russia and *Ukraine* with China, and the UK, and the USA, excluding Russia; Bosnia, Moldova, Montenegro, San Marino, and Serbia, include the Russian vaccine in their vaccination plan. Also in this case, these data are consistent with the current geopolitical frictions in Belarus and Ukraine, territories like Cuba and Venezuela are located on the border between two opposite geopolitical influences [16]. On the other hand, Denmark, Norway, and Switzerland are the three countries of Europe with a markedly unipolar influence, relying on a single commercial partner: the USA.

In Africa, the territories with a marked multipolar influence are in the Gulf of Guinea, such as *Nigeria*, in the Horn of Africa, such as *Kenya*, and in the countries belonging to the Mediterranean area of Africa. Nigeria distributes vaccines produced by all the four most important international players, China, Russia, the UK, and the USA. Notably, Nigeria hosts the headquarters of the most important oil multinationals such as Chevron, ENI, Shell, and Total. It represents Africa's leading hydrocarbon producer and one strategic world trade hub and is threatened by growing piracy (being main global piracy hotspot). Kenya also has commercial relations with all the main international players; the Horn of Africa, in fact, constitutes the most important trade hub in East Africa. In 2013, it was included in the Chinese Maritime Silk Road (Belt and Road Initiative, BRI). Rosatom and Lukoil, Russian energy companies, are committed to supporting Kenya's civil nuclear ambitions, and there is also a strong Russian presence in the Kenyan and Nigerian arms markets. As for the Mediterranean area, Egypt and Tunisia have established commercial relationships with all international players. The former, in fact, has strategic importance for world trade routes due to its control of the Suez Canal and the latter, through the Mediterranean routes. All the international players except China have commercial relations with Libya, while all the international players except the USA have commercial relations with Algeria and Morocco.

In the Middle East, we find Turkey, which has commercial relations with China, Russia, and the USA; *Georgia*, which has commercial ties with all the four international players except Russia, despite being a Russian neighbouring state; Israel and Saudi Arabia only with the USA; the State of Palestine (West Bank) with all except the UK; the United Arab Emirates with all the international players. The ports of the United Arab Emirates are among the most important in the world for productivity of its terminals, and in addition, the country hosts about 45 "free zones": areas with practically no taxation for foreign investors that is worth billions of dollars for the country.

In Asia, Afghanistan only distributes Oxford/AstraZeneca; India has commercial relations with all the four main players except China; Japan only with the UK and the USA; *Indonesia*, *Iran*, *Pakistan*, Mongolia, the Philippines, and Vietnam are territories with markedly multipolar influence, establishing commercial relations with China, Russia, the UK, and the USA. Through the new Silk Road, China has invested around 600 billion dollars in infrastructure in Southeast Asian countries,

including Pakistan. For China, in fact, this area represents an important connection with the Indian Ocean. Chinese interest is demonstrated by the fact that within the BRI project there are many investments specifically destined for foreign ports, such as Gwadar in Pakistan, which leads to the Gulf of Oman, and Malacca in Malaysia, a strategic commercial hub that connects the South China Sea to the Indian Ocean. On the other hand, the United States seeks to leverage other major regional players such as Australia, India, and Japan (Quadrilateral Security Dialogue, Quad) in order to contain Chinese trade expansionism. To date, this area includes: four countries with nuclear weapons such as China, India, North Korea, and Pakistan; Iran, with ongoing international negotiations regarding the completion or containment of nuclear development (the eighth round of indirect talks between Iran and the USA on the Joint Comprehensive Plan of Action, JCPOA, took place on January 28); three of the largest economies in the world such as China, India, and Japan; and the South China Sea, which is a transit route for about 1/3 of the volume of world maritime traffic. This complexity is in accordance with the results of this study, which show the marked multipolarity of this region. Two territories of extreme geopolitical interest in this area are also *Taiwan* and *South Korea*. The former relies exclusively on USA vaccines, despite being on the Chinese coast; the latter only conducts commercial relations with the UK and USA. A particular case is that of North Korea about which there is no available data regarding vaccine distribution within the country.

The results of this study show that Cuba and Venezuela, Belarus and Ukraine, Kenya and Nigeria, Georgia, Indonesia, Iran, and Pakistan, and South Korea and Taiwan seem to be those territories with strong opposing geopolitical pressures, therefore, areas of possible international fractures [17]. However, the reader's attention is drawn to an important distinction. While Indonesia, Iran, Kenya, Nigeria, and Pakistan are countries with a marked multipolar influence, Belarus, Cuba, Georgia, South Korea, Taiwan, Ukraine, and Venezuela are countries with marked unipolar influence, despite being at the border of two opposing geopolitical pressures. This differentiation leads to hypothesizing a different risk for the geopolitical *status quo*. In case of an open political, and/or economic, and/or military conflict, the countries with a marked multipolar influence would first experience a period of strong internal instability and only later, in the event of a regional polarization, might the conflict evolve from a local to a global crisis. On the other hand, the countries with a marked unipolar influence, being themselves outposts of a geographically distant geopolitical influence (Cuba and Venezuela tied to Russia in opposition to the USA; South Korea and Taiwan tied to the USA in opposition to China; Belarus to Russia in opposition to the west; Georgia and Ukraine tied to the west in opposition to Russia), in the event of an open conflict, this would not pass through the intermediate stage characterized by strong local instability, but it would escalate much more rapidly towards a global scale. This hypothesis is put forward in accordance with all the literature on network analysis and contagion or dissipation problems (for a literature review see [18]).

While this work has the merit of analysing the geopolitical influences of the different regions of the globe through the distribution of the vaccines, it is certainly not devoid of limitations. The first refers to the updating of the data, which for most of the aspects dealt with here, dates to November 2021. The second refers to the specific health focus of the article: various economic, commercial, military aspects have not been taken into consideration here.

In conclusion, we can answer our research questions based on those results:

1. The distribution of COVID-19 vaccines mirrors the geopolitical *status quo*. Consideration of this fact must be taken extremely seriously, given that we are dealing with health variables, devices meant to save lives that, in theory, should have no political implications. The results of this study clearly show that even essential health variables, such as the distribution of vaccines during a pandemic, reflect the geopolitical *status quo*, that is, the relations of power and control exercised by one country over another in order to guarantee its own safety.
2. The analyses identified two groups of countries that could conceivably be a source of geopolitical crisis. Indonesia, Iran, Kenya, Nigeria, and Pakistan are those countries with a marked multipolar influence, with the potential to trigger regional crises, while Belarus, Cuba, Georgia, South Korea, Taiwan, Ukraine, and Venezuela are those countries with marked unipolar influence, potentially capable of triggering global crises.

From psychology we certainly know that an external enemy (e.g., a pandemic) constitutes a very strong drive to unite a group [19]. On the other hand, these results show the predominance of geopolitical interests over care interests during a global health crisis. Therefore, we should perhaps acknowledge that the fear of potential danger from others, and the desire for control, outweigh the drive towards behaviors of authentic cooperation.

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Data sharing statement: Data supporting the findings and conclusions are available upon request from corresponding author.

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APPENDIX A

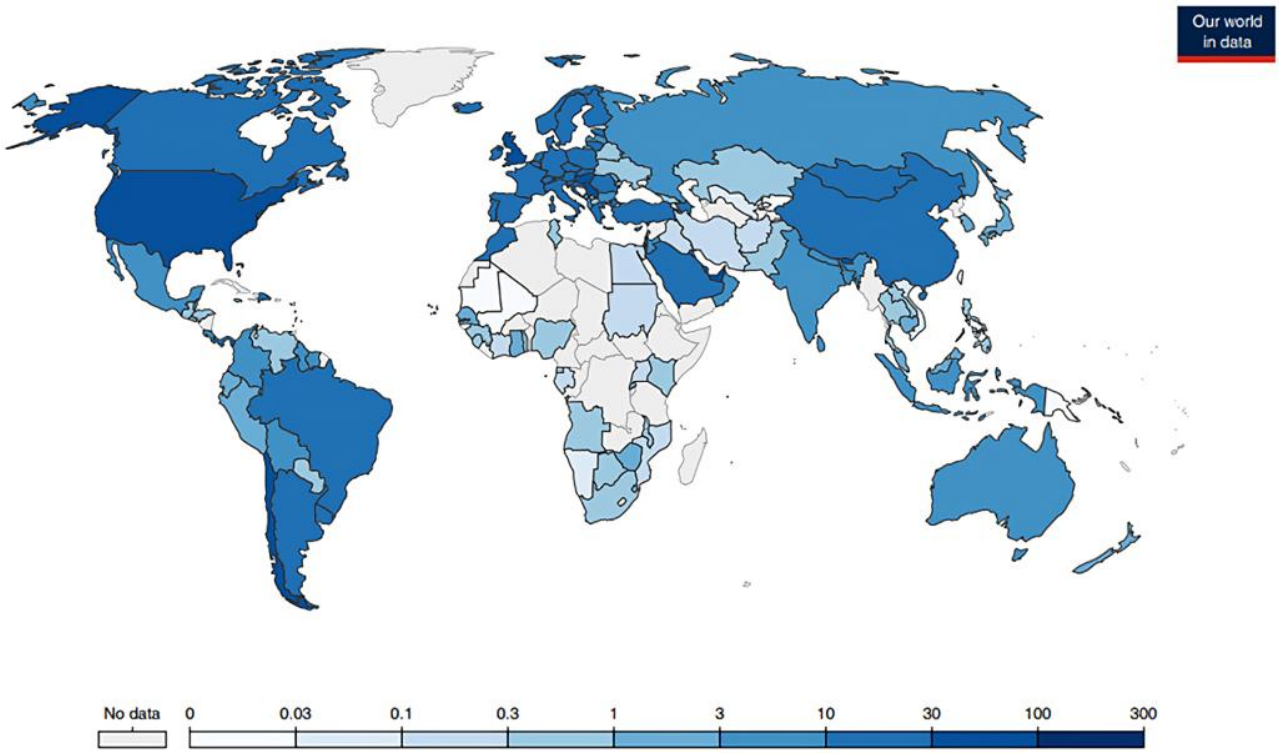


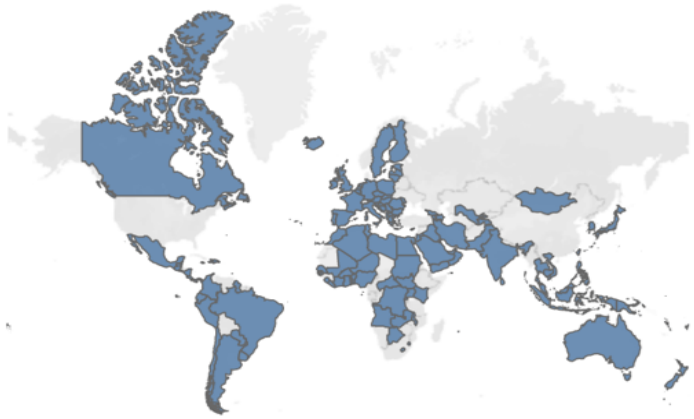
Figure A1. Doses of vaccines distributed per 100 inhabitants; single doses are also considered although most vaccines are complete after a double dose. Data updated to April 7, 2021 [20].

Moderna, countries where it is distributed: Argentina, Australia, Austria, Bangladesh, Belgium, Bhutan, Botswana, Brunei Darussalam, Bulgaria, Canada, Colombia, Croatia, Cyprus, Czechia, Denmark, Estonia, Faroe Islands, Fiji, Finland, France, Germany, Ghana, Greece, Greenland, Guatemala, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Kenya, Kuwait, Latvia, Libya, Liechtenstein, Lithuania, Luxembourg, Malaysia, Maldives, Malta, Mexico, Micronesia (Federated States of), Mongolia, Netherlands, Nigeria, Norway, Pakistan, Philippines, Poland, Portugal, Puerto Rico, Qatar, Republic of Korea, Romania, Rwanda, Saint Vincent and the Grenadines, Saudi Arabia, Seychelles, Singapore, Slovakia, Slovenia, Spain, Sri Lanka, Sweden, Switzerland, Taiwan, Thailand, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United States of America, Vietnam, West Bank

Johnson & Johnson, countries where it is distributed: Australia, Austria, Bahrain, Bangladesh, Belgium, Bolivia (Plurinational State of), Brazil, Bulgaria, Canada, Chile, Colombia, Croatia, Cyprus, Czechia, Denmark, Egypt, Estonia, Faroe Islands, Finland, France, Germany, Ghana, Greece, Hungary, Iceland, India, Indonesia, Iran (Islamic Republic of), Ireland, Italy, Kenya, Kuwait, Latvia, Liberia, Libya, Liechtenstein, Lithuania, Luxembourg, Madagascar, Malawi, Malaysia, Maldives, Malta, Mexico, Micronesia (Federated States of), Netherlands, New Zealand, Nigeria, Norway, Papua New Guinea, Peru, Philippines, Poland, Portugal, Puerto Rico, Republic of Korea, Romania, Saint Vincent and the Grenadines, Senegal, Slovakia, Slovenia, South Africa, Spain, Sudan, Sweden, Switzerland, Thailand, Tunisia, Ukraine, United Kingdom of Great Britain and Northern Ireland, United Republic of Tanzania, United States of America, Viet Nam, Zambia, Zimbabwe

Pfizer/BioNTech, countries where it is distributed: Albania, Argentina, Australia, Austria, Azerbaijan, Bahrain, Bangladesh, Belgium, Bermuda, Bolivia (Plurinational State of), Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Cabo Verde, Canada, Chile, Colombia, Costa Rica, Croatia, Cyprus, Czechia, Denmark, Dominican Republic, Ecuador, El Salvador, Estonia, Faroe Islands, Finland, France, Georgia, Germany, Greece, Greenland, Hong Kong, Hungary, Iceland, Indonesia, Iraq, Ireland, Israel, Italy, Japan, Jordan, Kenya, Kuwait, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, Malaysia, Maldives, Malta, Mexico, Monaco, Mongolia, Netherlands, New Zealand, Nicaragua, Nigeria, North Macedonia, Norway, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Puerto Rico, Qatar, Republic of Korea, Republic of Moldova, Romania, Rwanda, Saint Vincent and the Grenadines, Saudi Arabia, Serbia, Singapore, Slovakia, Slovenia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Taiwan, Thailand, Trinidad and Tobago, Tunisia, Turkey, Ukraine, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United States of America, Uruguay, Vatican, Vietnam, West Bank

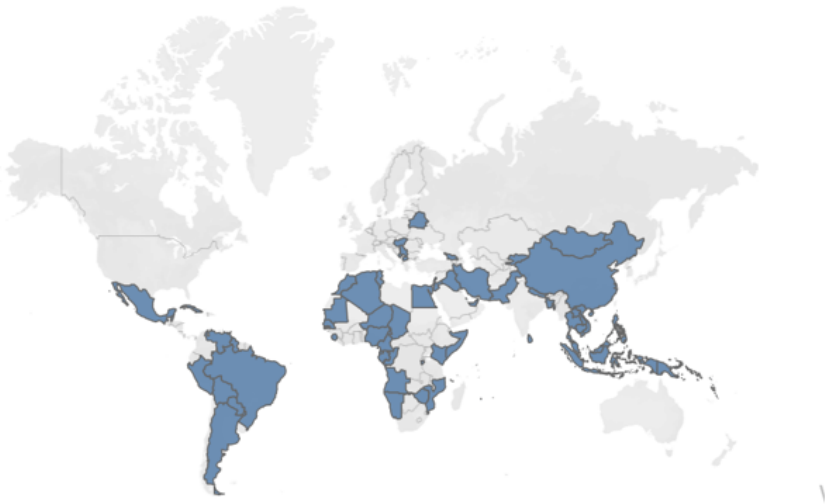
Figure A2. Distribution of the USA vaccines as of November 2021 (Source: Authors' own elaboration)



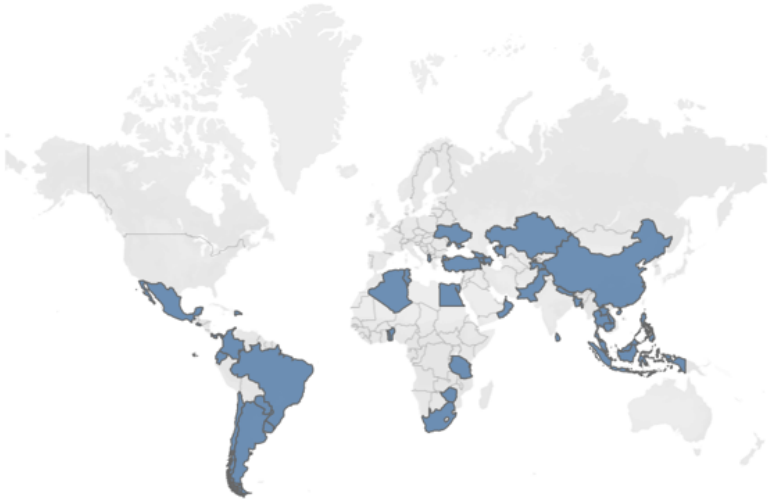
Oxford/AstraZeneca, countries where it is distributed**:** Albania, Algeria, Angola, Argentina, Armenia, Australia, Austria, Azerbaijan, Belgium, Belize, Benin, Bermuda, Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Cambodia, Canada, Central African Republic, Chile, Colombia, Costa Rica, Croatia, Cyprus, Czechia, Côte d'Ivoire, Democratic Republic of the Congo, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Eswatini, Fiji, Finland, France, Gambia, Georgia, Germany, Ghana, Greece, Grenada, Guatemala, Guinea-Bissau, Guyana, Haiti, Hungary, Iceland, India, Indonesia, Iran (Islamic Republic of), Iraq, Ireland, Italy, Jamaica, Japan, Jordan, Kenya, Kosovo, Kuwait, Latvia, Lesotho, Liberia, Libya, Liechtenstein, Lithuania, Luxembourg, Malawi, Malaysia, Mali, Malta, Mauritius, Mexico, Mongolia, Morocco, Nauru, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, North Macedonia, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Republic of Korea, Republic of Moldova, Romania, Rwanda, Sao Tome and Principe, Saudi Arabia, Senegal, Serbia, Sierra Leone, Slovakia, Slovenia, South Sudan, Spain, Sri Lanka, Sudan, Sweden, Taiwan, Tajikistan, Thailand, Timor-Leste, Togo, Tunisia, Uganda, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, Uruguay, Uzbekistan, Vanuatu, Vietnam, Yemen, Zambia

Serum Institute of India: Covishield (Oxford/AstraZeneca formulation), countries where it is distributed: Afghanistan, Antigua and Barbuda, Argentina, Bahamas, Bahrain, Bangladesh, Barbados, Bhutan, Bolivia (Plurinational State of), Botswana, Brazil, Cabo Verde, Canada, Côte d'Ivoire, Dominica, Egypt, Ethiopia, Ghana, Grenada, Honduras, Hungary, India, Jamaica, Lebanon, Madagascar, Maldives, Morocco, Myanmar, Namibia, Nepal, Nicaragua, Nigeria, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Seychelles, Solomon Islands, Somalia, South Africa, Sri Lanka, Suriname, Syrian Arab Republic, Togo, Tonga, Trinidad and Tobago, Ukraine

Figure A3. Distribution of the UK vaccines as of November 2021 (Source: Authors' own elaboration)



Sinopharm (Beijing), countries where it is distributed: Algeria, Angola, Argentina, Bahrain, Bangladesh, Belarus, Belize, Bolivia (Plurinational State of), Brazil, Brunei Darussalam, Burundi, Cambodia, Cameroon, Chad, China, Comoros, Cuba, Egypt, Equatorial Guinea, Gabon, Gambia, Georgia, Guyana, Hungary, Indonesia, Iran (Islamic Republic of), Iraq, Jordan, Kenya, Kyrgyzstan, Lao People's Democratic Republic, Lebanon, Malaysia, Maldives, Mauritania, Mauritius, Mexico, Mongolia, Montenegro, Morocco, Mozambique, Namibia, Nepal, Niger, Nigeria, North Macedonia, Pakistan, Papua New Guinea, Paraguay, Peru, Philippines, Republic of the Congo, Senegal, Serbia, Seychelles, Sierra Leone, Solomon Islands, Somalia, Sri Lanka, Thailand, Trinidad and Tobago, Tunisia, United Arab Emirates, Vanuatu, Venezuela (Bolivarian Republic of), Vietnam, West Bank, Zimbabwe



Sinovac (Beijing), countries where it is distributed: Albania, Algeria, Argentina, Armenia, Azerbaijan, Bangladesh, Benin, Brazil, Cambodia, Chile, China, Colombia, Dominican Republic, Ecuador, Egypt, El Salvador, Georgia, Hong Kong, Indonesia, Kazakhstan, Lao People's Democratic Republic, Malaysia, Mexico, Nepal, Oman, Pakistan, Panama, Paraguay, Philippines, South Africa, Sri Lanka, Tajikistan, Thailand, Timor-Leste, Togo, Tunisia, Turkey, Ukraine, United Republic of Tanzania, Uruguay, Zimbabwe

Figure A4. Distribution of Chinese vaccines as of November 2021 (Source: Authors' own elaboration)

Sputnik V, countries where it is distributed: Albania, Algeria, Angola, Antigua and Barbuda, Argentina, Armenia, Azerbaijan, Bahrain, Bangladesh, Belarus, Bolivia (Plurinational State of), Bosnia and Herzegovina, Brazil, Cameroon, Chile, Djibouti, Ecuador, Egypt, Gabon, Ghana, Guatemala, Guinea, Guyana, Honduras, Hungary, India, Indonesia, Iran (Islamic Republic of), Iraq, Jordan, Kazakhstan, Kenya, Kyrgyzstan, Lao People's Democratic Republic, Lebanon, Libya, Maldives, Mali, Mauritius, Mexico, Mongolia, Montenegro, Morocco, Myanmar, Namibia, Nepal, Nicaragua, Nigeria, North Macedonia, Oman, Pakistan, Panama, Paraguay, Philippines, Republic of Moldova, Republic of the Congo, Russian Federation, Saint Vincent and the Grenadines, San Marino, Serbia, Seychelles, Sri Lanka, Syrian Arab Republic, Tunisia, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan, Venezuela (Bolivarian Republic of), Vietnam, West Bank, Zimbabwe

Figure A5. Distribution of the Russian vaccine as of November 2021 (Source: Authors' own elaboration)

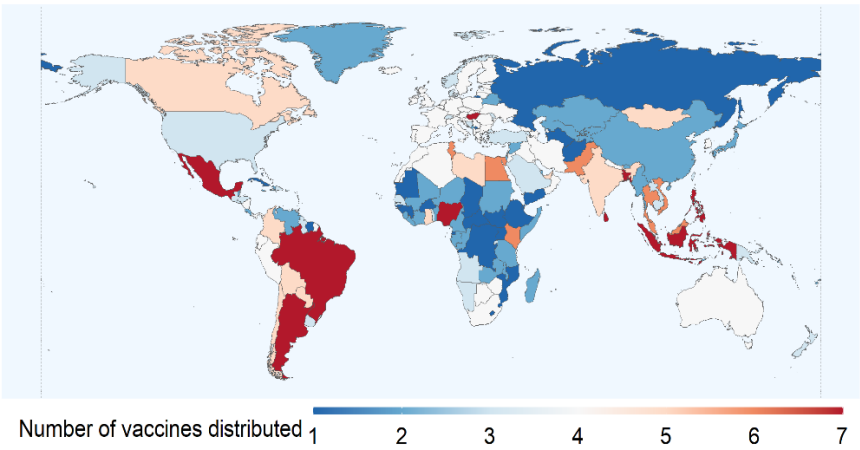


Figure A6. Number of types of vaccines distributed within each country as of November 2021 (Source: Authors' own elaboration)