VACCINATION WORLDWIDE: STRATEGIES, DISTRIBUTION AND CHALLENGES

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ABSTRACT

The Coronavirus 2019 (Covid-19) pandemic caused by the SARS-CoV-2 virus represents an unprecedented crisis for our planet. It is a bane of the uber connected world that we live in that this virus has affected almost all countries and caused mortality and economic upheaval at a scale whose effects are going to be felt for generations to come. While we can all be buoyed at the pace at which vaccines have been developed and brought to market, there are still challenges ahead for all countries to get their populations vaccinated equitably and effectively. This paper provides an overview of ongoing immunization efforts in various countries. In this early draft, we have identified a few key factors that we use to review different countries’ current COVID-19 immunization strategies and their strengths and draw conclusions so that policymakers worldwide can learn from them. Our paper focuses on processes related to vaccine approval, allocation and prioritization, distribution strategies, population to vaccine ratio, vaccination governance, accessibility and use of digital solutions, and government policies. The statistics and numbers are dated as per the draft date [June 24th, 2021].

1 INTRODUCTION

Currently, at least seven different vaccines have been rolled out across all countries. Scientific knowledge to make well-informed decisions for vaccine distribution strategy is highly important (Jeyanathan et al., 2020). Countries worldwide currently approve different vaccines and prepare their vaccine roll-out plans, working on the ongoing vaccination effort based on their priority groups. Various vaccination efforts have their pros and cons (Mills & Salisbury, 2021), (Bae et al., 2020), (Sallam, 2021), and we summarize the study of vaccine distribution and administration in different countries (Kim et al, 2021).

In this early draft, the paper focuses on five countries and contributing factors such as approved vaccines, priority groups, vaccination administration, and distribution.

The paper examines the following factors of vaccine supply affecting the last-mile administration across the world:

1. Prioritization: This focuses on the prioritization schemes for the vaccine administered by the government and health authorities. We include a timeline where they have been made available as per the country’s public records. Certain population groups have been identified as to be vaccinated first, as they are at greater risk of exposure or serious consequences
Vaccination Worldwide: Strategies, Distribution and Challenges

![Worldwide Vaccinations](image)

Figure 1: Vaccinations administered by Country. The map depicts the total number of COVID-19 vaccine doses administered in each region. Note that this amount represents a single dose depending on the particular dosing schedule and does not represent the total number of people vaccinated (e.g., people will receive multiple doses). Official data collected from the Pathcheck Foundation’s Vaccination Dashboard (https://vax.uab.edu/) - Last updated June 24, 2021.

2. Approved vaccines: This section includes information on vaccines approved for distribution in the country.

3. Vaccine Administration and Distribution: This section contains necessary strategies taken by the country for equitable distribution, logistics and regulations, and timelines (Ismail et al., 2020).

4. Population to Vaccine ratio: This ratio is calculated as per dosage per 100 people on any given date as recorded by the national vaccination control board. Depending on the individual dosing schedule, this is counted as a single dose and does not reflect the total number of people vaccinated.

5. Vaccination Governance: This section mentions the governing bodies of the country for the vaccination process.

6. Accessibility and Digital Solutions: This section covers accessibility of all vaccine-related information services, scheduling service, the authenticity of vaccine coupons (Bae et al., 2021b) and overall vaccination insights available, and intermediary data collection through any digital (Bae et al., 2021a) or offline-based medium.

7. Government Strategies and Decisions: This largely focuses on government initiatives and decisions that were imposed as a directive or policy for vaccination (Piraveenan et al., 2020), (Acuna-Zegarra et al., 2020), (Valiati & Villela, 2021).
2 COUNTRIES

2.1 INDIA

2.1.1 PRIORITIZATION

The schedule for the roll-out of vaccination in these three priority groups is adjusted according to the availability of the vaccine. It is planned to vaccinate nearly 30,000 people in the first phase of the vaccination campaign (GovtofIndia [2020]):

1. Health workers (HCW): health care providers and workers in health care facilities.
2. Frontline Workers (FLWs): state and central police personnel, armed forces, custody and accommodation, prison staff, disaster management, and civil defense volunteers, municipal volunteers workers, and finance officials engaged in the containment, surveillance, and related activities of COVID-19.
3. population ≥ 60 years and < 45 years with co-morbidities such as diabetes, hypertension, cancer, lung disease, etc.
4. Population above age 45 years

2.1.2 APPROVED VACCINES

Two vaccines have been approved so far:

- Covaxin (Bharat Biotech) (Ella et al. [2020])
- Covishield (Oxford-AstraZeneca) (Knoll & Wonodi [2021])
2.1.3 Vaccine Administration and Distribution

Vaccination is carried out in fixed and nearby locations. Fixed locations with public health facilities such as primary health centers and private health facilities with more than 100 medical professionals will be used for vaccination sites. Besides, outreach facilities such as schools, colleges, community halls, Panchayat Bhawans, wedding venues, etc., can also be used. Mobile teams can be used in some inaccessible areas or areas with a migrant population. Immunization days and times are planned and determined in advance. Vaccination and all auxiliary workers and beneficiaries are assigned to a specific location. Only one type of vaccine will be given on a given day, at a given vaccination site, and each beneficiary will receive a second dose of the same vaccine.

Vaccination Rate

- 3.8% fully vaccinated till now
- 300 million vaccine doses have been administered
- 52.4 million people fully vaccinated
- Population to Vaccine ratio: 21 COVID-19 vaccine doses administered per 100 people as recorded on June 24, 2021. 3.8% of the total population of the country have received all doses prescribed by the vaccination protocol [Data 2020].

Vaccination Governance: India has set up an apex body called NEGVAC (National Expert Group On Vaccine Administration For COVID-19) to provide guidance on all issues related to vaccine trial and selection, distribution of vaccine, developing delivery mechanisms, priority allocation to population groups, vaccine safety surveillance, mass communication, etc. Key Ministries and Institutions with on-the-ground know-how are cooperating and collaborating at the national level.

2.1.4 Accessibility and Digital Solutions

Co-WIN (COVID-19 Vaccine Intelligence Network) was developed in India as a robust cloud-based IT solution for the preparation, implementation, monitoring, and evaluation of the COVID-19 immunization program [Sahoo et al. 2021]. It is a holistic approach that uses the entire public health system, from the national level down to the vaccination doctor level. The system allows the registration of beneficiaries, planning units, vaccination sites, planning meetings, and the implementation of the vaccination process. The real-time Co-WIN system is used to track beneficiaries and vaccinators at the national, state, and district levels. Administrators at the national, state, and district levels can use the website www.cowin.gov.in to manage and distribute immunization-related materials, identify immunization sites, and register either by bulk download or by self-registration of beneficiaries. The www.app.cowin.gov.in application allows registering individual beneficiaries and registering successful vaccinations at vaccination sites [Ghosh 2021].

Vaccines are sent to the vaccination sites in suitable containers on the same day in order to meet the temperature requirements throughout the cold chain, which will be monitored by the Ministry of Health. Text messages or self-created emails are sent to all beneficiaries and the vaccination and support staff regarding the date, time, and place of the vaccination appointment. The vaccination module of the Co-WIN system is used by the vaccination team to verify and authenticate the beneficiaries using Aadhar contact details or another approved photo ID. Once authenticated, the vaccine is administered and the status is updated in the system. The recipient will then receive an SMS with the details of a link indicating the date and time of the next vaccination. The Co-WIN system tracks every vaccine dose (name, manufacturer, batch number, date of manufacture) to every vaccination site and recipient [GovtofIndia 2020].

2.1.5 Government Strategies and Decisions

Various preparatory activities were carried out in the government advisory body for the COVID-19 vaccine roll-out in collaboration with States/ Union territories. A multi-level coordination system was set up for vaccinating priority groups, which includes strengthening the cold chain infrastructure, additional vaccinators across the country, a communication strategy to address the safety and effectiveness of the vaccine among the masses. Co-WIN, a digital platform for COVID-19 Vaccination, will be used to track the beneficiaries and vaccines on a real-time basis. [GovtofIndia 2020].
2.1.6 Money Spent

According to data provided to the Rajya Sabha by the Ministry of Health and Family Welfare, the Centre spent $191 million on COVID-19 vaccines from the Serum Institute of India and Indian producer Bharat Biotech between early January and mid-March (MoHFW). This is a preliminary indication of the direct cost of the COVID-19 immunization program to the exchequer. Additionally, the government has earmarked $65 million to meet the operation and maintenance costs incurred by the state governments in this fiscal. So far, the Centre has released $17 million to states. [Times (2021c)]

2.1.7 Variant Info

In numerous states with high case numbers, samples bearing the "double mutant," or B.1.617 variety, have been discovered. Maharashtra, Karnataka, West Bengal, Gujarat, and Chhattisgarh were among the states where the B.1.617 variation was found. [BBC (2021c)]

2.2 Japan

2.2.1 Prioritization

Healthcare workers, the elderly, and those with pre-existing health conditions.

DISTRIBUTION TIMELINE [Bloomberg (2020)]:

- In February, 10,000 frontline healthcare employees will be vaccinated;
- Mid-March: 3 million general healthcare workers will be vaccinated.
- Late March to early April: 30-40 million elderly people will be vaccinated.
- Citizens with pre-existing ailments will be eligible to get vaccinated starting in April.
- End-June: The government hopes to provide enough doses for the whole population, but the exact date has yet to be determined.

2.2.2 Approved Vaccines

Three vaccines have been approved so far:

- Pfizer-BioNTech [Polack et al., 2020]
- Oxford-AstraZeneca [Knoll & Wonodi, 2021]
- Moderna [Baden et al., 2021]

2.2.3 Vaccine Administration and Distribution

The government is developing a system to streamline and share information on vaccine stocks at all medical institutions. The responsibility of promoting the vaccine program will fall onto the local governments. Once the national immunization campaign launches, the public will have to enroll in a reservation system in order to receive a vaccine. Initially, they will register on a vaccination website or through a call center, and they will then obtain a vaccine voucher that will enable them to receive a shot. The vaccine coupon will also be proof of vaccination for each immunized citizen. Currently, Japan has not released much more information on the details of its vaccine distribution plan.

Vaccination Rate

- 35.7 million doses administered
- 11 million people fully vaccinated
- 8.7% population fully vaccinated
- Population to Vaccine ratio: 28.3 COVID-19 vaccine doses administered per 100 people as recorded on June 24, 2021 [in Data (2020)]
- In the midst of a fourth wave of illnesses, Japan has hastened the distribution of vaccinations with the goal of vaccinating all of the elderly by the end of July [News (2021)].

**Vaccination Governance**: Vaccine administration in Japan is governed by the Japanese Health Ministry.

### 2.2.4 ACCESSIBILITY AND DIGITAL SOLUTIONS

A reservation system will be developed for the general public to enroll for vaccination. Japan plans to use medical facilities, public health centers, gyms, event venues, and shopping malls as vaccination sites and is also working to re-purpose non-medical facilities as vaccination sites [TheJapanTimes, 2020].

### 2.2.5 GOVERNMENT STRATEGIES AND DECISIONS

Japan has already passed legislation to provide free COVID-19 vaccines to all inhabitants, and has set aside approximately $6.32 billion from the emergency budget for COVID-19 vaccines [EuropeanPharmaceuticalReview, 2021]. Japan intends to collect data from persons infected with the new coronavirus, even if they have been vaccinated, to see how effective the vaccines are at preventing the virus from spreading. The new system will allow authorities to view vaccination records for coronavirus patients, e.g., what vaccines they received from the companies and whether they received a single or double dose, depending on the sources.

In Japan, vaccinations are likely to begin in late February. According to the sources, the Ministry of Health would build a method to collect vaccination records from all afflicted persons by including checkboxes on a document that doctors must send to public health centres when coronavirus infection is confirmed. [TheJapanTimes, 2021].

### 2.2.6 MONEY SPENT

According to the Ministry of Finance, the Japanese government approved a budget of $6.32 billion from its emergency budget reserve to secure COVID-19 vaccinations. The Japanese government has stated that it is willing to cover the expense of supplying vaccinations to the whole population in order to carry out a thorough pandemic inoculation campaign. According to reports, the government is planning to create funds to pay for vaccine-related adverse effects that might be common. [Today (2020)].

### 2.2.7 VARIANT INFO

Around 30 cases of variations from the United Kingdom and South Africa were previously documented in Japan. Experts are concerned that the mutations appear to be spreading more quickly.

In Japan, a new variation has arisen, dubbed ‘Eek’ by scientists. According to NHK, a Japanese public station, the new E484K mutation, which is known to reduce vaccination protection, was found in nearly 70% of coronavirus illness patients at a Tokyo hospital last month. [News (2021e), Times (2021b)].

### 2.3 CANADA

#### 2.3.1 PRIORITIZATION

People at high risk of serious illness and death from COVID-19:

- Advanced age.
- People with high-risk diseases.
- Healthcare, personal-care and nursing staff
- Family members of people at higher risk of serious illness and death from COVID-19
- Police, firefighters, Grocery stores employees [GovtofCanada (2021b)].

Distribution Timeline [GovtofCanada (2021c)].
1. Phase I: December 2020 to February 2021 — Hospital Health care workers.
2. Phase II: February to March 2021 — Seniors over the age of 80, hospital personnel, neighborhood general practitioners (GPs), and medical professionals who were not immunized during Phase 1.
3. Phase III: April to June 2021 — People aged 60 to 79.
4. Phase IV: July to September 2021 — People aged 18 to 59.

2.3.2 Approved Vaccines

Two vaccines have been approved so far (GovtofCanada, 2021c):

- Pfizer-BioNTech (Polack et al., 2020)
- Moderna (Baden et al., 2021)

2.3.3 Vaccine Administration and Distribution

Canada has a healthcare system that is universal. The Canadian healthcare system is decentralized, with provinces and territories administering it. In Canada, the military is playing a central role in vaccine distribution; the government is sending shipments to all ten provinces. Provinces receive an allocated number of doses of vaccine on a weekly basis. FedEx Express Canada and Innomar Strategies Inc. have been awarded a contract by the Canadian government to provide an end-to-end logistics solution for COVID-19 vaccines. The contract will support vaccine distribution across. To facilitate fast and effective vaccine distribution throughout Canada, Canada and provide a range of facilities to support storage and transportation to national, territorial, and Indigenous partners.

Vaccination Rate

- 33 million total doses given
- 8.2 million people fully vaccinated
- 21.9% fully vaccinated
- Population to Vaccine ratio: 88.99 COVID-19 vaccine doses administered per 100 people as dated June 24, 2021 (in Data, 2020)

Vaccination Governance: The National Advisory Committee on Immunization (NACI) is an autonomous, ongoing, and timely medical, scientific, and public health advisory body that gives the Public Health Agency of Canada (PHAC) independent, ongoing, and timely medical, scientific, and public health advice on PHAC vaccines. (GovtofCanada, 2021a, Ismail et al., 2010).

2.3.4 Accessibility and Digital Solutions

Public Services and Procurement Canada (PSPC) uses a service provider to add additional functions to the PHAC. This Enhanced National Vaccine Management Information Platform (NVMIP) is a well-developed and ready-to-use monitoring and recording computer system which will manage the use, administration, and reporting of vaccines as the volume of deliveries increases.

People will receive a paper and digital copy of their immunization record cards. The immunization record will be also be stored in the online provincial database, accessible to the individual, public health, and your doctor (GovtofCanada, 2021d).

2.3.5 Government Strategies and Decisions

The Government of Canada is providing approximately $220 million so that the facility can purchase 15 million doses of vaccine for all Canadians. The COVID-19 vaccine will be free to anyone living in Canada who is eligible. It will then be available to anyone in Canada who is recommended by federal, provincial, and territorial health authorities to be vaccinated.
2.3.6 Money spent

Imports in this category fell by more than half (-55%) from December to January in 2018 and 2019. Imports grew by 21.4 percent to $56 million this year, a 73.7 percent rise over the previous year. In January, Canada’s imports of COVID-19 vaccinations were anticipated to be over $24 million. Imports of vaccines for human medicine other than influenza would have declined in January if the COVID-19 vaccines had not been imported, and would have been on level with imports in January 2020. *Canada (2021)*

- Both Moderna and Pfizer supplied 695,275 doses to Canada in January. On a per-dose basis, this means the Canadian government spent $34.41 on each dosage item.
- According to a recent research based on StatCan data, the federal government spent $16 million in December to purchase the initial shipments of 423,900 Pfizer and Moderna pharmaceuticals, which cost an average of $37.74 per dose. *News (2021b)*

2.3.7 Variant info

The highly contagious B.1.1.7 strain of SARS-CoV-2, which was initially discovered in the UK in early December, is to blame for the rising number of cases in numerous countries, including India and Canada. *Express (2021)*

The Canadian province of British Columbia curbed an outbreak of the P.1 SARS-CoV-2 variant, which was believed to have originated in Brazil through a combination of targeted vaccinations and physical-distancing rules. Health experts widely regarded these moves as lessons in social distancing and controlling the pandemic. *Journal (2021)*

2.4 China

2.4.1 Prioritization

China’s top priority groups are doctors, hotel workers, border control personnel, food storage and transportation workers, and travelers. Nine critical groups of people between the ages of 18 and 59 were identified as being prioritized: [*ChinaDaily (2021)*]:

- Transport workers
- Social workers
- Custom inspection officers who deal with imported cold chain products
- The guards at the entrance to the ports
- International and national transport officials
- People who have to travel abroad for professional or personal reasons
- Medical Staff
- Employees of government agencies
- Employees of public enterprises
- Members of the People’s Liberation Army.

Huawei employees and Chinese diplomats have also received the vaccine, with several other employees of state-owned organizations receiving emergency authorization vaccines [*BusinessToday, 2021]*.

2.4.2 Approved vaccines

Two vaccines have been approved so far:

- **BBIBP-CorV (CNBG / Sinopharm)** [*Xia et al., 2021]*
- **CoronaVac (Sinovac)** [*Zhang et al., 2021]*
2.4.3 **Vaccine Administration and Distribution**

Everyone received detailed vaccination information and personalized advice on safety issues before heading to the injection area to receive the long-awaited dose against the coronavirus. Each compartment in the vaccination area is also equipped with a small refrigerator, which is set at 5 degrees to store the vaccine. Each vaccine can be traced back to its source using a code. Data from each vaccination is immediately recorded and then transmitted to China’s national system at the Center for Disease Control and Prevention (CDC).

**Vaccination Rate**

- China’s vaccination program started slow but due to the resurgence of COVID-19 cases recently, the process has gained some momentum
- China has vaccinated 15.5% of its people fully, and 43.2% of its people with at least one dose
- 1.1 billion doses have been administered so far
- Population to Vaccine ratio: 76.14 COVID-19 vaccine doses administered per 100 people, as dated June 24, 2021 [In Data](2020)

**Vaccination Governance:** Vaccines are regulated and authorized by the National Medical Products Administration of China [BeijingReview](2020).

2.4.4 **Accessibility and Digital Solutions**

The National Healthcare Security Administration has stated that the COVID-19 vaccine is free to the public. Health insurers and governments cover the cost of the vaccine. China has established 25,392 vaccination points nationwide, along with detailed regulations and plans for handling and administering the vaccine. The National Medical Products Administration (NMPA) established a traceability information system to manage approved vaccines.

2.4.5 **Government Strategies and Decisions**

China joined the COVAX Facility in October [GlobalTimes](2020). National Medical Products Administration (NMPA) and the National Health Commission are in the change to draft laws and regulations for national health policies; These organizations tend to organize the monitoring, evaluation, and handling of adverse drug reactions. The NMPA and provincial drug agencies will implement national and provincial surveillance systems for vaccine traceability.

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2.4.6 **Money Spent**

- China has not publicly released its expenditure on the immunization process, thereby rendering any per capita calculations impossible
- However, China’s leading vaccine producer Sinopharm has received upwards of $500 million in funding from private and public investors in the production of the vaccine [of India](2020)

2.4.7 **Variant Info**

Though no mutations of the virus have been found to cause significant damage to China, it has reported 18 cases of the double-mutant variant B.1.617 from India. Over resurgence fears, China has increased its lockdown capacity from May 1. [Times](2021c)
2.5 **TURKEY**

2.5.1 **PRIORITIZATION**

Citizens are mainly being vaccinated according to their risk factors, as determined by the Turkish Science Board. They are mainly following COVAX protocols.

- Science board members, healthcare workers, and the elderly over the age of 90 are vaccinated in the first round.
- Essential workers in the second round and those who have at least one chronic disease.
- Third round - young adults
- Fourth round - everyone else

2.5.2 **APPROVED VACCINES**

Two vaccines have been approved so far:

- SinoVac \(\text{Zhang et al.} \ [2021]\)
- Sinopharm \(\text{Xia et al.} \ [2021]\)

2.5.3 **VACCINE ADMINISTRATION AND DISTRIBUTION**

The vaccine is currently used in preventative health care services in Turkey, the highest priority group. The antiserum, the injectors, and the logistic management of the cold chain materials such as transport containers are carried out by the Vaccine Logistics Unit of the Ministry of Health. All vaccines purchased by the Turkish Ministry of Health are evaluated in terms of security before being offered to the citizens, a process that will continue for the COVID-19 vaccines. The evaluation is conducted by Pharmaceuticals and Medical Devices Agency. \(\text{of Turkey} \ [2021]\).

The shipping containers are managed by the Department of Vaccines / Antiserum of the Ministry of Health, General Directorate of Public Health for Vaccine-Preventable Diseases. The vaccines are distributed to each healthcare facility under the control of the Vaccine Tracking System (ATS). The Vaccine Tracking System (ATS) is a national and domestic system in which each dose is identified, and the population and temperature are monitored \(\text{GovtofTurkey} \ [2021b]\).

**Vaccination Rate**

- Turkey has vaccinated 35.8% of its population as of 24th of June with at least the first dose and 17.4% of the people are completely vaccinated
- Turkey’s vaccination rate has been unsteady. It started off rapidly but slowed down during the months of March-April in 2021 and has since picked up again
- Total doses administered: approximately 44.9 million as of 24th of June 2021
- Population to Vaccine ratio: 53.3 COVID-19 vaccine doses administered per 100 people as dated June 24, 2021 \(\text{Data} \ [2020]\)

**Vaccination Governance**: Vaccination Governance is administered by the Ministry of Health and Turkish Medicines and Medical Devices Agency.

2.5.4 **ACCESSIBILITY AND DIGITAL SOLUTIONS**

The Family Health Center administers the vaccine. It is administered to the general medicine department where the person is registered \(\text{TRTWorld} \ [2020]\). Each person receives the vaccination application form, from which they can access all the details of the vaccine (electronic vaccination card, etc.) through a text message (SMS) and an e-Nabız account sent to the mobile phone. e-Nabız is an application that enables citizens and health professionals to access health data collected by health care facilities via the internet and mobile devices \(\text{GovtofTurkey} \ [2021a]\). Turkey introduced a vaccine tracking system in 2014 to monitor all processes related to vaccines. By using the QR codes required in the country on vaccine doses against any disease, the authorities can monitor
storage, delivery, and expiration dates and intervene at any time. Vaccine Tracking System (ATS) monitors and manages information about which vaccines are given to whom and by whom and monitors potential side effects for immediate intervention. Adverse reactions following vaccination are recorded electronically in consultation with the nearest public health institution and are subject to careful monitoring and evaluation (of Turkey 2021).

2.5.5 **GOVERNMENT STRATEGIES AND DECISIONS**

Turkey has administered 98 percent of all childhood vaccinations needed, giving them a stable vaccination infrastructure. The health ministry has ordered that special vaccination rooms be installed in hospitals and clinics to maintain a safe distance from other medical facilities during the vaccination campaign.

The Ministry of Health has also introduced a mobile application called "aşıla" (vaccination) to track vaccinations. The app, which healthcare workers can use for free, allows them to schedule vaccinations. Through the app, healthcare workers can determine if a candidate is eligible for vaccination and track the schedule for the second dose.

2.5.6 **MONEY SPENT**

- Turkey has spent $850mn by ordering and administering the SinoVac vaccine. Turkey’s per-capita expenditure on COVID-19 vaccines so far has been $10.3 per person
- Turkey has also been in talks with Pfizer-BioNTech and plans on ordering an additional 105 million doses of COVID-19 vaccine (though the producer remains undisclosed)
- If this producer is to be SinoPharm, Turkey’s per-capita expenditure could triple to approximately $31/person

[Reuters (2021x)]

2.5.7 **VARIANT INFO**

- The UK B.1.1.7 strain, which originated in the United Kingdom, caused an early surge in infections in Turkey
- In early April, Turkey’s health minister indicated that the B.1.1.7 variation was responsible for 85 percent of all new COVID-19 infections
- Many instances in Turkey have recently been linked to the double-mutant variation B.1.617

[Agency (2021b) Print (2021)]

2.6 **MALAYSIA**

2.6.1 **PRIORITIZATION**

In the vaccine distribution procedure, frontline healthcare workers, the elderly, and individuals with noncommunicable diseases and chronic respiratory disorders would be prioritised. [CNA (2020a)]

The distribution of vaccines will be carried out in phases as such [Pfordten (2021)]:

- 1st Phase (February – April 2021) Frontline healthcare workers in both public and private healthcare are the first priority category. Frontline workers in key facilities, defence, and security are the second priority group.
- 2nd Phase (April – August 2021) Priority group 1: Healthcare workers, defence and security personnel who didn’t get in Phase-1 Priority group 2: Senior folks (over 60 years old), those with chronic diseases like heart disease, obesity, diabetes, and high blood pressure, and people with disabilities make up priority group 2.
- 3rd Phase (May 2021 – February 2022) Priority group: Adult population aged above 18 years.
2.6.2 **Approved Vaccines**

Malaysia has approved three vaccines: Pfizer-BioNTech, Sinovac, AstraZeneca.

2.6.3 **Vaccine Administration and Distribution**

Pharmaniaga Bhd, a government-linked company (GLC), is in charge of the vaccine distribution. From the Kuala Lumpur International Airport (KLIA), the team at Pharmaniaga delivers the vaccines to 5 warehouses in the states: Selangor, Pahang, Penang, Sabah and Sarawak.

Delivery of vaccines from the warehouse to a hospital follows a Just-In-Time (JIT) format according to capacity and vaccination schedules determined by the Malaysian government. JIT is key to avoid stockpiling at hospital storage facilities Online (2020). Pharmaniaga is also prioritizing vaccine supply to the government healthcare institutions before supplying to the private healthcare institutions Saieed (2021). Currently, the government aims to vaccinate 75,000 people a day across 600 vaccination sites across the country.

**Vaccination Rate**

- 6.3 million total doses administered
- 1.73 million fully vaccinated
- 5.3% population fully vaccinated
- Population to Vaccine ratio: 19.4 COVID-19 vaccine doses administered per 100 people as dated June 24, 2021 In Data (2020)

**Vaccination Governance**: Malaysia’s Ministry of Health is in charge of accreditation governance. In Malaysia, the National Pharmaceutical Regulatory Agency (NPRA) is in charge of vaccine testing and registration. On the other hand, the Drug Control Authority (DCA) approves the vaccines’ usage based on the NPRA’s results. for Ensuring Access to COVID-19 Vaccine Supply (JKJA V)

2.6.4 **Accessibility and Digital Solutions**

The COVID-19 vaccines is free for all Malaysians and is not compulsory. Foreigners however will have to pay a charge which is yet to be determined by the Ministry of Health (MOH) Official Website (2020). Rural residents are more likely to receive vaccines from other licensed vaccines that do not require severe cold storage, such as the Pfizer-BioNTech vaccine and the AstraZeneca vaccine, which must be stored between 2°C and 8°C.

The contact tracing app known as MySejahtera is used to coordinate vaccine administration. The app plays a key role in registering people who are eligible to receive the COVID-19 vaccine and is used to monitor them post-vaccination for adverse events as there are a high number of users on the app Kwan (2021). The app has a sign-up feature to get the user’s consent as well as register the user for vaccination. Reporting of adverse events is done on a self-reporting basis through the app CodeBlue (2021).

Those without access to smartphones will receive a card upon their first vaccination, which must be kept. This card will serve as a record of vaccination and remind them to come for their second dose on the date specified on the card itself. Bernama (2021)

It is currently unclear how the data is stored but all personal data collected by the app complies with current laws Kwan (2021).

2.6.5 **Government Strategies and Decisions**

The Malaysian government has set aside US$504 million to purchase enough vaccines to protect 26.5 million citizens (about 80% percent of total population). The Malaysian government aims
for 80% of its population to be vaccinated. This would mean that some portion of children under 16 years old would have to be vaccinated. However, they are still waiting for Phase 3 trials to be completed for this specific age group [Kwan (2021)]. On top of that, vaccinations will not be made mandatory. The Malaysian government has repeatedly emphasized that vaccinations will follow a voluntary basis [Larsen (2021)].

2.6.6 Money spent

- The government tapped into the national trust fund to help fund its vaccine purchases. The fund totalled $4.6 billion, of which national oil company Petronas contributed $2.5 billion.
- The government has raised vaccine allocation to $840 million from $550 million and expects to spend an additional $360 million on the immunization program – more than double the initial forecast.

[ Bloomberg (2021) ]

2.6.7 Variant info

The highly infectious COVID-19 variant B.1.617 that originated from India was detected in Malaysia as a first in early May during a screening of Indian nationals at the Kuala Lumpur International Airport. [ Reuters (2021) ]

2.7 Germany

2.7.1 Prioritization

Germany has established three priority groups for vaccination:

- Group 1 (Highest Priority): over 80 years old, or elderly-care workers, or healthcare workers with any relation to COVID-19 [5.4 M People of this group got their first dose of vaccination. Vaccination for this high priority group is almost completed] (March-9) [for Ensuring Access to COVID-19 Vaccine Supply] (JKJAV)
- Group 2 (Higher Priority): over 70 years old, or deadly underlying health conditions, or live/in contact with pregnant women, or doctors and other healthcare workers, police, teachers and essential workers who maintain hospital infrastructure (Vaccination for this group is going on currently)
- Group 3 (High Priority): over 60 years old, or underlying health conditions like diabetes, asthma, or all other healthcare workers and essential workers who are not there in group-2 (Vaccination for this group can be started around May)
- Group 4 Everyone else, who did not get vaccinated. [Will be started in July and probably completed by the end of September]

2.7.2 Approved Vaccines

- Moderna
- Oxford/AstraZeneca
- Pfizer/BioNTech

2.7.3 Vaccine Administration and Distribution

Vaccines are delivered to a central location within Germany and thereafter distributed to the federal states with respect to population sizes. There are 27 designated delivery points that the government has isolated. Germany has sent “mobile” vaccination teams to elderly care homes with many vaccination centers closed right now. [1] Load boxes with each vaccine to defrost overnight [2] Deliver vaccines (84 shots in each box) within a few hours or else it will be useless [3] Repeat

Vaccination Rate

- 69.5 million total vaccine doses administered

[ Bloomberg (2021) ]
Vaccination Worldwide: Strategies, Distribution and Challenges

- 27.8 million (around 33.2% of population) fully vaccinated
- Population to Vaccine ratio: 82.9 COVID-19 vaccine doses administered per 100 people as dated June 24, 2021

**Vaccination Governance:** The European Medicines Agency (EMA) previously issued a corresponding recommendation for the vaccines, which the European Commission approves. The vaccine batches are delivered to a central location in Germany and subsequently released by the Paul Ehrlich Institute.

2.7.4 **ACCESSIBILITY AND DIGITAL SOLUTIONS**

With € 2.7 billion set aside for vaccination, Germany has made the coronavirus vaccine free for all individuals residing in Germany (either through health insurance or through German registration certificate). At the time of writing, only people within priority groups (see "Priority") can request for vaccination.

Most states offer two options: online appointment or appointment by phone. In Berlin, only people who have received a letter of invitation from the Senate Health Administration can request an appointment.

The Robert Koch Institute (a Germany federal government agency) has released an app called Corona-Warn App [18] that utilizes the GAEN 2.0 framework to implement contact-tracing within their country.

2.7.5 **GOVERNMENT STRATEGIES AND DECISIONS**

The current motto of the German government is "Vaccinate-Vaccinate-Vaccinate." Though vaccination is not mandated, this push is at the crux of many government decisions in Germany.

2.7.6 **MONEY SPENT**

- The German government intends to spend almost 9 billion euros ($10.9 billion) this year alone to assist in the procurement of up to 635 million COVID-19 vaccine injections for its citizens and other EU member states
- Bettina Hagedorn, the deputy of Finance Minister Olaf Scholz, has made a proposition to the lawmakers in a letter demanding that they approve a request of an additional 6.22 billion euros by the Health Minister
- Jens Spahn for acquiring more doses. This is an addition to the pre-existing 2.66 billion euros that have already been earmarked for the immunization programme in the 2021 budget

[Reuters (2021)]

2.7.7 **VARIANT INFO**

- Cases of B.1.617 variant of COVID-19, which was first found in India

[Xpress (2021)]

2.8 **SINGAPORE**

2.8.1 **PRIORITIZATION**

The Singaporean government has decided to prioritize the following groups of people in their vaccination program (in order of highest to lowest priority):

- Healthcare frontliners
- Elderly above 70 years old
- Singaporeans with vascular medical comorbidities
- Elderly from 60 - 69 years old
• Personnel in essential services (i.e water, utilities, etc.)
• Other Singaporeans under 60 years old and long-term residents

2.8.2 APPROVED VACCINES

Available Vaccines in Singapore:

• Arcturus, Pfizer, Moderna: mRNA type
• Astra-Zeneca, Gamaleya, Can-Sino: Virus Vectored
• Sinovac, Bharat-BioTech: Inactivated Virus
• Novavax, Sanofi-Pasteur: Protein Subunit Vaccines

2.8.3 VACCINE ADMINISTRATION AND DISTRIBUTION

It has been estimated that they should have enough vaccine supply for their whole population by
the third quarter. The Singaporean Government has announced that all Singaporeans and long-term
residents in Singapore will be vaccinated by the end of 2021 for free. Prior-booking is required for
Singaporeans to get vaccinated when it’s their turn and is necessary due to the cold-chain require-
ments

Vaccination Rate

• 5 million doses have been administered in Singapore so far
• Almost 35.1% of the country is fully vaccinated
• People of Singapore are getting vaccinated at a rate of 45,636 doses per day
• Population to Vaccine ratio: 85.96 COVID-19 vaccine doses administered per 100 people
  as recorded on June 24, 2021.

Vaccination Governance: Before authorising the vaccine, the Health Sciences Authority (HSA)
and the Expert Committee on COVID-19 Vaccination scrutinised the clinical evidence. Under the
Pandemic Special Access Route, the Health Sciences Authority (HSA) approved an interim licence
for the COVID-19 vaccinations to be used in Singapore for the prevention of Coronavirus Disease
2019 (COVID-19) in people aged 18 and up (PSAR).

2.8.4 ACCESSIBILITY AND DIGITAL SOLUTIONS

Singapore is setting up special centers where large numbers of people are vaccinated against
COVID-19 every day. The delivery is easily accessible to all citizens at any time following the
priority hierarchy. The Ministry of Health will send a personalized letter notifying you that it’s your
turn to be vaccinated.

Singaporeans can either choose to book online at the vaccine.gov.sg website or book physically
at a local community centre . The Singaporean government is concurrently preparing clinics and
vaccination centres for COVID-19 vaccination.

When patients arrive for vaccinations they are given a vaccine information sheet and vaccine selec-
tion form. Before their turn, they are asked to fill out the first part of the Vaccination Screening Form
for personal information, medical information, declaration and consent.

Once they’ve received the first shot, they are given a vaccination card. These vacci-
nation cards are given to patients after the first dose. The card serves to provide information such as:

Type of vaccine administered

• Appointment dates for the second dose
• Brief post-vaccination advice
Singaporeans that choose to get inoculated also have the option to check vaccination records online. These vaccine records will be updated in Singapore’s National Immunization Registry. The Singaporean government mainly relies on the Health Science Authority (HSA) to report adverse events post-vaccination. The Vaccine Adverse Event (VAE) Online Reporting Platform seems to be the main digital platform to report adverse events post-vaccinations [Authority](2021a).

2.8.5 **GOVERNMENT STRATEGIES AND DECISIONS**

Singapore has set aside roughly S$1 billion (US$754 million) for vaccines[1]. They’ve also publicly announced that Singaporeans will not be given the choice to pick which COVID-19 vaccines they would like as this further complicates the process. Incase of any injury during the vaccination process, the victim will get Financial Assistantship. Singaporeans will take the vaccines on a voluntary basis [Times](2021i).

2.8.6 **MONEY SPENT**

- Singapore Government announced a 8.3 billion dollar package to support the Covid Vaccination efforts

[CNBC](2021b)

2.8.7 **VARIANT INFO**

- Singapore witnessed the B.1.1.7 variant, which was initially found in UK during December of 2020
- B.1.617 variant from India has been detected in Singapore recently which lead to the shutting down of schools

[Mint](2021)

2.9 **HONG KONG**

2.9.1 **PRIORITIZATION**

- Residents and employees in nursing homes for the elderly and people with disabilities, as well as other institutional services Staff in health-care settings
- workers in other critical healthcare services that are at a higher risk of COVID-19 exposure and people aged 60 and above
- People between the ages of 16 and 59 who have chronic medical conditions

[Government](2021b)

2.9.2 **APPROVED VACCINES**

- CoronaVac (by Sinovac Biotech)
- Tozinameran (by BioNTech-Fosun Pharma)
- ChAdOx1 nCoV-19 (by AstraZeneca-Oxford)

2.9.3 **VACCINE ADMINISTRATION AND DISTRIBUTION**

The program’s goal is to provide vaccines to approximately 7.5 million Hong Kong residents by 2021. The public has the choice of being vaccinated or not being vaccinated. The vaccines will arrive in Hong Kong in batches and be distributed to private clinics and hospitals.

**Vaccination Rate**

- It is estimated that, people of Hong Kong are getting vaccinated at a rate of 29,515/day
- Till date, around 1.32 million people have been fully vaccinated in Hong Kong, which approximates to 17% of the country’s population [Reuters](2021g)
Vaccination Worldwide: Strategies, Distribution and Challenges

- Population to Vaccine ratio: 44.66 COVID-19 vaccine doses administered per 100 people, June 24, 2021 [In Data](2020)

**Vaccination Governance:** The Government of Hong Kong has set up the Advisory Panel on COVID-19 Vaccines, with members appointed by the Chief Executive. The Advisory Panel provides expert advice on recommendation of authorization of the vaccines to the Government, which is made available for public information.

### 2.9.4 Accessibility and Digital Solutions

Private clinics and hospitals are keeping digital records to be shared with the government, although it may not be available to private medical institutions. Hong Kong has not yet provided specifics on this, however. The government will introduce a free COVID-19 vaccination programme for all Hong Kong citizens throughout the territory. COVID-19 vaccines will be distributed via the programme in a variety of environments, including hospitals, clinics, outreach to institutions, and neighbourhood vaccination centres. The Department of Health (DH) has an adverse drug reaction (ADR) reporting system which receives adverse events following immunization (AEFIs) reports to monitor the safety of COVID-19 vaccines. COVID-19 Electronic Vaccination and Testing Record System. This system facilitates free download by the general public of their own electronic testing records for the COVID-19 testing conducted within 31 days. The system will add a function to allow checking of electronic vaccination records. By that time, the public can download both of their COVID-19 electronic vaccination records and testing records after verifying their identity through “iAM Smart”. The system will not store or check the public’s other vaccination records. One can download the electronic testing record by inputting the personal information (such as Hong Kong identity card number, specimen bottle number or laboratory number/specimen number, etc.) of one’s into the system.

### 2.9.5 Government Strategies and Decisions

During vaccination campaigns, the number of measures that are used. To tie up with the vaccination programme and document any adverse events that occur to the patient associated with the relevant vaccine delivery, the government established the Expert Committee on Clinical Events Assessment Following COVID-19 Immunisation. The Expert Committee will monitor any potential adverse events that occur after COVID-19 vaccines are administered and provide clinical advice and recommendations on how to assure the safety of the licenced vaccines [6]. The Hong Kong government’s ultimate goal is to distribute the COVID-19 vaccine to the majority of Hong Kong’s population by 2021. [Government](2021c)

### 2.9.6 Money spent

- The Hong Kong government allocated around 8.4 billion dollars for Covid-19 Vaccination in their budget

[Business](2021)

### 2.9.7 Variant Info

- The mutated B.1.617 variant originated in India was found in Hong Kong in April, 2021

[Post](2021b)

### 2.10 Italy

#### 2.10.1 Prioritization

Italy will prioritize the following population groups:

- Health and social care workers.
- Elderly above 70 years old.
- Residents and staff of residential care facilities for the elderly.
• Older persons.

2.10.2 **APPROVED VACCINES**

Approved Vaccines in Italy are:

- Moderna
- Oxford/AstraZeneca
- Pfizer/BioNTech
- Johnson and Johnson

2.10.3 **VACCINE ADMINISTRATION AND DISTRIBUTION**

A distribution model focused on a single national storage site and a collection of second level territorial sites will be used for vaccines that need a normal cold chain (2°C/8°C). Vaccines that require an extremely cold chain (-20°C/-70°C) would instead be supplied directly by the manufacturer to the territory’s vaccination points (approximately 300 at the moment), in accordance with Regions. The initial phase of the campaign involves a centralized management of vaccination, using hospitals and mobile units to vaccinate those who cannot independently reach the centers set up for vaccination. The administration plans to involve territorial clinics, general practitioners, pediatricians, military health department and doctors working for private companies [di Sanita](2020), in addition to mobile units [della Sera](2020). The vaccine is to be administered in two doses, with the supply sufficient for 101 million people in total. Vaccines are not purchased by states, but by the European Commission, and divided according to population size. Italy is entitled to 13.5% of the doses bought by the EU [Repubblica](2020).

**Vaccination Rate**

- Around 47.7 million doses have been administered in Italy
- 16.6 million people (or 27% of the population) are fully vaccinated
- The rate of vaccination in Italy is 497,487 doses per day [Reuters](2021h)
- Population to Vaccine ratio: 78.93 COVID-19 vaccine doses administered per 100 people, as of June 24, 2021. [in Data](2020)

**Vaccination Governance:** A strategy plan for anti-SARS-CoV-2 / COVID-19 vaccination was prepared by the Ministry of Health, the Extraordinary Commissioner for Emergency, the National Institute of Health (ISS), the National Agency for Regional Health Services (AGENAS), and the Italian Medicines Agency. (AIFA).

2.10.4 **ACCESSIBILITY AND DIGITAL SOLUTIONS**

Italy did not set up a national information system to make reservations. Instead, each of the 20 regions built its own booking platform [Wired.it](2021). Only the Italian Postal service developed a platform to manage bookings and Sicily is the first region using it [Costruiresalute.it](2020). To track vaccinations, the Italian Minister of Public Health Official is using a dashboard powered by Microsoft PowerBi.

2.10.5 **GOVERNMENT STRATEGIES AND DECISIONS**

On December 2, 2020, the Italian Ministry of Health, the Covid-19 Emergency Commissioner, and the Italian Medicines Agency presented the Strategic Plan for SARS-CoV-2/COVID-19 vaccine protocols to the Italian Parliament. Here are the key points of the Plan:

- Mfree and guaranteed vaccination for all: December 27, 2020, start of vaccination in Italy and Europe (Vaccine Day)
- identification of the categories to be vaccinated with priority in the initial phase of limited availability of vaccines: health and social workers, residents and staff of RSAs for the elderly
• The Special Commissioner is in charge of item logistics, procurement, storage, and transportation.
• Governance of the immunisation plan will be ensured by regular cooperation between the Ministry of Health, the Emergency Commissioner, and the Regions.
• Setting up an information system to manage the vaccination campaign in an effective, integrated, secure and transparent way.
• Pharmacosurveillance and immunological surveillance to ensure the highest level of safety throughout the vaccination campaign and the immune response to the vaccine. [della Salute (2021)]

AIFA (Italian Medicines Agency) will promote the launch of some independent post-authorization studies on COVID-19 vaccines. Vigilance activities will concern both the collection and evaluation of spontaneous reports of suspected adverse reactions (passive pharmacovigilance) and proactive actions, through pharmaco-epidemiology studies/projects (active pharmacovigilance). AIFA has set up a Scientific Committee, which, for the entire period of the vaccination campaign, will have the function of supporting the Agency in the phase of setting up activities, in the overall analysis of the data that will be collected and in the identification of possible interventions. The aim is to have, also through an international collaborative network, the ability to highlight any sign of risk and, at the same time, to compare the safety profiles of different vaccines that will become available, to provide recommendations. [Agency (2020b)]

2.10.6 Money spent
• 400 million euros will be spent on vaccinations and medications to treat COVID-19 patients, while 70 million euros will be spent on rapid tests.
• Italy is slated to get the largest share of the European Union’s recovery fund, with a portion of these funds going toward addressing some of the long-standing challenges that are largely perceived as holding Italy and its economy behind. [EuroNews (2020)]

2.10.7 Variant info
• Around September 2020, UK’s B.1.1.7 variant was found in Italy. [News-Medical.Net (2020)]
• Indian variant has been detected in the northern parts of Italy in April 2021. [Times (2021a)]

2.11 Vietnam
2.11.1 Prioritization
The 11 priority groups include:
• health professionals
• pandemic prevention and fight task force (members of steering committees, people working in quarantining areas, reporters and others)
• diplomats, and customs and immigration staffs, military personnel, police force, teachers
• elderly aged over 65
• those working to maintain the supply of essential services such as aviation, transportation, tourism, electricity and water supply
• people with chronic diseases
• people going abroad on a mission, to work, or study
• those in pandemic-hit areas
2.11.2 **APPROVED VACCINES**

Approved Vaccines in Vietnam are:

- Sputnik V
- Oxford/AstraZeneca

2.11.3 **VACCINE ADMINISTRATION AND DISTRIBUTION**

Around 600,000 Vietnamese people, comprising healthcare and COVID-19 combat workers, will be given shots in the first quarter. Meanwhile, 1.8 million customs officers, diplomats, army and police personnel, and teachers will be injected in the second quarter. During the second half, over 16 million teachers and people above 65 will access 33 million doses of vaccines to be provided by the COVAX Facility later. The government plans free vaccinations. Hospitals and health centers at the central, provincial, city, district levels administer injections. At the grassroots level, commune health stations are organizing a campaign to vaccinate COVID-19 through mobile stations and injection sites.

**Vaccination Rate**

- Only 1.5% (approximately 3 million) of Vietnam’s population is fully vaccinated as of now at a speed of approximately 6000 doses per day.
- Population to Vaccine ratio: 3.00 COVID-19 vaccine doses administered per 100 people, as of June 24, 2021.

**Vaccination Governance:** The Centers for Disease Control in provinces and cities synthesize the list of immunization units and the number of vaccinated subjects in the provinces and cities and notify the Department of Preventive Medicine, the Central Institute of Hygiene and Epidemiology to be supplied with vaccines. Implementation time is March 7-10, 2021. Based on the plan of the Ministry of Health, the provincial health departments of the provinces and cities take the lead in developing the local COVID-19 vaccine use plan and directing the preparation of the list of injecting subjects according to risk groups within 7 days after the Ministry of Health issued the Plan on receipt, transportation, storage and use of COVID-19 vaccine.

2.11.4 **ACCESSIBILITY AND DIGITAL SOLUTIONS**

The Ministry of Health has set up a webpage specifically dedicated to COVID-19 influenza disease section. WHO also offers a curation of situation reports. As of April 6, 2021, there are up to Report 36. The Ministry of Health, in collaboration with the Ministry of Information and Communications, has also launched a mobile application called NCOVI. According to its Google Play page, the app seeks to "assist people nationwide to make voluntary medical declarations, contributing to the prevention and fight against acute pneumonia caused by new strains of COVID-19." The app will also serve as an official communication channel for state agencies.

2.11.5 **GOVERNMENT STRATEGIES AND DECISIONS**

On the evening of April 7, the Ministry of Health issued Decision No. 1821 / QD-BYT on the distribution of COVID-19 round 2. Accordingly, there are 811,200 doses of Astra Zeneca’s vaccine funded by COVAX. The Prime Minister decided to supplement the state budget estimate in 2021 to the Ministry of Health 502.9 billion VND from the central budget reserve in 2021 to continue the procurement of materials, chemicals, bio-products and equipment, medical equipment necessary for the prevention and control of COVID-19 epidemics according to the plan approved by the National Steering Committee for COVID-19 epidemic control in 2020. The Ministry of Health is fully responsible for the management, use and settlement of the additional funding; Carry out procurement in accordance with the provisions of the law, for the right purposes and subjects, to ensure thrift, efficiency, publicity, transparency and in accordance with the epidemic’s manifestation in 2021.
2.11.6 Money spent

- Vietnam government spend more than 1 Billion dollars on vaccination to get 150 Million doses

\[\text{Reuters (2021y)}\]

2.11.7 Variant info

- Vietnam has witnessed B.1.222, B.1.619, D614G, B.1.17, B.1.351, A.23.1 and B.1.617.2 which includes both Indian and UK variant
- Recently a new variant which seems like a hybrid of Indian and UK mutants

\[\text{of India (2021)}\]

2.12 Thailand

2.12.1 Prioritization

- Front-line health workers
- Patients with acute and chronic respiratory disorders, chronic obstructive lung disease, and difficult-to-control asthma are all included in this category.
- Patients with cardiovascular disorders, chronic kidney disease at stage 5 or higher, stroke patients, and cancer patients undergoing chemotherapy
- Persons suffering from diabetes or obesity
- Staff involved in disease prevention and control Exposure to COVID-19

\[\text{of Thailand (2021)}\]

2.12.2 Approved Vaccines

Approved Vaccines in

- Coronavac
- Oxford/AstraZeneca
- Pfizer/BioNTech
- Johnson and Johnson

2.12.3 Vaccine Administration and Distribution

There are two phases of vaccination. The first phase’s target groups include frontline medical and public health workers, chronic disease patients, people over the age of 60, and disease control authorities. Non-frontline medical and public health professionals, tourism industry employees, international travellers, the general public, ambassadors, representatives of international organisations, foreign business people, long-stay visitors, and manufacturing and service sector workers are among the target categories in the second phase. The Cabinet also authorised the Ministry of Public Health’s plan to increase its order of AstraZeneca vaccine from 26 million to 61 million doses. Thailand has also authorised the private sector to import vaccines to complement the national vaccination programme. Despite criticisms and concerns regarding black market formation and inequitable access to vaccines, the government holds a lax attitude towards such demand from the private sector “as it would help accelerate the progress of our inoculation program.” Thailand’s private hospitals and drugmakers are awaiting government approval to manufacture some COVID-19 vaccines on their own to satisfy demand from affluent Thais and businesses who want their shots as soon as possible. Just two vaccines, made by China’s Sinovac and the United Kingdom’s AstraZeneca, will be administered free of charge via public hospital networks under the government’s vaccination policy, which began March 1. For those who are able to pay, private companies are now offering expedited vaccinations. The government is being accommodating when it
comes to vaccine imports. So far, at least one pharmaceutical firm based in the United States and a hospital operator have applied for import licences.\textsuperscript{34}

**Vaccination Rate**

- 2.45 Million people (approximately 3.51\%) of Thailand’s population is fully vaccinated as of now at a speed of approximately 98713 doses per day.\textsuperscript{35}
- Population to Vaccine ratio: 12.40 COVID-19 vaccine doses administered per 100 people, as of June 24, 2021.\textsuperscript{36}

**Vaccination Governance:** The Center reports vaccination progress for COVID-19 Situation Administration (CCSA). The Ministry of Public Health oversees vaccine distribution. It expects to distribute 800,000 doses of Sinovac’s COVID-19 vaccine across the country by April 1, 2021. The first 22 provinces will begin immunisation on April 1st, followed by the rest of the provinces in June.\textsuperscript{37}

**2.12.4 ACCESSIBILITY AND DIGITAL SOLUTIONS**

The Ministry of Health plans to issue “vaccine passports” to residents who have completed their COVID-19 vaccinations so that they can travel abroad. For vaccinated visitors from abroad, Thailand also plans to shorten the mandatory quarantine period from 14 days to 7 days. Starting October 2021, vaccine passport holders may be completely waived from quarantine upon arrival. For travelers without vaccine passports but with negative test results, they still need to quarantine for 10 days upon arrival.

In May 2021, the Ministry of Public Health will launch ”Mor Prom (Health Wallet)” a mobile application that allows citizens to make COVID-19 vaccination appointments. The app, expected to launch on May 1, allows users to book their free jabs at designated state hospitals and public health stations, from June. It also includes a feature that enables post-vaccination monitoring to check for side effects. A recent survey found that 80\% of people living in Bangkok use phone apps as their main means of communication, a number that falls to 50\% for people outside the capital.\textsuperscript{38}

**2.12.5 GOVERNMENT STRATEGIES AND DECISIONS**

The Thai cabinet agreed on Sunday not to join the WHO-sponsored coronavirus vaccine scheme, claiming that doing so would result in the nation spending more on vaccines and putting delivery times in jeopardy. Responding to media claims that Thailand is the only Southeast Asian nation to miss the WHO’s COVAX system, government spokesman Anucha Buraphachaisri said that Thailand is not eligible for free or low-cost vaccinations as a middle-income country under the initiative.\textsuperscript{39}

**2.12.6 MONEY SPENT**

- The government of Thailand announced a budget of around 1.9 billion dollars to support the COVID-19 vaccination in Thailand

**2.12.7 VARIANT INFO**

- UK variant has been found in Thailand in April 2021

**2.13 NORWAY**

**2.13.1 PRIORITIZATION**

Norway’s vaccine prioritization guidelines are as follows:
• Nursing home residents and selected groups of healthcare personnel
• Age ≥ 85 years as well as certain types of healthcare workers, are at risk.
• Age 75 to 84 years
• People between the ages of 65 and 74, as well as people between the ages of 18 and 64 who have major diseases
• Age 55 to 64 years
• Age 45 to 54 years
• Age 18-44 years

2.13.2 APPROVED VACCINES

Approved Vaccines in Norway are [Public Health (2021a):

• Moderna
• Oxford/AstraZeneca *
• Pfizer/BioNTech
• Johnson and Johnson

Authorities halted the introduction of the AstraZeneca vaccination on March 11, 2021, after a small group of younger people were hospitalised due to problems such as blood clots, haemorrhage, and low platelet counts. [Public Health (2021b) The Norwegian Institute of Public Health (FHI) advised a permanent suspension of the AstraZeneca vaccination in Norway on April 15 due to a rare but serious risk of problems with the vaccine. The Norwegian government is still deliberating over the recommendation, given the WHO advice to continue administering the vaccine. [Public Health (2021d)

2.13.3 VACCINE ADMINISTRATION AND DISTRIBUTION

The dispatch, packaging and distribution of the vaccine doses must be planned well in advance, as the vaccines currently planned for usage in Norway require sub-zero storage and transportation. Norway Institute of Public Health (NIPH) or Folkehelseinstituttet (FHI) is based on a distribution key that includes the geographical distribution of the population in priority groups, based on their share of the total population. The model aggregates population density, hospital admissions, and risk group proportions. However, while it does account for distribution of risk groups per municipality, it does not take into account the geographical distribution of health personnel. [Folkehelseinstituttet (2020)

Vaccination Rate

• A total of around 3.9 million doses have been administered in Norway. Vaccination is happening at a rate of 38,281 doses per day [Reuters (2021)]
• Population to Vaccine ratio: 72 COVID-19 vaccine doses administered per 100 people, as of June 24, 2021. [in Data (2020)]

Vaccination Governance: The Norwegian Institute of Public Health (FHI) is responsible for publishing coronavirus guidelines, vaccine information, vaccine approvals, and conducting vaccination priority and distribution guidelines. However, the Norwegian government has final say in official policies regarding vaccination roll-out and guidelines and also considers WHO guidelines. [Public Health (2021c)

2.13.4 ACCESSIBILITY AND DIGITAL SOLUTIONS

A downloadable vaccination card will be available on the vaccine service provided by helsenorge.no. The vaccination stage will be visible on the card. If an individual is not registered with helsenorge.no, a simplified vaccination card is provided by the vaccinator where the vaccinated individual must remember when their second dose takes place. The service is available in English and Norwegian. [Kommune (2020)
The EU plans to implement vaccine certificates, both digital and physical, to travel across all EU borders and further is appealing to the Norwegian government to opt into the EU plan. The certificate will utilize an encrypted QR code and is collaborating with the WHO to ensure international recognition of the EU certificate. [BBC(2021a)]

2.13.5 GOVERNMENT STRATEGIES AND DECISIONS

The Norwegian government oversees the implementation of any policies and guidelines regarding coronavirus vaccination. The Norwegian Institute of Public Health (FHI) is responsible for researching and providing recommendations about vaccine guidelines and decisions. [of Public Health (2021c)] However, the Norwegian government takes into account multiple factors, such as WHO guidelines, before implementing FHI recommendations. [of Public Health (2021d)]

2.13.6 MONEY SPENT

- Norway has donated 2.2 billion crowns to the Oslo-based Coalition for Epidemic Preparedness Innovation (CEPI), which aims to prevent epidemics by funding vaccine research.
- Norway will contribute $1 billion to the global rollout of any COVID-19 vaccine, as well as vaccinations for other diseases.
- GAVI, the Global Partnership for Vaccines and Immunization, a global alliance of commercial and governmental organisations dedicated to global immunisation, will receive $1 billion in direct support from Norway between 2021 and 2030.
- Norway has given the World Health Organization an additional 50 million crowns ($4.8 million) to fight the novel coronavirus outbreak. [Reuters (2020b)]

2.13.7 VARIANT INFO

- A new variant was found in Norway in February, 2021 called the B1525 variant.
- The B1525 has close resemblance with B117 and B1351 variants found in UK and South Africa respectively. [Norway (2021)]

2.14 RUSSIA

2.14.1 PRIORITIZATION

Priority vaccination against COVID-19 applies to the following groups: Employees of medical institutions (all), educational institutions, the police, local public transport, retail, charities, public catering companies and other organizations whose work involves direct contact with a large number of people includes (hotels, hairdressers, dry cleaners, banks, security companies and others). [Agency (2020c)]

The age of the vaccinated is limited to 60 years. People with underlying health problems, pregnant women, people with respiratory diseases in the last two weeks are excluded from vaccination. [Reuters (2020c)]

2.14.2 APPROVED VACCINES

Approved Vaccines in

- Sputnik V
- EpiVacCorona
- Pfizer/BioNTech
- CoviVac
2.14.3 Vaccine Administration and Distribution

The Russian-made Sputnik V vaccine has been distributed at 70 clinics around Moscow with the Kremlin stating that mass vaccinations will be voluntary and free of charge, beginning December 2022. The vaccine in its lyophilized dry form can be stored at temperatures being +2 and +8 degrees celsius. The cost for international markets will be $10 per dose. [Reuters (2020c)]

Based to the Russian Direct Investment Fund (RDIF), Russia was the most trusted vaccine production country (54 percent) as of March 24, 2021, according to the results of a YouGov survey of 9,417 respondents from 9 countries. Furthermore, the survey indicated that 33.2% of respondents would prefer the Sputnik V vaccine, second only to Pfizer/BioNTech at 36.6%. [Sputnikvaccine.com (2021)]

Due to a vaccine surplus in Moscow, the government is offering appointment-free walkins to get the Sputnik V vaccine free of charge. They are further incentivizing it with a free ice pop upon vaccination. [9] Furthermore, in order to reach limited-mobility residents, Russia is offering at home vaccination visits beginning April 13. [Times (2021g)]

Putin announced that in early March, all but 9 Russian regions have begun to deploy the vaccine. The delay has been attributed to logistical concerns regarding the locations of the regions. [CNBC (2021a)]

Vaccination Rate

- As of June 24, 2021, 11% (16.29 million) of Russia’s population is fully vaccinated at a speed of 312,634 doses per day [Reuters (2021n)]
- Population to Vaccine ratio: 25.33 COVID-19 vaccine doses administered per 100 people, 24 June, 2021 in Data (2020)

Vaccination Governance: The Russian Health Ministry oversees and recommends health decisions and advice regarding covid guidelines, treatment, and vaccination rollout.

2.14.4 Accessibility and Digital Solutions

Although not many details about the country’s accessibility and digital initiatives have been made public, in terms of vaccine passports, Russia’s foreign minister has voiced concerns about such passports infringing upon people’s right to travel. Russia is currently issuing proof of vaccination documents. [Euronews (2021)]

2.14.5 Government Strategies and Decisions

The Russian government has approved three vaccines for use, by recommendation of the Russian Health Ministry. Furthermore, the Health Ministry provides input on vaccination priority group phase openings. [Reuters (2021o)]

2.14.6 Money Spent

- The Russian government reported in July 2020 that it has spent over 116 billion rubles ($1.67 billion) battling the pandemic [Agency (2020a):
  - 76 billion rubles were invested across the country to equip beds for COVID-19 patients
  - Free delivery of test systems to the government, municipal medical institutions, and treatment of coronavirus-infected patients were allotted 40 billion rubles.
- The Russian Direct Investment Fund (RDIF), the organisation in charge of global Sputnik V vaccine manufacturing and supply partnerships, announced in April 2021 that the country is already allowing free technology transfer and capital expenditure support to its Covid-19 vaccine manufacturing partners in other countries. Twenty vaccine companies from ten nations, including Korea, China, and India, are members of Russia’s vaccine collaboration [Today (2021a)]

2.14.7 Variant Info

- The Russian government has not officially recorded confirmed cases of variants. Currently there are two pieces of conflicting reports
• The Kommersant newspaper reported 16 cases of the variant among Indian students at Ulyanovsk State University, some 700 kilometres (435 miles) east of Moscow. Tatiana Golikova, the country’s deputy prime minister, had stated that no cases of the variation had been reported Times (2021d).

• However, the regional branch of consumer health watchdog Rospotrebnadzo on Thursday denied the Kommersant report Reuters (2021m).

2.15 EGYPT

2.15.1 PRIORITIZATION

Egypt started vaccinating its medical staff and front-line workers. The vaccine was then made available to elderly people and patients with chronic diseases by early March 2021 Reuters (2021a). Egypt plans on vaccinating close to 65% of its population under the age of 35, and 40 million people in the 35-40 year range by the end of 2021. Immunocompromised patients, children and pregnant women will not be administered vaccines in the initial phases of the program before the side-effects of the vaccine are studied in greater detail Today (2021b).

2.15.2 APPROVED VACCINES

Approved Vaccines in

• China/Sinopharm
• Oxford/AstraZeneca
• Pfizer/BioNTech
• Russia/Sputnik IV

2.15.3 VACCINE ADMINISTRATION AND DISTRIBUTION

Egypt had earlier set up 34 distribution centers across the country, but as the demand increases, it continues to set up more facilities. It currently has 139 centers but the government plans on increasing that to 339 by May Today (2021c).

Vaccination Rate

• As of June 24, 2021, 0.7% (720K) of Egypt’s population is fully vaccinated at a speed of 86,831 doses per day Reuters (2021b).

• Population to Vaccine ratio: As of June 24, 2021, Egypt has vaccinated 4.04 people per 100 people in Data (2020).

Vaccination Governance: Egypt’s Ministry of Health is in charge of most vaccination protocols - the initial one has been to vaccinate 2 million Egyptians starting in February, with 4 million doses in agreement with Long Live Egypt (Tahya Misr) Fund and the Talaat Mostafa group. AstraZeneca is also receiving approval from the Egyptian Drug Authority. Independent (2021).

2.15.4 ACCESSIBILITY AND DIGITAL SOLUTIONS

It is free of charge as a part of the Coronavirus Vaccine for Free initiative and for digital solutions - they are also launching an online registration portal (concurrently with Lebanon) that will allow citizens and healthcare workers to keep records of their vaccinations. Though Egypt’s portal does not make its methods and privacy protocols clear on its website, Lebanon’s ministry of health has assured that the platform protects privacy and has been tested for safety. The vaccine will be free of cost for all Streets (2021). Egypt plans on acquiring a total of 4.5 million doses by June and has already vaccinated 149K individuals as of 4th April 2021. Egypt also plans on manufacturing the Sinopharm vaccine in its own facilities, and a negotiation deal with the pharmaceutical is in the works. Citizens can register through an online portal and opt for the vaccine. Egypt also received 800,000+ doses of the AstraZeneca vaccine from the COVAX facility Organization (2021a).
2.15.5 Government Strategies and Decisions

The emergency approval granted by Egypt was for frontline workers, and Egypt even had a publicity campaign describing the vaccine to be effective which a doctor considered to be propaganda. With two doses, a case study had also revealed that there was a 19 percent occurrence of dangerous side effects in recipients after the trial. Like Nepal, they do receive support from GAVI in acquiring the vaccine doses—however, for the frontline workers, Sinopharm has primarily aided in providing the vaccines to Egypt in the initial phases.

2.15.6 Money Spent

- Egypt received $50 million from the World Bank Group’s new Fast Track COVID-19 Facility in May 2020 as an emergency response. Egypt has been approved for $50 million in financing, which is the highest amount available for a country with Egypt’s population.

2.15.7 Variant Info

- While the Indian strain of the virus has spread to 17 countries, including Iraq and Jordan, it has yet to be found in Egypt, according to the Ministry of Health for Preventive Affairs.

2.16 South Africa

2.16.1 Prioritization

South Africa plans to vaccinate 40 million South Africans as a part of their vaccination roll out campaign. In this process of vaccination, the South African government has planned nationwide coverage in three distinct phases. Included in this phased approach are various levels of prioritization groups of population.

- The first phase of vaccination will target the front-line health workers. The government is aware that there will be constrained vaccine supplies to cater to the demands during the initial phase of the implementation. So, it is planned to first provide vaccination to this priority group. As a part of the phase 1 plan, the government plans to vaccinate roughly 1.2 million front-line workers in the nation.

- In Phase 2, as the supply increases the following groups with a rough population of 16.6 million individuals will be targeted:

  - This phase will include essential workers, persons in crowded settings, persons greater than 60 years of age (about 5 million people) and persons greater than 18 years of age who are suffering from associated comorbidities (about 8 million people) like diabetes, heart and kidney disease, HIV, Tuberculosis, and other diseases that can make an individual immunocompromised.

  - The essential workers who will be vaccinated as a part of the phase 2 will be officers in the police department, workers in the mining and security industry, staffs of retail food and grocery chains and shops and border control staff. In addition, they will also embrace staff of other public services including funeral places, academic and financial institutions, municipality and home affairs. The government targets to vaccinate 2.5 million people in this category.

  - Individuals working in care homes, centers of detention, hospitality and tourism industry will also be covered in phase 2. As a part of this, it is targeted to vaccinate 1.1 million people.

- Once the critical groups of the population are vaccinated, the final phase 3 will be implemented to cover approximately a population of 22.5 millions. In this final phase all other
persons greater than 18 years of age will be vaccinated. This phase will be a continuous vaccination process, and the government has plans to shift into a part of the routine strategy. [Team] (2021)

2.16.2 APPROVED VACCINES

The National Department of Health and the Ministerial Advisory committee discussed the various numbers of vaccines that will be needed to vaccinate the country’s populace. [for Communicable Diseases] (2021) These include:

- Moderna
- Oxford/AstraZeneca
- Pfizer/BioNTech
- Johnson and Johnson
- Cipla

2.16.3 VACCINE ADMINISTRATION AND DISTRIBUTION

The government of South Africa wants to make sure that there is a supply of sufficient doses of vaccines to vaccinate its populace. This process collaborates with different vaccine suppliers and is working on supply chain logistics to ensure having enough quantities of vaccines in the shortest possible time. This will allow them to protect the most liable population in the community as early as possible. The government has also joined the COVAX programme, which is part of the Covid-19 Vaccines Global Access Facility’s global pooled buying strategy. South Africa, in particular, has been promised that it will be among the first countries to receive a significant allotment of vaccines from this worldwide endeavour. [Organization] (2021c)

On February 1, 2021, the Serum Institute of India (SII) delivered 1 million doses of the Oxford University-AstraZeneca vaccine to South Africa. According to the National Institute for Communicable Diseases’ website. [for Communicable Diseases] (2021) In the process of continuously procuring further supply the following has been done:

- The global CVOX programme is expected to produce around 12 million doses in total by March 2021.
- In conjunction with Johnson & Johnson, it has also supplied 9 million immunisation doses. This will commence in the second quarter of 2021. Johnson & Johnson has engaged the support of another company, Aspen, to assist in the production of these vaccines in the United States.
- Pfizer is planned to supply another 20 million vaccine doses, with deliveries starting in the second quarter of 2021. [for Communicable Diseases] (2021)

The country discovered a novel SARS-CoV-2 variation known as 501Y.V2 or B.1.351, which is now the virus’s dominant form in the country. Following this, the government had to revisit the vaccine supply chain. The vaccine from AstraZeneca and the University of Oxford which the South African officials had begun to stockpile has proven largely ineffective at preventing mild-to-moderate COVID-19 due to B.1.351. In addition, it is mostly unknown if the vaccine offers any protection against severe disease caused by the new variants. [Madhi et al.] (2021)

In Phase 1 of its countrywide vaccination drive, South Africa will employ the Johnson & Johnson vaccine rather than the AstraZeneca vaccine. The 501Y.V2 has been confirmed to be resistant to the Johnson & Johnson vaccination. As part of the Phase 3 Ensemble clinical trials, Johnson & Johnson conducted efficiency experiments. The Sisonke Programme comes to mind in this context. This initiative is a research project to assess the Johnson & Johnson vaccine’s real-world efficacy among health care personnel. After vaccination, the programme will track, monitor, and assess the rate of hospitalizations and infection incidence among healthcare professionals. The South African Medical Research Council and the National Department of Health are collaborating on this programme. [Portal] (2021)

Vaccination Rate
Vaccination Worldwide: Strategies, Distribution and Challenges

- As of June 24, 2021, 0.8% (479K) of Egypt’s population is fully vaccinated at a speed of 41,055 doses per day [Reuter (2021p)]
- Population to Vaccine ratio: 4.3 vaccine doses administered per 100 people in South Africa as of June 24, 2021. [Data (2020)]

Vaccination Governance: The Ministerial Advisory Committee (MAC) on Vaccines is the non-statutory advisory committee appointed by the Ministry of Health. Another institutional agency in the country related to the vaccines safety and efficacy is South African Health Products Regulatory Authority (SAHPRA). This agency assesses the safety, efficacy and quality of vaccines used in the country using stringent assessment methods and mechanisms. [Authority (2021b) for Communicable Diseases (2021)]

2.16.4 ACCESSIBILITY AND DIGITAL SOLUTIONS

In the current context of the pandemic, the Government follows a centralised procurement policy in the sense that the government of South Africa will be the sole purchaser of vaccines. A national and provincial distribution network will then support this. A national rollout committee will monitor the vaccine supply planning and implementation in both the public and private sectors.

It is planned to include all the vaccinated population into a national register and provide them with vaccination cards for tracking and monitoring the vaccinated population.

The country has established an electronic vaccination data system (EVDS) to facilitate the nationwide vaccine rollout. The online EVDS is a self-enrolment platform where citizens can register for an appointment using a digital device. Citizens who meet the criteria will receive an SMS message with a unique code notifying them of the time and location. They will be required to present their national ID and a contact number to receive the immunisation. All Healthcare Workers (public & private) who intend to be vaccinated in Phase I are encouraged to enroll on the EVDS. During the registration in the EVDS the following data is also collected and or provided:

- Patient information (including demographic data, dose interval)
- Health establishment where service is accessible (name and type of clinic / hospital)
- Vaccine administered (manufacturer, batch number, etc.)
- Safety information of the vaccine administered (including Adverse Events Following Immunization)
- A record of vaccination issued to individuals where appropriate and required

2.16.5 GOVERNMENT STRATEGIES AND DECISIONS

Experts in the field have been appointed to a Ministerial Advisory Committee (MAC) on Covid-19 Vaccines. The committee is made up of vaccinology and virology experts, SAHPRA stakeholders, and WHO, Gavi Alliance, and Department of Health specialists. They’ve devised a plan to ensure that immunizations are distributed fairly. The approach covers a variety of purchase techniques, financial implications, local production, opportunities, and determining immunisation priority groups.

2.16.6 MONEY SPENT

- The South African government estimates a total funding of 19.3 billion Rand. It will be funded through budget allocations, contingency reserve, and emergency allocations
- The breakdown of the allocation is as follows:
  - R6.5 billion will be allocated to the Department of Health to procure and distribute vaccines
  - R100 million will be allocated to the South African Medical Research Council for vaccine research
  - R2.4 billion will be allocated to provincial health departments to administer vaccines
  - R50 million will be allocated to the Government Communication and Information System for a communications campaign on vaccines
Vaccination Worldwide: Strategies, Distribution and Challenges

- Vaccines will be provided free of charge according to rollout schedules [News24 (2021)]
- Over the next two years, South Africa will allocate more than R10 billion ($712 million) to purchase and deliver vaccines [Hour (2021)]

2.16.7 VARIANT INFO
- South Africa is one of the African continent’s hardest impacted countries. The B.1.617.2 and B.1.1.7 variations have been discovered, according to the National Institute of Communicable Diseases
- The first variant, B.1.617.2 (initially detected in India), has been detected in four positive cases, the institute said. Two of those are in Gauteng, South Africa’s most populous province
- The second variant, B.1.1.7 (initially detected in the U.K.), has been detected in 11 cases [News (2021)]

2.17 ESTONIA

2.17.1 PRIORITIZATION

Estonia has started mass vaccinations, and commencing from May 17 all Estonian people can get vaccinated against COVID-19. When sufficient vaccine quantities are available, the government plans to open up the possibility of vaccinating everyone who wants to get vaccinated. The government is planning to provide vaccines for free to all individuals living in Estonia. This will also include those individuals who do not have an official health insurance.

Because vaccine supplies may be limited, the state began immunising healthcare workers, residents and employees of social care facilities, and people who are considered high-risk because of their elderly age.

In order to ensure that society’s vital services continue to run, Estonia adopts a phased vaccination approach, with initial priority given to people in a high-risk group or who need to be vaccinated first. In collaboration with the Estonian Family Doctors’ Association, the country’s Immunoprophylaxis Expert Committee has created six risk groups and divided diseases into two categories: very high risk and high risk. Prioritization will follow the following order:

- Group 1 includes all adults over the age of 80
- Group 2 People who are 70 years old or older and have concomitant diseases or disorders that put them at a very high or high risk of serious disease progression.
- People who are 70 years old or older, regardless of comorbidities, fall into group 3. This group also includes people aged 16 to 69 who have diseases or conditions that put them at a high risk of serious disease progression.
- Individuals in group 4 are those who are 60 years old or older and have diseases or disorders that put them at a high risk of serious disease progression.
- People in Group 5 are those who are 50-59 years old or older and have diseases or disorders that put them at a high risk of serious disease progression.
- People in the last group are 16-49 years old or older and have diseases or disorders that put them at a high risk of serious disease progression.

[Of Social Affairs (2021)] [Vaktsineeri (2021)]

2.17.2 APPROVED VACCINES

The following vaccines have been approved for use in the country:

- Moderna
- Vaxzevria (COVID-19 Vaccine AstraZeneca)
Vaccination Worldwide: Strategies, Distribution and Challenges

- Pfizer/BioNTech
- Johnson and Johnson

2.17.3 Vaccine Administration and Distribution

The process of vaccine administration started with a pre-analysis of all the patient lists of all the family doctors in the country. The Estonian Health Insurance Board mapped people who fall into a COVID-19 risk group based on diseases and illnesses defined by the state Immunoprophylaxis Expert Committee as part of this process. Patients were categorised by the Health Insurance Board based on diagnosis codes found on medical bills and prescriptions written in the prior five years. Following the preparation of the lists, the family doctors are given the opportunity to review them and make any necessary modifications. Starting March 22, members of risk groups will be able to get information about their risk group status through the patient portal.

Estonia is participating within the joint EU procurement for purchasing the coronavirus vaccines. The joint European Union vaccine portfolio contains vaccines and vaccine candidates of seven different vaccine manufacturers. The European Commission has signed pre-purchase agreements with the following vaccine manufacturers – AstraZeneca, Sanofi, Janssen Pharmaceutica NV, Pfizer/BioNTech, Curevac and Moderna. Estonia has also joined pre-purchase agreements with five vaccine manufacturers - AstraZeneca, Janssen Pharmaceutica NV, Pfizer/BioNTech, Curevac and Moderna. Additionally, negotiations are underway between the European Commission and the vaccine manufacturer Novavax and Valneva. [Government](2021a)

Vaccination Rate

- As of June 24, 2021, 27.57% (365K) of Estonia’s population is fully vaccinated at a speed of 8,757 doses per day [Reuters](2021c)
- Population to vaccine ratio: 68.95 doses administered per 100 people as of June 24, 2021 in Data (2020)

Vaccination Governance: The Estonian Health Board and the Ministry of Social Affairs govern the country’s overall process. Partial redistribution of vaccines and delivery schedules are managed by the Steering Committee for the Joint Procurement of COVID-19 Vaccines. [Reuters](2021d)

2.17.4 Accessibility and Digital Solutions

The central patient portal of the national digital registry allows the citizens to see his or her health data, and to book specialist appointments. In addition to the national digital registry, the country also has a central national database for their Health Information System and this allows the healthcare professionals to notify the older and younger people about their risk grouping. The country is collaborating with WHO in implementing VaccineGuard a digital platform to effectively support vaccination. VaccineGuard is a digital platform that connects various healthcare stakeholders and the different participants in the vaccine ecosystem of the country. Vaccine producers, hospitals, public health authorities, certificate suppliers, wellness app providers, citizens, border guards, vaccination programme managers, and insurance companies are among the numerous actors in this ecosystem. VaccineGuard will promote and enable these participants to share and verify data across organisational and international boundaries. VaccineGuard will also enable the development of real-time insights, pharmacovigilance, counterfeit identification, and a slew of other features that will help the government respond to pandemics faster and more reliably. [Health & Centre](2021) [Board](2021) [Guardtime](2021)

2.17.5 Government Strategies and Decisions

The Estonian government has strategically signed a memorandum of understanding with WHO that will allow Estonian entrepreneurs and researchers to start working on digital immunization certificate, interoperability, and other projects. This will allow for an improved immunization record, robust and transparent exchange of vaccination data across borders of what we hope will be an eventual vaccine for COVID-19, as well as immunizations records for other diseases. [Valitsus](2021)
2.17.6 Money spent

- Estonia is planning to donate 800,000 vaccines through the COVAX initiative and to the EU’s Eastern Partnership countries (Georgia, Ukraine, Moldova, Armenia, Azerbaijan, and Belarus). Additionally, Estonia will donate €70,000 to COVAX.

[News][2021d]

2.17.7 Variant info

- As of May 6, 2021, 90% of COVID-19 cases are the British variant (B.1.1.7).

[News][2021c]

2.18 Kazakhstan

2.18.1 Prioritization

On February 1, 2021, the vaccination with the Russian Sputnik V vaccine began with a supply of 20,000 units. The vaccination will be carried out in stages, taking into account the supply of the vaccine. The vulnerable groups of the population at a high risk of infection and spread of coronavirus will be vaccinated first. Next, the rest of the population will be vaccinated.

In detail, the following groups of the population will be vaccinated at the first stage:

- healthcare workers of infectious diseases hospitals
- ambulance
- intensive care units
- emergency hospitals
- hospital admissions
- sanitary and epidemiological service

The second stage of vaccination will include:

- teachers of secondary schools and universities
- other healthcare workers

The third stage of vaccination will include:

- teachers of boarding schools and preschool institutions
- students
- persons with chronic diseases

Additional vulnerable sections of the population, such as employees of the Ministry of Emergency Situations, Ministry of Internal Affairs, Ministry of Defense, National Security Committee, State Security Service, and others, will be vaccinated in the future. If the vaccinations are registered and available on the market, it is predicted that around six million individuals will be immunised by the end of the year.

[CABAR][2021] [Xinhuanet][2021]

2.18.2 Approved Vaccines

Approved Vaccines in Kazakhstan

- Sputnik V vaccine
• QazVac vaccine - No clear evidence of the start of usage of this locally manufactured vaccine

Agency (2021a)

2.18.3 VACCINE ADMINISTRATION AND DISTRIBUTION

Kazakhstan citizens will receive free vaccination within the guaranteed volume of free healthcare. According to the Ministry of Health, about $118.5 million will be allocated from the budget to vaccinate Kazakhstan citizens against coronavirus.

Gavi (2021) Egov (2021)

Vaccination Rate

• A cumulative of 4.71 million doses have been administered in the country
• 9.55% of the population has been fully vaccinated, while 15.55% has gotten at least one dose of immunisation. At least one dose of vaccine has been administered to a total of 2.92 million persons.

Reuters (2021i)

• According to the platform OurWorldinData, the number of administered coronavirus vaccine doses per 100 people in Kazakhstan is 25.10 (as of June 24, 2021). This is considered as a single dosage, and depending on the dose regimen, it may or may not equal the total number of people vaccinated (e.g. people receive multiple doses). This is high compared to neighboring countries like Uzbekistan (8.05 per 100 people) and Kyrgyzstan (2.66 per 100 people)

in Data (2020)

Vaccination Governance: Vaccination of the population is carried out at the vaccination points of territorial medical organizations. Vaccination of a special contingent is carried out at the duty point of the relevant department. In some cases (small population, lack of stationary inoculation room, lack of refrigeration equipment with low temperature), mobile vaccination points or mobile vaccination groups are organized for vaccination.

Vaccination group is formed taking into account the daily load per team at each vaccination point - no more than 60 vaccinations (on-site or mobile - no more than 40 vaccinations).

In this case, 1 vaccination team consists of: 1 doctor, 1 vaccinating nurse and, if necessary, 1 registrar

In rural areas, it is allowed to create a vaccination team consisting of 1 paramedic (in the absence of a doctor), 1 vaccination nurse and, if necessary, 1 registrar.

Vaccination is carried out in the prescribed registration forms with indication of the date of vaccination, type of vaccination (component I or II), manufacturer, serial number, reaction to the vaccine (personal logbook of prophylactic vaccinations against KVI, preventive vaccination card, outpatient medical record, vaccination department of the medical information system).

2.18.4 ACCESSIBILITY AND DIGITAL SOLUTIONS

Electronic vaccination passport is a document certifying the receipt of preventive vaccinations. It contains information about what medications a person has taken, what dose, what days, and what symptoms have occurred after vaccination. After a person receives the coronavirus vaccine, information about him will be available in the eGov mobile application.

2.18.5 GOVERNMENT STRATEGIES AND DECISIONS

In Kazakhstan, the Russian vaccine is produced at the Karaganda Pharmaceutical Complex. More precisely, the substance is imported from Russia, and in Kazakhstan the finished substance is made from that substance. Kazakhstani materials and raw materials are used

2.18.6 MONEY SPENT

• TBD
2.18.7 VARIANT INFO
• TBD

2.19 NEPAL

2.19.1 PRIORITIZATION
Nepal’s Inoculation strategy is contingent on its ability to acquire more doses from other countries. Out of the various vaccines currently approved, Nepal began its vaccination program in the first phase by vaccinating with the Astrazeneca COVISHIELD®.

• (Highest Priority) Nepal began its vaccination program in the first phase by vaccinating front-line medical workers, sanitation workers, and security officers
• (High Priority) After the completion of the initial phase, and as part of the second phase, journalists, diplomats, and government employees have been prioritized
• (High Priority) Nepal has also set age as a criterion for prioritization. Starting from March 7th, the vaccination drive has primarily focused on persons over 55 years of age
• Everyone else will be vaccinated later on, after the completion of the above categories

2.19.2 APPROVED VACCINES
Approved Vaccines in Nepal [Standard (2021a)]
• Oxford/AstraZeneca
• China/Sinopharm
• India/Bharat BioTech Covaxin

2.19.3 VACCINE ADMINISTRATION AND DISTRIBUTION
In the first phase of the program, district hospitals undertook the responsibility of distribution. Owing to a less than ideal rate of vaccination, Nepal then set up primary health centers to aid in the process. Nepal has set up 177 medical centers to carry out the program. [Post (2021c)] In the capital city of Kathmandu itself, over 15 medical facilities, comprising over 32 medical wards have been set up since the second vaccination phase. Eligible persons have been asked to carry their personal identification card, proof of their citizenship, and conclusive proof of their occupation. Education staff like professors and teachers are required to bring their identity cards, whereas vehicular operators are required to bring a letter ascertaining their position as the same. [Times (2021f)]

Vaccination Rate
• As of June 24, 2021, 2.51% (731K) of Nepal’s population is fully vaccinated at a speed of 22,003 doses per day [Reuters (2021k)]
• 11.09 doses administered per 100 people as of June 24, 2021 [Data (2020)]

Vaccination Governance: The Ministry of Health and Population (MoHP) carried out the immunization program in Nepal. Since Nepal has largely depended on vaccine supplies from China, India and the GAVI framework, its government has had to work in close proximity with international leaders and representatives to acquire vaccine jabs [Organization (2021b)]. Nepal has negotiated a deal of 5 million doses of the COVISHIELD® vaccine with the Serum Institute of India which is yet to be finalised. Amidst India’s reduction in vaccine exports to cater to its domestic population in the second wave, many countries including Nepal have suffered. Foreign Minister of Nepal, Mr Pradeep Gyawali has remarked that Nepal has already paid for the second round of 1 million vaccine doses from India, and has been forced to halt its immunization program. [Hindu (2021)]
2.19.4 **Accessibility and Digital Solutions**

As of 9th April 2021, Nepal ran out of the COVISHIELD® vaccine doses. Though the vaccine is free of cost, its distribution has remained limited. Nepal has not been able to meet its immunization goals so far, but with a new resurgence of daily cases, it is said to have started its immunization again with China’s vaccines. [Organization (2021b)] Nepal’s use of technology in fighting the COVID-19 pandemic, and its immunization program has been limited at best. As of 9th April 2021, there is no digital system for vaccination-appointment, and all scheduling and organising is done on-site. Furthermore, Nepal has loosely been tracking the number of doses that it has administered, and has not updated its COVID-19 vaccination data in the last 2 weeks. [for Systems Science & Engineering (2021)]

2.19.5 **Government Strategies and Decisions**

Nepal also became the first country in the Asia-Pacific region to administer vaccines to refugees. As of 24th March, over 700 refugees who are also senior persons have been administered the first dose. [UNHCR (2021)] Nepal financing for the inoculation drive has largely depended on charitable funds from the World-Bank, and vaccination supplies free of cost from China and India. Nepal has been the beneficiary of a $75 million donation from the World Bank, over 800,000 shots of the Sinopharm vaccine from China [Livemint (2021a)], and over 450,000 jabs from India [Livemint (2021b)].

2.19.6 **Money Spent**

- Nepal received $75 million from the World Bank for better “access to safe and effective COVID-19 vaccines and equitable vaccine distribution”. This additional funding “builds on the $29 million for the original COVID-19 Emergency Response and Health Systems Preparedness Project [Bank (2021a)] that was approved in April 2020."

- Here is a rough breakdown of how the fund will be spent [Bank (2021b)]:
  - Most (90%) will be used for purchasing COVID-19 vaccines and deploying them to prioritized populations
  - Rest will be used to support the COVID-19 vaccination effort and procure other COVID-19-related supplies such as diagnostic tests, laboratory equipment and therapeutics

- The Nepalese government has also taken a $250 million concessional loan from the Asian Development Bank (ADB). This is in addition to a $300,000 grant received from ADB to procure medical supplies [Bank (2020a)].

2.19.7 **Variant Info**

- According to Nepal’s Ministry of Health and Population, three variants of the virus have been detected. In 97 percent of the samples, the B.1.617.2 variant was found, while the B.1.617.1 variant was found in the rest.

[Standard (2021b)]

2.20 **Republic of Korea**

2.20.1 **Prioritization**

The priority groups are as follows:

- Healthcare workers
- First responders, contact tracers
- Workers at care facilities for the elderly
- Senior residents
2.20.2 **APPROVED VACCINES**

The Republic of Korea has signed deals to purchase COVID-19 vaccines from the following Approved Vaccines:

- Pfizer-BioNTech
- Moderna (NIAID)
- AstraZeneca-Oxford (AZD1222)
- Johnson & Johnson’s (JNJ-78436735)
- Sputnik V.

2.20.3 **VACCINE ADMINISTRATION AND DISTRIBUTION**

The government of the Republic of Korea started its first wave of vaccinations in February of 2021. Korea has demarcated approximately 250 vaccine centers alongside the tens of thousands of hospitals as facilities that carry out the program. The first group to receive the vaccine were approximately 50,000 frontline COVID-19 healthcare workers throughout February. The next group to receive the vaccine were the first responders, residents, contact tracers, and workers at care facilities for the elderly. Korea plans to immunize the third group, the elderly people over 65, homeless people, and the remainder of the previous group during May & June. From July to November, the government aims to vaccinate the general public with bulk use of the Pfizer-BioNTech and Moderna vaccines to achieve herd immunity by the end of the year. These groups serve as a rough estimate for the government’s ambitious goal of inoculating 70% of its 52,000,000 people.

**Vaccination Rate**

- As of June 24, 2021, 8.82% (4.52M) of Korea’s population is fully vaccinated at a speed of 332,606 doses per day [Reuters(2021)].
- South Korea has vaccinated 36.27 people for every 100 people, as of June 24, 2021, in Data (2020).

**Vaccination Governance:** The government’s ministry of health and welfare is responsible for proper functioning of the program. The ministry of Drug Safety is responsible for testing the safety and efficacy of all the vaccines. The government is implementing a two-track strategy that involves using the COVAX Facility to distribute 10 million doses of vaccination in addition to acquisition of 20 million more from AstraZeneca. The strategy is to have the first and second dosage of COVID-19 vaccine 2 months apart in order to observe potentially negative side effects. The government has also secured 106 million doses as of January 4, 2021, allowing for the full vaccination of 56 million people. It recently decided to exclude people under 30 from the Astrazeneca COVISHIELD drive due to blood clotting concerns. A leading pharmaceutical in South Korea, Huons Global, with the government’s support plans on manufacturing over 100 million doses of the Sputnik V vaccine per month.

2.20.4 **ACCESSIBILITY AND DIGITAL SOLUTIONS**

COVID-19 vaccines for all of South Korea’s 52 million people are free of cost [Healthworld(2021)]. South Korea will issue a ‘green-pass’ to all of its vaccinated residents via a mobile-app to ensure that fully vaccinated people can return to normalcy. The vaccination digital passports are protected via a state of the art blockchain technology to prevent counterfeiting [Reuters(2021)]. The government’s responses to disease control, including vaccinations and a responsive map of the state of COVID-19 in South Korea, are made available through the Coronomap website maintained by the government. [Opengovasia(2020)]

2.20.5 **GOVERNMENT STRATEGIES AND DECISIONS**

South Korea won’t provide its residents the opportunity of choosing a vaccine of their own. The vaccines will be voluntary, however, the government aims to encourage as many people as possible to reach the herd-immunity target. As of now, the government denies any causal relationship between
injuries and the COVID-19 vaccines. It is unclear as of now the extent of customer protection and compensation that will be offered if and when a relationship between the recent deaths and the vaccine is proved. [BBC (2021b)]

2.20.6 MONEY SPENT

- The exact amount of money the South Korean government has spent on vaccine procurement remains undisclosed
- “South Korea’s vaccine rollout has been hampered by global shortages and shipment delays, while the government has also sought to boost immunisation by easing restrictions for people who have been vaccinated.” [Reuters (2021r)]
- US donated 1 million doses of Johnson & Johnson’s (J&J) vaccines to Korea, including 550,000 shots for the South Korean troops [Asia (2021a)]

2.20.7 VARIANT INFO

- All four variant strains (those initially detected in the UK, India, South Africa, and Brazil) are present in Korea. Variant cases are increasing at an alarming rate
- As of May 12, 2021, the rate for estimating the spread of major COVID-19 variants (UK, South African, Brazilian) within South Korea has risen to nearly 25%, nearly double that of last week’s 12.8% [Hankyoreh (2021)]

2.21 FRANCE

2.21.1 PRIORITIZATION

Priority groups for vaccine administration have majorly been divided on the basis of two factors: age and pre existing conditions that increase the vulnerability of patients getting seriously affected by COVID-19. At the beginning phase of vaccine roll out in January, people above the age of 75 or people having pre existing conditions which could lead to serious effects (irrespective of age) were allowed to get vaccinated. Since March the age limit of people allowed to get vaccinated changed to 70 years old which further changed to 55 years old in April 2021 [Solidarités et de la Santé (2021)]. Currently the Priority groups allowed to get vaccinated are as follows:

- People aged 55 and over
- People who are residents in residential facilities for elders or hosted in residential autonomy
- People over 18 years of age with pre existing conditions that can lead to severe form of COVID-19 such as:
  - suffering from multiple chronic pathologies and presenting at least two organ insufficiencies
  - transplanted by allogeneic hematopoietic stem cell transplantation
  - Down’s Syndrome
  - with severe chronic kidney disease, including dialysis patients
  - Cancer
  - Malignant haematological diseases during treatment with chemotherapy
  - People having disabilities in specialised homes or foster homes medicalised
- Residents 60 and over in homes of migrant workers
- Health sector professionals and people working in the healthcare industry like:
  - medical secretaries in town offices and medical assistants
  - professions with "use of title" recognized by various uncoded laws (osteopaths, chiropractors, psychotherapists, psychologists)
  - home help professionals and employees of the private employer working with vulnerable elderly and disabled people (receiving APA or PCH)
2.21.2 Approved Vaccines

Four vaccines have been approved for administration in France [trackvaccines.org](https://trackvaccines.org) (2021):

- Pfizer-BioNTech
- Moderna (NIAID)
- AstraZeneca-Oxford (AZD1222)
- Johnson & Johnson’s (JNJ-78436735)

2.21.3 Vaccine Administration and Distribution

18.3 million doses have been administered till now and the result is 5.03 million people being fully vaccinated in France [in Data](https://in-data.com) (2020). Two distinct logistics circuits were set up to ensure that France’s nursing homes (around 10,000) receive the vaccines with ease, including the Pfizer-BioNTech jabs, which require conditions like storage temperatures of -70 degrees Celsius. The vaccines would be stored in assigned pharmaceutical warehouses before reaching nursing homes and hospitals. [Post](https://www.poste.com) (2020b)

**Vaccination Rate**

- 51 million doses given
- 18.57 million fully vaccinated
- 27.49% of the population fully vaccinated
- Population to vaccine ratio: 75.47 doses administered for every 100 people as of June 24, 2021. [in Data](https://in-data.com) (2020)

**Vaccination Governance:** The government has appointed Professor Alain Fischer, a paediatric immunologist, to lead France’s vaccine plan. The French National Authority of Health has made vaccination rollout and distribution plans recommendations. [France24](https://france24.com) (2020)
2.21.4 ACCESSIBILITY AND DIGITAL SOLUTIONS

France is participating in a month-long trial of an air travel vaccine passport. On Thursday, transport minister Jean-Baptiste Djebbari announced the start of a month-long pilot for Air France passengers (11 March). Passengers traveling to Martinique and Guadeloupe in the French Caribbean will be able to use the International Chamber of Commerce’s (ICC) AOKpass app to verify a COVID-19 immunisation certificate negative test result under the scheme. [Media (2021)] France became the first EU country to test an app-based travel permit that retains negative COVID-19 test results, and vaccination certificates will soon be accepted on flights to Corsica and its offshore territories. [trust.org (2021)]

2.21.5 GOVERNMENT STRATEGIES AND DECISIONS

The French government has stepped up immunisation efforts and developed policies and strategies to protect specific priority groups based on pre-existing conditions and age. The government has implemented laws that prioritise health-care workers, the elderly, and persons with medical disorders that put them at risk of acquiring a severe form of COVID-19 as those who must be vaccinated first. France has announced a multi-stage vaccination policy, with priority given to those who are at risk. The majority of patients who died in France due to COVID-19 (approximately 78 percent) were over 75 years old. They currently occupy 28 percent of ICU beds, making senior citizens the first category at danger from the virus. [statista.com (2021)] French government has consulted private firms like Mckinsey & Company for vaccine distribution strategies, a move which has been heavily criticised. [Times (2021b)] French government has consulted various health professionals and vaccine manufacturers for the plan of action.

2.21.6 MONEY SPENT

- France has set aside 1.5 billion euros ($1.82 billion) from this year’s social security budget to cover the expense of COVID-19 vaccines for all members of its social security system. [Reuters (2020a)]

2.21.7 VARIANT INFO

- According to French Health Minister Olivier Veran, some 20 persons in France have been diagnosed with the B.1.617 strain [Reuters (2021e)]

3 CONCLUSION AND FUTURE SCOPE

The world needs safe, effective COVID-19 vaccine strategies to return to a pre-covid normal situation. The vaccination process is getting adopted in every country across the globe, and there are certain challenges in terms of logistics, distribution, availability, and accessibility of vaccines across various countries. This study aims to help different countries learn from each other to develop and improve their vaccine roll-out plans based on different parameters. This study indicates the various strategies, distribution, and challenges faced in different countries for COVID-19 vaccinations. It also shared the information related to the spread of variants in different parts of the world and how the vaccination rate is curbing the rate of infection spread. We also focused on governance strategies and accessibility of the vaccination information and supply of the same. Vaccinations have been proven helpful to provide herd immunity in certain countries and have not been effective in countries with large populations and a shortage of vaccines. The future version of this study will focus on post-vaccination’s social and economic effects and returning to normalcy.

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REFERENCES

Manuel Adrian Acuna-Zegarra, Saul Diaz-Infante, David Baca-Carrasco, and Daniel Olmos Liceaga. Covid-19 optimal vaccination policies: a modeling study on efficacy, natural and vaccine-induced immunity responses. medRxiv, 2020.

Anadolu Agency. Russia to hold phase 3 of covid-19 vaccine trial abroad, 2020a. URL https://www.aa.com.tr/en/latest-on-coronavirus-outbreak/russia-to-hold-phase-3-of-covid-19-vaccine-trial-abroad/1912694

Anadolu Agency. Kazakhstan’s covid-19 vaccine to be bottled in turkey, 2021a. URL https://www.aa.com.tr/en/asia-pacific/kazhstans-covid-19-vaccine-to-be-bottled-in-turkey/2204040

Anadolu Agency. Turkey: 85% of new covid-19 cases due to uk variant, 2021b. URL https://www.aa.com.tr/en/health/turkey-85-of-new-covid-19-cases-due-to-uk-variant/2206883

Italian Medicines Agency. First aifa report on covid-19 vaccine surveillance, 2020b. URL https://www.aifa.gov.it/en/web/guest/-/primo-rapporto-aifa-sulla-sorveglianza-dei-vaccini-covid-19

Russian News Agency. Russian health ministry expands list of priority coronavirus vaccination groups, 2020c. URL https://tass.com/coronavirus-outbreak-in-china/1197127

Channel News Asia. South korea says 1 million doses of j&j covid-19 vaccines to arrive this week from us, 2021a. URL https://www.channelnewsasia.com/news/asia/south-korea-says-1-million-doses-of-j-j-covid-19-vaccines-to-arrive-this-week-from-us-14914688

Channel News Asia. Covid-19 vaccination begins for land transport sector with jabs to be offered to 80,000 workers, 2021b. URL https://www.channelnewsasia.com/news/singapore/covid-19-vaccination-drive-begins-for-land-transport-workers-lta-14038186

Nikkei Asia. Thai businesses to offer covid shots to wealthy and companies, 2021c. URL https://asia.nikkei.com/Spotlight/Coronavirus/COVID-vaccines/Thai-businesses-to-offer-COVID-shots-to-wealthy-and-companies

Robin Augustin. What’s our covid-19 vaccination game plan, ask mps, 2021. URL https://www.freemalaysiatoday.com/category/nation/2021/01/31/whats-our-covid-19-vaccination-game-plan-ask-mps/

Health Sciences Authority. Suspected vaccine adverse event (vae) online reporting form, 2021a. URL https://eservice.hsa.gov.sg/adr/adr/vaeOnline.do?action=load

South African Health Products Regulatory Authority. Covid-19 vaccines regulatory status update, 2021b. URL https://www.gov.za/sites/default/files/gcis_documents/SAHPRA_COVID-19%20vaccines%20update.pdf

Lindsey R Baden, Hana M El Sahly, Brandon Essink, Karen Kotloff, Sharon Frey, Rick Novak, David Diemert, Stephen A Spector, Nadine Rouphael, C Buddy Creech, et al. Efficacy and safety of the mrna-1273 sars-cov-2 vaccine. New England Journal of Medicine, 384(5):403–416, 2021.

Joseph Bae, Darshan Gandhi, Jil Kothari, Sheshank Shankar, Jonah Bae, Parth Patwa, Rohan Sukumar, Sethuraman TV, Vanessa Yu, Krutika Misra, et al. Challenges in equitable covid-19 vaccine distribution: A roadmap for digital technology solutions. arXiv preprint arXiv:2012.12263, 2020.
Joseph Bae, Rohan Sukumaran, Sheshank Shankar, Anshuman Sharma, Ishaan Singh, Haris Nazir, Colin Kang, Saurish Srivastava, Parth Patwa, Abhishek Singh, et al. Mobile apps prioritizing privacy, efficiency and equity: A decentralized approach to covid-19 vaccination coordination. *arXiv preprint arXiv:2102.09372*, 2021a.

Joseph Bae, Rohan Sukumaran, Sheshank Shankar, Saurish Srivastava, Rohan Iyer, Aryan Mahindra, Qamil Mirza, Maurizio Arseni, Anshuman Sharma, Saras Agrawal, et al. Mit safepaths card (misaca): Augmenting paper based vaccination cards with printed codes. *arXiv preprint arXiv:2101.07931*, 2021b.

The Asian Development Bank. Adb approves $250 million support for nepal’s covid-19 response, 2020a. URL [https://www.adb.org/news/adb-approves-250-million-support-nepals-covid-19-response](https://www.adb.org/news/adb-approves-250-million-support-nepals-covid-19-response).

The World Bank. Egypt: World bank provides us$ 50 million in support of coronavirus emergency response under new fast-track facility, 2020b. URL [https://www.worldbank.org/en/news/press-release/2020/05/17/egypt-world-bank-provides-us-50-million-in-support-of-coronavirus-emergency-response-under-new-fast-track-facility](https://www.worldbank.org/en/news/press-release/2020/05/17/egypt-world-bank-provides-us-50-million-in-support-of-coronavirus-emergency-response-under-new-fast-track-facility).

The World Bank. Nepal: Covid-19 emergency response and health systems preparedness project, 2021a. URL [https://projects.worldbank.org/en/projects-operations/project-detail/P173760](https://projects.worldbank.org/en/projects-operations/project-detail/P173760).

The World Bank. Nepal receives $75 million for covid-19 vaccines and stronger response to pandemic, 2021b. URL [https://www.worldbank.org/en/news/press-release/2021/03/18/nepal-receives-75-million-for-covid-19-vaccines-and-stronger-response-to-pandemic](https://www.worldbank.org/en/news/press-release/2021/03/18/nepal-receives-75-million-for-covid-19-vaccines-and-stronger-response-to-pandemic).

BBC. Covid passports: What are different countries planning?, 2021a. URL [https://www.bbc.com/news/world-europe-56522408](https://www.bbc.com/news/world-europe-56522408).

BBC. South korea coronavirus: Pm aims for 'herd immunity by autumn', 2021b. URL [https://www.bbc.com/news/world-asia-56156234](https://www.bbc.com/news/world-asia-56156234).

BBC. Coronavirus: 'double mutant' covid variant found in india, 2021c. URL [https://www.bbc.com/news/world-asia-india-56507988](https://www.bbc.com/news/world-asia-india-56507988).

BeijingReview. China’s covid vaccines to be produced, distributed under strict management, 2020. URL [http://www bjreview com/Nation/202012/t20201231_800231511 html](http://www bjreview com/Nation/202012/t20201231_800231511 html).

Bernama. Dr adham: Registration for covid-19 vaccination to open soon, 2021. URL [https://www.nst.com.my/news/nation/2021/01/657602/dr-adham-registration-covid-19-vaccination-open-soon](https://www.nst.com.my/news/nation/2021/01/657602/dr-adham-registration-covid-19-vaccination-open-soon).

Bloomberg. A bitter vaccine history means hurdles for japan’s covid fight, 2020. URL [https://www.bloomberg.com/news/articles/2020-12-22/a-bitter-vaccine-history-means-hurdles-for-japan-s-covid-fight](https://www.bloomberg.com/news/articles/2020-12-22/a-bitter-vaccine-history-means-hurdles-for-japan-s-covid-fight).

Bloomberg. Malaysia recovery seen driven by tech upcycle, vaccines, 2021. URL [https://www.bloomberg.com/news/articles/2021-04-26/malaysia-recovery-to-be-driven-by-tech-upcycle-vaccines-jobs](https://www.bloomberg.com/news/articles/2021-04-26/malaysia-recovery-to-be-driven-by-tech-upcycle-vaccines-jobs).

Health Board. Republic of estonia, 2021. URL [https://terviseamet ee/en](https://terviseamet ee/en).

Hong Kong Business. Hong kong budget 2021: $8.4b for covid-19 vaccines; no new taxes, 2021. URL [https://hongkongbusiness.hk/economy/news/hong-kong-budget-2021-84b-covid-19-vaccines-no-new-taxes](https://hongkongbusiness.hk/economy/news/hong-kong-budget-2021-84b-covid-19-vaccines-no-new-taxes).

BusinessToday. China begins covid-19 vaccination drive; over 73,000 receive first shot, 2021. URL [https://www.businesstoday.in/current/economy-politics/china-begins-covid-19-vaccination-drive-over-73000-receive-first-shot/story/426896.html](https://www.businesstoday.in/current/economy-politics/china-begins-covid-19-vaccination-drive-over-73000-receive-first-shot/story/426896.html).
CABAR. What should kazakhstan citizens know about the upcoming covid-19 vaccination?, 2021. URL https://cabar.asia/en/what-should-kazakhstan-citizens-know-about-the-upcoming-covid-19-vaccination

Statistics Canada. Canadian international merchandise trade, january 2021, 2021. URL https://www150.statcan.gc.ca/n1/daily-quotidien/210305/dq210305a-eng.htm

ChinaDaily. Covid-19 vaccine: Answers to frequently asked questions, 2021. URL http://en.nhc.gov.cn/2021-01/c82699.htm

CNA. Malaysia pm muhyiddin to be among the first in country to take covid-19 vaccine, 2020a. URL https://www.channelnewsasia.com/news/asia/6point4-million-doses-astazeneca-coronavirus-vaccine.html

CNA. Malaysia agrees to buy 12.8 million doses of pfizer's covid-19 vaccine, 2020b. URL https://www.channelnewsasia.com/news/asia/malaysia-covid-19-pfizer-vaccine-coronavirus-13651672

CNBC. Malaysia buys astrazeneca covid-19 vaccines, seeks more from china, russia, 2020. URL https://www.cnbc.com/2020/12/22/malaysia-procures-6point4-million-doses-astazeneca-coronavirus-vaccine.html

CNBC. Putin gets a covid vaccine — but the Kremlin refuses to say which one, 2021a. URL https://www.cnbc.com/2021/03/23/putin-to-get-coronavirus-vaccine-russias-vaccine-strategy-in-focus.html

CNBC. Singapore sets aside over $8 billion in 2021 budget for new covid support package, 2021b. URL https://www.cnbc.com/2021/02/16/singapore-announces-2021-government-budget-to-support-covid-recovery.html

CodeBlue. Mysejahtera for covid vaccine registration, reporting side effects: Khairy, 2021. URL https://codeblue.galencentre.org/2021/01/06/mysejahtera-for-covid-vaccine-registration-reporting-side-effects-khairy/

Costruiresalute.it. Vaccini, 2020. URL https://testcovid.costruiresalute.it/

Ministero della Salute. Piano vaccini anti covid-19, 2021. URL http://www.salute.gov.it/imgs/C_17_pubblicazioni_2986_allegato.pdf

Corriere della Sera. Vaccino covid, arcuri: campagna da metà gennaio in padiglioni a forma di primula disegnati da stefano boeri, 2020. URL https://www.corriere.it/cronache/20_dicembre_13_vaccino-covid-arcuri-campagna-meta-gennaio-padiglioni-forma-primula-disegnati-stefano-boeri-1478a0b6-3d2e-11eb-943e-95a1c9e91e01.shtml

Ministère des Solidarités et de la Santé. La stratégie vaccinale et la liste des publics prioritaires, 2020. URL https://www.sante.fr/cf/centres-vaccination-covid.html

Ministère des Solidarités et de la Santé. Trouver un lieu de vaccination covid-19, 2021. URL https://www.epicentro.iss.it/vaccini/covid-19-piano-vaccinazione

Istituto Superiore di Sanità. Piano nazionale di vaccinazione covid-19, 2020. URL https://www.epicentro.iss.it/vaccini/covid-19-piano-vaccinazione

Egov. Vaccination against the coronavirus infection, 2021. URL https://egov.kz/cms/kk/articles/health-care/Vakcinaciya-protiv-koronavirusnoy-infekcii-

Raches Ella, Siddharth Reddy, Harsh Jogdand, Vamshi Sarangi, Brunda Ganneru, Sai Prasad, Dipankar Das, Dugyala Raju, Usha Praturi, Gajanan Sapkal, et al. Safety and immunogenicity clinical trial of an inactivated sars-cov-2 vaccine, bbv152 (a phase 2, double-blind, randomised controlled trial) and the persistence of immune responses from a phase 1 follow-up report. medRxiv, 2020.
EuroNews. Italy’s 2021 budget attempts to cushion covid-19 financial impact, 2020. URL https://www.euronews.com/2020/11/18/italy-s-2021-budget-attempts-to-cushion-covid-19-financial-impact

Euronews. The pros and cons of vaccine passports: Russian foreign minister latest to voice concerns, 2021. URL https://www.euronews.com/travel/2021/03/23/the-pros-and-cons-of-vaccine-passports-russian-foreign-minister-latest-to-voice-concerns

EuropeanPharmaceuticalReview. Japan has pre-ordered covid-19 vaccine doses for more than four times its population, 2021. URL https://www.europeanpharmaceuticalreview.com/news/140133/japan-has-pre-ordered-covid-19-vaccine-doses-for-more-than-four-times-its-population-says-report/

The Indian Express. Canadian researchers release first image of b.1.1.7 variant of covid-19, exude faith in existing vaccines, 2021. URL https://indianexpress.com/article/coronavirus/ubc-researches-release-first-image-b-1-1-7-variant-covid-19-faith-vaccines-7301544/

Folkehelseinstituttet. Covid-19 vaksinasjonsprogrammet, 2020. URL https://www.fhi.no/contentassets/1af4c6e655014a738055c79b72396de8/vedlegg/mulige-kriterier-for-a-prioritere-mellom-helsepersonellgrupper-i-speialisthelsetjenesten.pdf

National Institute for Communicable Diseases. Covid-19 vaccine rollout strategy faq, 2021. URL https://www.nicd.ac.za/covid-19-vaccine-rollout-strategy-faq/

The Special Committee for Ensuring Access to COVID-19 Vaccine Supply (JKJA V). Explained: When will i be in line for a covid-19 vaccination in germany?, 2021a. URL https://www.thelocal.de/20210309/explained-when-will-i-be-in-line-for-a-vaccination-in-germany/

The Special Committee for Ensuring Access to COVID-19 Vaccine Supply (JKJA V). National covid-19 immunisation programme. location of vaccination centres, 2021b. URL https://www.vaksincovid.gov.my/pdf/National_COVID-19_Immunisation_Programme_English.pdf#page=21

Johns Hopkins University Center for Systems Science and Engineering. Covid-19 data repository by the center for systems science and engineering (csse) at johns hopkins university, 2021. URL https://github.com/CSSEGISandData/COVID-19

France24. Experts welcome france’s covid-19 vaccine strategy – with caveats, 2020. URL https://www.france24.com/en/europe/20201208-experts-welcome-france-s-covid-19-vaccine-strategy-\0T1\textendash-with-caveats

Gavi. Covax vaccine roll-out, 2021. URL https://www.gavi.org/covax-vaccine-roll-out

Abantika Ghosh. What is cowin and what you need to register on the app for covid vaccine shot, 2021. URL https://theprint.in/health/what-is-cowin-and-what-you-need-to-register-on-the-app-for-covid-vaccine-shot/579307/

GlobalTimes. China joins covax, to provide vaccines to developing countries first, 2020. URL https://www.globaltimes.cn/content/1202940.shtml

Estonian Government. Frequently asked questions, 2021a. URL https://www.kriis.ee/en/korduma-kippuvad-kysimused

Hong Kong Special Administrative Region Government. Covid-19 vaccination programme, 2021b. URL https://www.covidvaccine.gov.hk/en/programme

Hong Kong Special Administrative Region Government. About the vaccines, 2021c. URL https://www.covidvaccine.gov.hk/en/vaccine
GovtofCanada. Covid-19 vaccine: Guidance on the prioritization of initial doses, 2021a. URL https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-on-immunization-naci/guidance-prioritization-initial-doses-covid-19-vaccines.html

GovtofCanada. Covid-19: Preliminary guidance on key populations for early immunization, 2021b. URL https://www.canada.ca/en/public-health/services/immunization/national-advisory-committee-on-immunization-naci/guidance-key-populations-early-covid-19-immunization.html

GovtofCanada. Covid-19 immunization plan, 2021c. URL https://www2.gov.bc.ca/gov/content/safety/emergency-preparedness-response-recovery/covid-19-provincial-support/vaccines

GovtofCanada. Procuring vaccines for covid-19, 2021d. URL https://www.canada.ca/en/public-services-procurement/services/procuring-vaccines-covid19.html

GovtofIndia. Covid-19 vaccines operational guidelines, 2020. URL https://www.mohfw.gov.in/pdf/COVID19Vaccine0G111Chapter16.pdf

GovtofTurkey. Covid-19 aşısı kayıt ve bildirim, 2021a. URL https://covid19asi.saglik.gov.tr/TR-77821/covid-19-asisi-kayit-ve-bildirim.html

GovtofTurkey. Aşı takip sistemi, 2021b. URL https://covid19asi.saglik.gov.tr/TR-77807/asi-takip-sistemi.html

Guardtime. Vaccineguard, 2021. URL https://guardtime.com/vaccineguard

The Hankyoreh. 1 in 4 new covid-19 cases in s. korea are variant cases, 2021. URL http://english.hani.co.kr/arti/english_edition/e_national/994909.html

Health and Welfare Information Systems Centre. Patient portal, 2021. URL https://www.digilugu.ee/login?locale=en

Healthworld. South korea to vaccine its 52 million people for free, 2021. URL https://health.economictimes.indiatimes.com/news/industry/south-korea-to-vaccine-its-52-million-people-for-free/80213666

The Hindu. Nepal runs out of vaccine, waiting for shipment from india, 2021. URL https://www.thehindu.com/news/national/nepal-runs-out-of-vaccine-waiting-for-shipment-from-india/article34275648.ece

PBS News Hour. South africa to spend $712 million on mass vaccination drive, 2021. URL https://www.pbs.org/newshour/world/south-africa-to-spend-712-million-on-mass-vaccination-drive

Our World in Data. Our world in data, 2020. URL https://ourworldindata.org/our-grapher/daily-covid-vaccination-doses-per-capita

Egypt Independent. Health minister signs protocol to vaccinate 2 million egyptians for free, 2021. URL https://egyptindependent.com/health-minister-signs-protocol-to-vaccinate-2-million-egyptians-for-free/

Shainoor J Ismail, Joanne M Langley, Tara M Harris, Bryna F Warshawsky, Shalini Desai, and Mahnaz FarhangMehr. Canada’s national advisory committee on immunization (naci): evidence-based decision-making on vaccines and immunization. Vaccine, 28:A58–A63, 2010.

Shainoor J Ismail, Kendra Hardy, Matthew C Tunis, Kelsey Young, Nadine Sicard, and Caroline Quach. A framework for the systematic consideration of ethics, equity, feasibility, and acceptability in vaccine program recommendations. Vaccine, 38(36):5861–5876, 2020.
Mangalakumari Jeyanathan, Sam Afkhami, Fiona Smaill, Matthew S Miller, Brian D Lichty, and Zhou Xing. Immunological considerations for covid-19 vaccine strategies. *Nature Reviews Immunology*, 20(10):615–632, 2020.

The Wall Street Journal. How a canadian province contained the brazilian covid-19 variant, 2021. URL https://www.wsj.com/articles/how-a-canadian-province-contained-the-brazilian-covid-19-variant-11620641317

Jerome H Kim, Florian Marks, and John D Clemens. Looking beyond covid-19 vaccine phase 3 trials. *Nature medicine*, pp. 1–7, 2021.

Maria Deloria Knoll and Chizoba Wonodi. Oxford–astrazeneca covid-19 vaccine efficacy. *The Lancet*, 397(10269):72–74, 2021.

Elverum Kommune. Information about coronavirus vaccine, 2020. URL https://www.elverum.kommune.no/om-oss/aktuelt/information-about-coronavirus-vaccine

Faye Kwan. Mysejahtera to register vaccination data soon, 2021. URL https://www.freemalaysiatoday.com/category/nation/2021/01/25/mysejahtera-to-register-vaccination-data-soon/

Mette Larsen. Covid-19 vaccine is not mandatory in malaysia, 2021. URL https://scandasia.com/covid-19-vaccine-is-not-mandatory-in-malaysia/

Livemint. Nepal to receive 100,000 more covid vaccine doses from india, 2021b. URL https://www.livemint.com/news/world/nepal-to-receive-100-000-more-covid-vaccine-doses-from-india-11616840756054.html

Shabir A Madhi, Vicky Baillie, Clare L Cutland, Merryn Voysey, Anthonet L Koen, Lee Fairlie, Sherman D Padayachee, Keertan Dheda, Shaun L Barnabas, Qasim Ebrahim Bhorat, et al. Safety and efficacy of the chadox1 ncov-19 (azd1222) covid-19 vaccine against the b. 1.351 variant in south africa. *MedRxiv*, 2021.

HIMSS Media. France to trial digital vaccine passport scheme, 2021. URL https://www.healthcareitnews.com/news/emea/france-trial-digital-vaccine-passport-scheme.

Melinda C Mills and David Salisbury. The challenges of distributing covid-19 vaccinations. *EClinicalMedicine*, 31, 2021.

Mint. New covid strain in singapore: What we know so far about b.1.617 variant affecting children, 2021. URL https://www.livemint.com/science/health/new-covid-strain-in-singapore-what-we-know-so-far-about-b-1-617-variant-affecting-children-11621358293334.html

Arab News. Covid-19: Egypt identifies next 10 days as dangerous for spread, urges caution, 2021a. URL https://www.arabnews.com/node/1853541/middle-east

CTV News. Canada spent $24m on covid-19 vaccines received in january: Statcan, 2021b. URL https://www.ctvnews.ca/health/coronavirus/canada-spent-24m-on-covid-19-vaccines-received-in-january-statcan-1.5335083

ERR News. Lanno: Rising infection rate has moved from north to south estonia, 2021c. URL https://news.err.ee/1608202870/lanno-rising-infection-rate-has-moved-from-north-to-south-estonia

ERR News. Estonia looking to donate 800,000 coronavirus vaccines, 2021d. URL https://news.err.ee/1608233595/estonia-looking-to-donate-800-000-coronavirus-vaccines
Kyodo News. Japan speeds up covid vaccine rollout for elderly amid virus surge, 2021e. URL https://english.kyodonews.net/news/2021/05/d64017a7b6ea-japan-speeds-up-covid-vaccine-rollout-for-elderly-amid-virus-surge.html

Kyodo News. Japan speeds up covid vaccine rollout for elderly amid virus surge, 2021f. URL https://english.kyodonews.net/news/2021/05/d64017a7b6ea-japan-speeds-up-covid-vaccine-rollout-for-elderly-amid-virus-surge.html

VOA News. Two highly contagious coronavirus variants appear in south africa, 2021g. URL https://www.voanews.com/covid-19-pandemic/two-highly-contagious-coronavirus-variants-appear-south-africa

News-Medical.Net. New n501 sars-cov-2 mutation may have been circulating in italy since august 2020, 2020. URL https://www.news-medical.net/news/20210113/New-N501-SARS-CoV-2-mutation-may-have-been-circulating-in-Italy-since-August-2020.aspx

News24. Treasury to spend r19.3bn buying covid-19 vaccines, 2021. URL https://www.news24.com/fin24/economy/treasury-to-spend-r193bn-buying-covid-19-vaccines-20210224

Asia Nikkei. Thailand, vietnam and cambodia hit covid variants with iron fist, 2021. URL https://asia.nikkei.com/Spotlight/Coronavirus/Thailand-Vietnam-and-Cambodia-hit-COVID-variants-with-iron-fist

The Local Norway. Several cases of new covid-19 variant detected in norway, 2021. URL https://www.thelocal.no/20210218/several-cases-of-new-covid-19-variant-detected-in-norway/

Danish-Thai Chamber of Commerce. Covid vaccine distribution plans for thailand, 2021. URL https://dancham.or.th/covid-vaccine-distribution-plans-for-thailand/

Ministry of Health. Need to know: Guidance on storage, distribution and use of covid-19 vaccines, 2021a. URL https://ncov.moh.gov.vn/vi/web/guest/-/6847426-1892

Ministry of Health. Ministry of health distributes vaccine covid-19 phase 2, 2021b. URL https://ncov.moh.gov.vn/vi/web/guest/-/6851640-33

Ministry of Health. The government added 502.9 billion vnd for covid-19 prevention and control, 2021c. URL https://ncov.moh.gov.vn/vi/web/guest/-/6851640-30

The Times of India. Chinese covid-19 vaccine maker gets $500 million funding boost, 2020. URL https://timesofindia.indiatimes.com/world/china/chinese-covid-19-vaccine-maker-gets-500-million-funding-boost/articleshow/79606524.cms

Times of India. New vietnam coronavirus variant: What we know so far and why we need to be careful, 2021. URL https://timesofindia.indiatimes.com/life-style/health-fitness/health-news/new-vietnam-coronavirus-covid-variant-what-we-know-so-far-and-why-we-need-to-be-careful/articleshow/83096223.cms

Prime Minister’s Office of Malaysia Official Website. Covid-19 vaccine to be given free to malaysians – pm muhyiddin, 2020. URL https://www.pmo.gov.my/2020/11/covid-19-vaccine-to-be-given-free-to-malaysians-pm-muhhyiddin/

Norwegian Institute of Public Health. Development and approval of coronavirus vaccine, 2021a. URL https://www.fhi.no/en/id/vaccines/coronavirus-immunisation-programme/development-of-covid-19-vaccine/
Norwegian Institute of Public Health. Astrazeneca vaccine still on hold in norway, 2021b. URL [https://www.fhi.no/en/news/2021/fortsatt-pause-for-astrazeneca-vaksinen-i-norge/](https://www.fhi.no/en/news/2021/fortsatt-pause-for-astrazeneca-vaksinen-i-norge/)

Norwegian Institute of Public Health. Norwegian institute of public health, 2021c. URL [https://www.fhi.no/en/](https://www.fhi.no/en/)

Norwegian Institute of Public Health. Norwegian institute of public health’s recommendation about astrazeneca vaccine, 2021d. URL [https://www.fhi.no/en/news/2021/astrazeneca-vaccine-removed-from-coronavirus-immunisation-programme-in-norw/](https://www.fhi.no/en/news/2021/astrazeneca-vaccine-removed-from-coronavirus-immunisation-programme-in-norw/)

National Academies of Sciences Engineering, Medicine, et al. Framework for equitable allocation of covid-19 vaccine. *The National Academies Press*, 2020.

Ministry of Social Affairs. Home site, 2021. URL [https://www.sm.see/en](https://www.sm.see/en)

Government of South Africa. Covid-19 coronavirus vaccine strategy, 2021. URL [https://www.gov.za/covid-19/vaccine/strategy](https://www.gov.za/covid-19/vaccine/strategy)

The Government Public Relations Department of Thailand. The government public relations department, 2021. URL [https://thailand.prd.go.th/ewt_news.php?nid=10847](https://thailand.prd.go.th/ewt_news.php?nid=10847)

Govt of Turkey. Covid-19 aşısı temin ve dağıtım süreçleri, 2021. URL [https://covid19asi.saglik.gov.tr/TR-77822/covid-19-asisi-temin-ve-dagitim-sureci.html](https://covid19asi.saglik.gov.tr/TR-77822/covid-19-asisi-temin-ve-dagitim-sureci.html)

The Star Online. Pharmaniaga to distribute covid-19 vaccines efficiently, prioritise safety aspects, says group md, 2020. URL [https://www.thestar.com.my/business-news/2020/12/28/pharmaniaga-set-to-distribute-vaccines-efficiently-prioritising-safety-aspects](https://www.thestar.com.my/business-news/2020/12/28/pharmaniaga-set-to-distribute-vaccines-efficiently-prioritising-safety-aspects)

OpenGovAsia. South korea looks to tech to combat covid-19, 2020. URL [https://opengovasia.com/south-korea-looks-to-tech-to-combat-covid-19/](https://opengovasia.com/south-korea-looks-to-tech-to-combat-covid-19/)

opengovasia.com. Vietnam launches health app to manage covid-19, 2020. URL [https://opengovasia.com/vietnam-launches-health-app-to-manage-covid-19/](https://opengovasia.com/vietnam-launches-health-app-to-manage-covid-19/)

World Health Organization. 854 400 covid-19 vaccine doses shipped by covax facility to egypt, 2021a. URL [https://www.emro.who.int/media/news/854-400-covid-19-vaccine-doses-shipped-by-covax-to-egypt.html](https://www.emro.who.int/media/news/854-400-covid-19-vaccine-doses-shipped-by-covax-to-egypt.html)

World Health Organization. Covax reaches over 100 economies, 42 days after first international delivery, 2021b. URL [https://www.who.int/news/item/08-04-2021-covax-reaches-over-100-economies-42-days-after-first-international-delivery](https://www.who.int/news/item/08-04-2021-covax-reaches-over-100-economies-42-days-after-first-international-delivery)

World Health Organization. 172 countries and multiple candidate vaccines engaged in covid-19 vaccine global access facility, 2021c. URL [https://www.who.int/news/item/24-08-2020-172-countries-and-multiple-candidate-vaccines-engaged-in-covid-19-vaccine-global-access-facility](https://www.who.int/news/item/24-08-2020-172-countries-and-multiple-candidate-vaccines-engaged-in-covid-19-vaccine-global-access-facility)

Govind Persad, Monica E Peek, and Ezekiel J Emanuel. Fairly prioritizing groups for access to covid-19 vaccines. *Jama*, 324(16):1601–1602, 2020.

Diyana Pfordten. Interactive: When to expect your covid-19 vaccine shots, and everything else you need to know about malaysia’s vaccination programme, 2021. URL [https://www.thestar.com.my/news/nation/2021/01/30/interactive-when-to-expect-your-covid-19-vaccine-shots-and-everything-else-you-need-to-know-about-malayisas-vaccination-programme](https://www.thestar.com.my/news/nation/2021/01/30/interactive-when-to-expect-your-covid-19-vaccine-shots-and-everything-else-you-need-to-know-about-malayisas-vaccination-programme)

Mahendra Piraveenan, Shailendra Sawleshwarkar, Michael Walsh, Iryna Zablotska, Samit Bhatcharyya, Habib Hassan Farooqui, Tarun Bhattacharyya, Anup Karan, Manoj Murhekar, Sanjay Zodpey, et al. Optimal governance and implementation of vaccination programs to contain the covid-19 pandemic. *arXiv preprint arXiv:2011.06455*, 2020.
Fernando P Polack, Stephen J Thomas, Nicholas Kitchin, Judith Absalon, Alejandra Gurtman, Stephen Lockhart, John L. Perez, Gonzalo Pérez Marc, Edson D. Moreira, Cristiano Zerbini, et al. Safety and efficacy of the bnt162b2 mrna covid-19 vaccine. *New England Journal of Medicine*, 383(27):2603–2615, 2020.

COVID-19 South African Online Portal. Vaccine news, updates & information portal, 2021. URL https://www.gov.za/covid-19/vaccine/strategy

Bangkok Post. B6bn covid vaccine budget, 2020a. URL https://www.bangkokpost.com/thailand/general/2021231/b6bn-covid-vaccine-budget

Bangkok Post. Govt to launch ‘health wallet’ app for covid-19 vaccine registration, 2021a. URL https://www.bangkokpost.com/thailand/general/2093951/govt-to-launch-health-wallet-app-for-covid-19-vaccine-registration

Financial Post. How france will distribute covid-19 vaccines, 2020b. URL https://www.financialpost.com/pmn/business-pmn/how-france-will-distribute-covid-19-vaccines-2

South China Morning Post. Coronavirus: mutated variant from india found in 10 hong kong covid-19 cases, 2021b. URL https://www.scmp.com/news/hong-kong/health-environment/article/3131755/coronavirus-least-10-previously-confirmed-hong

The Kathmandu Post. Primary health centres to administer covid-19 vaccine to expedite first phase, 2021c. URL https://kathmandupost.com/health/2021/01/31/primary-health-centres-to-administer-covid-19-vaccine-to-expedite-first-phase

The Print. ‘double mutant, triple mutant, bengal lineage’ — covid variants driving india surge decoded, 2021. URL https://theprint.in/science/double-mutant-triple-mutant-bengal-lineage-covid-variants-driving-india-surge-decoded/643766/

La Repubblica. Domande e risposte sul vaccino. sicurezza, efficacia ed effetti collaterali, le 10 cose da sapere, 2020. URL https://www.repubblica.it/cronaca/2020/12/28/news/domande_e_risposte_Il_vaccino_ai_raggi_x_e_l_italia_covid-free_speranza_d_autunno-280245263/

Reuters. France says covid-19 vaccine will be free for all, 2020a. URL https://www.reuters.com/article/us-health-coronavirus-vaccination-france-says-vaccines-will-be-free-for-all-757123554

Reuters. Norway pledges $1 billion to vaccines against covid-19, other diseases, 2020b. URL https://www.reuters.com/article/us-health-coronavirus-eu-norway-idUSKBN22G1NZ

Reuters. Moscow rolls out sputnik v covid-19 vaccine to most exposed groups, 2020c. URL https://www.reuters.com/article/health-coronavirus-russia-vaccination/moscow-rolls-out-sputnik-v-covid-19-vaccine-to-most-exposed-groups-idINKBN28F09G

Reuters. Egypt begins vaccine rollout to wider population, 2021a. URL https://www.reuters.com/article/uk-health-coronavirus-egypt-vaccine-egypt-idUSKCNZ2W15U

Reuters. Reuters covid-19 tracker, 2021b. URL https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/egypt/

Reuters. Reuters covid-19 tracker, 2021c. URL https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/estonia/
Vaccination Worldwide: Strategies, Distribution and Challenges

Reuters. World coronavirus tracker and maps, 2021d. URL https://graphics.reuters.com/world-coronavirus-tracker-and-maps/vaccination-rollout-and-access/

Reuters. Around 20 people in france detected with indian covid variant -health minister, 2021e. URL https://www.reuters.com/world/europe/around-20-people-france-detected-with-indian-covid-variant-health-minister-2021-05-10/

Reuters. Berlin earmarks 9 billion euros to buy covid-19 shots for europeans, 2021f. URL https://www.reuters.com/article/us-health-coronavirus-germany-vaccines-idUSKBN2A91QI

Reuters. Russia approves its third covid-19 vaccine, covivac, 2021o. URL https://www.reuters.com/article/us-health-coronavirus-russia-vaccine/russia-approves-its-third-covid-19-vaccine-covivac-idUSKBN2AK07H

Reuters. Russia approves its third covid-19 vaccine, covivac, 2021o. URL https://www.reuters.com/article/us-health-coronavirus-russia-vaccine/russia-approves-its-third-covid-19-vaccine-covivac-idUSKBN2AK07H

Reuters. South korea to issue blockchain-protected digital ‘vaccine passports’, 2021q. URL https://www.reuters.com/article/us-health-coronavirus-southkorea-idUSKBN2B043W

Reuters. S.korea says 81% of elderly signed up for covid-19 vaccination, 2021r. URL https://news.yahoo.com/korea-says-81-elderly-signed-084723659.html

Reuters. Reuters covid-19 tracker, 2021g. URL https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/hong-kong/

Reuters. Reuters covid-19 tracker, 2021h. URL https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/italy/

Reuters. Reuters covid-19 tracker, 2021i. URL https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/kazakhstan/

Reuters. Malaysia reports first case of indian covid-19 variant, 2021j. URL https://www.reuters.com/world/india/malaysia-reports-first-case-indian-covid-19-variant-2021-05-02/

Reuters. Reuters covid-19 tracker, 2021k. URL https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/nepal/

Reuters. Reuters covid-19 tracker, 2021l. URL https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/norway/

Reuters. Russian watchdog denies report on first cases of indian covid variant, 2021m. URL https://www.reuters.com/world/russia-records-first-cases-indian-covid-variant-kommersant-2021-05-13/

Reuters. Reuters covid-19 tracker, 2021n. URL https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/russia/

Reuters. Reuters covid-19 tracker, 2021p. URL https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/south-africa/

Reuters. Reuters covid-19 tracker, 2021t. URL https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/singapore/
Vaccination Worldwide: Strategies, Distribution and Challenges

Reuters. Reuters covid-19 tracker, 2021u. [URL](https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/thailand/)

Reuters. Thailand defends decision not to join covax vaccine alliance, 2021v. [URL](https://www.reuters.com/article/us-health-coronavirus-thailand-idUSKBN2AE0C2)

Reuters. B6bn covid vaccine budget, 2021w. [URL](https://www.reuters.com/world/asia-pacific/thailand-sees-first-local-cases-indian-covid-19-variant-2021-05-21)

Reuters. Turkey to procure 105 million doses of covid-19 vaccines by end-april: Sabah, 2021x. [URL](https://news.yahoo.com/turkey-procure-105-million-doses-142748082.html)

Reuters. Vietnam to set up $1.1 bln covid-19 vaccine fund, 2021y. [URL](https://www.reuters.com/world/asia-pacific/vietnam-set-up-11-bln-covid-19-vaccine-fund-2021-05-20)

Reuters. Reuters covid-19 tracker, 2021z. [URL](https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/vietnam/)

Ranjit Sah, Asmita Priyadarshini Khatiwada, Sunil Shrestha, K.C. Bhuvan, Ruchi Tiwari, Ranjan K. Mohapatra, Kuldeep Dhama, and Alfonso J. Rodriguez-Morales. Covid-19 vaccination campaign in nepal, emerging uk variant and futuristic vaccination strategies to combat the ongoing pandemic. *Travel Medicine and Infectious Disease*, 41:102037, 2021. [ISSN](1477-8939). [doi](https://doi.org/10.1016/j.tmaid.2021.102037). [URL](https://www.sciencedirect.com/science/article/pii/S1477893921000788)

Jyoti Prakash Sahoo, Sudhanya Nath, Lipi Ghosh, and Kailash Chandra Samal. Concepts of immunity and recent immunization programme against covid-19 in india. *Biotica Research Today*, 3 (2):103–106, 2021.

Zunaira Saieed. Pharmaniaga to supply vaccines to private sector, 2021. [URL](https://www.thestar.com.my/business/business-news/2021/02/03/pharmaniaga-to-supply-vaccines-to-private-sector)

Malik Sallam. Covid-19 vaccine hesitancy worldwide: A concise systematic review of vaccine acceptance rates. *Vaccines*, 9(2):160, 2021.

Sputnikvaccine.com. Russia is the most trusted vaccine producer alongside the us, with sputnik v being the most recognizable vaccine, a yougov poll shows, 2021. [URL](https://sputnikvaccine.com/newsroom/pressreleases/russia-is-the-most-trusted-vaccine-producer-alongside-the-us-with-sputnik-v-being-the-most-recogniza/)

Reuters Staff. Malaysia buys additional 12.2 million doses of pfizer-biontech covid-19 vaccine, 2021. [URL](https://www.reuters.com/article/us-health-coronavirus-malaysia-vaccine-idUSKBN29G0AA)

Business Standard. Nepal gives emergency use approval to bharat biotech’s covid-19 vaccine, 2021a. [URL](https://www.business-standard.com/article/current-affairs/nepal-gives-emergency-use-approval-to-bharat-biotech-s-covid-19-vaccine-121032000400_1.html)

Business Standard. Nepal confirms presence of third b.1.617.2 variant of coronavirus, 2021b. [URL](https://www.business-standard.com/article/current-affairs/nepal-confirms-presence-of-third-b-1-617-2-variant-of-coronavirus-12105190034_1.html)
statista.com. Cumulative number of people who received one or two doses of vaccines against the coronavirus (covid-19) in france from december 27, 2020, to may 23, 2021. URL https://www.statista.com/statistics/1195620/vaccines-again-covid19-france/

Egyptian Streets. What you need to know: Egypt’s vaccine distribution plan, 2021. URL https://egyptianstreets.com/2021/01/08/what-you-need-to-know-egypts-vaccine-distribution-plan/

Bhekisisa Team. Sa’s first j&j jabs could arrive next week. here’s what our roll-out plan looks like, 2021. URL https://bhekisisa.org/health-news-south-africa/2021-02-10-what-does-sas-new-vaccine-roll-out-plan-look-like-heres-what-we-do-dont-know/.

TheJapanTimes. Reservations, gyms and thousands of freezers: Japan’s vaccine rollout takes shape, 2020. URL https://www.japantimes.co.jp/news/2020/12/10/national/science-health/japan-vaccine-rollout-plans/.

TheJapanTimes. Japan to study cases of people infected after coronavirus vaccination, 2021. URL https://www.japantimes.co.jp/news/2021/01/18/national/japan-study-coronavirus-vaccination/.

Hindustan Times. Indian covid variant detected in northern italy, 2021a. URL https://www.hindustantimes.com/world-news/indian-covid-variant-detected-in-northern-italy-101619453846951.html.

Hindustan Times. New coronavirus variant ‘eek’ found in japan, lowers vaccine protection, 2021b. URL https://www.hindustantimes.com/world-news/new-coronavirus-variant-eek-found-in-japan-lowers-vaccine-protection-101617601060352.html.

Hindustan Times. Covid-19: China detects 18 cases of double mutant variant from india, 2021c. URL https://www.hindustantimes.com/world-news/china-detects-18-cases-of-double-mutant-covid-19-virus-from-india-101620275569038.html.

The Economic Times. Russia records first cases of covid variant found in india, 2021d. URL https://economictimes.indiatimes.com/news/international/world-news/russia-records-first-cases-of-covid-variant-found-in-india/articleshow/82598450.cms.

The Economic Times. As of march 10, government spent close to rs 1,400 crore on vaccine: Health ministry, 2021e. URL https://economictimes.indiatimes.com/news/politics-and-nation/govt-spent-close-to-1400-cr-on-vaccine/articleshow/81538018.cms.

The Himalayan Times. Kathmandu metropolitan city designates 15 health facilities for covid-19 vaccination drive, 2021f. URL https://thehimalayantimes.com/kathmandu/kathmandu-metropolitan-city-designates-15-health-facilities-for-covid-19-vaccination-drive.

The Moscow Times. Coronavirus in russia: The latest news, 2021g. URL https://www.themoscowtimes.com/2021/02/01/coronavirus-in-russia-the-latest-news-feb-1-a69117.

The New York Times. France hired mckinsey to help in the pandemic. then came the questions., 2021h. URL https://www.nytimes.com/2021/02/22/business/france-mckinsey-consultants-covid-vaccine.html.

The Straits Times. Covid-19 vaccine and you: What to expect, 2021i. URL https://www.straitstimes.com/singapore/covid-19-vaccine-and-you-what-to-expect.
The Straits Times. All who take covid-19 jabs will get physical vaccination card, cannot choose which vaccine to take, 2021. URL https://www.straitstimes.com/singapore/politics/all-vaccinated-against-covid-19-will-get-physical-vaccination-card-cannot-choose

Business Today. Covid-19 vaccine: Japan to spend $6.3 billion from emergency budget reserve, 2020. URL https://www.businesstoday.in/sectors/pharma/covid-19-vaccine-japan-to-spend-63-billion-from-emergency-budget-reserve/story/415473.html

Business Today. Russia offers free transfer of covid-19 vaccine tech to india, other manufacturing partners, 2021a. URL https://www.businesstoday.in/current/economy-politics/russia-offers-free-transfer-of-covid-19-vaccine-tech-to-india-other-manufacturing-partners/story/436620.html

Egypt Today. Egyptians aged above 40 yrs start registering for covid-19 vaccination sunday, 2021b. URL https://www.egypttoday.com/Article/1/99087/Egyptians-aged-above-40-yrs-start-registering-for-COVID-19

Egypt Today. Egypt vaccinates 149k individuals, to acquire total of 4.5m doses by june, 2021c. URL https://www.egypttoday.com/Article/1/100476/Egypt-vaccinates-149K-individuals-to-acquire-total-of-4-5M

trackvaccines.org. 4 vaccines approved for use in france, 2021. URL https://covid19.trackvaccines.org/country/france/

TRTWorld. How turkey plans to administer covid-19 vaccines, 2020. URL https://www.trtworld.com/magazine/how-turkey-plans-to-administer-covid-19-vaccines-42242

trust.org. Covid-19: Are digital health passports a good idea?, 2021. URL https://news.trust.org/item/20201221125814-sv8ea/

UNHCR. Nepal becomes first country in asia pacific to vaccinate refugees against covid-19, 2021. URL https://www.unhcr.org/news/stories/2021/3/6062c7184/nepal-becomes-first-country-asia-pacific-vaccinate-refugees-against-covid.html

Vaktsineeri. Vaccination in estonia, 2021. URL https://vaktsineeri.ee/en/covid-19/vaccination-in-estonia/

Naiara CM Valiati and Daniel AM Villela. Mitigation policies and vaccination in the covid-19 pandemic: a modelling study. medRxiv, 2021.

Valitsus. Estonia and the who signed a memorandum of understanding, 2021. URL https://www.valitsus.ee/en/news/estonia-and-who-signed-memorandum-understanding

vir.com.vn. 11 priority groups eligible to first covid-19 vaccination in vietnam, 2021. URL https://www.vir.com.vn/11-priority-groups-eligible-to-first-covid-19-vaccination-in-vietnam-82809.html

Wei Wang, Qianhui Wu, Juan Yang, Kaige Dong, Xinghui Chen, Xufang Bai, Xinhua Chen, Zhiyuan Chen, Cécile Viboud, Marco Ajelli, et al. Global, regional, and national estimates of target population sizes for covid-19 vaccination: descriptive study. bmj, 371, 2020.

Singapore Government Agency Website. Covid-19 vaccination, 2021. URL https://www.gov.sg/features/covid-19-vaccination

Wired.it. Come e quando prenotare il vaccino anti-covid-19, regione per regione, 2021. URL https://www.wired.it/scienza/medicina/2021/02/04/vaccino-covid-19-prenotazione/?refresh_ce
Shengli Xia, Yuntao Zhang, Yanxia Wang, Hui Wang, Yunkai Yang, George Fu Gao, Wenjie Tan, Guizhen Wu, Miao Xu, Zhiyong Lou, et al. Safety and immunogenicity of an inactivated sars-cov-2 vaccine, bbibp-cov: a randomised, double-blind, placebo-controlled, phase 1/2 trial. *The Lancet Infectious Diseases*, 21(1):39–51, 2021.

Xinhuanet. Kazakhstan begins mass vaccination against covid-19, 2021. URL [http://www.xinhuanet.com/english/2021-02/02/c_139713832_2.htm](http://www.xinhuanet.com/english/2021-02/02/c_139713832_2.htm)

Medical Xpress. Germany reports cases of indian covid variant, 2021. URL [https://medicalxpress.com/news/2021-04-germany-cases-indian-covid-variant.html](https://medicalxpress.com/news/2021-04-germany-cases-indian-covid-variant.html)

Yanjun Zhang, Gang Zeng, Hongxing Pan, Changgui Li, Yaling Hu, Kai Chu, Weixiao Han, Zhen Chen, Rong Tang, Weidong Yin, et al. Safety, tolerability, and immunogenicity of an inactivated sars-cov-2 vaccine in healthy adults aged 18–59 years: a randomised, double-blind, placebo-controlled, phase 1/2 clinical trial. *The Lancet Infectious Diseases*, 21(2):181–192, 2021.