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Study on COVID-19 vaccinations

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Abstract
The period beginning in December 2019 will be remembered forever in human history as the victim of the unique COVID-19 pandemic. Causing distress to every country it touches, it has created damaging economic, political, social and health impacts that will leave behind everlasting scars. Despite the use of numerous strategies by governments around the world, just a few have succeeded. The new outbreak of COVID-19 has recently become a serious threat to the health of people around the 250 countries. SARS-CoV-2, a single-stranded positive-sense RNA virus that causes infection and respiratory failure and has killed thousands of people, is the causem of COVID-19. Vaccines are needed to protect the human race from COVID-19. Vaccines that induce large quantities of high-affinity virus-neutralized antibodies may optimally prevent infection and avoid unfavorable effects. Vaccination trials require precise clinical supervision, complemented with a detailed evaluation of safety and immune responses.

Keywords: Coronavirus, COVID-19, vaccination, pandemic

Introduction
The COVID-19 epidemic has struck the entire world, and it has been spreading quickly since December 2019. As of July 10th, 2021, this had resulted in roughly 185.1 million positive cases and 4 million deaths. It has put pressure on the governments of the countries to act quickly in order to effectively control the disease's spread. Millions of people suffered economically, physically, emotionally, and socially as a result of it. The emergence of novel coronavirus has tremendously impacted the public health system as it reached across the globe in a span of a few months. It has alarmed the people across the globe, engrossed the news channels gravely, impacted the economic stability, given a new dimension to research areas and created political havoc across the globe especially amongst the developed countries because of their inability in tackling this issue smoothly. Although humanity was lucky to have the vaccine available in a short duration, the emergence of the new strains of the virus tells us about its vast unpredictability. With cases again on the rise, most countries are going through the third wave of the coronavirus. Coronaviruses belong to the Corona viridae family that have crown-like spikes on their outer surface, thus, named a coronavirus. It is a large family of viruses that are common to occur in human beings and many different species of animals, including camels, cattle, cats, and bats. Animal coronaviruses can infect people and spread from person to person on rare occasions.

However, novel severe acute respiratory syndrome coronavirus-2 (SARS-COV-2) is supposed to have originated from a bat that crossed over to humans in Wuhan China at the end of 2019, causing Corona Virus Disease. It was unknown before the outbreak began in Wuhan, China, in December 2019, killing more than eighteen hundred and infecting over seventy thousand individuals within the first few weeks of the epidemic.

Because China was significantly more mobile in December 2019 and January 2020 owing to the Chinese New Year, the new virus had an easy path to the rest of the world, and the World Health Organization declared it a pandemic on March 11, 2020, due to its global spread. The people infected by it, experience symptoms like fever, dry cough and tiredness. They may have mild to moderate respiratory illness and may recover without requiring special treatment or can have severe respiratory problems due to the accumulation of water in the lungs, which leads to pulmonary failure and results in casualties. The symptoms may arise in three to four days or the patients are totally asymptomatic.

Symptoms vary greatly from person to person and include headaches, nasal congestion, sore throat, loss of taste, rashes on the skin, and rashes on the fingers and toes. Serious sickness is more likely to strike the elderly and those with underlying medical conditions such as cardiovascular disease, diabetes, chronic respiratory disease, and cancer.

While the whole world is still in the grip of Covid-19, the virus is having devastating effects on the country with no near signs of its end. Experts, scientists and virologists say that vaccination is the leap towards the beginning of the end of the pandemic and aids in achieving herd immunity faster. WHO and its partners are dedicated to developing COVID-19 vaccines as quickly as possible while maintaining the highest safety requirements. Vaccines have previously been developed through a sequence of steps that can take years to complete.

Given the critical need for COVID-19 vaccines, enormous financial investments and scientific collaborations are now transforming vaccine development. This indicates that several steps in the research and development process have been completed concurrently while still adhering to strict clinical and safety guidelines. To stop this destruction made by corona there is a need for a “vaccine”. The paper deals with the working of vaccines made by many scientists across the world. It differentiates vaccines based on the type of their manufacture, working and efficiency to fight corona.

What is a vaccine?

A vaccination is a biological substance that gives active acquired immunity against a specific infectious disease. A vaccination usually contains an agent that looks like a disease-causing germ and is manufactured from weakened or destroyed microbes, their toxins, or one of their surface proteins. The agent stimulates the body's immune system to detect and eliminate the agent as a threat, as well as any linked bacteria it may encounter in the future. Vaccination is the most effective strategy to avoid influenza virus infection and severe consequences.

Vaccines are brilliant because they teach our bodies to create immunity to infectious diseases without actually causing the illness. Our immune system is usually exposed to a dead or weakened version of the disease causing germ (bacteria or virus). To establish immunity, inactivated toxins produced by the germ are sometimes employed in vaccines (for example, diphtheria and tetanus vaccines). These substances are known as antigens, and they constitute the most crucial component of all vaccines. If our immune system comes into contact with the ‘real' disease-causing germ after we've been vaccinated, it reacts swiftly and produces antibodies and memory cells to defend the body. Vaccination (immunization) is the most efficient way to prevent dangerous infections. Some immunizations provide lifetime protection. Occasionally, ‘catch-ups' or booster shots are required.

What’s inside a Vaccine?

Vaccine components differ depending on the infection. They may also vary year to year as new viral strains (such as the flu) emerge. Some vaccines may include a small dose of:

- A germ that is alive (but weakened).
- Germs that have died.
- Germ components that are little (for example, a molecule from the surface of a germ).
- Toxins are created by bacteria that have been rendered inactive.
- To prevent the vaccination from becoming contaminated or going bad, antibiotics or preservatives are used.
- Diluting agents (such as sterile water or saline) mRNA vaccines, on the other hand, instruct our cells how to generate a protein that triggers an immune response.

When were vaccines developed?

The phrases vaccine and vaccination are taken from Edward Jenner's term Variolae vaccinae. He developed the concept of vaccines and created the first vaccine for cowpox. Edward Jenner guessed that the germ responsible for cowpox was similar enough to the smallpox germ to ‘train’ the immune system to defeat both diseases.

How do vaccines work?

Our immune system is made up of specific cells and substances that fight illness (antibodies). Immunity to diseases can be acquired either spontaneously (by catching an illness) or by immunization. Vaccines contain a modified version of a disease-causing germ or toxin (known as "antigens"), or mRNA vaccines instruct our cells to activate an immune response. They're normally given as an injection or as a small quantity of drink containing the vaccination. The immune system reacts to weakened, partially or fully dead, or inactivated germs.

How do vaccines help our immunity?

Our immune system is similar to a library in that it keeps track of every germ that has ever been destroyed. This is sometimes referred to as immunological memory. Some antibodies remain in our bloodstream, ‘on patrol.' As a result, if we ever come across a real germ in the future, our immune system will be able to immediately activate memory cells and manufacture antibodies to combat it. And it often happens before we show any signs of disease. Each vaccine is designed according to how the specific germs make us sick. For example, measles is caused by the body's reaction to the entire virus, thus the vaccination contains a weakened version of the virus. On the other hand, tetanus is caused by the body’s reaction to the toxin generated by the tetanus bacteria and so the vaccine contains inactivated tetanus toxin (antigen) as if it was a fully-fledged germ and makes antibodies to eliminate it. These antibodies are made without us catching the illness.

How are vaccines developed?

A new vaccine can take a long time to develop. Research, Discovery, Pre-clinical testing, Clinical testing, and Regulatory approval are all steps in the creation of a vaccine. After the vaccine has been approved, it is manufactured and transported to the location where it is needed.

Corona (Covid-19) Vaccines

Coronavirus disease was first Identified on November 17, 2019, in Wuhan, China. After research scientists have discovered that SARSCOV- 2, originated from a bat and passed to pangolins which then passed to humans. The coronavirus spreads very easily when an infected person coughs, sneezes or speaks. People can also be infected by touching a contaminated surface and then their eyes, mouth or nose. As corona can spread very easily, it has affected people in no time leading to many active cases around the world and around 185 million people got infected. There was a worldwide lockdown and it affected many people financially and the economy of many countries collapsed. To control the situation there is a need for a vaccine that can

control infection and leads to herd immunity which can eliminate the disease entirely. There are around 106 vaccines available around the world. Every individual must take special care while taking a vaccine because not everyone is eligible to take the vaccine.

The worldwide endeavor to create a safe and effective COVID-19 vaccine is bearing fruit. More than a dozen vaccines now have been authorized around the globe. Many more remain in development. The vaccines which are authorized include:

- Comirnaty (BNT162b2)-mRNA-based vaccine
- Moderna - (mRNA-based vaccine)
- AstraZeneca (also known as Vaxzevria and Covishield) -(Adenovirus vaccine)
- Sputnik V(Recombinant adenovirus vaccine)
- Janssen – (Non-replicating viral vector)
- Corona Vac(Inactivated vaccine)
- BBIBP-CorV(Inactivated vaccine)
- EpiVacCorona (Peptide vaccine)
- Convidicea (Recombinant vaccine)
- Covaxin (Inactivated vaccine)
- Unnamed (No name announced from Wuhan Institute of Biological Products)- (Inactivated vaccine)
- CoviVac (Inactivated vaccine)
- ZF2001- (Recombinant Vaccine).

Vaccines which are under development

- NVX-CoV2373-(Phase 3)
- ZyCov-D (Phase 3)
- Abdala (CIGB 66) (phase 3)
- VIR-7381 (phase 3)
- CVnCoV (Phase 2b/3)
- Bacillus Calmette-Guerin (BCG) (phase 2/3)
- INO-4800 (phase 2/3)… many more

Types of Vaccines Based on their preparation and working

Vaccines are created in a variety of ways. The immune system is triggered either by employing the entire virus or only parts of the virus; or by using only the genetic information that provides instructions for manufacturing specific proteins rather than the entire virus. When these vaccines are supplied they help to produce antibodies by the human immune system. These antibodies in turn produce antibody memory cells. So, later when a human (who took the vaccine) comes in contact with a real virus the already existing antibody memory cells recognize them and produce antibodies which in turn kill the virus.

The whole-microbe approach:

Inactivated vaccine: This is made by killing the virus by sunlight, radiation or chemicals. Polio and other flu vaccines are made using this approach. Eg: Covaxin, coviVac, corona Vac, BBIBP-CorV.

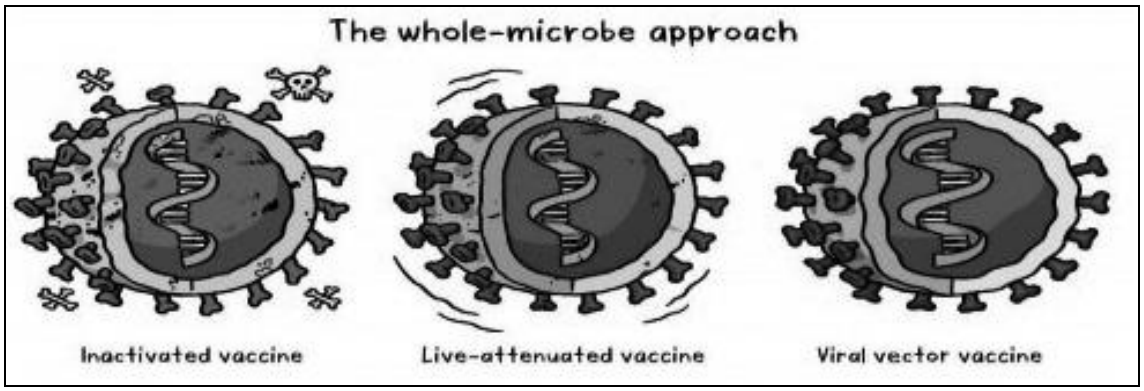

Fig 1: The whole-microbe approach

Live-attenuated vaccine: This uses a living but weakened version of the virus. The measles, mumps and rubella vaccines are made this way. This is not highly applicable if people are with compromised immune systems.

Viral Vector Vaccine: It uses a safe virus that triggers the immune system without causing disease. The safe virus serves as a vector to deliver vectors to the body. Eg: Janssen.

The Subunit Approach: A subunit vaccine is one that only uses the very specific parts of a virus or bacterium that the immune system needs to recognize. The subunits may be proteins or sugars. Eg: EpiVacCorona (Peptide vaccine).

The Genetic Approach (Nucleic acid vaccine): It just uses a section of genetic material that provides the instructions for certain proteins, rather than the entire microbe. Our cells use DNA and RNA as instructions to produce proteins. In our cells, DNA is converted to messenger RNA in our cells, which is then used as the blueprint to make specific proteins. AstraZeneca (Covi Shield), Moderna (mRNA-based vaccination), and Sputnik V (recombinant adenovirus vaccine) are only a few examples.

Different Examples of Vaccines:

Comirnaty(BNT162b2)-mRNA-based vaccine Comirnaty vaccine is a nucleoside modified mRNA-based vaccine developed by BIONTech and Pfizer. It is given in 2 doses within 84 days apart. Comirnaty demonstrated 95% interim efficacy in preventing COVID-19 in those without prior infection after the second case.

Working: It contains a substance called mRNA, which contains the spike protein's instructions. This is a protein found on the surface of the SARS-CoV-2 virus that allows the virus to enter the cells of the body. There is insufficient information on how the vaccination works inside a corona patient, as well as how long it lasts.

Key Points

- Only people above 16 years old can be vaccinated.

- Comirnaty has received an emergency validation from the WHO, which should accelerate help approval in other countries.
- Pfizer and BioNTech predict 1.3 billion doses will be available in 2021.

AstraZeneca (Vaxzevria or Covishield)- (Adenovirus vaccine):
AstraZeneca and the Oxford Vaccine Group at the University of Oxford have developed COVID-19 Vaccine AstraZeneca, a chimpanzee adenovirus vaccine. In India, it is jointly developed by the Serum Institute of India(SII) and AstraZeneca goes by the name Covishield. The vaccine is given in 2 doses, between 12-16 weeks apart.

Working: The vaccine works by delivering the genetic code of SARS-CoV-2 spike protein to the body's cells, similar to the BNT162b2 vaccine. Once the spike protein is produced, causing the immune system to recognize it and initiate an immune response.

Key points
- In a phase 3 trial of over 32000 participants, the vaccines indicated 79% effectiveness at preventing COVID-19.
- In march 2021 reports began to circulate of blood clotting issues and thrombotic events after patients were vaccinated.

Ingredients: adenovirus vector(took from chimpanzee), Histidine, Histidine Hydrochloride monohydrate, sodium chloride, Magnesium Chloride hexahydrate, Disodium edetate (EDTA), Sucrose, Ethanol absolute, Polusorbate 80 and water.

COVAX in® - India's First Indigenous COVID-19 Vaccine:
Bharat Biotech is developing an indigenous COVID-19 vaccine in conjunction with the Indian Council of Medical Research (ICMR) - National Institute of Virology (NIV). Bharat Biotech's BSL-3 (Bio- Safety Level 3) high containment facility develops and manufactures the indigenous, inactivated vaccine. The vaccine is being developed using a platform derived from Whole-Virion Inactivated Vero Cells. Because inactivated vaccinations do not multiply, they are unlikely to revert and cause disease. They include dead viruses that are unable to infect individuals but can nevertheless educate the immune system to create a defensive response in the event of an infection.

Key Points
- Immuno-potentiators, also known as vaccine adjuvants, are added to the vaccine to increase and boost its immunogenicity. COVAXIN® is one of them.
- It's a two-dose vaccine that's administered 28 days apart.
- It's a vaccination that doesn't require sub-zero storage, doesn't require reconstitution, and comes in ready-to-use liquid form in multi-dose vials that's stable at 2-8 degrees Celsius.
- Preclinical investigations: Animal challenge experiments in hamsters and nonhuman primates revealed significant immunogenicity and protective effectiveness.
- In July 2020, the vaccine gained DCGI approval for Phase I and II Human Clinical Trials.
- The Phase 1 study enrolled a total of 375 participants and produced outstanding safety data without any reactogenicity.
- Neutralizing antibodies generated by vaccination yyA total of 380 people aged 12 to 65 were enrolled in the Phase 2 research. COVAXIN® produced acceptable safety results as well as improved humoral and cell-mediated immune responses.
- A total of 25,800 participants were enrolled and randomized in a 1:1 ratio to receive the vaccine and control in an Event- Driven, randomized, double-blind, lacebo-controlled, multicentre phase 3 study.
- After the second dose, COVAXIN® showed 81 percent interim efficacy in preventing COVID-19 in those who had not previously been infected.

COVAX in includes the following ingredients:
COVAXIN contains 6µg of whole-virion inactivated SARS-CoV-2 antigen (Strain: NIV-2020-770), and the other inactive ingredients such as aluminum hydroxide gel (250 µg), TLR 7/8 agonist (imidazoquinoline) 15 µg, 2-phenoxyethanol 2.5 mg, and phosphate ® buffer saline up to 0.5 ml. The vaccine (COVAXIN) thus has been developed by using inactivated/killed viruses along with the aforementioned chemicals.

Resources on COVID-19 vaccine development:
- COVID-19 Vaccine Target Product Profile (WHO) This Target Product Profile (TPP) provides the desirable and minimally acceptable profiles for human vaccines for longterm protection of those at high ongoing risk of COVID-19, such as health care workers, as well as for reactive use in outbreaks with a quick onset of immunity.
- Vaccine landscape documents were prepared by the WHO for information purposes concerning the 2019-2020 global development of new COVID-19 vaccines. yyTrial of a Solidarity Vaccine This big, multinational, randomized controlled clinical trial aims to evaluate the benefits and dangers of numerous candidate COVID-19 preventative vaccinationsat international sites with sufficient COVID-19 attack rates in a timely, agile, and concurrent manner.
- Access to COVID Tools (ACT) Accelerator The vaccines pillar of the ACT Accelerator, convened, is speeding up the search for an effective vaccine for all countries.
- Covax facility (WHO) Covax explained (GAVI) COVAX (CEPI)
- CEPI, Gavi and WHO launched COVAX to ensure equitable access to COVID-19 vaccines and end the acute phase of the pandemic by the end of 2021.
- WHO Guidance on ethics of vaccine allocation This policy brief answers a number of questions about the ethic.

Working together to deliver vaccines to all countries:
In April 2020, the Access to COVID-19 Tools (ACT) Accelerator was launched to accelerate the development and delivery of diagnostics, treatments, and vaccinations to

countries. A health systems connection is included to aid in the transfer of these resources to countries.

- The World Health Organization (WHO) created a framework for ensuring equitable and affordable access to safe and effective vaccines.
- The COVAX Facility is an umbrella framework that pools demand and resources to enable COVID19 vaccine procurement and fair access.
- By the end of 2021, the ACT Accelerator hopes to have delivered two billion vaccination doses to meet global demand.
- In the beginning, vaccine allocation will be based on public health needs for priority groups, which might account for up to 20% of the population.
- Countries will be asked to develop immunization policies based on SAGE's recommendations.
- Front-line professionals (such as health workers) and the elderly should obtain immunizations first, according to the WHO.
- GAVI, the Coalition for Epidemic Preparedness Innovations (CEPI), and WHO are coordinating the effort.

Measures to be taken while taking corona vaccine:

Not everyone is eligible to receive the same vaccine that is available in their country. It is dependent on the individual. Before taking the vaccination, he or she must verify the sort of substances used to see whether they are allergic to any of them. Pregnant or breastfeeding women should seek medical advice before deciding whether or not to receive a vaccine. Vaccines are not available for all age groups. The majority of vaccines contain age restrictions for children under the age of 16. People with compromised health (such as those living with HIV or cancer) choose not to take it.

Results

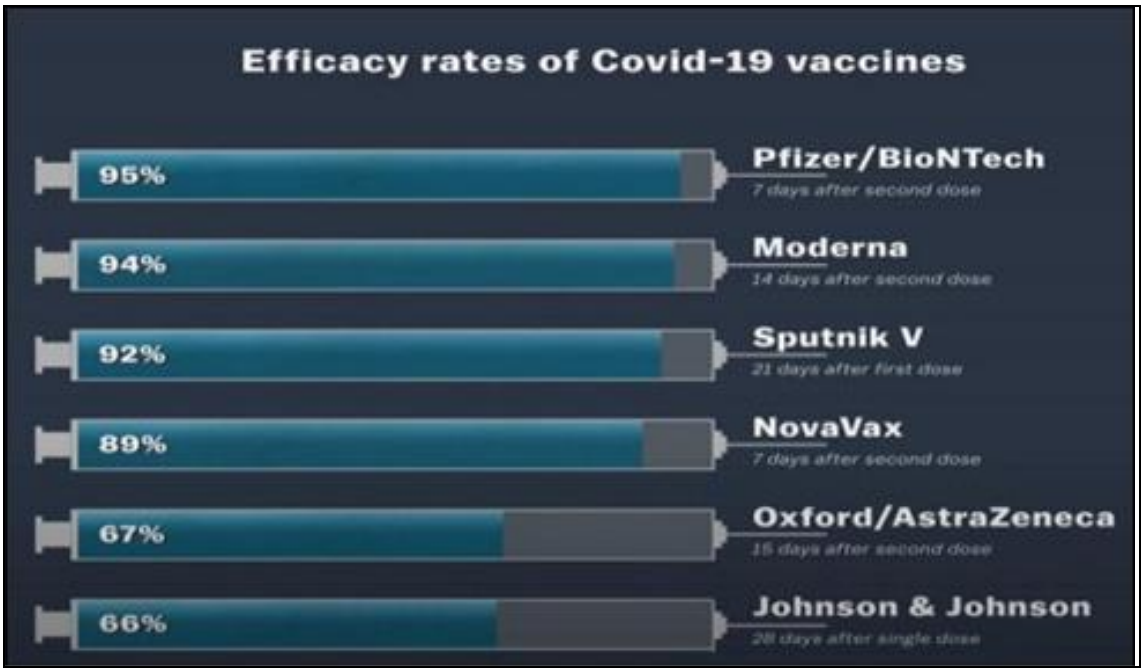

Fig 2: Efficacy rates of Covid-19 vaccines

The study will result in the figure shown above as a conclusion. Pfizer is the company with the highest Efficacy. However, while measuring vaccination efficiencies, the time period and types of individuals (i.e., country) must be the same; however, vaccine efficiencies are computed at different times, with different people, and with different types of the corona. So the preceding report isn't entirely correct because Pfizer vaccine efficacy is only tested with Americans in May, whereas Johnson and Johnson vaccine efficacy is tested with African-Americans in Winter with a different strain of coronavirus. One thing we must realize is that the true purpose of vaccine development is to prevent "severe sickness, hospitalizations, and, eventually, death."

All of the vaccines mentioned above are effective in achieving it. Even if they are infected with the virus, none of the persons who received the vaccine have been hospitalized or have experienced serious disease or death. So all the present vaccines are working well to fulfill their mission as a vaccine. So to end the pandemic all the vaccines are equally important.

Conclusion

Hundreds of corona viruses exist, the majority of which are spread by animals. Only seven of these viruses can infect humans, and four of them cause cold symptoms. However, a coronavirus has leapt from animals to humans three times in the previous 20 years, causing severe sickness. SARS, a beta coronavirus that first appeared in 2002, was mostly contained by rigorous public health measures. Since 2004, there have been no new cases. MERS was first discovered in camels in 2012, and it can infect people who come into close contact with them. COVID-19, a new and potentially fatal respiratory ailment thought to have started in a live animal market in China, has quickly spread throughout the country and around the world.

The novel coronavirus was originally discovered in December 2019 in Wuhan, China. In China, tens of thousands of people have been infected, with the virus easily spreading from person to person in various areas of the country. The novel coronavirus illnesses wereinitially linked to travel from Wuhan, but the virus has now spread

to 177 nations and territories worldwide in a rapidly spreading pandemic. Public health measures including social distancing, contact tracing, testing, quarantines, and travel restrictions are being used by health officials in the United States and around the world to try to stop the virus from spreading. Scientists are striving to produce a vaccine and find treatments to treat the sickness. The new coronavirus outbreak was declared a "public health emergency of worldwide significance" by the World Health Organization on January 30. The World Health Organization labeled the COVID-19 epidemic a pandemic on March 11, 2020, after the sickness spread outside of China. Public health measures, such as those implemented in China and now around the world, are hoped to slow the virus's spread while therapies and a vaccine are produced.

Fig 3: Vaccine COVID-19

References

1. https://www.bharatbiotech.com/covaxin.html
2. https://www.seruminstitute.com/product_covishield.php
3. https://www.cdc.gov/coronavirus/2019-ncov/vaccines/differentvaccines/mrna.html
4. https : / /www. r aps.or g /news - and - a r t i c l e s /news -articles/2020/3/covid-19-vaccine-tracker
5. https://www.who.int/news-room/feature-stories/detail/the race-for-a-covid19-vaccine-explained
6. https://www.ema.europa.eu/en/documents/productinformation/comirnatyepar-product-informati on_en.pdf
7. https://vk.ovg.ox.ac.uk/vk/covid-19-vaccines
8. https://www.livescience.com/first-case-coronavirus-found.html
9. https://www.raps.org/news-and-articles/legislation-tracker