

1. Introduction of COVID-19 Vaccine Development

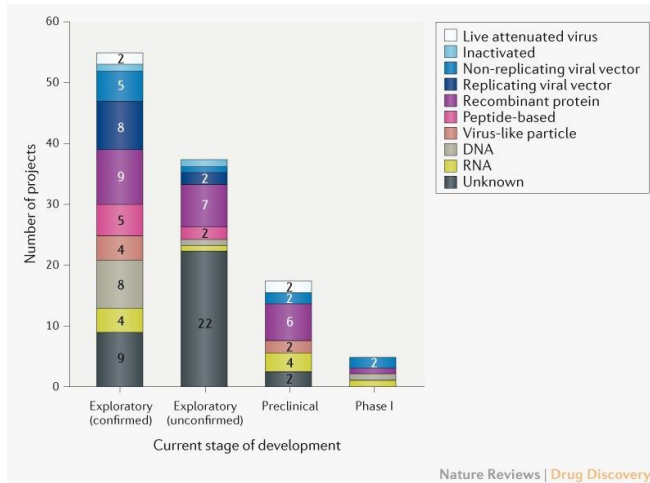
This essay is formulated in accordance with the following. (A) First, COVID-19 is briefly introduced and transitions into the factors that contribute to producing a vaccine. (B) Then the developmental process of creating the vaccine is discussed. (C) Next, trials that are currently taking place are explained with details and tables regarding the results. (D) Availability of the vaccine is then described, and factors that could reduce availability are evaluated. (E) The financial burden of creating a vaccine is explained next. (F) A conclusion ends the paper with a summary of all of the factors that go into creating a vaccine introduced above.

A. Introduction of COVID-19 and vaccination

COVID-19 has devastated the world in 2020 with millions of cases and hundreds of thousands of deaths. Containing the virus has overwhelmed health care systems everywhere and progress is still being made. Vaccination has become the primary focus, and there are currently over 100 vaccine candidates being developed [5]. Some vaccines are being used in clinical trials and could be available in early 2021. The vaccine development process is very challenging financially, but with global cooperation it is possible [1].

B. Vaccine development

Development of a vaccine began shortly after the pandemic became a global crisis. There were 115 vaccine candidates in April of 2020, and 78 of them are in active trial while the progress of the other 37 is classified [5]. 73 of the 78 vaccine candidates were in preclinical stages as of May, 2020 [5]. Vaccines that made it past this stage were then moved to clinical development [5]. mRNA-1273 from Moderna, Ad5-nCoV from CanSino Biological in Wuhan, and INO-4800 from Inovio are some of the candidates that made it past the preclinical stages to clinical development [5]. Private companies are responsible for 72% of the confirmed vaccines, and the other 28% were developed by academic or non profit organizations [5]. Also, different vaccine types were created for different population subtypes like people with illnesses, obesity, and elderly people. Lastly, North America is where almost half of the vaccine development has taken place. Asia, Australia, and Europe make up the other half of regions responsible for vaccine candidates [5].



The different stages of vaccine development are represented by the x-axis, and the number of vaccine projects is represented by the y-axis. The key in the right hand corner displays that the colors in the bars of the graph represent characteristics of each vaccine and how many vaccines in each stage have a particular characteristic [5].

C. Vaccine trials

A study was conducted by the Jenner Institute at Oxford University that was supported by AstraZeneca, and another was conducted by CanSino Biologics in Wuhan, China. The study conducted by the Jenner Institute had a sample size of 1077 healthy adults with a median age of 35 years old [2]. Meanwhile, the study done by CanSino had a sample size of 508 healthy adults with an average age of 39.7 years, 382 of them got the vaccine, and 126 received a placebo [2]. Mild adversities occurred in both trials like fever, headache, and injection site pain, but no severe adversities were experienced [2]. Also, an increase in neutralizing antibodies of over 85% occurred in both studies [2]. Each study also had its own unique differences. In the trial held by the Jenner Institute of Oxford University, some of the subjects received a second dose of the vaccine. An even higher increase of neutralizing antibodies was found in these subjects which shows more doses of the vaccine will strengthen immunity to COVID-19 [2]. Additionally, The CanSino trial found that males were less susceptible to the fever side effect, and even the placebo subjects felt the adversities of the vaccine [2]. Phase 3 for these vaccines is to test them on a much larger sample size in order to better understand the efficiency and safety of the vaccines [2].

D. Vaccine availability

According to the journal "The Lancet", a vaccine could be available by early 2021 [3]. However, when it becomes available the vaccine would only be accessible by health care workers and those considered to be at high risk of fatality if they contract COVID-19 [3]. Wealthy countries are also a major concern for availability of the vaccine once it is released. Equitable distribution of the vaccine is vital, and if wealthy countries

were to hoard the vaccine lower income nations would be unable to compete economically [4]. Hoarding of a vaccine has occurred before, and it made circumstances for low income countries very difficult. Lastly, if a vaccine is made available by 2021 that would be an amazing accomplishment. On average, a vaccine typically takes up to ten years to produce, and in accelerated cases only five [3]. If a vaccine for COVID-19 really does come out in 2021, it will have been produced in under two years.

E. Economic impact

Money is a very important aspect of making a vaccine available to the world. At least two billion US dollars is the estimated cost of creating a vaccine, but it could be much more depending on complications [1]. The many steps that must be taken are the reason why creating a vaccine is so expensive. Government cooperation of countries of every continent is needed to produce the necessary funds [1]. However, investors losing interest complicates the process [4]. As the number of active cases decreases it is common for the number of investors to decrease because the problem isn't as relevant to them anymore [4].

F. Conclusion

Many factors go into producing a vaccine, and it is very important that each is being carried out. Over 100 vaccine candidates have been presented, and they are continuing to be developed in order to advance from the preclinical stages to clinical development. Increased neutralizing antibodies were produced in the vaccines created by the Jenner Institute at Oxford University and ConSino in Wuhan, China, which is one step closer to making the vaccine available. Early 2021 is when a vaccine is expected to become available, and if it does become available it will have been completed in a remarkable time frame of under two years. Lastly, global cooperation is vital in order to gather the two billion dollars needed to release a vaccine to the world.

References

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