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Letter to Editor

The Rapid Development and Early Success of Covid 19 Vaccines Have Raised Hopes for Accelerating the Cancer Treatment Mechanism

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The Covid-19 pandemic has brought about rapid change in medical science. The production of new generation vaccines for this disease has surprised even their most optimistic supporters. Not only have these vaccines proven to be effective, but the importance of this disease and pandemic situation also significantly shortened the long-standing process of validating such products. Vaccination is a type of immunotherapy. Researchers have long been looking at vaccines as a possible treatment for cancer (Geynisman et al., 2014). In the same way that vaccines work against infectious diseases, attempts are being made to develop vaccines to identify specific proteins on cancer cells. This helps the immune system recognize and attack cancer cells. Cancer vaccines may help: I) Prevent the growth of cancer cells (Bialkowski et al., 2016), II) Prevent recurrence of cancer (Stanton and Disis, 2015), III) Destroy cancer cells left over from other treatments. The following types of cancer vaccines are being studied: **Antigen Vaccines**. These vaccines are made from specific proteins or antigens of cancerous cells. Their purpose is to stimulate the immune system to attack cancer cells (Tagliamonte et al., 2014). **Whole-Cell Vaccines.** A whole-cell vaccine uses the entire cancer cell, not just a specific molecule (antigen), to generate the vaccine. (Keenan and Jaffee, 2012). **Dendritic Cell Vaccines.** Dendritic cells help the immune system identify abnormal cells, such as cancerous cells. Dendritic cells are grown with cancer cells in the laboratory to produce the vaccine. The vaccine then stimulates the immune system to attack cancer. (Wang et al., 2014; Mastelic-Gavillet et al., 2019)**. DNA Vaccines.** These vaccines are made from DNA fragments of cancer cells. They can be injected into the body to facilitate immune system cells can better respond and kill cancer cells (Gatti-Mays et al., 2017). **Other Types of Cancer Vaccines.** such as Anti idiotype vaccines. This vaccine stimulates the body to generate antibodies against cancerous cells. An example of an anti-idiotype antibody is Racotumomab or Vaxira (Cancer, 2016).

However, conditions and considerations after Corona does not seem to be the same as before. The current pandemic situation has also led to major changes in the pharmaceutical and Vaccine production process and international protocols. Some of the most critical issues that can accelerate the introduction of cancer vaccines are:

1. Typical drug and vaccine development timeline. A typical vaccine needs 5 to 10 years and sometimes longer to design secure funding, and get approval (Figure 1). Less than 10 percent of new drugs, which are entered in the different phases of clinical trials, are advanced to approval by the Food and Drug Administration (FDA) (Cancer, 2020a). However, now the situation is not normal. Dozens of Covid 19 vaccines are starting clinical trials. Some of them use RNA and DNA technology, which delivers the body with missions to produce its antibodies against the virus. There are already at least 254 therapies and 95 vaccines related to Covid-19 being explored. However, it seems that the experiences gained in this pandemic, and advances in technology, may be effective in shortening the production path of other vaccines and drugs and the process of its approval at the national and international levels in the future.

In Figure 2, the time course of production of conventional vaccines in comparison with Covid 19 vaccines (Cancer, 2020b) is shown.

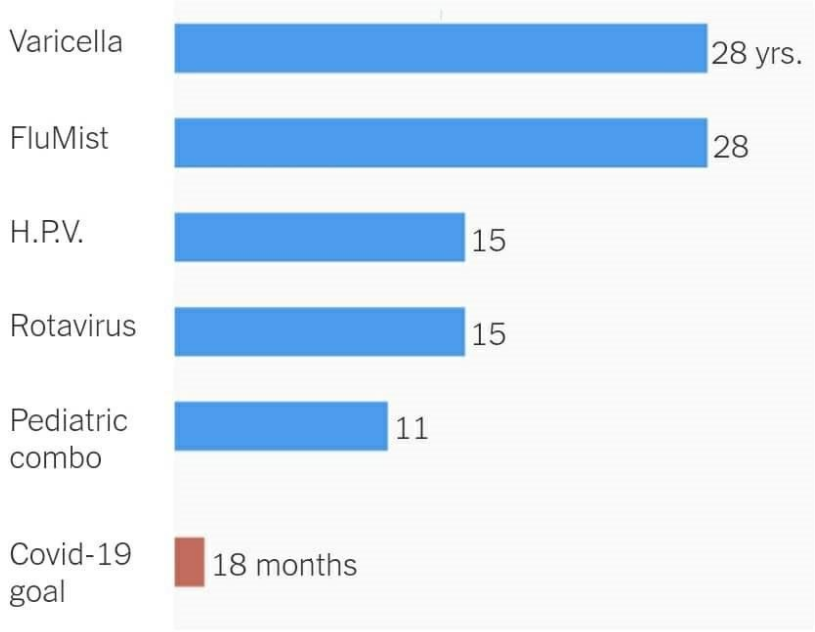

Figure 1. Source: Plotkin's Vaccines - 7th edition – 2017 -Elsevier

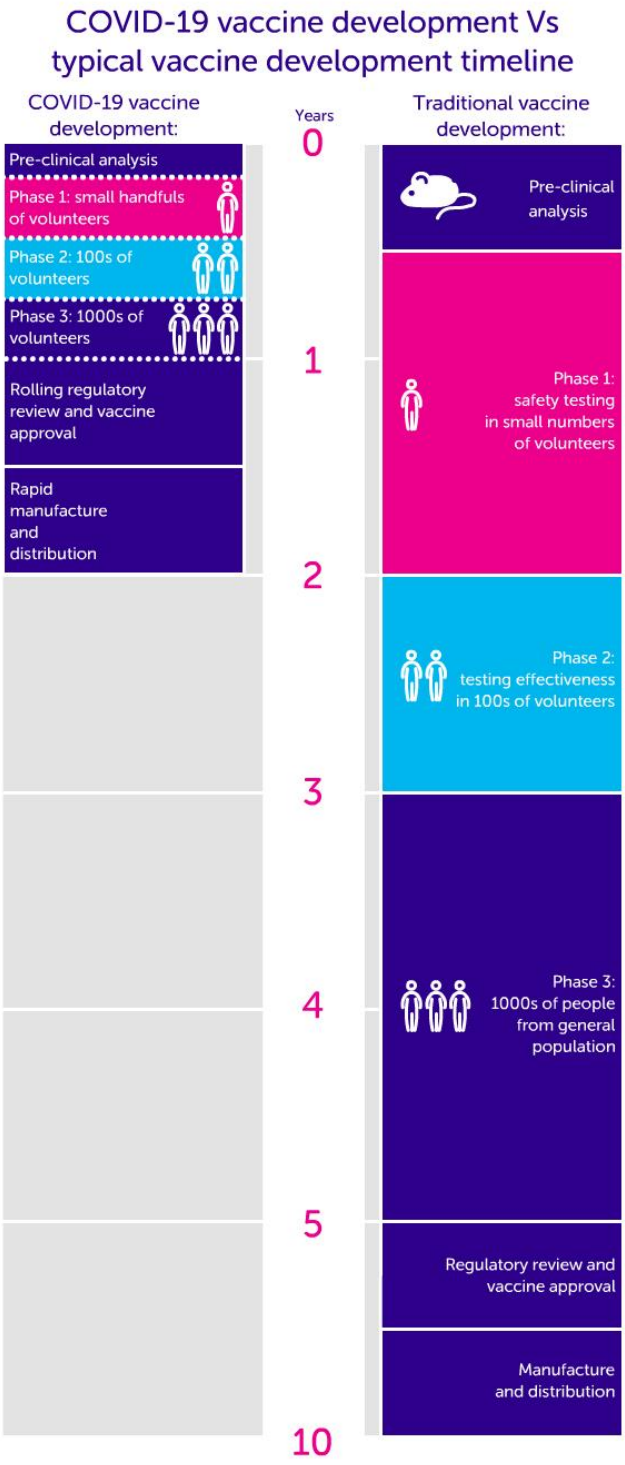

Figure 2. Vaccines development timelines. Copy this link and share our graphic. Credit: Cancer Research UK

2. The introduction of messenger RNA (mRNA) technology into the field of prevention and treatment. Over the past decades, this technology has been considered an excellent alternative to conventional vaccination methods. Proper potency and low side effects, the possibility of fast production and relatively low production cost are its advantages. However, until recently, the instability of this molecule has been a major problem in its application. This research was started many years ago by two companies that played a significant role in developing the first Covid vaccines, so BioNTech and Moderna were able to quickly transfer their experience in the field of Covid vaccine development (Pardi et al., 2018; Moderna, 2020). Figure 3 shows how mRNA vaccines work. Bout Pfizer – BioNTech and Moderna mRNA vaccines were more than 90 % effective in preclinical stages. Millions of doses of these two vaccines are currently being injected into eligible individuals worldwide.

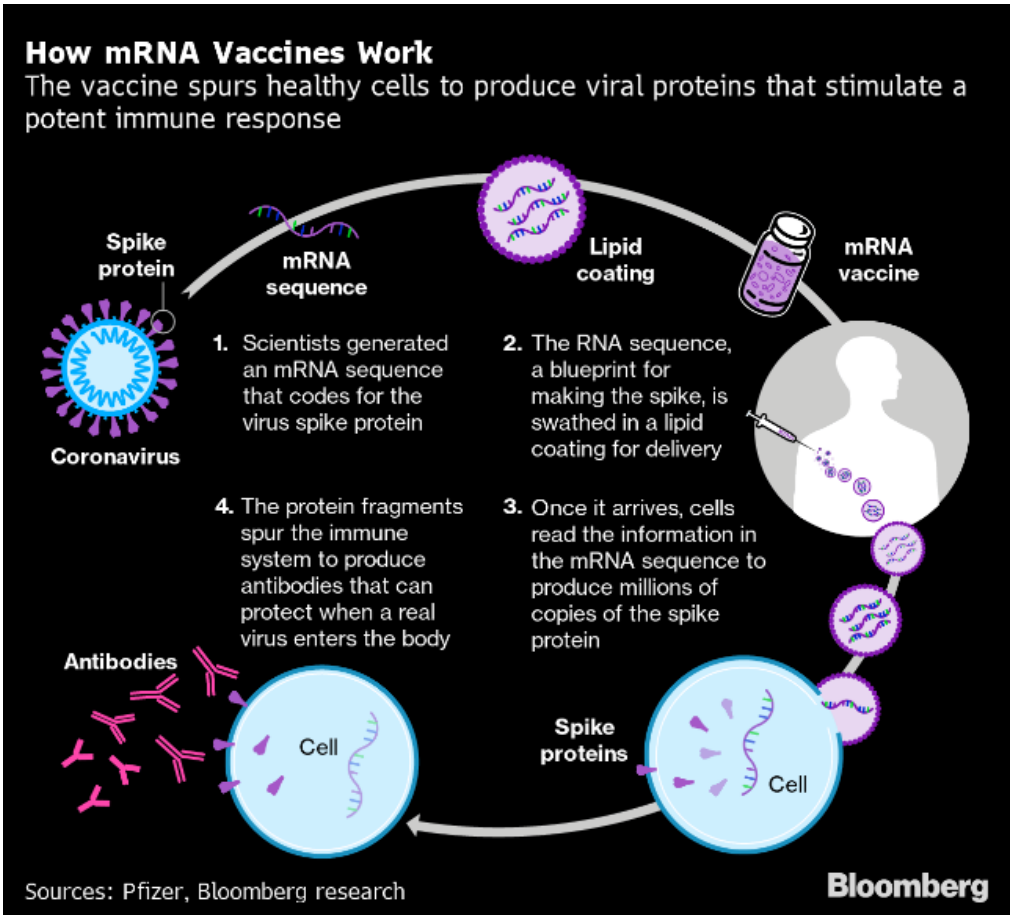

Figure 3. Sources: Pfizer, Bloomberg research

3. Considering the use of artificial intelligence in assessing the effectiveness of vaccines. There are always doubts about the effectiveness of the new drug in treating the disease. Once the vaccine is widely available, we will know more about its effectiveness versus it works under carefully controlled scientific testing conditions. Vaccines will continue to be monitored after use. The data collected helps professionals understand how they work in different groups of people (depending on factors such as age, ethnicity, and people with different health conditions) and also the length of protection provided by the vaccine. Artificial intelligence (AI) is an emerging field, which reaches everywhere and not only as a beneficial industrial tool but also as a practical tool in medical science and plays a crucial role in developing the computation vision, risk assessment, diagnostic, prognostic, etc. models in the field of medicine (Amisha et al., 2019). According to the wide range of AI applications in the analysis of different types of data, it can be used in vaccine production, safety assessments, clinical and preclinical studies and Covid 19 vaccines adverse reactions (CDC, 2019).

Indeed, most cancer vaccines are therapeutic, rather than prophylactic, and seek to stimulate cell-mediated responses, such as those from CTLs, capable of clearing or reducing tumor burden. There are currently FDA-approved products for helping cancer treatment such as BREYANZI, TECARTUS and YESCARTA for lymphoma, IMLYGIC for melanoma, KYMRIAH for acute lymphoblastic leukemia, and PROVENGE for prostate cancer. Over the past decade, most of BioNTech's activities have been in the field of cancer vaccine design and production for melanoma (two clinical trials), breast cancer (one clinical trial), and the rest concerning viral and veterinary vaccines (two clinical trials). Also Maderno company has been working on Individualized cancer vaccines (one clinical trials), and vaccines for viral infections such as Zika and Influenza and veterinary vaccines (several clinical trials) (Pardi et al., 2018). Therefore, it can be said, mRNA technology that has been the subject of much research into the treatment of cancer has been shifted and rapidly used to produce and use the Covid 19 vaccine. The current pandemic situation has necessitated the acceleration of Covid 19 vaccines and drugs and national and international protocols for their approval. If the currently produced vaccines can continue to be as successful as the preclinical and early phase studies, these changes and evolution have raised hopes for accelerating the use of these technologies and mechanisms in the field of cancer and other diseases vaccines, including HIV and influenza.

Conflict of Interest

The authors declare that they have no conflict of interest.

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