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Strategic Equity & Business Solutions

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Markets: Vaccines, Pharmaceuticals, Medical Devices

Pfizer (PFE)
BioNTech (BNTX)
Moderna (MRNA)
Novavax (NVAX)
Johnson & Johnson (JNJ)
GlaxoSmithKline (GSK)

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The Vaccine Frontier

Introduction

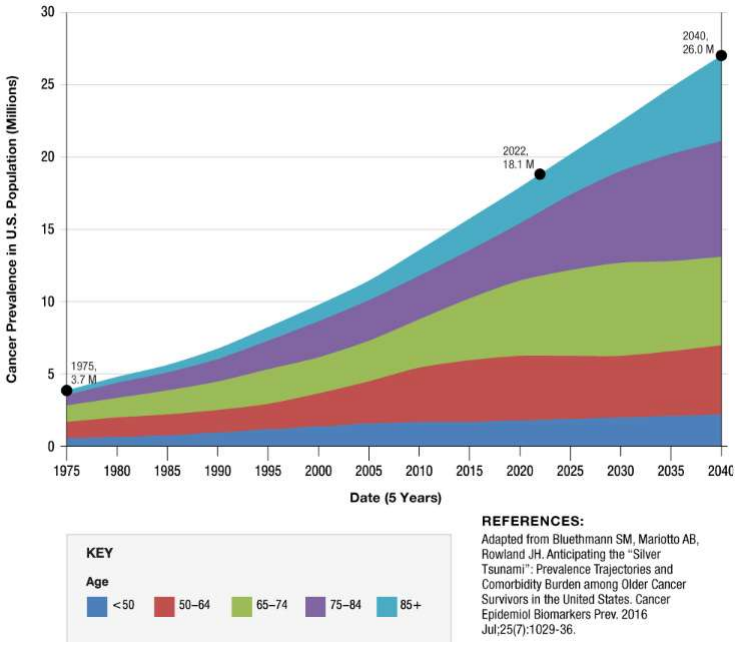
The rapid development and growing excitement around AI over the past two years has fueled tremendous optimism about the future of speculative opportunities. So far, we've witnessed this surge in industries such as cryptocurrencies, space exploration, nuclear energy, and quantum computing. Additionally, tools like ChatGPT and the constant evolution of Google Search further amplify this wave of innovation to the public. However, for us at SEBS, there is one area that has yet to receive its runway debut.

Cancer research and the resulting vaccine developments stand out as a primary candidates poised to capitalize on the advancements of large language models (LLMs) and AI. For over 50 years, finding a cure for cancer has remained at the top of the medical community's to-do list. The disease has personally affected nearly everyone, whether through a loved one's diagnosis or loss. Today, we are more confident than ever that with the help of these new computing tools, we are only single digit years, and quite possibly months, away from witnessing the release of a cancer vaccine for widespread production and distribution. This article will delve into the current research, breakthroughs, and financial developments surrounding cancer vaccines, and explore what this means for both patients and market participants.

Abstract

The COVID-19 pandemic served as an unprecedented proving ground for mRNA technology, with vaccines from companies like Moderna and Pfizer providing quick responses to the virus. While the effectiveness is still a much-debated topic, one thing cannot be denied: mRNA vaccines were able to put to the test on the largest sample size in human history. The technology's noted success in the context of infectious diseases has now led scientists and pharmaceutical companies to explore its potential in oncology, a market expected to reach nearly $200 billion by 2026. Researchers are now working on mRNA cancer vaccines aimed at both preventing and treating cancers, with some of the first candidates already undergoing trials. In particular, companies like Moderna (MRNA), BioNTech (BTNX), and emerging research labs like Oxford University are at the forefront of mRNA cancer vaccine development. These efforts promise to revolutionize how we approach cancer, offering potential breakthroughs in both treatment and prevention. However, while the potential is immense, the road ahead is filled with challenges.

Cancer Prevalance and Projections in U.S. Population from 1975–2040



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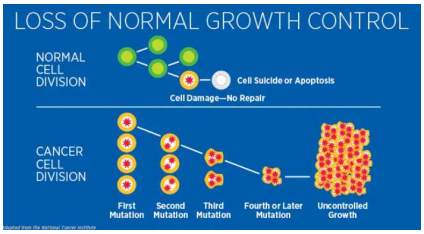
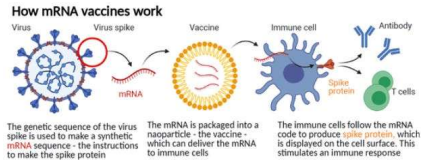
Adapted from Bluethmann SM, Mariotto AB, Rowland JH. Anticipating the "Silver Tsunami": Prevalence Trajectories and Comorbidity Burden among Older Cancer Survivors in the United States. Cancer Epidemiol Biomarkers Prev. 2016 Jul;25(7):1029-36.



What is Cancer?

Cancer is a term used for a disease that is characterized by the uncontrolled growth of abnormal cells. Severity, or "stage", is usually dependent on the spread of this growth to other parts of the body. Cancer is very difficult to cure because it is not a single disease but a collection of many different diseases, each with its own unique characteristics. The cancerous cells can mutate and evolve rapidly, making them resistant to treatments over time. Additionally, cancer cells often mimic normal cells, allowing them to evade detection by the immune system. The complexity of each cancer type, combined with the ways tumors adapt and resist treatment, makes finding a universal cure incredibly challenging. And unfortunately, current treatments like chemotherapy and radiation can be toxic to healthy cells, leading to difficult side effects and limited effectiveness.



What are mRNA vaccines?

mRNA vaccines, a groundbreaking form of immunotherapy, work by instructing cells to produce a protein that triggers an immune response against specific targets, such as viruses or abnormal cells. In the context of cancer, mRNA vaccines can be tailored to teach the immune system to recognize and attack cancer cells based on their unique genetic signatures. By combining the precision of mRNA technology with cancer research, scientists are advancing the development of vaccines that could train the immune system to effectively identify and destroy cancer cells.

OvarianVax

Before we get into big pharma developments, we wanted to focus in on one of the more recent developments at the University of Oxford, where researchers have begun developing the world's first ovarian cancer vaccine. Today, ovarian cancer is one of the deadliest cancers to affect women. The vaccine, known as OvarianVax (a rather straight-forward name), aims to harness the power of the immune system to detect and attack early-stage ovarian cancer cells. This development builds on the success of vaccines like the HPV vaccine, which has significantly reduced the incidence of cervical cancer by preventing viral infections that can lead to cancer.

The OvarianVax vaccine is being developed specifically for women with high genetic risk, particularly those with mutations in the BRCA1 and BRCA2 genes, which are linked to an increased risk of ovarian and breast cancer. The ultimate goal is to create a vaccine that would offer protection to these women without requiring them to undergo the drastic option of preventive surgery which deprives them of their fertility. Researchers at Oxford have continued to receive fiscal support from numerous sources, including a $785,000 grant from Cancer Research UK, to continue their efforts. Even though there is still much testing to be done, early optimism shows a defining north star to follow for a potential cure.

Above: Ovarian Cancer facts

BioNTech's Advancements

BioNTech, the German pharmaceutical company that co-developed the mRNA COVID-19 vaccine with Pfizer, has recently shifted its focus toward developing personalized cancer vaccines. These vaccines are designed to target specific mutations in an individual's tumor, making the treatment highly customized and more effective than traditional therapies.

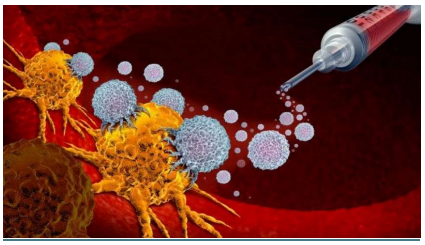
This approach involves sequencing the DNA of a patient's tumor to identify neoantigens (unique proteins expressed by cancer cells but not healthy cells). If we can get the vaccine to do this and thereby train our immune systems to attack these unique neoantigens, it would be arguably the greatest scientific breakthrough of our lifetime. At its current stage, this approach is being explored for cancers like melanoma, lung cancer, and colorectal cancer.

Above: BioNTech lab technologist running analysis on mRNA vaccines

The personalized nature of BioNTech's vaccine makes it one of the most sophisticated approaches to cancer immunotherapy. However, it also presents significant challenges, particularly in terms of production costs and the time required to develop a vaccine for each individual patient.

Moderna's mRNA-4359

Moderna (MRNA), which became a household name with its COVID-19 vaccine, is also making significant strides in cancer immunotherapy. One of their leading candidates is mRNA-4359, a cancer vaccine aimed at treating melanoma and other solid-state tumors. Early-stage trials of mRNA-4359 have shown promising results, with some patients reporting a halt in tumor growth after receiving the vaccine.



Above: Illustration from Moderna's mRNA-4359 reports

The vaccine works similar to BioNTech's (above): instructing the body's immune system to recognize and attack specific cancer antigens. While still in the experimental phase, the technology used in mRNA-4359 is similar to the COVID-19 vaccine platform, offering a rapid and adaptable means of generating personalized cancer treatments. Moderna is also exploring the possibility of combining these mRNA vaccines with other immunotherapies, such as checkpoint inhibitors, to enhance their effectiveness.

The financial backing for Moderna's cancer vaccine program is substantial, with the company investing hundreds of millions into clinical trials. Given Moderna's track record with mRNA vaccines, many wall street analysts are growing optimistic about the company's ability to succeed in oncology. However, the challenge remains consistent across all major players in big pharma. The costs to bring these personalized therapies to market at a reasonable cost will be a struggle.

The Financial Landscape:

I think it goes without being said, but the financial opportunities surrounding mRNA cancer vaccines are immense. To put this in perspective, COVID-19 killed 7 million people worldwide from 02/2020-02/2024. Cancer kills ~10 million people **per year** worldwide. It is estimated that, over the same time period of FEB 02/2020-02/2024, ~40 million died from cancer. And also, COVID-19 was highly cyclical, and cancer has been ever present for decades.

I know many of you don't need convincing as to how dramatic cancer is in terms of fatality, but the purpose is to show a relative comparison for what might occur in the stock market. Take a quick look at the response in the market of leading pharmaceutical companies like Moderna, Pfizer, and BioNTech for the COVID-19 vaccine creation and distribution (right side).

Now imagine those charts when a cancer vaccine is released to the public with high efficacy. As long as the medical backing and research is sound and adverse effects are nominal, you can almost guarantee every single person in the world will want to have access.

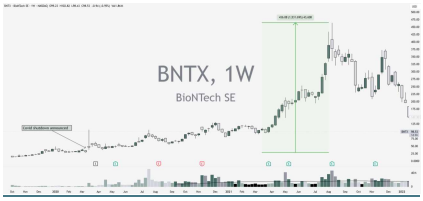
There really is only one main sticking point for me that is still unknown and a large barrier to the financial boom. As mentioned above, these vaccines will more than likely have to be customized to each person. This key detail that is the reason for the high efficacy, could also be one of the largest hurdles to profitability. What does this mean for scalability and market affordability?

There will always be the common objections with cancer 'cures' of ongoing experimental phases, uncertain approval timelines, and complex clinical trial processes. But that is where AI comes into play. And that is where we start to grow extremely bullish on the short- and long-term potential in this space.

MRNA 1W

PFE 1W

BNTX 1W



NVAX 1W

AI's Impact On Oncology:

I come from a traditional science background, studying sciences in undergraduate, and staying in related fields for a couple years post-graduation. When I started investing, it was biotechnology that grabbed hold of my attention. The idea of financial profits with medical advancement and, ultimately, lifesaving motives, has always been the ideal investment. Right now, many market participants are focused on AI, but from a supplier perspective such as NVDA, to provide the engine, and also energy companies, to supply the fuel. While these have been credible investments and noted themes across the market, it hasn't been the thing that has me in a frenzy.

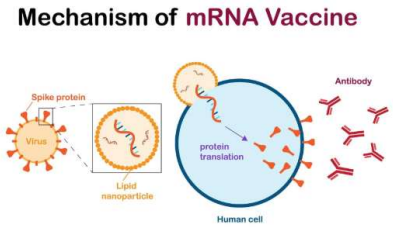
The advancement in LLMs and AI has already revolutionized medical advancements. The ability to cross-analyze data with these tools is a key development that could reduce both times to market and costs. By leveraging this ability to analyze vast amounts of biological data, researchers can identify specific genetic markers and mutations unique to each cancer type more efficiently. Think about the evolution in analytics over time:

- 40 years ago: These calculations were done by hand.
- 20 years ago: This was done via hand coding tasks into small terminal windows took 10sec to run simple lines of code.
- Currently: We have access to the largest record of data every to exist and upload, clean, sort, arrange, and use this data in a moment's notice. Now imagine where we will be in 6-12 months when the AI and LLM ecosystem becomes even more advanced. Solving, what was previously impossible cancer mutations, will be a task requiring near zero effort.

For LLMs specifically, they will be able to design mRNA vaccine sequences that are tailored to target cancer specific proteins, such as neoantigens referenced earlier, to significantly improve the precision and effectiveness of treatments. AI will accelerate the discovery of new neoantigens, optimize vaccine formulations, and predict how patients' immune systems will respond to specific mRNA treatments. This combination of AI driven analysis and mRNA technology will streamline vaccine development, making it faster, more accurate, and better able to prevent or treat cancers at an individualized level.

Conclusion:

We are on the precipice of the greatest medical revolution in the history of mankind, and this is one of the most exciting times to be an investor and market participant. No matter how you feel about big pharma, you cannot refute the potential for these companies to make potentially hundreds of billions, and maybe trillions, with the development of cancer vaccines. Greedy as they are, as long as they do not cut corners with safety and efficacy, AI and LLMs will be the secret ingredients that big pharma needs to make the final push into the new frontier.



Investing Challenges:

We would be remiss not to mention the investing challenges in the medical space. Historically speaking, biotechnology names that focus on new age medical or 'breakthrough' developments are extremely difficult to time. From a short-term investing standpoint, we rely heavily on technical setups. Great examples of this from similar spaces is Abbott (ABT) and AbbVie (ABBV). Long term, many of these breakthroughs are treated with high speculation. This is mainly due to the lack of control over regulatory and testing timelines. COVID-19 was a bit of an anomaly and stocks were able to grip into tight stock runs because of 'Operation Warp Speed'.

We, at SEBS, currently do not hold any vaccine related names but we are monitoring very closely now that developer names are removing excess premium in the larger, broad market reversion. Our goal is to take a position in 2025 based on technical entry indicators and begin to further double-click into vaccine development schedules.

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