Nurses and
Nurse Practitioners
of British Columbia

COVID-19 Vaccines

And What to Expect

Types of COVID-19 Vaccines

The following is a list of several COVID-19 vaccines that are either currently undergoing advanced stage trials or are at the point of approval in some jurisdictions. Vaccine manufacturers around the world are producing different types of COVID-19 vaccines, each of which are held to a high standard of quality and efficacy before they are approved. Some of these vaccine types include messenger RNA or 'mRNA', adenovirus-based, protein-based and inactivated vaccines, all of which can be equally effective at preventing infection from COVID-19.

LPN NP RN RPN

Messenger RNA Vaccines

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Pfizer-BioNTech

Name of vaccine: **BNT162b2, Comirnaty, or tozinameran**

The Pfizer-BioNTech vaccine was approved in Canada on December 9, 2020. This vaccine uses messenger RNA, also known as 'mRNA' which are made up of a gene from the coronavirus that is surrounded by an oily lipid nanoparticle shell. This lipid shell is very fragile and needs to be kept at a very cold temperature prior to use (-70 degrees Celsius).

Once the mRNA vaccine is injected the vaccine particles start doing their job. These particles fuse with our cells and release the mRNA. Our cells read the 'instructions' provided by the mRNA, and spike proteins are formed. Our bodies recognize that these spike proteins are foreign, and our immune system starts to fight them off and it will do it again if exposed to COVID-19.

Based on studies involving 44,000 participants, the Pfizer-BioNTech vaccine has demonstrated a 95% efficacy rate just one week after the second dose is administered.[vi]

Did you know?

Messenger RNA vaccines are quicker and easier to make than other types of vaccines. These types of vaccines are relatively new, but mRNA has been tested in humans before, specifically for rabies, influenza, cytomegalovirus and zika.[ii]

Side Effects

The most common side effects of the Pfizer-BioNTech and Moderna vaccines include pain, itchiness, swelling and/or hardness at the injection site, headache, tiredness, muscle pain, chills, nausea, and mild fever. Some rarer side effects include swollen lymph nodes in the arm that received the vaccine, dizziness, numbness and laboured breathing.[iii] In very rare cases, some people may also experience an allergic reaction (anaphylaxis) to the chemical polyethylene glycol (PEG) which is used in the formulation of both mRNA vaccines.[iv] For further information on mRNA vaccine aftercare, see the BCCDC Vaccine Aftercare guidelines.[v]

Moderna

Name of vaccine: **mRNA-1273, Spikevax**

The Moderna vaccine is similar to the Pfizer-BioNTech vaccine in that it also uses messenger RNA or mRNA. The Moderna vaccine was approved in Canada on December 23, 2020.

The Moderna vaccine also needs to be maintained at cold temperatures. Moderna has said that their vaccine can be kept at -20 degrees.

Once the vaccine is injected, the vaccine particles fuse with our cells and the process of creating spike proteins and an immune system response begins. This gives our immune system a preview of what the real COVID-19 virus would look like, so it can pre-emptively design antibodies that can fight off the real virus if it ever needs to.

Based on studies involving approximately 30,000 participants, the Moderna vaccine has demonstrated a 94.1% efficacy rate within just two weeks of the second dose.[i]

Adenovirus-Based Vaccines

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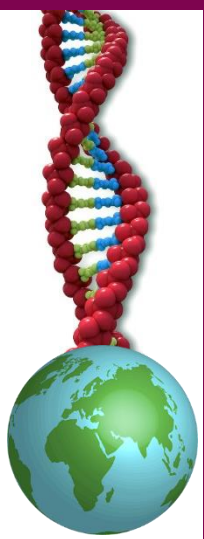
Oxford-AstraZeneca

AstraZeneca | University of Oxford



Name of vaccine: **AZD1222, ChAdOx1-S, Vaxzevria, Covishield (version)**

The University of Oxford partnered with British-Swedish company AstraZeneca to create an adenovirus-based vaccine. It was first approved for use in Canada on February 26, 2021.[xvi] However, European reports have stated that this vaccine may be linked to very extreme cases of blood clots. Since this was announced, the National Advisory Committee on Immunization (NACI) has amended the age group of Canadians who can use this vaccine.[xvii]

This vaccine is made with the use of an adenovirus, which is another type of virus that commonly causes cold-and flu however it cannot replicate inside the body.[xviii] Once inside the body, the adenovirus is transmitted into cells, and those cells send out a warning signal that provokes the immune system to respond.[xix]

Adenovirus-based vaccines use COVID-19 DNA rather than mRNA. DNA is not as fragile as mRNA, meaning that the vaccine does not need to be maintained at the same extremely low temperatures as the Pfizer-BioNTech or Moderna vaccines. Oxford-AstraZeneca states that their vaccine lasts for at least 6 months when refrigerated between 2 and 8 degrees Celsius.

The Oxford-AstraZeneca vaccine requires two injections given 8 to 12 weeks apart. This vaccine has demonstrated a 63.1% efficacy rate.[xx]

Oxford-AstraZeneca is a non-profit COVID-19 vaccine that can be deployed all around the world for truly global use.[xxi] The 6-month shelf-life at standard refrigeration temperatures will allow for easier shipping and storage.

Side Effects

The most common side effects associated with the Oxford-AstraZeneca and Johnson & Johnson vaccines include pain at the injection site, chills, tiredness, and mild fever.[xii] Rare side effects may include fatigue, chills, muscle pain, nausea, and mild fever. With the Oxford-AstraZeneca vaccine, rare cases of developing blood clots have been reported in approximately 1 to 10 people per million vaccinated.[xiii] With the Johnson & Johnson vaccine, rare cases of blood clots and low levels of blood platelets have been reported, but the level of incidence is not yet determined.[xiv] Symptoms that may indicate a developing blood clot include severe headaches that do not go away in the weeks following vaccination, seizures, difficulty moving the body, blurry vision that does not go away, difficulty speaking, chest pain, severe abdominal pain, and abnormal bruising, blistering, or skin colour pigmentation under the skin, especially in an arm or leg.[xv] For more information, see the BCCDC Vaccines Aftercare guidelines.

Johnson & Johnson (Janssen Pharmaceutica)

Janssen Pharmaceutical Companies of Johnson & Johnson

Name of vaccine: **Ad26.COV2.S or JNJ-78436735**

This Johnson & Johnson (Janssen) vaccine was approved for use in Canada on March 5, 2021. Similar to the Oxford-AstraZeneca vaccine, the Johnson & Johnson vaccine may be associated with very rare cases of blood clots. However, further investigation needs to be done. At this time, research demonstrates that the benefits outweigh the potential risks.[vii]

This vaccine is another adenovirus-based vaccine where the genetic material from COVID-19 is combined with an adenovirus that acts as a carrier when inserted into the human body. The adenovirus used is known as adenovirus serotype 26 or 'Ad26', and Johnson & Johnson has used the same adenovirus to formulate vaccines for other diseases before, such as the one they created for Ebola.[viii],[ix] Like the Oxford-AstraZeneca vaccine, the adenovirus triggers an immune response, but does not replicate inside human cells. However, unlike all other advanced stage vaccines to date, Johnson & Johnson has been testing a vaccine that only requires one injection, rather than two.

Johnson & Johnson's commitment to producing an effective single-injection vaccine would allow them to help vaccinate up to one billion people each year.[x] After wrapping up clinical trials earlier this year, the efficacy rate of this vaccine is estimated to be approximately 66% based on trials involving 43,000 participants.[xi]

Protein-Based Vaccines

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Novavax

Name of vaccine: **NVXCoV2373, Nuvaxovid**

The Novavax vaccine was approved for use in Canada on February 17, 2022. This vaccine is protein-based, meaning that it contains a coronavirus protein mixed with a proprietary MatrixM™ 'adjuvant' which is injected into the body and prompts an immune system response. The coronavirus protein is modified so that it cannot replicate, making it safe for injection. This vaccine is also manufactured inside of moth cells, which is much faster than manufacturing a vaccine through more traditional mammalian cells.[xxii]

An adjuvant is a special ingredient that can be used in a vaccine to make it work better.[xxiii] Studies show that immune system results are stronger when the protein is combined with the adjuvant, compared to when the vaccine is administered with the protein alone.[xxiv]

The Novavax vaccine requires two injections. Through Phase 3 trials, researchers discovered that the vaccine produced both disease-fighting antibodies as well as T-lymphocyte cells, which are an immune system cell that help to fight off infection.[xxv]

Did you know?

Other protein-based vaccines have been used before for diseases such as Hepatitis B and shingles.[xxvi]

Side Effects

Evidence from other protein-based vaccines show that by restricting the immune system's contact to only the protein fragment, chances of side effects are minimized.[xxvii, xxviii] Some common side effects are still experienced, including local reactions such as mild pain and tenderness at the site of injection.[xxix] After completing phase 1 trials, Novavax reported that approximately 80% of participants experienced mild side effects including pain at the injection site, and about 6% (8 out of 130 participants) experienced moderate to severe reactions that resolved within a few days.[xxx] After completion of phase 1 trials, Medicago reported that 100% of trial participants developed significant antibody response with no severe side effects.[xxxi]

Medicago

Name of vaccine: **VIR-7831, Covifenz**

The Medicago vaccine was approved for use in Canada on February 24, 2022. The Medicago vaccine is another unique vaccine made by injecting coronavirus proteins into a plant known as nicotiana benthamiana. Once the proteins have been injected, the plant produces something called "virus-like particles" which upon injection, promote an immune response in humans.[xxxii] Medicago is also testing their vaccine by combining it with various adjuvants, and has noted encouraging results from the different combinations.

Medicago has discovered that growing these virus-like particles inside of plants is much quicker than developing a vaccine traditionally by incubation inside of chicken eggs. In fact, Medicago was able to formulate an early version of their vaccine within only 20 days of receiving the genetic sequence information for COVID-19.[xxxiii]

Medicago has two primary locations in North America. One manufacturing plant is in North Carolina, and the other smaller plant just outside of Quebec City is currently undergoing some large-scale expansions.

Inactivated Vaccines

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Sinopharm

Name of vaccine: **BBIBP-CorV**

Sinopharm developed their vaccine in collaboration with the Beijing Institute of Biological Products and it has already been approved for emergency and full use in several countries including United Arab Emirates, Bahrain and Egypt.[xxxiv] The Sinopharm vaccine is made using inactivated coronaviruses, meaning that these viruses are either weakened or killed before they are used to create a vaccine. The Sinopharm vaccine cannot cause COVID-19 infection when it is injected into the human body. An adjuvant is then added to the dead coronaviruses, which prompts the body to start its immune response.

This method of creating vaccines with an inactivated virus has been used for over a century and is the same method that Salk employed to create the polio vaccine in the 1950s.[xxxv]

Side Effects

Common side effects associated with both Sinopharm and Sinovac vaccines include soreness at the injection site, fatigue, headaches and nausea.[xxxix] Rare side effects associated with the Sinovac vaccine include stroke-like symptoms including drowsiness and numbness in the arms. To date, Thailand has reported 6 cases of stroke-like symptoms out of approximately 600,000 people vaccinated with Sinovac, all of which have recovered fully.[xl]

Sinovac (Sinovac Life Sciences)

Name of vaccine: **CoronaVac**

Sinovac, a privately-owned company headquartered in Beijing, developed the CoronaVac vaccine early in 2020 and to date has been approved for use in 22 countries including China, Brazil, and Mexico, among others.[xxxvi] Sinovac is one of the most used vaccines in China, and together with Sinopharm has helped to vaccinate more than 65 million people with their first injection, and approximately 34 million people with the full two doses.[xxxvii] Like Sinopharm's vaccine, CoronaVac is formulated using inactivated coronavirus.

As of April 2021, studies show that CoronaVac may have around a 50% efficacy rate.[xxxviii]

The Nursing Role in Understanding COVID-19 Vaccines

As the COVID-19 vaccines are approved around the world, doses of these vaccines will be deployed. To date, Canada has approved six COVID-19 vaccines, including those manufactured by Pfizer-BioNTech and Moderna in 2020, Oxford-AstraZeneca and Johnson & Johnson in 2021, and Novavax and Medicago in early 2022. The goal is that as Phase 3 trials are completed, other equally effective vaccines can be approved for general use in Canada.

Nursing is guided by science and scientific evidence. All nurses have a professional obligation to be part of health promotion and disease prevention public health strategy that will save future lives. Through decades of research and clinical testing, vaccines have been proven to be both safe and effective. Because nurses consistently rank as one of the most trusted professions, nurses are integral to sharing this information with the public. When science is combined with a patient and family centered care approach, there is an opportunity to inform and clarify. NNPBC encourages all nurses to share this information and bring clarity and facts to patients and clients around COVID-19 vaccines.

Further Reading

Nurses and Nurse Practitioners of British Columbia

BCCDC: Vaccines for COVID-19
CBC News: Coronavirus vaccine tracker
NNPBC Blog- Tackling Vaccine Hesitancy
What you need to know about Vaccine Roll-Out

ImmunizeBC: How do vaccines work?
WHO: How do vaccines work?
WHO: Coronavirus disease (COVID-19) advice for the public

Endnotes

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