Community of Practice:

Vaccines

August 2022

Royal Victoria Regional Health Centre

www.rvh.on.ca

What is a vaccine?

Vaccines are products that protect people against many diseases that can be very dangerous and even deadly. Different than most medicines that treat or cure diseases, vaccines prevent you from getting sick with the disease in the first place.

Vaccines are products that produce immunity to a specific disease. When you are immune to a disease, it means you are protected against that disease (you can be exposed to it without becoming sick). Most vaccines are given by injection (needle), but some are given orally (by mouth) or nasally (sprayed into the nose).

Vaccination is the act of introducing a vaccine into the body to produce immunity to a specific disease.

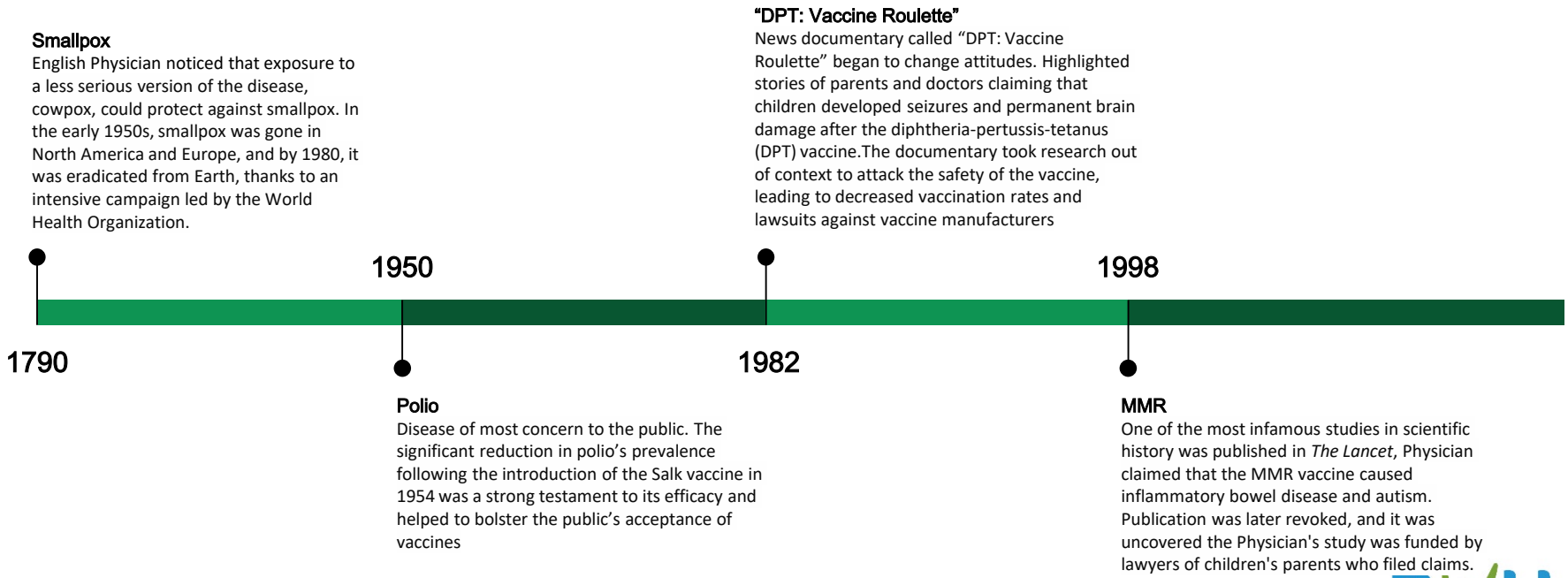
Immunization is the process by which a person or animal becomes protected against a disease. This term is often used interchangeably with vaccination.

Vaccines are not always perfect, but can be thought of like shields. And when the shield fails (you get infected), there is knowledge we have acquired through the vaccine to not allow much damage to occur (prevention of severe illness).

What is the history behind vaccine hesitancy?

Vaccine hesitancy: a story as old as vaccines themselves

From smallpox to COVID, people have resisted a tool that saves millions. Why?



A few decades of hesitancy and myths later…

- Despite medical literature showing no link between the development of autism and vaccination, many still believe this myth.
- Public figures, from actress Jenny McCarthy to former president Donald Trump latched onto the study and used their platforms to repeat vaccine misinformation.
- The rise of social media sites has created echo chambers where these views are shared and reinforced.
- The effect of this has been alarming—a clear and dramatic downward effect on vaccination rates since the Wakefield study.

Where are we today with Vaccine trust?

- Almost immediately after the emergence of COVID-19, work on a vaccine began, building on decades of previous vaccine development research. In less than a year, four vaccines were developed and distributed around the world to combat a global pandemic that had claimed millions of lives.
- We still have community members who are fearful of, and susceptible to, misinformation about vaccines for a variety of reasons.
- The volume of data, and the access to such data, can be confusing and easily misinterpreted by those who are not “trained” to read research.

What is important moving forward?

- We need to be upfront about vaccine side effects and diligent about reporting adverse reactions
- Downplaying or hiding this information would do a disservice to patients and would only strengthen anti-vaccination claims.
- Those with large audiences must recognize the impact that they can have and encourage their followers to be vaccinated.
- Perseverance, openness, and trust in Science

Types of Vaccines (6)

- **Inactivated vaccines**
  - Use the killed version of the germ that causes a disease.
  - Don't provide immunity (protection) that's as strong as live vaccines; so need several doses over time (booster shots) in order to get ongoing immunity against diseases.
- **Live-attenuated vaccines**
  - Use a weakened (or attenuated) form of the germ that causes a disease.
  - Because these vaccines are so similar to the natural infection that they help prevent, they create a strong and long-lasting immune response
- **Messenger RNA (mRNA) vaccines**
  - Make proteins in order to trigger an immune response
- **Subunit, recombinant, polysaccharide, and conjugate vaccines**
  - Use specific pieces of the germ—like its protein, sugar, or capsid (a casing around the germ)
  - Because these vaccines use only specific pieces of the germ, they give a very strong immune response that's targeted to key parts of the germ
- **Toxoid vaccines**
  - Use a toxin (harmful product) made by the germ that causes a disease
  - The immune response is targeted to the toxin instead of the whole germ
- **Viral vector vaccines**
  - Use a modified version of a different virus as a vector to deliver protection.

Type	Examples
Inactivated Virus Vaccine	• Inactivated polio vaccine or IPV (99-100% effective) • Hepatitis A (94-100% effective) • Rabies
Live-attenuated Virus Vaccine	• MMR (100% effective) • Shingles (91-97% effective) • Chickenpox (98% effective) • Smallpox, and now Monkeypox • TB (51% effective) • Yellowfever (99% effective)
Messenger RNA (mRNA) vaccines	• COVID-19 (see next slide)
Subunit, recombinant, polysaccharide, and conjugate vaccines	• Hib (95% effective) • Hepatitis B (98-100% effective) • HPV (Human papillomavirus) (~100% effective) • Whooping cough (85% effective)
Toxoid Vaccines	• Diphtheria (97% effective) • Tetanus (100% effective) • Pertussis (80-90% effective)
Viral Vector Vaccines	• Malaria (>75% effective) • Ebola (95-100% effective)

COVID-19 Vaccine Efficacy

Demonstration of the need for a new, bivalent vaccine

	Effectiveness at preventing											
	Ancestral		Alpha		Beta		Gamma		Delta		Omicron	
Vaccine	Severe disease	Infection	Severe disease	Infection	Severe disease	Infection	Severe disease	Infection	Severe disease	Infection	Severe disease	Infection
AstraZeneca	94%	63%	94%	63%	94%	69%	94%	69%	94%	69%	71%	36%
CanSino	66%	62%	66%	62%	64%	61%	64%	61%	64%	61%	48%	32%
CoronaVac	50%	47%	50%	47%	49%	46%	49%	46%	49%	46%	37%	24%
Covaxin	78%	73%	78%	73%	76%	72%	76%	72%	76%	72%	57%	38%
Johnson & Johnson	86%	72%	86%	72%	76%	64%	76%	64%	76%	64%	57%	33%
Moderna	97%	92%	97%	92%	97%	91%	97%	91%	97%	91%	73%	48%
Novavax	89%	83%	89%	83%	86%	82%	86%	82%	86%	82%	65%	43%
Pfizer/BioNTech	95%	86%	95%	86%	95%	84%	95%	84%	95%	84%	72%	44%
Sinopharm	73%	68%	73%	68%	71%	67%	71%	67%	71%	67%	53%	35%
Sputnik-V	92%	86%	92%	86%	89%	85%	89%	85%	89%	85%	67%	44%
Other vaccines	75%	70%	75%	70%	73%	69%	73%	69%	73%	69%	55%	36%
Other vaccines (mRNA)	91%	86%	91%	86%	88%	85%	88%	85%	88%	85%	67%	45%

Immune Response to Vaccines

Immunocompromised People and Vaccines

Immunocompromised means that either a congenital condition, an illness, or medications are **suppressing the immune function and reduce the ability of the immune system to fight against different infections.**

- Immunocompromised persons are more susceptible to vaccine-preventable infections and may have severe infections.
- The safety and effectiveness of vaccines in immunocompromised persons are determined by the type of immunodeficiency and degree of immunosuppression. Each immunocompromised person is different and presents unique considerations regarding immunization.

Type	Can immunocompromised people receive?
Inactivated Virus Vaccine	yes
Live-attenuated Virus Vaccine	generally, no
Messenger RNA (mRNA) vaccines	yes
Subunit, recombinant, polysaccharide, and conjugate vaccines	yes
Toxoid Vaccines	sometimes
Viral Vector Vaccines	sometimes

Click for more information

What's different about COVID-19 compared to Influenza?

- We have a lot of historical data on the evolution of the Influenza Virus
- The vaccine we receive for the Influenza Virus is a "predictive" vaccine that targets anticipated gene expressions
- "Seasonal Influenza" is a result of antigenic drift, and therefore typically evolves x1/year

- The COVID-19 Virus is evolving in a more frequent pattern; several variants per year.
  - Alpha, Beta, Delta, Gamma, Omicron
- The COVID-19 Vaccine is designed using a different mechanism, and has more "variant coverage" as a result.

Why do we need Booster doses for COVID-19?

Influenza Vaccine

Two key processes that influenza viruses evolve through are: **antigenic drift** and **antigenic shift**.

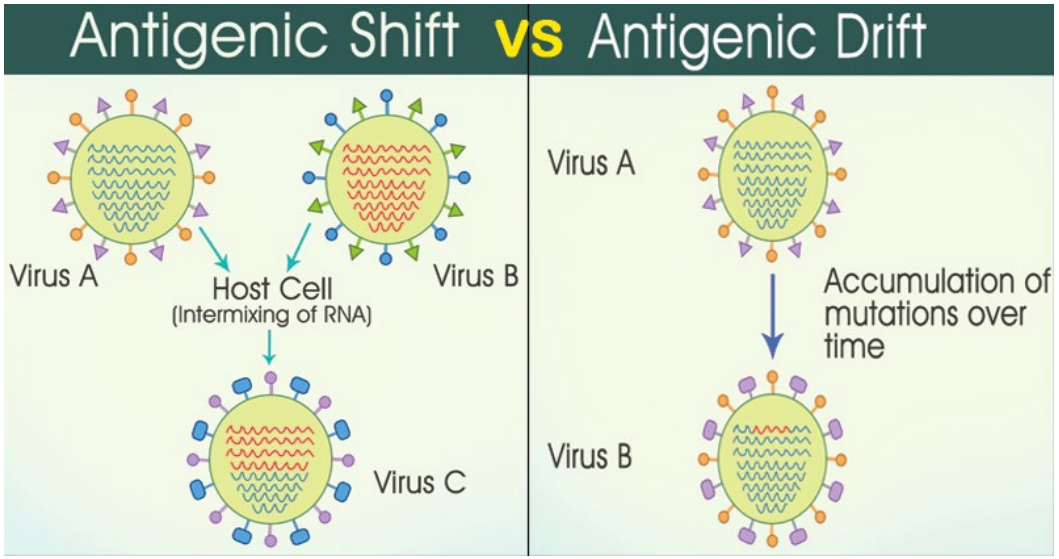
Antigenic shift:

- change is sudden and drastic.
- May jump from one species to another, for instance, animal to human.

Antigenic drift:

- change is gradual.
- May infect animals of the same species only.

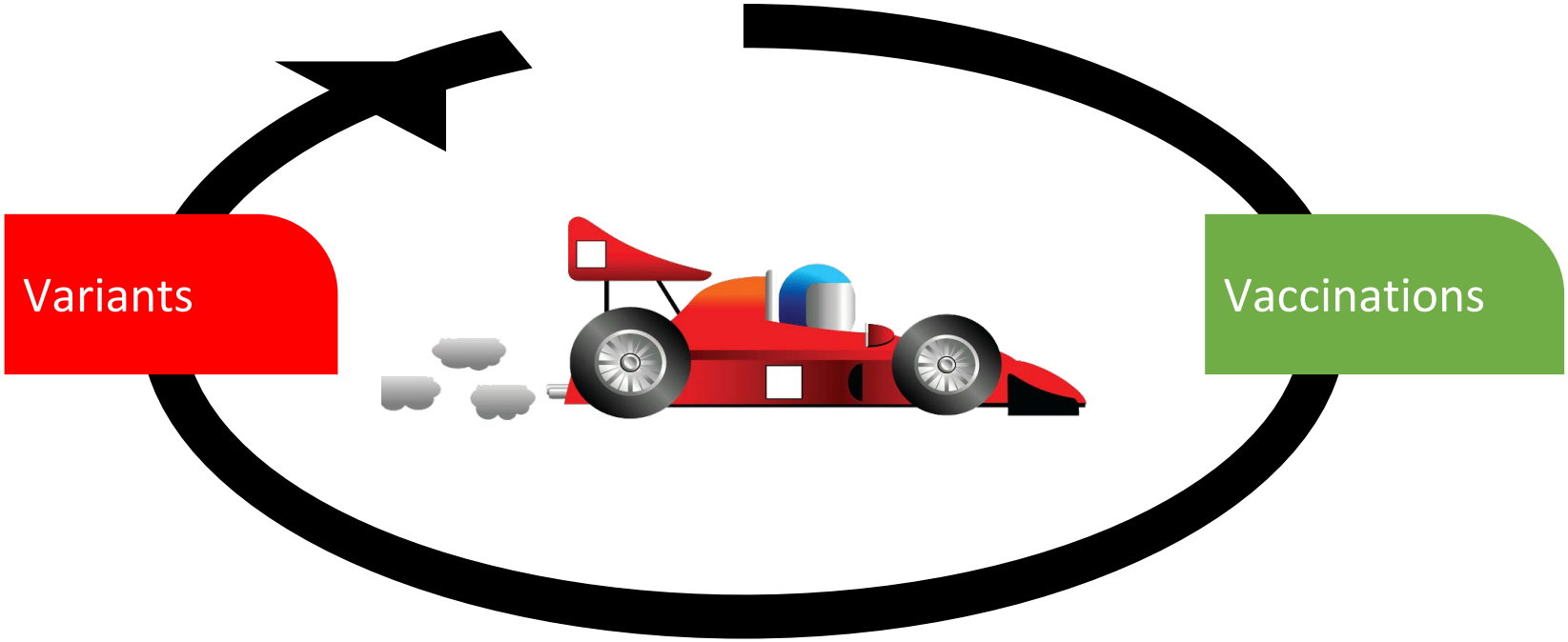
Novel strain
ex. "Avian Influenza"



Normal, seasonal influenza

What is Herd Immunity?

Why don’t we have Herd Immunity with COVID-19 yet?



An Analogy to think about:

It’s like a boat that has a slow leak. The water is the disease, and a bucket for bailing is the vaccine. Before we started bailing out the water (vaccinating), the boat was filled with water (disease). We have been bailing (vaccinating) fast and hard, and now the boat is almost dry. We could say, "Good. The boat is dry now, so we can throw away the bucket (stop vaccinating) and relax" — except that the leak hasn't stopped (the diseases are still present). Before long, we'd notice water (disease) seeping in, and soon it might be back up to the same level as when we started. Unless we can "stop the leak" (eliminate the disease), it is important to keep bailing (vaccinating).

Questions and Answers about Vaccines:

Question: If I have Rheumatoid arthritis and am taking immunosuppressant drugs to manage my condition, can I get an mRNA COVID-19 vaccine (ex. Pfizer, Moderna)? (ie. this person is immunocompromised)

Answer: Yes

Explanation: COVID-19 is an mRNA vaccine, and is important for immunocompromised people to receive. mRNA vaccines are safe for immunocompromised people. (Reference slide 11).

Question: If my 2 years old is undergoing chemotherapy (immunosuppression) for childhood cancer, can they get their second dose of MMR vaccine?

Answer: Likely not

Explanation: Severely immunocompromised people should not receive live vaccines because of the risk of disease caused by the vaccine strains. In this case, this child would have to rely on Herd Immunity, to protect them as much as possible. (Reference slide 11 + 15).

Question: Will multiple injections overwhelm the immune system?

Answer: No

Explanation: Every day our bodies come into contact with millions of germs, causing our immune systems to work continuously to protect us. Therefore, exposure to antigens (parts of weak or dead viruses or bacteria) in vaccines is easily handled by our immune systems. In fact, our immune system needs to be challenged continually to stay vigorous. (Reference slide 13 + 15).

Question: Is it worth it to get a booster dose of the COVID-19 vaccine if it is only showing 40-50% effectiveness at preventing infection?

Answer: Yes

Explanation: Receiving a booster dose of COVID-19 helps your body "remember" how to fight against COVID-19 if you are exposed (refer to video on slide 12). Reminding your body of what to do, even if not 100% effective, helps to reduce the risk of severe illness from COVID-19. Receiving a booster dose re-teaches your immune system what to do if exposed. Kind of like re-learning how to do long division after years of using a calculator. (Reference slide 13).

Question: Can I get my booster COVID-19 vaccine at the same time as an Influenza vaccine?

Answer: Yes

Explanation: For people 12 years of age and older, all seasonal influenza vaccines, including live-attenuated influenza vaccine (LAIV), may be given at the same time as, or at any time before or after administration of other vaccines, including COVID-19 vaccines.

*Children aged 5 to 11 years of age can receive the COVID-19 vaccine 14 days before or after the influenza vaccine.

Question: Will getting an influenza or other immunization put me at a higher risk of getting COVID-19?

Answer: No.

Explanation: There is no evidence that getting an immunization makes you more likely to catch COVID-19. There is also no evidence that getting an immunization makes it harder for your body to fight COVID-19.

Do you have Questions?