



# Optimizing Vaccination after Cancer

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# Disclosures

- I work as an investigator at the BCCHR Vaccine Evaluation Center
- We receive funding from variety of sources to conduct vaccine research, including pharmaceutical companies to conduct clinical trials.
- All the funds go towards operational costs. I have not received any personal payments.
- I got influenza and COVID-19 shots this season



# TOPICS FOR TODAY

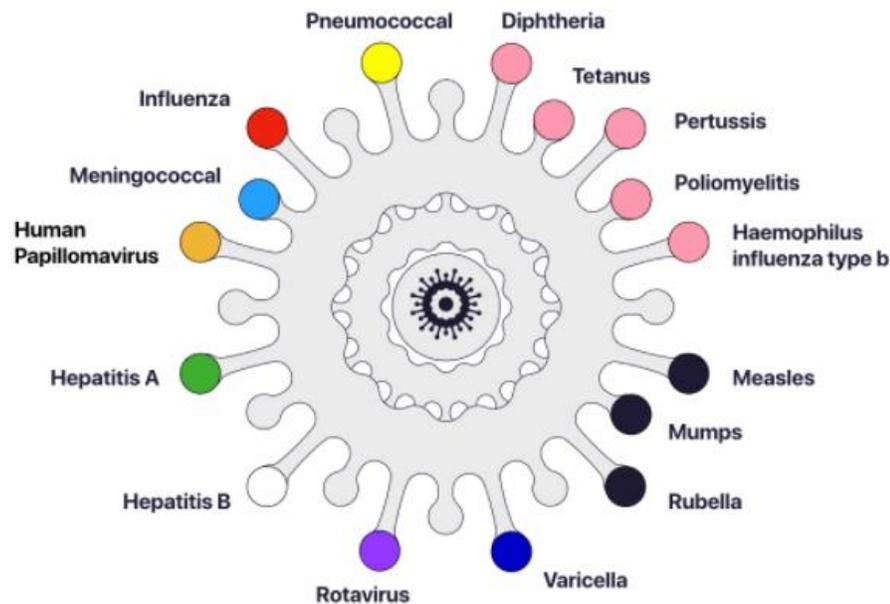
1. What are vaccines and how do they work
2. What do we know about vaccines after cancer
3. Vaccine recommendations that are “unique” for people who had cancer

# Background

**VACCINE:** a biological preparation that provides active acquired immunity to a particular infectious or malignant disease

## PROPHYLACTIC

## THERAPEUTIC



## Cancer vaccines and the future of immunotherapy



Orrin Pail, Matthew J Lin, Theodora Anagnostou, Brian D Brown, Joshua D Brody

Vaccines have had a major impact on the control of infectious disease, most recently by helping to combat the COVID-19 pandemic. Prophylactic cancer vaccines have prevented several malignancies by protecting against cancer-causing pathogens. By contrast, therapeutic vaccines training the immune system to eliminate established tumours are now showing real promise in clinical settings. In the adjuvant setting, vaccines against melanoma and pancreatic cancer appear to be reducing minimal residual disease and relapse. In the macrometastatic setting, in-situ vaccines have induced systemic regressions in advanced-stage lung and breast cancers and lymphomas. More effective cancer vaccines are being developed through having a deeper understanding of crucial cellular factors in tumour immunology, the incorporation of newer vaccine components to effectively mobilise and activate cells, the use of omics and artificial intelligence in vaccine design, and addition of immune checkpoint blockade. In this Viewpoint, we analyse cancer vaccine trials, the strengths and limitations of different vaccine approaches, and we discuss how the next generation of cancer vaccines can help improve patient outcomes and quality of life.

Lancet 2025; 406: 189–202

Published Online

June 17, 2025

[https://doi.org/10.1016/S0140-6736\(25\)00553-7](https://doi.org/10.1016/S0140-6736(25)00553-7)

The Tisch Cancer Institute (O Pail MD, M J Lin PhD, T Anagnostou MD, B D Brown PhD, J D Brody MD), Precision Immunology Institute (M J Lin, B D Brown, J D Brody), and Icahn Genomics Institute at Mount Sinai, New York, NY, USA

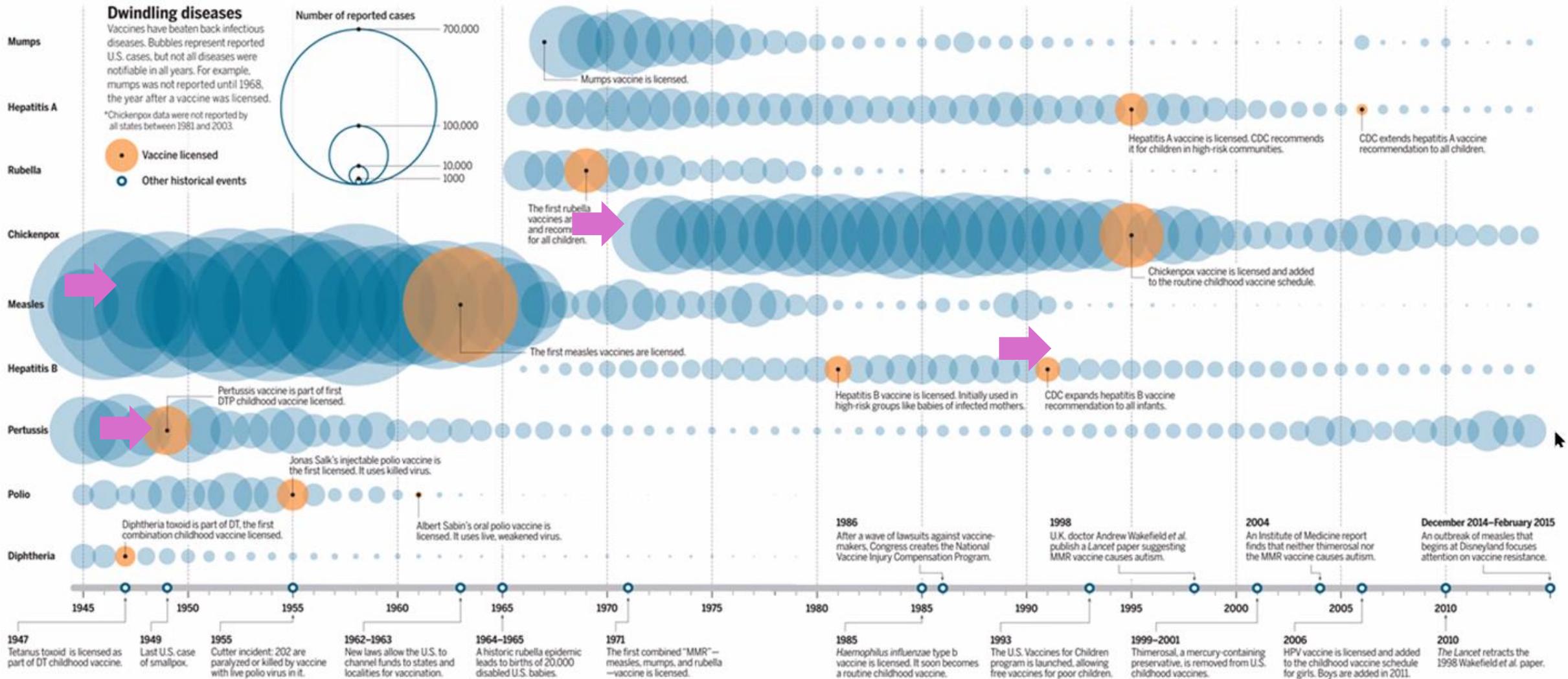


# How do vaccines work?

- [https://www.youtube.com/watch?v=\\_N1xX49AqwQ](https://www.youtube.com/watch?v=_N1xX49AqwQ)

When antibodies arrive, everything changes.

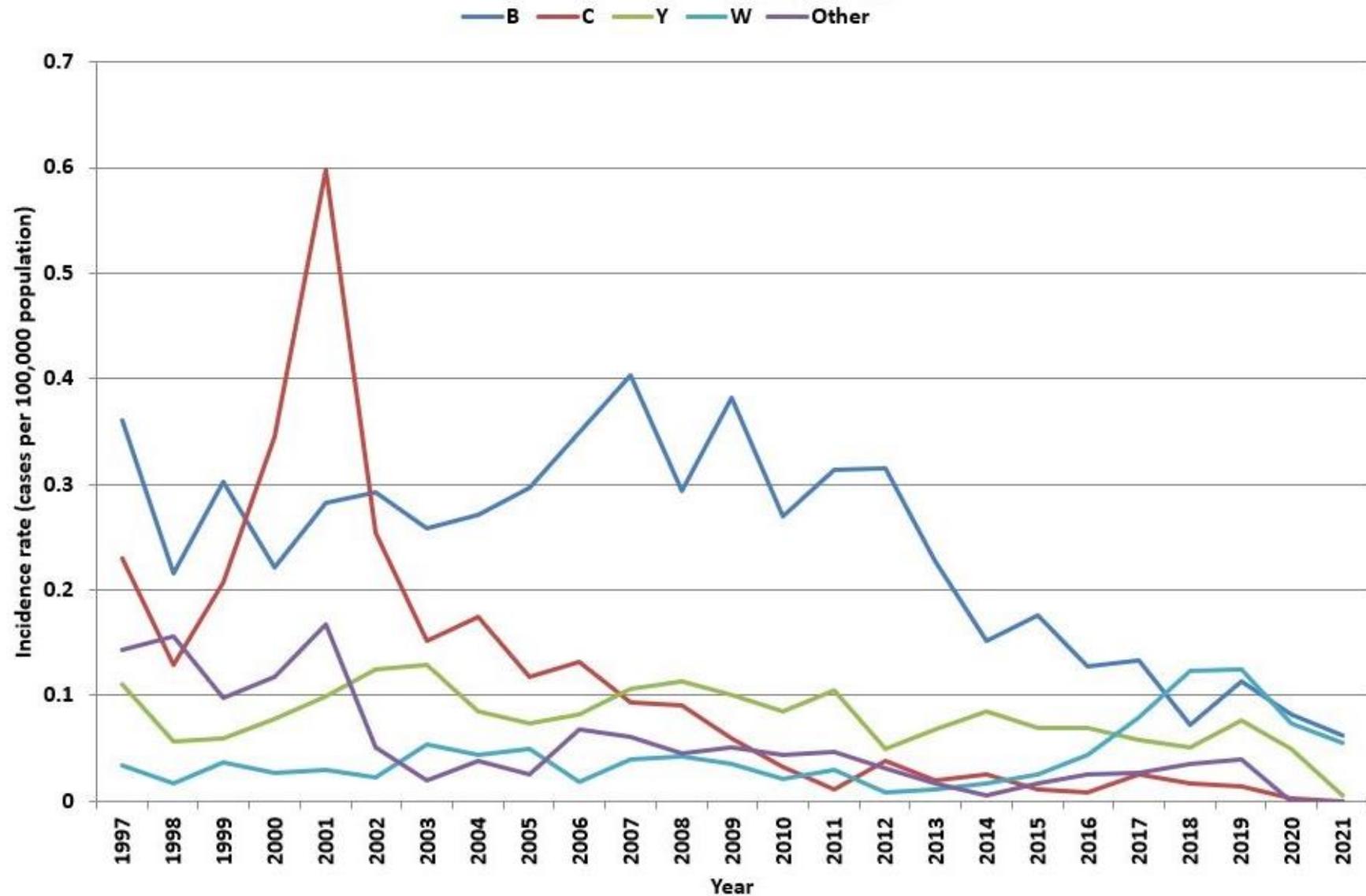




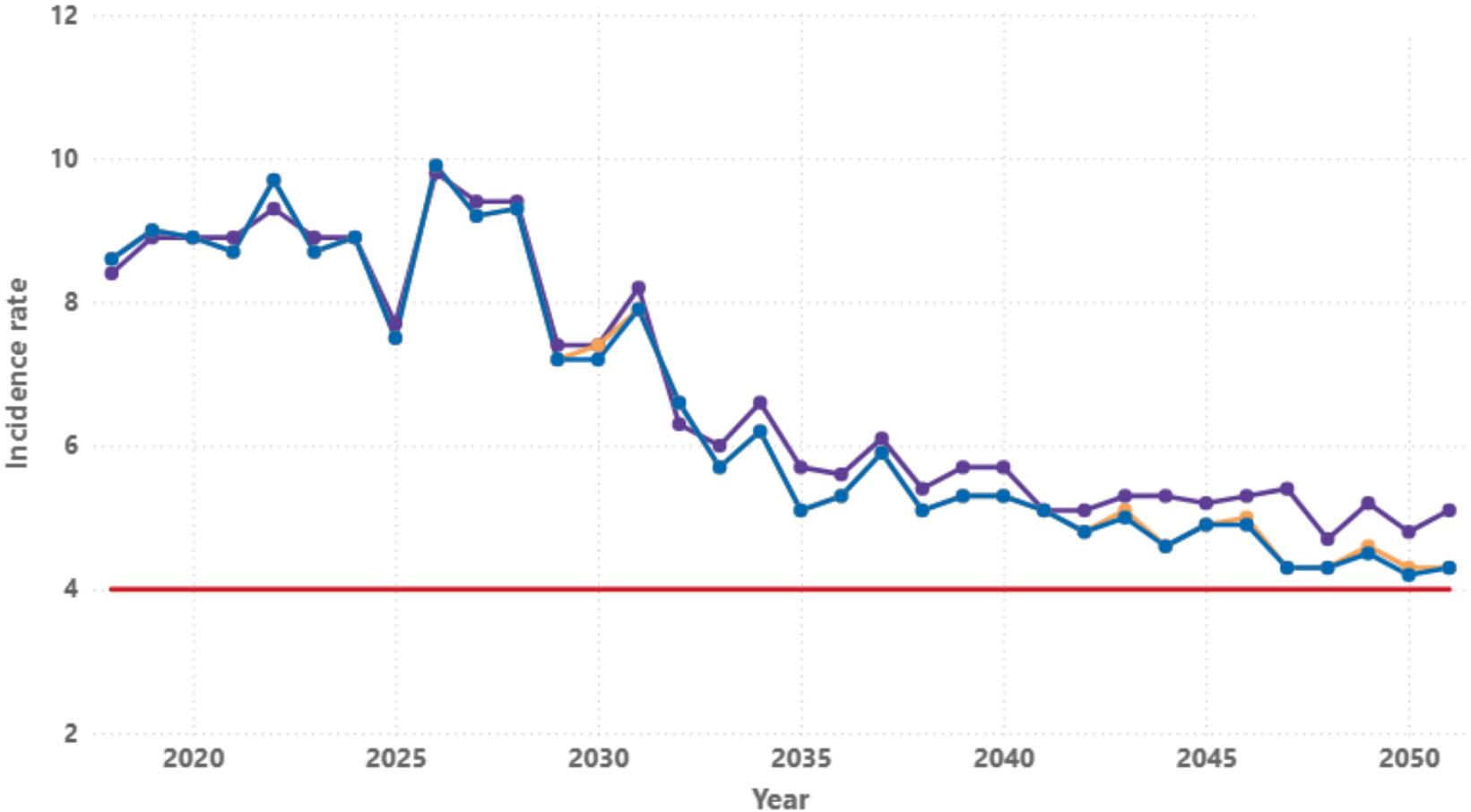
The vaccine wars - Debunking myths, owning real risks, and courting doubters. Meredith Wadman and Jia You, Science 2017



Figure 2. Serogroup specific invasive meningococcal disease incidence rates in Canada, 1997 to 2021



# Projected age-standardized incidence rate (per 100,000) for cervical cancer by level of HPV vaccination uptake, 2018 to 2051



<https://www.partnershipagainstcancer.ca/ecc-data/#cervical-cancer-rates>



## Inactivated (non live)

Diphtheria-tetanus-pertussis (DTaP, Tdap, Td)

Polio (IPV)

*Haemophilus influenzae* type b (Hib)

Hepatitis B (HB)

**Pneumococcal conjugate (PCV13, PCV20)**

Meningococcal conjugate (MenC, MenACWY)

**Influenza (intramuscular)**

Hepatitis A (HepA)

Human papillomavirus (HPV)

Pneumococcal polysaccharide (PPV23)

**Shingles/Herpes zoster**

Meningococcal Group B (MenB)

**COVID-19**

Respiratory syncytial virus (RSV)

Rabies



<b>Inactivated (non live)</b>	<b>Live</b>
<b>Diphtheria-tetanus-pertussis (DTaP, Tdap, Td)</b>	<b>Rotavirus (RV)</b>
Polio (IPV)	Oral polio – outside Canada (OPV)
<i>Haemophilus influenzae</i> type b (Hib)	<b>Measles-mumps-rubella (MMR)</b>
Hepatitis B (HB)	<b>Varicella (Var, MMRV)</b>
<b>Pneumococcal conjugate (PCV13, PCV20)</b>	Yellow fever (YF)
Meningococcal conjugate (MenC, MenACWY)	Mpox (Smallpox)
<b>Influenza (intramuscular)</b>	<b>Influenza (LAIV - intranasal)</b>
Hepatitis A (HepA)	BCG
<b>Human papillomavirus (HPV)</b>	
Pneumococcal polysaccharide (PPV23)	
<b>Shingles/Herpes zoster</b>	
Meningococcal Group B (MenB)	
<b>COVID-19</b>	
Respiratory syncytial virus (RSV)	
Rabies	



1. Protection from infection
2. Protecting others
  - Household / community
  - Mom -> newborn baby

1. Side effects
  - Not serious (common)
  - Serious (rare, may be unknown)
2. Not responding to vaccine/  
losing protection over time
3. Time, money

# Vaccines after childhood/ young adult cancer

- Systemic therapies for childhood cancer affect the immune system: by intent or as a side effect
- Long term function of the immune system in children and young adults who completed treatment for cancer is not known
- Treatment for different diseases varies - duration, schedule, type of treatment (chemotherapy, radiation, monoclonal Ab-s, cellular therapies)
- Persistent immune compromise:
  - Splenic dysfunction
  - Chronic GVHD
- Increasing use of “B-cell depleting” regimens: Rituximab, Blinatumomab, CAR-T cells

# Vaccines after childhood/ young adult cancer

- Most patient data about immune recovery and vaccination after cancer comes from:
  - ALL
  - HSCT
- Vaccine recommendations largely based on what we know about these two groups
- Less data from other malignancies - some loss of vaccine immunity after therapy

## Waning Vaccine Immunity and Vaccination Responses in Children Treated for Acute Lymphoblastic Leukemia: A Canadian Immunization Research Network Study

Karina A. Top,<sup>1</sup> Wendy Vaudry,<sup>2</sup> Shaun K. Morris,<sup>3</sup> Anne Pham-Huy,<sup>4</sup> Jeffrey M. Pernica,<sup>5</sup> Bruce Tapiéro,<sup>6</sup> Soren Gantt,<sup>7</sup> Victoria E. Price,<sup>8</sup> S. Rod Rassekh,<sup>9</sup> Lillian Sung,<sup>3</sup> Athena McConnell,<sup>10</sup> Earl Rubin,<sup>11</sup> Rupesh Chawla,<sup>12</sup> and Scott A. Halperin<sup>13</sup>

- Multicenter trial of 74 children with ALL enrolled 4–12 months post chemotherapy completion.
- Healthy children recruited as controls
- Post-chemotherapy participants received **Tetanus-Diphtheria-Pertussis and Pneumococcal vaccines**

**Table 3. Geometric Mean Concentrations (95% Confidence Intervals) and Seroprotection Among Participants With ALL Versus Controls**

Vaccine Antigens	Participants With ALL				Control Participants			
	N	GMC <sup>a</sup>	95% CI	% Seroprotected <sup>b,c</sup>	N	GMC <sup>a</sup>	95% CI	% Seroprotected <sup>b,c</sup>
Pneumococcal serotype (µg/mL)	73				78			
1		0.19	.16–.22	16		0.52	.41–.66	58
3		0.17	.14–.21	15		1.01	.72–1.42	68
4		0.19	.16–.22	21		0.54	.43–.68	54
6B		0.38	.29–.50	36		1.20	.92–1.57	83
7F		0.26	.20–.33	33		0.70	.57–.87	77
9V		0.45	.37–.55	56		0.92	.77–1.10	88
14		0.46	.35–.59	52		1.76	1.24–2.50	88
18C		0.21	.16–.27	26		0.49	.38–.62	56
19F		0.99	.77–1.26	82		3.21	2.73–3.76	99
23F		0.29	.23–.36	30		1.15	.87–1.52	81
Pertussis toxin (EU/mL)	71	4.10	3.67–4.58	N/A	78	10.35	8.15–13.16	N/A
Tetanus toxoid (IU/mL)	71	0.16	.12–.20	70	78	1.73	1.26–2.37	100
Varicella (AI)	69	0.33	.24–.45	20	78	1.00	.77–1.29	53

Baseline Ab levels to Tetanus, Pertussis, Pneumococcal serotypes, varicella in chemotherapy participants significantly lower than in controls (adjusted for # previous vaccines received)



**Table 4. Geometric Mean Concentrations and Geometric Mean Ratios to Pertussis Toxin, Tetanus Toxoid, and Pneumococcal Serotypes Pre- and Post-DTaP-IPV-Hib, PCV13, and PPV23 Vaccination in Children With ALL**

Antigen	Prevaccination (N = 73)		2 months Postvaccination (N = 67)		12 months Postvaccination (N = 66)		GMR 2 mos vs prevaccination
	GMC	95% CI	GMC <sup>a</sup>	95% CI	GMC <sup>a</sup>	95% CI	(95% CI)
Pertussis toxin IgG (EU/mL)	4.10	3.67–4.58	30.67	22.25–42.29	10.39	7.76–13.91	7.63 (5.53–10.53)
Tetanus toxoid IgG (IU/mL)	0.16	.12–.20	4.00	2.57–6.22	1.08	.77–1.52	24.49 (16.77–35.76)
Pneumococcal serotype (µg/mL)							
1	0.19	.16–.22	1.66	1.29–2.13	1.04	.83–1.31	8.72 (6.83–11.14)
3	0.17	.14–.21	0.75	.56–1.00	0.42	.32–.56	4.61 (3.46–6.15)
4	0.19	.16–.22	1.45	1.09–1.92	0.81	.60–1.09	7.76 (5.94–10.15)
6B	0.38	.29–.50	3.07	2.12–4.45	1.65	1.14–2.40	8.62 (5.79–12.83)
7F	0.26	.20–.33	2.05	1.68–2.50	1.01	.82–1.24	8.29 (6.55–10.48)
9V	0.45	.37–.55	2.40	1.90–3.03	1.43	1.17–1.74	5.53 (4.24–7.22)
14	0.46	.36–.59	5.52	4.12–7.41	4.38	3.34–5.75	12.98 (9.35–18.03)
18C	0.21	.16–.26	2.18	1.70–2.79	1.21	.97–1.50	10.51 (8.16–13.55)
19F	0.99	.77–1.26	3.68	3.02–4.48	3.21	2.68–3.83	3.72 (2.90–4.77)
23F	0.29	.23–.36	2.46	1.78–3.39	1.41	1.07–1.86	9.24 (6.63–12.89)

Chemotherapy participants showed a significant and sustained increase in Ab levels to Tetanus, Pertussis, Pneumococcal serotypes post vaccination.

**Personalized Schedule Worksheet for Immunization of Pediatric (those under 18 years of age) Oncology Clients who have Completed Treatment, Including Autologous HSCT**

Date:					
YYYY/MM/DD					
<b>CLIENT INFORMATION</b>					
Name:	Last		First		
DOB:	YYYY/MM/DD		PHN:		
Treatment Completion Date:					
Inactivated Influenza Vaccine	Effective Date (YYYY/MM/DD):				
All Other Inactivated Vaccines	Effective Date (YYYY/MM/DD):				
Live Vaccines	Please Complete the <a href="#">LAIV</a> , <a href="#">MMR</a> and <a href="#">Varicella</a> Referral Forms				
Oncologist recommendation for Men ACYW conjugate vaccine?	Yes <input type="checkbox"/> No <input type="checkbox"/>				
	1 <sup>st</sup> visit	2 <sup>nd</sup> visit	3 <sup>rd</sup> visit	4 <sup>th</sup> visit	5 <sup>th</sup> visit
Date: YYYY/MM/DD					
COVID-19					
Influenza					
DTaP-HB-IPV-Hib					
PCV20					
Men C					
Hep A					
Men ACYW Conjugate					
HPV					
MMR					
Varicella					

**Table 1: Worksheet for Immunization of Adult Hematopoietic Stem Cell Transplant (HSCT) Recipients and CART Therapy Recipients (those 18 years of age and older)**

Date:	YYYY/MM/DD	Date of Transplant/Therapy:	YYYY/MM/DD
<b>CLIENT INFORMATION</b>			
Name:	Last	First	
DOB:	YYYY/MM/DD	PHN:	

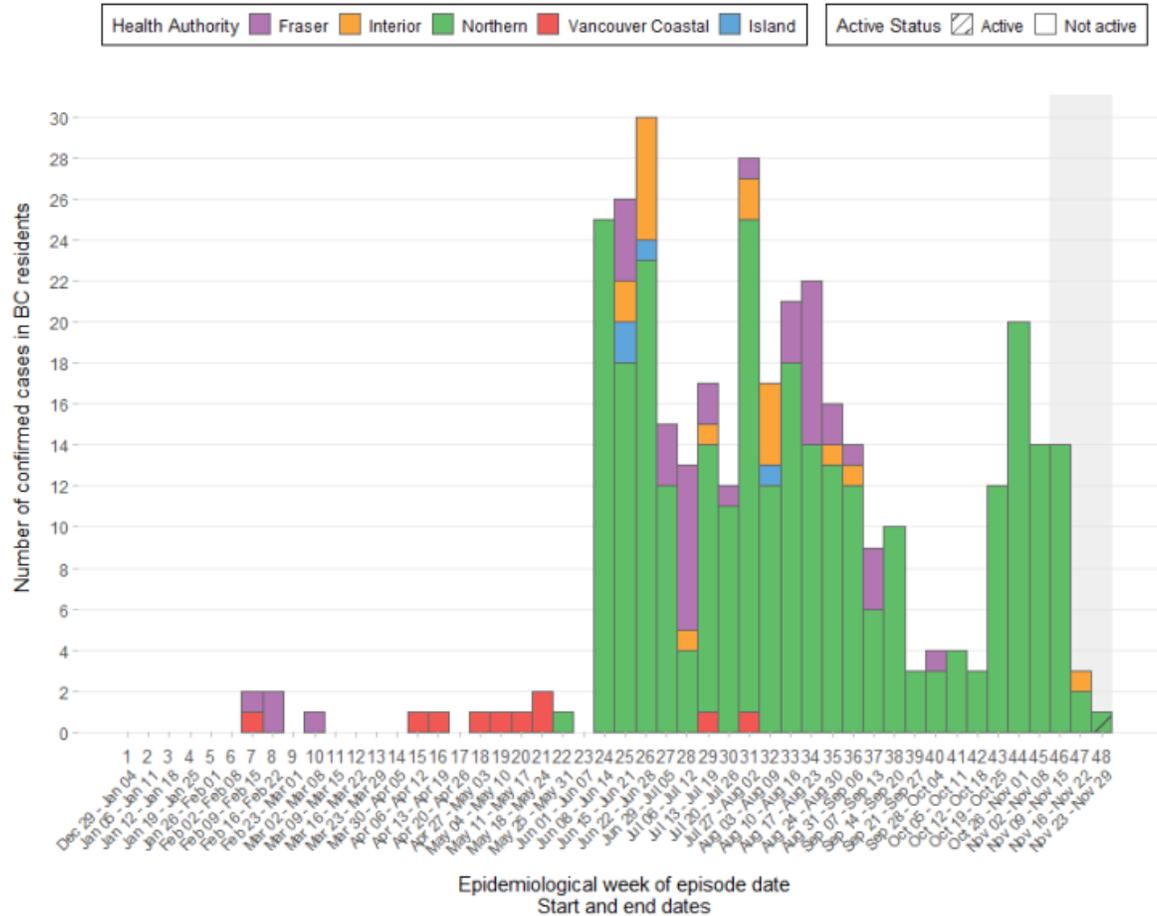
1 <sup>st</sup> Visit (6-12 months after HSCT/ CART therapy) <sup>A</sup>	2 <sup>nd</sup> Visit (1 month after 1 <sup>st</sup> visit)	3 <sup>rd</sup> Visit (2 months after 1 <sup>st</sup> visit)	4 <sup>th</sup> Visit (8 months after 1 <sup>st</sup> visit)	5 <sup>th</sup> Visit (12 months after 1 <sup>st</sup> visit)	6 <sup>th</sup> Visit (24 months after HSCT/ CART therapy)
Date given:	Date given:	Date given:	Date given:	Date given:	Date given:
DTaP-IPV-Hib <sup>B</sup>	DTaP-IPV-Hib <sup>B</sup>	DTaP-IPV-Hib <sup>B</sup>		DTaP-IPV-Hib <sup>B</sup>	
Hepatitis B <sup>C, D</sup>	Hepatitis B <sup>C, D</sup>	Hepatitis B <sup>C, D</sup>		Hepatitis B <sup>C, D, E</sup>	
	Hepatitis A			Hepatitis A <sup>E</sup>	
PCV20 <sup>F</sup>	PCV20 <sup>F</sup>	PCV20 <sup>F</sup>	PCV20 <sup>F</sup>		
Men-C-A,C,Y,W <sup>G</sup>			Men-C-A,C,Y,W <sup>G</sup>		
		HPV <sup>H</sup>	HPV <sup>H</sup>		HPV <sup>H</sup>
					MMR <sup>L, J</sup>
					Varicella <sup>J, K</sup>

Inactivated Influenza: During influenza season (usually November to April), inactivated influenza vaccine may commence 3 months after HSCT/CART therapy. If this is done < 6 months post-transplant/CART therapy, a 2nd dose should be offered 28 days later. Live attenuated influenza vaccine is contraindicated for HSCT/CART therapy recipients.

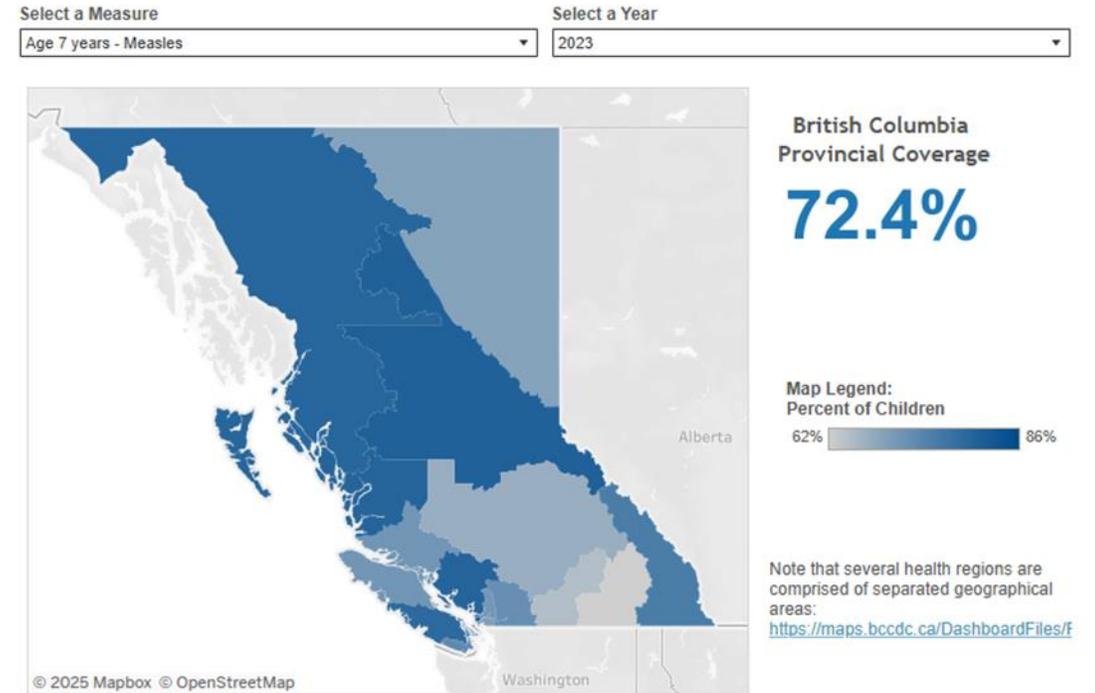
COVID-19 vaccine can be given as early as 3 months post-HSCT/CART therapy. For up-to-date COVID-19 immunization recommendations, refer to [Part 4 – Biological Products, COVID-19 Vaccines](#).

# Measles

Figure 1. Epidemic curve of confirmed measles cases reported in BC in 2025, by RHA and active status



## Childhood Immunization Coverage by BC Health Region Age 7 years - Measles, 2023



# Measles –Mumps-Rubella (MMR) vaccine

- **Live attenuated viral vaccine**
- **Children:** 12 months after stopping chemotherapy, normal lymphocyte counts
- **Adults:** no longer immunocompromised due to malignant disease and  $\geq 3$  months after completion of treatment or maintenance therapy for ALL that can be held
- **HSCT:** 24 months after HSCT if no GVHD, off immunosuppression, deemed immunocompetent
  - can be as early as 12 months for adults
- **Physician or NP approval**



## Measles, mumps, rubella (MMR) vaccine

### Keep your child safe.

### Get all vaccines on time.

By getting all vaccines on time, your child can be protected from many diseases over a lifetime.

The vaccine is given at the same time as other childhood immunizations.

MMR vaccine	Child's age at immunization
1 <sup>st</sup> dose	12 months
2 <sup>nd</sup> dose	4 to 6 years

The MMR vaccine is also provided free of charge to the following people:

- Infants aged 6 to 11 months who will be travelling to areas with measles outbreaks or to countries where measles is of concern, or who are known to have been in contact with someone with measles. These children will need 2 more doses of the vaccine, at 12 months and 4 to 6 years of age
- Women of child-bearing age who are not immune to rubella
- Older children and adults who have not been immunized or do not have evidence of immunity to measles, mumps and rubella, including those traveling to areas with measles outbreaks or to countries where measles is of concern

It is recommended that people born in 1970 or later (1957 for health care workers) get 2 doses of the vaccine. This is especially important for travellers. Most people born before 1970 are not eligible for the MMR vaccine as they will have

Immunization has saved more lives in Canada in the last 50 years than any other health measure.

### What is the MMR vaccine?

The MMR vaccine protects against:

- Measles
- Mumps
- Rubella

The MMR vaccine contains weakened forms of the measles, mumps and rubella viruses and is approved by Health Canada. It is free as part of your child's routine immunizations. You can get the vaccine from [public health units or community health centres](#), nursing stations, some doctor's offices, [travel health clinics](#) and [pharmacies](#). Pharmacies can only provide the vaccine to people 4 years of age and older.

### Who should get the MMR vaccine?

The MMR vaccine is given to children as a series of 2 doses. The first dose is given at 12 months of age and the second dose at 4 to 6 years of age. For children who also need protection against chickenpox (varicella), the second dose of vaccine can be given as the combined

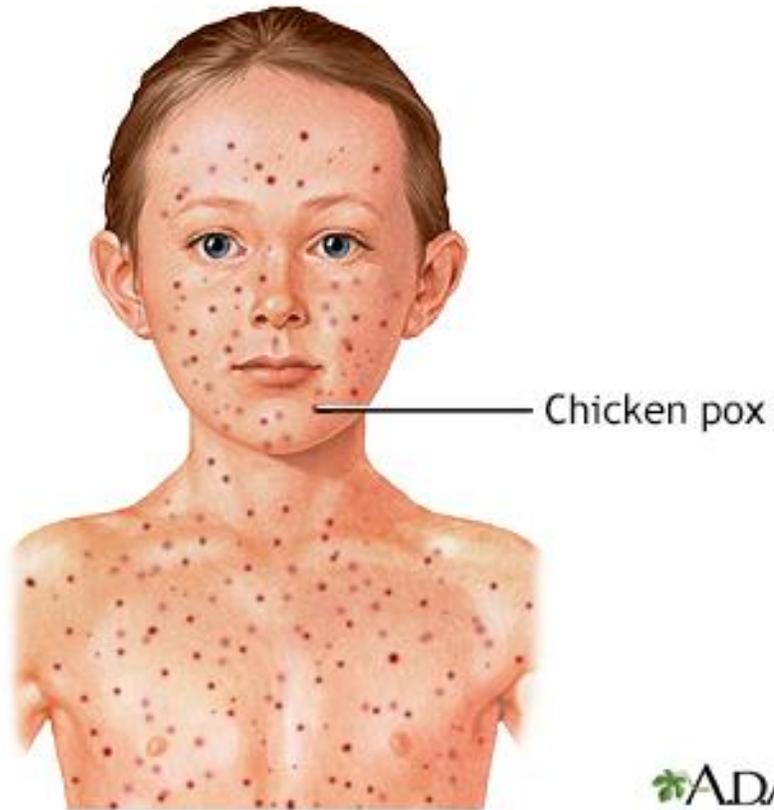
### Side effects:

- Fever, headache, muscle soreness, nausea, a rash that looks like measles, and swelling of glands in the cheeks or neck can occur about 7 to 12 days after getting the vaccine.
- Temporary joint pain in teenage and adult women.

### Rare side effects:

- Temporary drop in platelets: 1: 30, 000
- Brain inflammation: 1: 1,000,000

# Varicella (chickenpox) and Varicella zoster (shingles)



# Varicella (chickenpox) vaccine

## Live attenuated viral vaccine

### For people who have never had chickenpox infection

- **Children:** 12 months after stopping chemotherapy, normal lymphocyte counts
- **Adults:** no longer immunocompromised due to malignant disease and  $\geq 3$  months after completion of treatment or maintenance therapy for ALL that can be held
- **HSCT:** 24 months after HSCT if no GVHD, off immunosuppression, deemed immunocompetent
- **Physician or NP approval**



## Chickenpox (Varicella) vaccine

Immunization has saved more lives in Canada in the last 50 years than any other health measure.

### What is the chickenpox vaccine?

The chickenpox vaccine protects against the varicella-zoster virus, the virus that causes chickenpox. The vaccine contains a weakened form of the virus. Health Canada approved the Vaccine. The chickenpox vaccine is free as part of routine immunizations. Call your health care provider to make an appointment.

### Who should get the chickenpox vaccine?

Children get the chickenpox vaccine as a series of 2 doses. The first dose is given at 12 months of age and the second dose is given at 4 to 6 years of age. For children who also need protection against measles, mumps or rubella, the 2nd dose can be given as the combined measles, mumps, rubella and varicella (MMRV) vaccine. For more information on the MMRV vaccine, see [HealthLinkBC File #14e Measles, Mumps, Rubella and Varicella \(MMRV\) vaccine](#). Children get the vaccine at the same time as other childhood immunizations.

Chickenpox Vaccine	Child's Age at Immunization
1st dose	12 months
2nd dose	4 to 6 years

Students in grade 6 who have not received 2 doses of the vaccine should also receive the vaccine.

Grade 6 students who have received 2 doses of the vaccine at a younger age do not need any more doses. Grade 6 students who have never received the vaccine should get 2 doses at least 3 months apart.

The vaccine is also available as a series of 2 doses to people 13 years of age or older who have not

People who had chickenpox before their 1st birthday should still get the vaccine. They may not have developed a long lasting immunity and could get chickenpox again. People who had chickenpox or shingles disease at 1 year of age or older do not need to get the vaccine if:

- They had the disease before 2004 or
- The disease was confirmed by a lab test

It is important to keep a record of all immunizations received.

### What are the benefits of chickenpox vaccine?

The chickenpox vaccine is the best way to protect against chickenpox and its complications. When you get your child immunized, you help protect others as well.

Although rare, some people may get chickenpox even after immunization. The illness will be much milder than if they had not been immunized.

### What are the possible reactions after the vaccine?

Vaccines are very safe. It is much safer to get the vaccine than to get chickenpox.

Common reactions to the vaccine may include soreness, redness and swelling where the vaccine was given. A mild fever and a rash, which looks like chickenpox but with fewer spots, can occur about 2 weeks after the vaccine.

Very rarely, a person who develops a rash after being immunized can spread the virus from the chickenpox vaccine. To prevent spreading it to others, cover the rash until the blisters have dried and crusted over.

For more information on Reye Syndrome, see [HealthLinkBC File #84 Reye syndrome](#).

## Side effects:

- Mild fever and a rash that looks like chickenpox 2 weeks after the vaccine (~ 5/100 people)

# Shingles vaccine **SHINGRIX**<sup>®</sup>

**Non-live vaccine, no special approval needed**

**For people who have had chickenpox or received varicella vaccine**

Prevents varicella virus reactivation (shingles), not primary varicella infection (chickenpox)

- Adults (50 years of age and older) with or without history of clinical varicella (assume past infection)
- **Immunocompromised adults 18 – 49 years of age who are or will be at increased risk for shingles** because of immunodeficiency or immunosuppression caused by known disease or therapy.
- **Not publicly funded in BC -> extended benefits**





## Shingles vaccine

Immunization has saved more lives in Canada in the last 50 years than any other health measure.

### What is the shingles vaccine?

The shingles vaccine, Shingrix®, protects against shingles. Shingles is caused by the varicella zoster virus, which also causes chickenpox. Shingrix® is not a live virus vaccine and cannot give you shingles or chickenpox. The vaccine is approved by Health Canada.

### Who should get the shingles vaccine?

Shingrix® is recommended for adults 50 years of age and older. This includes if you:

- Have had shingles
- Received a live virus shingles vaccine. You should wait at least 1 year before getting Shingrix® if you received a live virus shingles vaccine. The live virus shingles vaccines are no longer available in Canada
- Are not sure if you had chickenpox (varicella) infection in the past

People 18 years of age and older with a weakened immune system can also get the vaccine.

### How can I get the shingles vaccine?

You can buy the shingles vaccine at most pharmacies and travel clinics. The vaccine is given as a series of 2 doses, 2 to 6 months apart, and costs about \$160 per dose. Some health insurance plans may cover the cost of the vaccine. Check with your provider.

more than 90% of cases of shingles in adults 50 years and older. In adults 18 years and older with a weakened immune system, the vaccine prevents about 70%-90% of cases of shingles.

For those who still get shingles after being immunized, the vaccine can reduce pain, including the type of pain that lasts after shingles.

### What are the possible reactions after the vaccine?

The shingles vaccine is very safe. Common reactions to the vaccine include soreness, redness and swelling where the vaccine was given. Other reactions include headache, fever, muscle soreness, fatigue, shivering, nausea, vomiting, diarrhea and stomach pain.

Acetaminophen (e.g. Tylenol®) or ibuprofen (e.g. Advil®) can be given for fever or soreness. ASA (e.g. Aspirin®) should not be given to anyone under 18 years of age due to the risk of Reye syndrome.

Guillain-Barré syndrome (GBS) is a rare condition that can result in weakness and paralysis of the body's muscles. GBS may occur in about 3 in 1 million people who get the shingles vaccine.

It is important to stay in the clinic for 15 minutes after getting any vaccine. There is an extremely rare possibility of a life-threatening allergic reaction called anaphylaxis. This happens in less than 1 in a million people who get the vaccine. Symptoms may include hives, difficulty breathing, or swelling of the throat

- In adults **18 years and older** with weakened immune system – prevents 70-90% of cases of shingles
- For those who still get shingles, reduces “nerve” pain that lasts after shingles
- Side effects: headache, fever, muscle soreness, nausea, vomiting – more common than with other non live vaccines (\*adjuvant)

# Pneumococcal vaccine

## Pneumococcal Conjugate Vaccine 20 (PCV-20) – “Pevnar 20”

Vaccine	Serotypes in pneumococcal vaccines																												
	1	4	6B	9V	14	18C	19F	23F	5	7F	3	6A	19A	22F	33F	8	10A	11A	12F	15B	2	9N	17F	20	15A	16F	20A	23A	23B
PNEU-C-10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																			
PNEU-C-13	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																
PNEU-C-15	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓														
PNEU-C-20	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓								

Replaces Pneumococcal Conjugate 13 valent vaccine and Pneumococcal polysaccharide 23 valent vaccine



## Pneumococcal conjugate (PCV 20) vaccine

**Keep your child safe.  
Get all vaccines on time.**

By getting all the vaccines on time, your child can be protected from many diseases over a lifetime.

Immunization has saved more lives in Canada in the last 50 years than any other health measure.

### What is the PCV 20 vaccine?

The PCV 20 vaccine protects against 20 types of pneumococcal bacteria. The vaccine is approved by Health Canada.

The vaccine is free as part of your child's routine immunizations. It is also free for people at high risk of getting sick from pneumococcal infection. Speak with your health care provider to make an appointment.

### Who should get the vaccine?

Babies receive the vaccine as a series of 3 doses at 2, 4 and 12 months of age. Babies with certain health conditions should get an extra dose of vaccine at 6 months of age.

The vaccine is also recommended for:

- Adults 65 years of age and older
- Residents of long-term care and assisted living facilities

People with any of the following:

- No spleen or a spleen that is not working properly
- Sickle-cell disease
- An immune system weakened by disease or medical treatment
- Chronic liver disease, including cirrhosis and chronic hepatitis B

- Hepatitis C, including those who had it in the past
- Chronic kidney, heart or lung disease
- An islet cell or solid organ transplant, or a cochlear (inner ear) implant, or are waiting for one
- Had a stem cell transplant or chimeric antigen receptor T-cell therapy
- A chronic neurological condition that makes it hard to clear fluids from the mouth or throat
- Diabetes, cystic fibrosis or a chronic cerebrospinal fluid leak
- Experiencing homelessness or are underhoused
- Substance use disorders (alcohol, cocaine, injection drug use)

People who are not eligible for the free vaccine but want to be protected can purchase the vaccine at most pharmacies and travel clinics. It is important to keep a record of all immunizations received.

### What are the benefits of the vaccine?

The vaccine protects against pneumococcal infection, a serious and sometimes fatal disease. When you get immunized, you help protect others as well.

### What are the possible reactions after the vaccine?

Vaccines are very safe. It is much safer to get the vaccine than to get pneumococcal disease.

Common reactions to the vaccine include soreness, redness and swelling at the injection site. Some people may have fever, headache, muscle or joint ache, and fatigue. Infants and toddlers may have loss of appetite, changes to their sleep patterns, crankiness, vomiting,

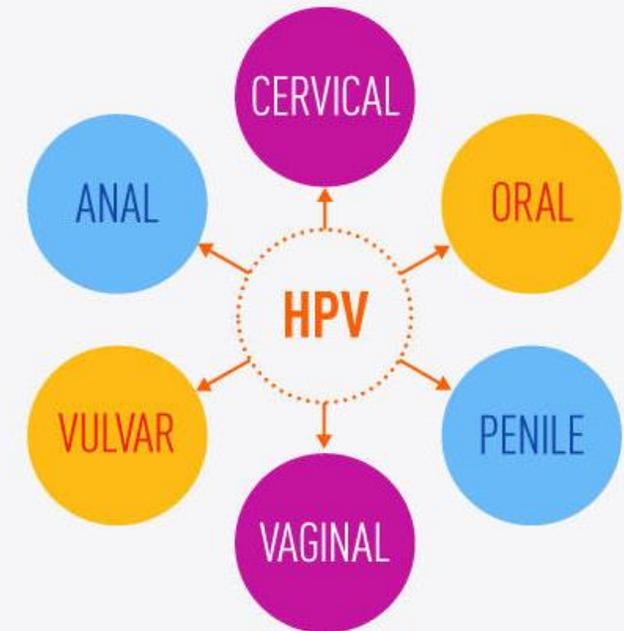
- Non-live vaccine
- Recommended for children and adults with cancer
- Side effects: headache, fever, muscle soreness, nausea, vomiting
- **Publicly funded for:**
  - **Children with cancer/HSCT**
  - **Adults**
    - **HSCT**
    - **Maintenance chemotherapy**
    - **Completed treatment in last 2 years and have not received PPV-23 x 2**

# Human Papilloma Virus (HPV) 9 vaccine – Gardasil 9<sup>®</sup> :

## Non-live vaccine, no special approval

- 1 dose for immunocompetent individuals (ages 9-20)
  - Previously 2 doses ages 9-14
- 3 doses for immunocompromised individuals (ages 9-45)

HUMAN PAPILLOMAVIRUS  
CAN CAUSE SEVERAL  
TYPES OF CANCER



[cancer.gov/hpv](https://cancer.gov/hpv)



BC Children's  
Hospital  
Research Institute

## Human papillomavirus (HPV) vaccine

### What is the HPV vaccine?

The HPV vaccine (Gardasil®9) protects against infection from 9 types of human papillomavirus (HPV) that can cause various cancers and genital warts. The vaccine is provided free to eligible people as part of B.C.'s routine immunization program. The vaccine is approved by Health Canada.

### Who should get the HPV vaccine?

The vaccine is recommended and free for people:

- 9 to 26 years of age
- 27 to 45 years of age (inclusive) who self-identify as belonging to the gay, bisexual and other men who have sex with men (GBMSM) community (including those who are not yet sexually active and/or questioning their sexual orientation). This includes cisgender males as well as individuals who are Two-Spirit, transgender and/or non-binary
- 27 to 45 years of age living with HIV
- Who were treated for abnormal changes to the cervix after a colposcopy on or after July 31, 2025.

It is important to have regular cervix screening because the HPV vaccine protects against most, but not all, types of HPV that cause cervical cancer.

School-aged children are routinely offered the vaccine in grade 6, with catchups in later grades for those who missed getting the vaccine. The vaccine is also available in several community-based settings. Contact your local pharmacy or public health unit to get immunized. People living in First Nations communities can contact their community health centre or nursing station to book an appointment.

Those not eligible for free HPV vaccine can buy it at most pharmacies and travel clinics.

### How is the vaccine given?

The vaccine is given as one dose or a series of doses depending on age and other factors. People 9-20 years of age should get one dose of the vaccine. People 21 years of age and older should get 2 doses. Three doses of vaccine are recommended for people 9 years of age and older who:

- Have a weakened immune system
- Are living with HIV
- Were treated for abnormal changes to the cervix after a colposcopy

It is best to get immunized before becoming sexually active and coming in contact with HPV because the vaccine prevents infection but does not clear it.

### What are the benefits of the vaccine?

The vaccine is very effective at preventing infection from 9 types of HPV. The vaccine protects against 7 types of HPV that can cause cancer of the anus, cervix, mouth and throat, penis, vagina and vulva. The vaccine also protects against two types of HPV that cause genital warts.

### What are the possible reactions to the vaccine?

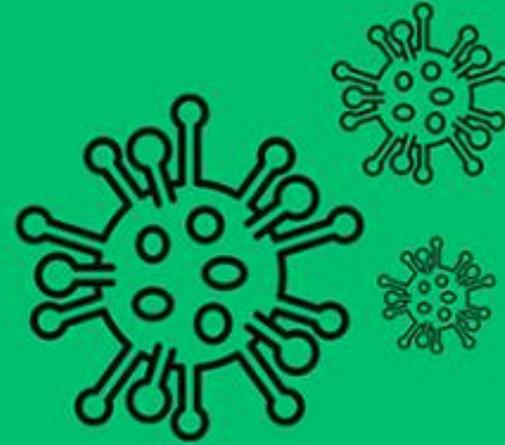
Common reactions may include soreness, redness and swelling where the vaccine was given. Headache, fever, nausea, dizziness, tiredness, diarrhea and muscle soreness may also occur.

- Side effects: headache, fever, muscle soreness, nausea, vomiting
- Doesn't replace the need for HPV screening

# Influenza (flu) and COVID-19



Blood cancer survivors are **9x more likely** to be hospitalised or die from seasonal influenza than the general population, even 10 years after diagnosis.



Cancer survivors are also likely to have other illnesses such as heart disease, diabetes, respiratory disease and kidney disease, which can raise the risk of **severe COVID-19 outcomes**.

2020: UK study 108,215 cancer survivors



## Inactivated influenza (flu) vaccine

### What is the inactivated influenza vaccine?

The inactivated influenza vaccine is made of killed influenza viruses or parts of the viruses. It protects against infection from influenza viruses and is given by injection. The vaccine does not protect against other viruses that cause colds or gastroenteritis (vomiting and diarrhea). Several different influenza vaccines are available in B.C., including a live attenuated influenza vaccine made from weakened influenza viruses that is given as a nasal spray. For more information, please visit [HealthLinkBC File #12e Live attenuated influenza \(flu\) vaccine](#). The vaccines are approved by Health Canada.

In B.C., influenza vaccines are usually available beginning in October. For your best protection, get immunized as soon as possible. You can find information on booking an appointment to get immunized on the Government of British Columbia's website at [www2.gov.bc.ca/gov/content/health/managing-your-health/immunizations/flu](http://www2.gov.bc.ca/gov/content/health/managing-your-health/immunizations/flu).

### Who should get the vaccine?

The influenza vaccine is available at no charge and recommended for everyone 6 months of age and older. The vaccine is especially recommended for people who are at high risk of serious illness from influenza and those able to spread influenza to people at high risk.

#### People at high risk of serious illness from

- People living in residential care, assisted living or other group facilities
- Children and teenagers required to take Aspirin® or ASA for long periods of time due to a medical condition
- Children and adults with certain medical conditions, including:
  - Heart or lung disorders that require regular medical care, such as asthma, chronic obstructive pulmonary disease or cystic fibrosis
  - Kidney disease, chronic liver disease such as hepatitis, diabetes, cancer, anemia or a weakened immune system
  - Conditions causing difficulty breathing, swallowing or a risk of choking on food or fluids, such as people with severe brain damage, spinal cord injury, seizures or neuromuscular disorders
- Children and adults who are very obese

Indigenous people may be at increased risk of serious illness from influenza due to health inequities resulting from colonialism.

#### People able to spread influenza to those at high risk of serious illness from influenza include:

- Household contacts (including children) of people at high risk
- Household contacts, caregivers and daycare staff of children under 5 years of age

## Live attenuated influenza (flu) vaccine

### What is the live attenuated influenza vaccine?

The live attenuated influenza vaccine (LAIV) is made from weakened influenza viruses. It protects against infection from influenza viruses and is given as a nasal spray. The vaccine does not protect against other viruses that cause colds or gastroenteritis (vomiting and diarrhea). In addition to LAIV, there are inactivated influenza vaccines available in B.C. The inactivated vaccines are made of killed influenza viruses or parts of the viruses and are given by injection. For more information, visit [HealthLinkBC File #12d Inactivated influenza \(flu\) vaccine](#). The vaccines are approved by Health Canada.

In B.C., influenza vaccines are usually available beginning in October. For your best protection, get immunized as soon as possible. You can find information on booking an appointment to get immunized on the Government of British Columbia's website at [www2.gov.bc.ca/gov/content/health/managing-your-health/immunizations/flu](http://www2.gov.bc.ca/gov/content/health/managing-your-health/immunizations/flu).

### Who should get the vaccine?

Influenza vaccines are available at no charge and recommended for everyone 6 months of age and older. Those younger than two years of age will need to receive the inactivated influenza vaccine given by injection. LAIV, or another influenza vaccine, is especially recommended for those at high risk of serious illness from influenza. This includes:

- All children two years to less than 5 years of age

asthma, chronic obstructive pulmonary disease or cystic fibrosis

- Kidney disease, chronic liver disease such as hepatitis, diabetes, cancer or anemia
- Health conditions causing difficulty breathing, swallowing or a risk of choking on food or fluids, such as people with severe brain damage, spinal cord injury, seizures or neuromuscular disorders
- Those who are very obese

Indigenous children may be at increased risk of serious illness from influenza due to health inequities resulting from colonialism.

Children 5 to 17 years of age who are household contacts of those who are at high risk of serious illness from influenza should also get the vaccine. A list of those at high risk of serious influenza illness is provided in [HealthLinkBC File #12d Inactivated influenza \(flu\) vaccine](#).

Adults 18 to 59 years of age with intense fear of needles may get LAIV if they are unwilling to get the inactivated influenza vaccine. However, the inactivated influenza vaccine is recommended for adults because it provides better protection against influenza infection than the live vaccine in this age group.

### How is the vaccine given?

LAIV is given as a spray into both nostrils. Children 9 years of age and older need one dose of vaccine. Children 2 to 8 years of age who have never received an influenza vaccine need two doses given 4 weeks apart. The second dose improves

Household contacts of cancer patients – can usually get intranasal vaccine.  
Exceptions – recent HSCT, severe immune compromise.

Don't let the flu get you down this season.  
Boost your protection.  
**Get immunized!**



Talk to your doctor, nurse, pharmacist, or local public health unit about getting immunized against the flu.

- Influenza vaccine effectiveness depends on:
  - How well the vaccine strains match with circulating influenza viruses
  - Health and age of the individual receiving the vaccine
- 30-60% effective against preventing any illness
- Significantly reduces the chance of serious illness/ ICU admission

## COVID-19 mRNA vaccines

Immunization has saved more lives in Canada in the last 50 years than any other health measure.

### What are the COVID-19 mRNA vaccines?

The COVID-19 mRNA vaccines such as Moderna (Spikevax) and Pfizer-BioNTech (Comirnaty) protect against infection from the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) that causes COVID-19. The vaccines are approved by Health Canada.

### Who should get the vaccines?

The vaccines are approved for those 6 months of age and older. The vaccines are strongly recommended for those at increased risk of infection or severe disease, including:

- People 65 years of age and older
- Residents of long-term care homes and assisted living facilities (including those awaiting placement)
- Individuals with underlying medical conditions
- People who are pregnant
- Health care workers
- First responders (police officers, firefighters and paramedics)
- Indigenous peoples and individuals living in Indigenous communities. Indigenous peoples may be at increased risk of serious illness from COVID-19 due to health inequities resulting from colonialism.

More information, including how to register for the vaccine, can be found on the Government of British Columbia's website: [www2.gov.bc.ca/gov/content/covid-19/vaccine/register](http://www2.gov.bc.ca/gov/content/covid-19/vaccine/register).

It is important to keep a record of all immunizations received.

### What are the benefits of the vaccines?

Immunization is the best way to protect you against COVID-19, which is a serious and sometimes fatal disease. The vaccines provide strong protection against severe COVID-19 illness, including hospitalization and death. When you get immunized, you help protect others as well, including those who are unable to get the vaccine.

### What are the possible reactions after the vaccines?

Vaccines are very safe. It is much safer to get the vaccine than to get COVID-19. The vaccines cannot give you COVID-19. Common reactions to the vaccines may include soreness, redness, swelling and itchiness where the vaccine was given. For some people, these reactions may show up 8 or more days after getting the vaccine. Other reactions may include tiredness, headache, fever, chills, muscle or joint soreness, swollen lymph nodes under the armpit, nausea and vomiting. Babies and young children may be irritable, sleepy and have a decreased appetite. These reactions are mild and generally last one to 2 days. If you have concerns about any symptoms you develop after receiving the vaccine, speak with your health care provider or call **8-1-1** for advice.

Rare cases of inflammation of the heart (myocarditis and pericarditis) have been reported after getting the COVID-19 mRNA vaccines. These were most often seen:

- After a second dose of the vaccine when the time

- COVID-19 generally circulates with other respiratory viruses
- Vaccine effectiveness harder to estimate now – fewer infections
- Updated formulation – LP8.1 variant
- Strongly recommended for people who are immune compromised and their contacts





# Immunizations

[Home](#) / [Health library](#) / Immunizations



## Immunization schedules

Learn what immunizations you and your family may need, and when and where to get them.



## Immunizations for children (0 to 18)

Routine vaccines are free and can save lives. Learn about consent, appointments and aftercare and what to do if you choose not to immunize.



## Immunizations for adults (18+)

Learn about routine vaccinations for adults, why it's important to get vaccinated and what to do if you are pregnant.



## Immunization aftercare

Learn what to expect after getting vaccines for yourself and your family, managing side effects and when to seek medical attention.



## Vaccine Information and safety

Learn about vaccine side effects, get information on how vaccines work and what goes into them.



## Travel

Information on immunizations for travel and where to get them.



## Immunization records

Get a history of any vaccines you have received through Health Gateway.



## Vaccines

Learn about specific vaccines.



## Immunization FAQ

Browse frequently asked questions and topics about immunizations.

<https://www.healthlinkbc.ca/health-library/immunizations>



» / Vaccine Education Center

# Vaccine Education Center

Where science leads the way toward  
healthy families at every age

Contact us online >



<https://www.chop.edu/vaccine-education-center>



Connect with MIIKOHVAC

Parents

New Canadians

Tips for Locating Immunization Records

Adults

Travellers

Kids and Teens

Pregnant and Breastfeeding Persons

Educational Resources

## Pocket Guide for Immunizers: Influenza Immunization 2025 – 2026

Pocket Guide for Immunizers: Influenza Immunization 2025 – 2026

## Video | How to administer the live-attenuated intranasal influenza vaccine (LAIV)

How to administer the live-attenuated intranasal influenza vaccine (LAIV)

## Online survey | Study invitation to healthcare professionals in Canada



CENTRE DE RECHERCHE  
CIHI de Québec  
BRIDGE

**STUDY INVITATION TO HEALTHCARE PROFESSIONALS ONLINE SURVEY**

We invite healthcare professionals across Canada to share their perspectives and experiences in relation to vaccination, harassment and moral distress during the pandemic.

**Your voice will support potential actions to:**

## Questions about the HPV vaccine? | Consult one of our vaccination counselors



**MIKOHVAC**  
Motivational interviewing to increase knowledge on HPV vaccination

The MIIKOHVAC project aims to address your concerns about the human papilloma virus (HPV) vaccine through



OUR MISSION To cure and prevent childhood and adolescent cancer through scientific discovery and compassionate care.

# Immunizations

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## Influenza and COVID-19 Vaccine Information for People with Cancer

Page updated: Nov. 7, 2025

The best source of up-to-date information on respiratory viruses including COVID-19, influenza (the flu), and vaccines in British Columbia is the [BC Centre for Disease Control website](#).

### Long-Term Follow-Up Guidelines for Survivors of Childhood, Adolescent, and Young Adult Cancers

Version 6.0 (October 2023)

## Health Link

Healthy living after treatment of childhood, adolescent, and young adult cancer



### Vaccines after Treatment for Cancer Survivors Treated with Chemotherapy and/or Radiation (Non-HCT)

Vaccines are an important tool to protect against infections and prevent infection-related deaths. Vaccines help the immune system recognize and fight serious infections. Most vaccines are given during childhood and provide protection against infection into adulthood. After cancer treatment, survivors may need to catch up on recommended childhood vaccines that were missed during treatment or get booster vaccines to protect against vaccine-preventable infections.

Sometimes recommended vaccine doses are delayed during cancer treatment. After completing treatment for cancer, it is important to make a plan to catch up on missed vaccines, even if delayed by months or years.



# Vaccines Work.



Talk to your healthcare provider  
about recommended  
vaccinations.