

# Vaccine Confidence InfoBulletin

Volume 2 | Issue 5 | May 2022 | Public Health Agency of Canada (PHAC)

Providing credible and timely information on vaccines to health care providers and public health decision makers to support vaccine confidence. Thank you for being a trusted source of vaccine information for individuals and communities across Canada.

## Trending topics

### Influenza activity in Canada

Since the beginning of April, detection of influenza has sharply increased in Canada. In week 19 (May 8-14, 2022), a total of 16,618 tests for influenza were performed at reporting laboratories and the weekly percentage of tests positive for influenza was 12.6%, which is above expected pre-pandemic levels for this surveillance week (5.0 to 11.9%)(see Figure 1 below).

## In this issue

### Trending topics

- Influenza activity in Canada

### Featured article

- Are any vaccines vegan?

### Vaccine confidence corner

- Optimism bias

### Mis/disinformation monitor alert

- Social media, mis/disinformation, and the vaccine continuum

### Science spotlight

- Vaccine-induced passive immunity from human milk and transplacental antibody transfer during pregnancy

### In the clinic

- The Canadian Immunization Guide: An introduction for health care professionals

### Community spotlight

- Supporting Canadian health service users with decision-making on COVID-19 vaccination during pregnancy and lactation

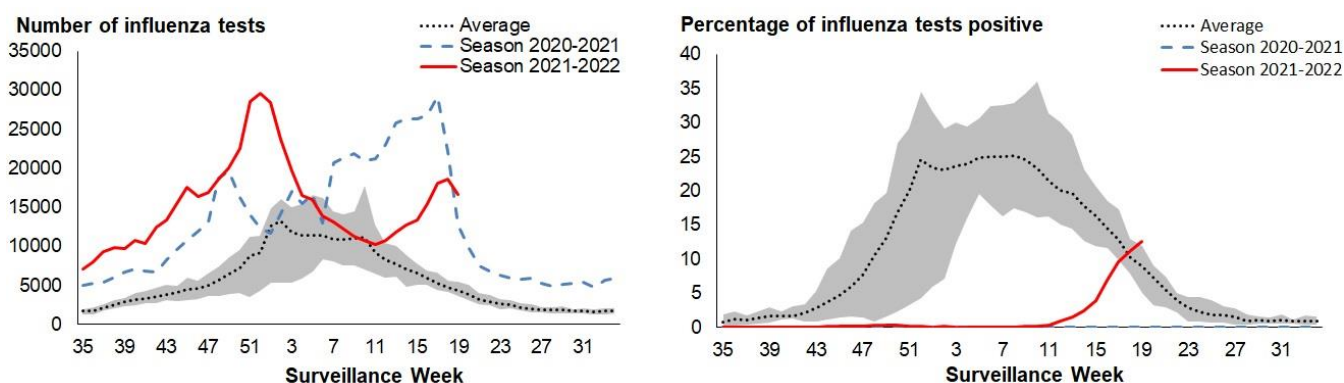
### PHAC webinars and webcasts for health care providers

- Understanding Canada's Vaccine Injury Support Program



## ...Trending topics continued

All indicators of influenza activity have increased in recent weeks. Influenza activity has reached seasonal thresholds and provinces and territories will now report influenza activity on a weekly basis to PHAC. For detailed information on influenza surveillance and epidemiological activity in Canada, visit [FluWatch](#).



**Figure 1-** Number of influenza tests and percentage of tests positive in Canada compared to previous seasons, weeks 2021-35 to 2022-19. The shaded area represents the maximum and minimum number of influenza tests or percentage of tests positive reported by week from seasons 2014-2015 to 2019-2020. Data from week 11 of the 2019-2020 season onwards are excluded from the historical comparison due to the COVID-19 pandemic.

The increase in influenza activity is not surprising as we continue to move forward with the lifting of public health measures. In addition to personal protective measures, influenza vaccination is a critical tool to protect against influenza-related disease and to reduce the influenza-associated burden on the Canadian health care system. This is important given the co-circulation of COVID-19 and influenza in the weeks and months ahead.

### Seasonal influenza vaccination

It is not too early to start planning your 2022-2023 seasonal influenza vaccination campaign. Refer to [the National Advisory Committee on Immunization \(NACI\) guidance and statement on seasonal influenza vaccine for 2021-2022](#) in the Canadian Immunization Guide chapter on influenza. This guidance document is updated annually to reflect identified changes in influenza epidemiology, available products and immunization practices. Federal/Provincial/Territorial governments are currently looking at options for concurrent administration of COVID-19 and influenza vaccines as part of fall campaign planning.

To learn more about seasonal influenza vaccination, visit:

- [2021 to 2022 seasonal influenza vaccine: Mobile guide for health professionals](#)

---

## Featured article

### **Are any vaccines vegan?**

The recent authorization of Medicago's 'plant-based' Covifenz® COVID-19 vaccine may have caught the attention of people interested in vegan COVID-19 vaccines. Vegan refers to a philosophy and way of living which seeks to exclude - as far as is possible and practicable - all forms of exploitation of, and cruelty to, animals for food, clothing or any other purpose. Vegan or plant-based products may also be of interest to people who abstain from products derived from specific animal sources for cultural, religious or other reasons.

For a vaccine to be considered vegan, it would need to be developed, produced and tested without using animal products of any kind.

### **How are animal products used in vaccines?**

Animals, or products derived from animal and human sources, are used to develop, produce, and test, all vaccines, including all COVID-19 vaccines, currently authorized and available in Canada. It is important to note, however, that manufacturers that use animal or human sourced materials to make their vaccine must have suitable controls in place to ensure that their vaccines do not contain animal or human cells and also do not contain any human or animal sourced materials at levels that could result in toxicities or adverse reactions.

To develop vaccines, scientists first need to grow the virus *in vitro* in laboratories. Viruses cannot grow outside of cells. To study viruses and other biological phenomenon, scientists have developed "cell lines" that can grow in laboratory conditions derived from historic sources of either animal or human tissue. The vaccine is tested for its ability to prevent viral growth *in vitro* before being tested *in vivo* in laboratory animals. Scientists then compare how vaccinated and unvaccinated animals respond when infected with the virus.

Once a vaccine candidate demonstrates promise during development, it is produced at scale, often using animal or human derived cell lines, for clinical testing before being made commercially available. Vaccine production is different for each vaccine platform and unique to each vaccine formulation. For example, the production of the protein components of the Medicago Covifenz® COVID-19 vaccine occurs in *Nicotiana benthamiana* plants, which is widely used for protein expression in plant virology and is leveraged to produce non-infectious virus-like particles (VLPs) for the active vaccine component.

Once vaccines are produced, they need to be tested for impurities, toxicity, stability, and other safety measures. Some of these tests again use animal or human-based cell lines and/or laboratory animals. All medications and vaccines are required by law to undergo animal testing, before testing occurs in humans, to ensure they are safe. There is no way to circumvent this critical step of vaccine testing. As such, all vaccines authorized and available in Canada involve animals in some capacity.

Although some people may be uncomfortable with the idea that animals and animal-derived products are used in the development of every authorized vaccine, animal health has also benefited from the advent of vaccine technologies. Domestic and wild animals are routinely vaccinated (where possible) to protect their health, and the health of people who care for them.

### **Vaccines are not vegan, but recommended for vegans by leading organizations**

Leading vegan and animal rights organizations, such as [PETA](#) and [The Vegan Society](#), advise vegans that they should not compromise their own health by refusing vaccines. While they should advocate for minimizing animal product use or animal cruelty in the development of medical products, there are no alternatives that are more ethical, and no animals will be protected by refusing the vaccines.

---

## Vaccine confidence corner

Providing evidence-informed tips, strategies and information in support of vaccine confidence.

### **The role of cognitive bias in vaccine attitudes**

Over the next few issues of the Vaccine Confidence InfoBulletin we will describe key cognitive biases and their impact on vaccine attitudes and decision-making, including how to address them with peers and patients.

#### **What is cognitive bias?**

Our brains take mental shortcuts to cope with and effectively process the huge volume of information we encounter every day. These shortcuts (called heuristics), which can be helpful in navigating our lives, can also distort our perceptions and impact our judgment and decision-making abilities. The results are often so-called “errors in thinking”, referred to as cognitive biases.

#### **How does a cognitive bias affect vaccine attitudes?**

Cognitive biases can impact how we process vaccine information, which information we use to guide our decision-making, our perceptions of risks and benefits of vaccines, how we understand the statistics that might inform our risk calculations, how we are influenced by messaging about vaccines, and more.

#### **Optimism bias**

Optimism bias is the tendency to overestimate the likelihood of good things happening to us and underestimate having bad things happen to us. One of the leading predictors of whether someone will choose to be vaccinated for COVID-19 is their level of concern about COVID-19. If someone feels that they are more likely to fare well if they contract COVID-19, they may be less likely to get vaccinated.

### How to address optimism bias

A natural reaction to someone's lack of concern about a health risk might be to try to amplify their fear. Fear appeals have a long history in public health (i.e., photographs of cancerous lungs on cigarette packs) and in some instances have effected positive change. However, the use of fear appeals is not recommended and, in many circumstances, can result in defensive downplaying of the threat. [1] Given the often-polarized nature of vaccine refusal and rhetoric surrounding fear mongering, an over-emphasis on rare risks may cause people to double down on their beliefs.

Optimism bias can be leveraged by highlighting the safety profile of the vaccines, noting that they are very unlikely to have a serious or lasting side effect, so why not avoid the worse outcome of severe COVID-19?

[More information on optimism bias is available here.](#)



### Addressing optimism bias

#### In Practice

There are several other strategies for overcoming optimism bias:

- **Invite people to take an outsider's perspective on risk**
  - Comparing risks objectively, imagining the risks for someone they care about
- **Ask people to recall unexpected events that have happened in the past**
  - Reminding individuals that unexpected outcomes do happen may help curb optimism bias
- **Encourage people to conduct a “pre-mortem” or reconsider the situation using a “starting at the end” approach**
  - Imagine something serious and unexpected happening (i.e., severe COVID-19)
  - Work backwards to identify what steps could be taken to avoid that outcome
  - Consider how they feel about their decision in that context

---

## Mis/disinformation monitor alert

Presenting credible sources to debunk mis and disinformation.

### Social media, mis/disinformation, and the vaccine continuum

Vaccine related misinformation can increase vaccine hesitance. In fact, the [WHO deemed vaccine hesitancy one of the ten threats to global health even before the COVID-19 pandemic](#). This article discusses the role of social media in building anti-vaccine or vaccine hesitant attitudes and illustrates one mom's journey from pro-vaccine to anti-vaccine and back again.

**Misinformation** is information that is false or misleading, but presented as fact, regardless of intention.

**Disinformation** is information which is intentionally created and circulated to deceive or mislead.

#### Social media: A place for the like-minded

The protective measures put in place during COVID-19 across the world impacted social interactions, isolating one another to reduce the spread of the virus. Social media provided an outlet for people to stay connected during these periods of isolation. [2]

Social media and online platforms allow for information to be generated and rapidly shared without scientific vetting, contributing to vaccine mis and dis-information. Furthermore, due to the algorithmic nature of many of the social media sites, the more you "like" or interact with specific content, the more likely you will continue to be shown similar information. [3] This has the negative effect of reducing the visibility of content you do not agree or interact with, creating clusters of like-minded communities continuing to reaffirm the individual's viewpoint, contributing to a phenomenon such as echo chambers and confirmation bias. [3] [4] However, timely response by experts can challenge the spread of misinformation. [3]

A fact-checking study on misinformation found that **88% of misinformation** during the COVID-19 pandemic **appeared on social media**. [5]

#### A shift in the vaccine continuum

Heather Simpson had been someone who saw the value and benefit of routine childhood vaccination. However, she and her husband watched a persuasive anti-vaccine documentary, eliciting fears for their daughter's health and shifting their perspective about the safety and benefits of vaccines. Heather attempted to have a conversation about the documentary with her child's health care providers but was dismissed for her concerns and labeled as anti-vaccine. [6]



The negative interactions with her health care providers, alongside continued exposure to vaccine misinformation and support from her anti-vaccine community gave Heather reassurance that it was best not to vaccinate her child.

During an [interview on CANVax's "Emerging Topics Podcast,"](#) Heather noted that she was experiencing a great deal of anxiety about exposure to vaccine preventable diseases such as tetanus. Eventually, a cat scratched their daughter and Heather visited her primary health care provider for treatment. Heather's provider noted her anxiety about vaccine preventable tetanus and affirmed that she did not have to live in such fear as a safe and a widely available vaccine could prevent the serious condition. The provider was not dismissive and was able to connect to Heather's concerns in the moment. Following this conversation, Heather realized that many parents have their children vaccinated with no long-term negative outcomes. Since then, Heather has become a vaccine advocate, has co-funded, alongside Lydia Greene, a vaccine advocacy website named [Back to the Vax](#), started a podcast, and runs a pro-vaccine support group all aimed at building resilience to vaccine mis and disinformation online based on their own experiences.

You can listen to Heather's and Lydia's journey at [CANVax Podcasts.](#)

### **How health care providers can facilitate change**

The story of Heather Simpson provides a valuable case study regarding the process by which someone's vaccine attitudes can be shaped by online information and the role of health care providers in helping or hindering vaccine confidence. Health care providers are among the most trusted information sources, and it has been shown that direct communication with clients can reduce vaccine concerns and improve vaccine uptake. [3] Given their degree of influence, health care providers are encouraged to address and correct misinformation on social media in a manner that is evidence-based, easily understood and respectful. [3], [7]

For resources that support addressing mis and disinformation visit [Science Up First](#) and [The Debunking Handbook 2020.](#)

Every health care interaction with patients has the potential to impact vaccine attitudes and should be taken as an opportunity to discuss vaccines and build vaccine confidence. As seen with Heather, negative interactions with providers can undermine vaccine confidence and send patients seeking information from unreliable sources. When engaging with individuals whose vaccine attitudes have been informed by vaccine misinformation, health care providers should attempt to achieve a thoughtful and positive interaction that builds trust through active listening and tailoring the conversation to each individual's circumstances and concerns.

CANVax Emerging Topics podcasts are available on [iTunes](#) and [Spotify](#) to listen and subscribe. Episodes engage experts from across Canada to better understand emerging issues in immunization and the initiatives that aim to combat them.



## Notes for health care providers on vaccine confidence

### Key points:

- Vaccine hesitancy is a domestic and global health concern
- Social media is an ideal platform to spread misinformation which can lead to individuals questioning vaccination and further anti-vaccine perspective.
- Every health care interaction is an opportunity to discuss vaccination, correct misinformation and build vaccine confidence

### Navigate vaccine conversations using these resources:

- [Addressing vaccine hesitancy in the context of COVID-19: A primer for health care providers](#)
- [The PrOTCT Framework for addressing vaccine hesitancy](#)

---

## Science spotlight

Providing explanations of the science underpinning vaccine guidance and public health response.

### Vaccine-induced passive immunity from human milk and transplacental antibody transfer during pregnancy

#### Types of immunity:

**Active immunity** is the result of the body responding to an antigen (through infection or vaccination) and producing antibodies to that pathogen.

**Passive immunity** occurs when the individual is given antibodies to the pathogen, rather than their immune system producing them themselves. This can occur through the transfer of antibodies through the placenta during pregnancy or through human milk, or by administration of an immune globulin (a therapy).

While active immunity takes longer to develop, as the body needs time to build a response, duration of protection is generally substantially longer for active immunity than for passive immunity.



The beneficial effects of immunization during pregnancy for the pregnant person, fetus and newborn infant have been well documented. Vaccination during pregnancy induces an immune response that causes the body to produce antibodies to the pathogen that is the target of the vaccine. These antibodies can cross the placenta and provide some protection via passive immunity to the fetus and newborn baby. During lactation, vaccine-induced antibodies can be passed through breast milk to the baby. At present, pertussis (which is given along with tetanus and diphtheria in the Tdap vaccine), and the seasonal influenza vaccine are recommended as routine vaccines during pregnancy. Additionally, it is recommended that pregnant and lactating individuals stay up-to-date on COVID-19 mRNA vaccines and receive a primary series and booster dose as recommended.

Other vaccines may be recommended, depending on individual exposure risk or underlying medical conditions. [See the CIG: Part 3 - Vaccination of Specific Populations: Immunization in pregnancy and breastfeeding. Immunization during pregnancy](#) for more information on additional vaccines that may be recommended during pregnancy.

For vaccines in general (not specific to COVID-19 vaccines), the majority of transplacental antibody transfer occurs during the third trimester. This helps provide protection while babies are too young to be immunized, however this protection is not long term. Transplacentally acquired antibody concentrations progressively decrease during the first year of life, increasing vulnerability to vaccine preventable disease as time goes on. [8] It is therefore important that babies get routine vaccinations when they are recommended to do so.

Although transplacental antibody transfer is generally the more efficient way to confer neonatal protection, antibodies can also pass through breast milk to the infant. Additionally, human milk contains a variety of immune properties that provide more generalized protection against infection. Breastfeeding alone is not enough to protect against vaccine preventable disease, so immunization infants and young children on schedule remains important, even when babies are breastfed. Routinely recommended vaccines can be safely administered to the lactating parent during the period that they are breastfeeding.

Vaccination with the Tdap vaccine is recommended in every pregnancy, ideally between 27 and 32 weeks of gestation, regardless of when the last Tdap vaccine was received. This is because immunization for pertussis between 27 and 36 weeks of gestation reduces the risk of pertussis infection in babies under two months by 77.7% (95% CI 48.3-90.4%) and hospitalization by 90.5% (95% CI: 65.2-97.4%). [9] No safety concerns have been identified with Tdap vaccination in pregnancy.

Pregnant individuals are at higher risk of severe outcomes due to influenza, and therefore vaccination is recommended for their own protection. In addition, influenza vaccination during pregnancy confers some protection to the baby in the first few months after birth. [10]

Vaccination for COVID-19 during pregnancy is also very important. Pregnant individuals are vulnerable to severe outcomes from COVID-19 and are at an increased risk of adverse pregnancy outcomes if they become infected with SARS-CoV-2. Like influenza and pertussis, protective antibodies for SARS-CoV-2 have been detected in umbilical cord blood, indicating they are passed through the placenta to the fetus. There is some evidence that COVID-19 vaccination during pregnancy confers protection to infants under 6 months of age against hospitalization. [11] SARS-CoV-2 antibodies are also transferred in breast milk following vaccination, but more data is needed to understand the level of protection conferred to the newborn. [See the Featured article \(p.2\) of the January issue of the Vaccine Confidence InfoBulletin for more information on the importance of vaccination for COVID-19 in pregnancy.](#)

Vaccination during pregnancy protects those who are pregnant from vaccine-preventable diseases that may otherwise be acquired and transmitted to the fetus, or infant. Additionally, protective concentrations of antibodies are transferred to the fetus transplacentally, resulting in increased infant protection in the early postnatal period.

For more information on vaccination during pregnancy, see:

- [CIG chapter on immunization in pregnancy and breastfeeding.](#)
- [Webcast - COVID-19 and vaccines during pregnancy and lactation](#)
- [Webinar – Building COVID-19 vaccine confidence before, during, and after pregnancy](#)

---

## In the clinic

Providing current recommendations, resources and vaccination best practices for immunizers.

### **The Canadian Immunization Guide (CIG): An introduction for health care professionals**

The CIG has been a trusted, reader-friendly summary of recommendations on immunization since 1979, when it was first published. This comprehensive resource is developed based on recommendations and statements of expert advisory committees including NACI and the [Committee to Advise on Tropical Medicine and Travel \(CATMAT\)](#). The CIG addresses advances in vaccines and immunization practices in Canada. It is written for health care providers and public health practitioners, policy makers, program planners and the general public with knowledge and interest in immunization and vaccines.

[Access the Canadian Immunization Guide](#)

### The CIG is divided into five parts:

- [Part 1 - Key Immunization Information](#) includes key scientific principles of immunology and vaccinology, vaccine administration, storage and handling of immunizing agents and information on communicating effectively about the benefits of immunization.
- [Part 2 - Vaccine Safety](#) provides information about vaccine safety monitoring in Canada, product-specific contraindications, precautions and concerns, assessment and management of anaphylaxis and other acute reactions following vaccination, and reporting of Adverse Events Following Immunization (AEFI).
- [Part 3 - Vaccination of Specific Populations](#) provides recommendations for the vaccination of specific populations, including adults, workers, persons with inadequate immunization records, persons who are pregnant or breastfeeding, infants born prematurely, persons in health care institutions, persons who are immunocompromised, persons with chronic diseases, travellers, and those who are new to Canada.
- [Part 4 - Active Vaccines](#) is organized into disease-specific chapters. It provides information about disease characteristics and epidemiology, as well as vaccine-specific information and recommendations for use.
- [Part 5 - Passive Immunization](#) is a single chapter addressing passive immunizing agents, providing guidance on the use of immune globulin products available in Canada.

### Chapter Updates

Chapters are updated as new evidence about vaccines and vaccine-preventable diseases becomes available and as NACI and CATMAT release new or updated recommendations.

The CIG contains select references. For additional references and other information, users may consult [NACI](#) and [CATMAT](#) statements and publications.

Additionally, on the [NACI: Statements and publications](#) web page, users may access the [CIG Part 4: Active Vaccines](#) chapters directly. Here, the CIG chapters are listed by vaccine-preventable disease with the applicable NACI statements directly below.

The most current information on COVID-19 vaccines is available in the [CIG Part 4: COVID-19 vaccine chapter](#) and in standalone statements on the NACI webpage under the COVID-19 section. New and updated recommendations are published as standalone statements on the NACI webpage and are incorporated into the CIG when possible. Other CIG chapters that are impacted by COVID-19 will be updated with COVID-19 vaccine content in the future.

Users are encouraged to [subscribe](#) to keep up to date with changes. Comments or questions regarding the CIG may be directed to PHAC using the "[Contact form for inquiries](#)".

---

## Community spotlight

Putting the spotlight on innovative projects and best practices from communities across Canada.

### Supporting Canadian health service users with decision-making on COVID-19 vaccination during pregnancy and lactation

The [McMaster University, Department of Obstetrics and Gynecology](#) (McMaster - OBGYN), is a large multi-site department, and has a strong affiliation with the university's academic Midwifery Education Program. It is committed to leadership in evidence-based and high quality care for pregnant individuals and their families.



DEPARTMENT  
OF OBSTETRICS  
AND GYNECOLOGY



With support from PHAC's [Immunization Partnership Fund \(IPF\)](#), Dr. Jon Barrett's and Dr. Rohan D'Souza's team at McMaster are developing and disseminating a tool, through multi-pronged national, provincial, and community proxies that supports decision-making regarding COVID-19 vaccination. They will also be studying the tool's impact on vaccine hesitancy for pregnant and lactating individuals, especially those belonging to Indigenous, racialized, and equity-seeking groups.

The decision-making tool will incorporate new and emerging evidence on vaccine safety in pregnancy and breastfeeding, and is being created in consultation with vaccine and pregnancy experts, patient advisors, and experts on equity, diversity and inclusion to ensure cultural safety. It will be translated into French, and five widely-spoken non-official languages in Canada, with provision to translate on demand to Indigenous and other less commonly spoken languages, as required.

In addition to the primary activities, the project leads are working to build a network of health care and community advocates involved in the care of pregnant and lactating individuals. Additionally, the project will generate reports that summarize study findings, barriers and facilitators to vaccination programs, lessons learned from collaborators, and methods for effective outreach Indigenous, racialized, and equity-seeking populations in Canada.

The team at McMaster has partnered with Health Nexus, a bilingual, non-profit organization with charitable status that specializes in targeted health promotion and education using inclusive and culturally safe approaches.

---

## PHAC webinars and webcasts for health care providers

PHAC, in collaboration with the Canadian Vaccination Evidence Resource and Exchange Centre (CANVax) and the National Collaborating Centre for Infectious Diseases (NCCID), offers expert-led webinars and webcasts focused on providing health care providers with clinical guidance and information related to key vaccine topics.

**Webcasts** are video resources.

**Webinars** are live events, with an audience and question & answer period. These live events are recorded and later posted for viewing.

### Live webinar coming soon

[Understanding Canada's Vaccine Injury Support Program – click to register now](#)

**Wednesday, June 1, 2022 from 2 p.m. to 3 p.m.**



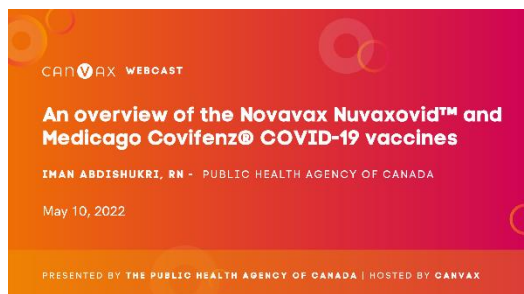
**Dr. Jennifer Crichton, Edward Maier and Stephanie Parisien**

will provide an overview of Canada's Vaccine Injury Support Program (VISP) for health professionals. The webinar will cover elements such as the program's purpose, eligibility criteria and processes, and will end with a Q & A opportunity.

(Veuillez voir la version française pour les coordonnées du webinaire en français qui aura lieu le 8 juin.)

### Webinar and webcast watch list

[Webcast - An overview of Novavax Nuvaxovid™ and Medicago Covifenz® \(40 mins\)](#)



**RN Iman Abdishukri** discusses the clinical evidence for the Novavax Nuvaxovid™ and Medicago Covifenz® COVID-19 vaccines and summarizes the NACI recommendations for the use of these vaccines.

[Webcast - Needle fear, pain and vaccines - introduction to the CARD™ system as a framework for vaccination delivery \(18 mins\)](#)



**Experts Dr. Anna Taddio and Dr. Meghan McMurtry** discuss contributors to stress-related reactions during vaccination and evidence-based strategies to improve the vaccine experience for people receiving vaccines and those who support them.

---

## Contact Vaccine Confidence

[Subscribe](#) to receive the PHAC Vaccine Confidence InfoBulletin directly in your inbox. To explore past issues, see [archived issues on CANVax's website](#).

Have questions or feedback to share? Email us: [vaccination@phac-aspc.gc.ca](mailto:vaccination@phac-aspc.gc.ca)

Please note that any medical questions should be directed to your local health care provider and any urgent medical questions should be directed to 911 or your local emergency department.



---

## Annex

### References

- [1] P. G.-J. Ygram, R. A. C. Ruiter and G. Kok, "Threatening communication: a critical re-analysis and a revised meta-analytic test of fear appeal theory," *Health Psychol Rev*, pp. S8-S31, 7 May 2013.
- [2] A. O. Osen, A. L. Holmes, N. Balluerka, M. D. Hidalgo, A. Gorostiaga, J. Gomez-Benito and T. Huedo-Medina, "Is social media a new type of social support? Social media use in Spain during the COVID-19 pandemic: A mixed methods study," *International Journal of Environmental Research and Public Health*, vol. 19, no. 7, pp. 1-20, March 2020.
- [3] N. Puri, E. A. Coomes, H. Haghbayan and K. Gunaratne, "Social media and vaccine hesitancy: New updates for the era of COVID-19 and globalized disease," *Human Vaccines & Immunizations*, vol. 16, no. 11, pp. 2586-2593, 2020.
- [4] Y. Su, "It doesn't take a village to fall for misinformation: Social media use, discussion heterogeneity preference, worry of the virus, faith in scientists, and COVID-19-related misinformation beliefs," *Telematics and Informatics*, vol. 58, pp. 1-12, 2021.
- [5] CANVax, "ET12 Back to the Vax: How two former anti-vax moms became vaccine advocates," August 2021. [Online]. Available: <https://canvax.ca/emerging-topics-podcast>.
- [6] J. R. Bautista, Y. Zhang and J. Gwizdka, "Healthcare professionals' act of correcting health misinformation on social media," *International Journal of Medical Informatics*, vol. 148, pp. 1-12, 2021.
- [7] Government of Canada, PHAC, "Canadian Immunization Guide: Immunization in pregnancy and breastfeeding," [Online]. Available: <https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-3-vaccination-specific-populations/page-4-immunization-pregnancy-breastfeeding.html>. [Accessed 02 05 2022].
- [8] e. a. Skoff TH, "Impact of the US Maternal Tetanus, Diphtheria, and Acellular Pertussis Vaccination Program on Preventing Pertussis in Infants <2 Months of Age: A Case-Control Evaluation.," *Clin Infect Dis.*, vol. 65, no. 12, pp. 1977-1983, 29 Nov 2017.
- [9] K. Zaman, "Effectiveness of maternal influenza immunization in mothers and infants.," *N Engl J Med.*, vol. 359, no. 15, pp. 1555-64, 9 Oct 2008.
- [10] N. e. a. Halasa, ". Effectiveness of Maternal Vaccination with mRNA COVID-19 Vaccine During Pregnancy Against COVID-19–Associated Hospitalization in Infants Aged <6 Months — 17 States, July 2021–January 2022.," *MMWR Morb Mortal Wkly Rep*, vol. 71, pp. 264-270, 2022.
- [11] J. S. Brennen, F. M. Simon, P. N. Howard and R. K. Nielson, "Types, sources, and claims of COVID-19 misinformation," Reuters Institute, April 2020. [Online]. Available: <https://reutersinstitute.politics.ox.ac.uk/sites/default/files/2020-04/Brennen%20-%20COVID%2019%20Misinformation%20FINAL%20%283%29.pdf>.