This episode was

- written by Sean Wang, a third-year Dalhousie medical student out of Halifax, Nova Scotia and
- peer-reviewed by another East-Coaster, Dr. Melissa Power, Dalhousie Family Medicine Staff and the Faculty Undergraduate Coordinator of South-West Nova.

Objective 1: Do not delay immunizations unnecessarily (e.g., vaccinate a child even if he or she has a runny nose).

A common encounter in the family medicine world is when there are delays from the standard immunization schedules that we've all grown to love. As is life, a patient may miss an appointment resulting in a longer than recommended interval between doses of a vaccine.

You may ask, well, are there any times we should consider delaying immunizing our patients?

First, although it may make sense to parents to delay their kiddo's immunizations if they have the sniffles, the National Advisory Committee on Immunization (NACI) inform us that there is no reason to put off immunizing kiddos with mild acute illnesses, including URTI, otitis media, mild diarrhea.

Immunizations also do not make symptoms of illness worse.

However, there are other moderate to severe acute illnesses that may postpone or defer vaccines including:

1. Gastroenteritis: Postpone oral typhoid, cholera and travellers' diarrhea vaccines until the illness has resolved. Defer rotavirus vaccine until condition improves unless deferral results in scheduling the first dose beyond the recommended age limit.
2. Measles: Delay varicella containing vaccine for 6 weeks (a minimum of 4 weeks delay can be applied if needed).
3. Medical attended wheezing in the 7 days prior to vaccination: Live Attenuated Influenza Vaccine (LAIV) is contraindicated.
4. Tuberculosis, active, untreated: Tuberculosis may be exacerbated by natural measles infection. Although there is no evidence that measles or varicella-containing vaccines have such an effect, MMR, MMRV, varicella, and live zoster vaccines (LZV) are contraindicated as a precautionary measure.

Antibiotic therapy does NOT interfere with response to non-live vaccines or most live vaccines with the following exceptions:

- The Typh-O vaccine series should be finished at least 3 days before commencing, or initiated at least 3 days after completing, treatment with sulphonamides or other antibiotics active against S. typhi, or antimalarials. Exceptions include chloroquine, mefloquine and Malarone®.

Individuals receiving long-term warfarin or heparin are not considered to be at higher risk of bleeding complications following immunization and may be immunized through either the intramuscular or subcutaneous route (as recommended for the vaccine product) without discontinuation of anticoagulation therapy.

Antiviral therapy does not interfere with response to non-live vaccines or most live vaccines with the following exceptions:

- Varicella vaccine and live herpes zoster (LZV) vaccine may have reduced effectiveness if given concurrently with antivirals active against varicella zoster virus (such as acyclovir, valacyclovir, famciclovir).
    - People taking long-term antiviral therapy should discontinue these drugs, if possible, from at least 24 hours before administration of varicella or LZV vaccine and should not restart antiviral therapy until 14 days after vaccination.
- LAIV should not be administered until 48 hours after antiviral agents active against influenza (e.g., oseltamivir) are stopped, and antiviral agents should not be administered until at least 14 days after receipt of LAIV unless medically indicated.
    - If antiviral agents are administered within this time frame (from 48 hours before to 14 days after LAIV), revaccination should take place at least 48 hours after the antivirals are stopped.

There are other rarer instances in which vaccines may be contraindicated or precautions are taken; however, we do not have the time to run through the whole list so we will link the chapter out of the Canadian Immunization Guide on contraindications and precautions associated with conditions that may be present in vaccine candidates in the show notes for full details.

In general, the NACI recommends that regardless of time between doses, interruption of a vaccine series does not require restarting the series as delays between doses do not result in a reduction in final antibody concentrations for most multi-dose products.

However, maximum protection may not be attained until the complete vaccine series has been administered.

Exceptions include cholera and travellers' diarrhea vaccine and rabies vaccine for post-exposure prophylaxis; both which specialized travel clinics would handle so we'll leave at that.

Objective 2: With parents who are hesitant to vaccinate their children, explore the reasons, and counsel them about the risks of deciding against routine immunization of their children.

A topic that all physicians will encounter in their offices and beyond.

The CPS offers great practice point articles on their website that we will summarize to address vaccine hesitancy with patients and families.

First of all, what is vaccine hesitancy?
Vaccine hesitancy can be defined as delays in accepting or refusing vaccines despite the availability of vaccination services.

What are some variables that make people hesitant?
Although not always the case, vaccine hesitancy tends to occur in pockets, such as in non-traditional medical, religious, and underserved communities. Also, something that we don't often think about is that a health care providers' own vaccine status has been shown to influence their patients' confidence in receiving vaccines.

Parents could be hesitant to vaccinate their children for a number of reasons, so remember that nifty mnemonic shoved down our throats during medical school – FIFE (feelings, ideas, function, expectations)? FIFE their concerns!

It has been shown that understanding and addressing concerns towards vaccine safety, respectfully providing consistent and accurate information about vaccine benefits and risks, and working collaboratively to ensure shared decision-making will allow for parents to be more comfortable with agreeing to vaccine schedules and helps maintain the therapeutic relationship.

Multiple visits for discussions around vaccine issues may be slow, but worth the effort.

Always remember to counsel parents about the risks of deciding against routine immunization of their children. These risks may include things such as:

- Serious illness, disability, and even death.
    - Examples include
        - pertussis causing pneumonia, seizures, brain damage, death,
        - meningococcal infections causing meningitis, mumps causing permanent deafness,
        - measles causing encephalitis, brain damage, death, and
        - polio causing paralysis.

    - There is also no treatment or cure for diseases such as measles, polio, and tetanus.
- Vaccine-preventable diseases are still a threat! Although small in numbers, pertussis, meningococcal disease, and mumps still occur in Canada. Measles and polio are also common in other countries – just a plane ride away.
- Also, unvaccinated children have a much greater chance of getting a vaccine-preventable disease than children who are vaccinated.
- Last, herd immunity does not guarantee protection for unvaccinated kiddos. If you live in an area with low immunization rates, your child will not be protected through herd immunity. It also does not protect against all-vaccines preventable diseases – for instance, tetanus.

Also, the CPS recommends that we talk about herd immunity as community protection as it may – and I quote – "be off putting for some parents as they see it implying their child is a cow or goat".

Incredible – always thought of being a vet but not in this lifetime.

- Not vaccinating your child can also put your family, loved ones, and others who cannot receive vaccines at risk – the newborn babes, immune-deficient patients, and patients with chronic health conditions.

There is some interest in alternative scheduling for vaccines as opposed to the standard vaccine schedules – whether this is to delay or space out children's vaccinations.

As per ImmunizeBC's website, there is no known benefit to alternative scheduling – only risks such as getting diseases while they are unvaccinated, decreased efficacy of the vaccines, and increased number of visits to your child's health care provider, increasing anxiety and needle fear.

We will include, in the show notes, a page out of the Canadian Immunization Guide on routine childhood immunization schedules for infants, children, and adults from birth as well as those who may have not received their immunizations at the routine ages from birth and those who are at-risk due to underlying medical conditions.

Objective 3: Identify patients who will specifically benefit from immunization (e.g., not just the elderly and children, but also the immunosuppressed, travellers, those with sickle cell anemia, and those at special risk for pneumonia and hepatitis A and B), and ensure it is offered.

Prevention of infection by immunization is not just for the kiddos, but many specific populations will benefit from vaccines for a number of reasons that we'll run through now.

And keep in mind that there are some vaccines that are publicly funded, and others that are not. These vary by provinces as well. Always consider this when recommending vaccines for patients.

As an example, the Shingles vaccine is recommended age 50 and over but not funded by Nova Scotia and is very expensive out of pocket – about $300.00. Likewise in Nova Scotia, if people missed out on HPV in school, they would pay out of pocket as well. It's always important to recognize these barriers for all our patients!

With that, let's jump into our populations.

First,
the adults.
In recent years, new vaccines such as herpes zoster and human papillomavirus have become available for adults.

Despite these advances, the vaccination rates of adults in Canada are low. A good tip is setting scheduling record audits on set birthdays to remind yourself of delivering vaccines. Adult vaccinations include the following:

- Diphtheria and tetanus with booster doses recommended every 10 years.
- Two-dose series of Recombinant Zoster Vaccine recommended for adults 50 years of age or older
- Bivalent or quadrivalent or nonavalent HPV vaccine recommended for women up to and including 26 years of age and may be administered to those 27 years of age and older who are at ongoing risk of exposure.
    - Quadrivalent or nonavalent HPV vaccine is recommended for men up to and including 26 years of age and may be administered to men 27 years of age and older who are at ongoing risk of exposure.
- Seasonal influenza vaccine is recommended annually.
- MMR vaccine, recommended for adults born in or after 1970 susceptible to one or more of these viruses.
- Meningococcal vaccine if it was not received in adolescence.
- One dose of Tdap if it was not previously received.
- Pneu-P-23 vaccine for all adults 65 years of age and older.

- For previously unimmunized adults, a primary series of inactivated poliomyelitis vaccine (IPV) should be provided at the time of immunization with a tetanus and diphtheria toxoid-containing vaccine.
- Univalent varicella vaccine is recommended for susceptible adults 18 to 49 years of age.

Next up,
pregnant individuals.
Inactivated vaccines are considered to be safe when administered in pregnancy. Reactions following vaccination with inactivated vaccines are usually limited to the injection site. No increase in anaphylactic reactions or events that might induce preterm labour has been observed following immunization with inactivated vaccines.

Vaccines are recommended for the protection of the pregnancy individual's health including:
- inactivated influenza vaccine
- Tdap
- hepatitis B vaccine if susceptible and with ongoing exposure risks
- hepatitis A vaccine if a close contact of a person with hepatitis A or if travelling to an endemic area
- meningococcal vaccine in an outbreak setting or post-exposure, or if indicated by medical condition
- pneumococcal polysaccharide vaccine with or without conjugate vaccine if indicated by medical condition
- any other inactivated vaccine if indicated by exposure (e.g. rabies), travel (e.g. inactivated typhoid vaccine) or by medical condition (e.g. asplenia).

The beneficial effects of immunization during pregnancy for the fetus as well as the newborn infant have been well documented. Protective concentrations of antibodies are transferred to the fetus transplacentally, resulting in increased infant protection in the early postnatal period.

Third, let's talk about
premature infants.
If in stable clinical condition, regardless of birth weight, NACI recommends that premature infants should be immunized with age-appropriate doses of vaccine at the same chronological age and according to the same schedule as full-term infants, with some specific exceptions as outlined that are outlined in the show notes.

Fourth, the
patients who have chronic conditions.
For the sake of time, we'll only identify the categories in which one should think especially for protection with immunization.

These include patients with:

- Asplenia, hyposplenia
- Autoimmune diseases such as lupus, systemic vasculitides, rheumatoid arthritis
- Cancer
- Cochlear implants
- Endocrine and metabolic diseases such as diabetes, thyroid disease
- Chronic heart disease
- Bleeding disorders such as hemophilia
- Anemia such as sickle cell anemia, thalassemia
- Chronic kidney disease
- Chronic liver disease
- COPD
- Cystic fibrosis
- Neurological and neurodevelopmental conditions

So basically, everyone over the age of 65, nice.

Fifth, immunocompromised patients –
as a result from a congenital condition, an illness, or medications that suppress immune function. In general, immunocompromised people 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.

These patients include those with B cell antibody deficiencies, combined T and B cell immunodeficiencies, phagocytic and neutrophil disorders, complement deficiency, innate immunity defects, acquired complement deficiency, malignant hematological or solid cancers, hematopoetic stem cell transplantation, HIV, and solid organ transplantation.

Sixth and lastly, never forget your
travelers!
Immunization to protect travellers can be life-saving and is a cornerstone of travel health protection. Other protective measures, such as sanitation and hygiene, food precautions, insect or animal bite prevention, and injury prevention, are also essential for health protection while travelling and are complementary to immunization.

A health care provider or travel health clinic should be consulted as early as possible, ideally at least 4 to 6 weeks in advance of travel, to provide sufficient time for completion of optimal immunization schedules.

Objective 4: Clearly document immunizations given to your patients.

When recording immunization records there are three locations, on paper or electronically, that vaccine providers ought to jot down:

- The personal immunization record held by the vaccine recipient, or their guardian.
- The record maintained by the health care provider who administered the vaccine.
- And the local provincial or territorial immunization registry (if one has been established).

Vaccine providers should include the following information in each of the above three locations:

- the brand name of the administered product
- time and date of administration
- quantity of administered dose (if applicable)
- anatomical site of administration
- route of administration
- lot number of the product and expiry date
- name and professional designation of the person administering the product

Vaccine providers should record additional relevant information, such as rubella or hepatitis B serology or tuberculin skin test results, in the personal immunization record, as well as in the record maintained by the health care provider.

Records should include:

- all relevant serologic data
- documentation of adverse events following immunization
- documentation of contraindications or reasons for deferring or withholding immunization
- other immunization related documentation, such as pre-vaccine and provider administration check lists

Objective 5: In patients presenting with a suspected infectious disease, assess immunization status, as the differential diagnosis and consequent treatment in unvaccinated patients is different.

People may present to health care providers with inadequate or no immunization records. Make sure to always attempt to obtain the person's immunization records from their previous physician.

Now, routine serologic testing to determine the immunity of children and adults without immunization records is generally not practical, but the following is recommended:

- individuals who report incomplete immunization or lacking adequate documentation of immunization should be considered unimmunized and started on an immunization schedule appropriate for their age and risk factors as per the recommended immunization schedules talked about earlier.

So, if your patient has a limited immunization record, be sure to expand your differential to include vaccine-amenable diseases such as

- diphtheria,
- rubella,
- pertussis,
- polio,
- rotavirus,
- pneumonia,
- meningitis,
- measles,
- mumps,
- rubella,
- chickenpox,
- hepatitis,
- HPV,
- COVID-19,

and so on, especially if the patients come from within special populations, as discussed in Objective 3.

One large category that wasn't talked about before is individuals who are newly arriving in Canada. They may be more susceptible to vaccine preventable diseases because of a lack of effective immunization programs in their country of origin.

If people who newly arrived in Canada are lacking adequate documentation of immunization, they should be considered unimmunized and started on an immunization schedule appropriate for their age and risk factors unless known to be immune by serologic testing.

Objective 6: In patients presenting with a suspected infectious disease, do not assume that a history of vaccination has provided protection against disease (e.g., pertussis, rubella, diseases acquired while travelling).

It is easy to assume that your patients generally have their immunization records properly filled out and up to date. But as we discussed in the last objective, we should always make sure that a patients immunization record is accurate, especially those at a higher-risk population.

Newborns, pregnant individuals, travelers, newcomers, the list goes on.

The efficacy and effectiveness of a vaccine depends on several factors including two major ones; the type of vaccine administered as well as the scheduling of the vaccine series. Here we focus on more common vaccine preventable conditions.

But just know that you can find the efficacy and effectiveness of any vaccine on the Canadian Immunization Guide.

For pertussis,
the vaccine efficacy following the primary series with acellular pertussis vaccines is estimated to be about 85%, and approximately 90% following booster immunization. Although the duration of protection afforded by acellular pertussis vaccine is unknown, available data suggests that protection does not significantly decline between the first booster (18 months) and second booster (4-6 years). However, a progressive decline in protection has been observed following the second booster dose.

For rubella,
in clinical trials, 95% or more of vaccine recipients aged 12 months and older developed serologic evidence of rubella immunity after a single dose of rubella-containing vaccine.

The duration of protection following immunization with rubella-containing vaccines is not known, but studies indicate that immunity exceeds 20 years.

Asymptomatic rubella re-infection, manifest by a rise in antibody, has been observed in some vaccine recipients. Asymptomatic re-infection has also been observed in women with naturally acquired immunity associated with very low antibody titres.

For travel-related diseases, it will depend on where you end up going. But if you go on travel.gc.ca (link in the appendix), you can search up the vaccinations recommended by destination and go off that list. But to cover two of the big names:

Yellow fever (YF)
endemic in sub-Saharan Africa and intermittently epidemic in tropical South America. More than 80% of persons immunized with YF vaccine develop neutralizing antibodies 10 days after vaccination and more than 99% by 28 days after vaccination.

In immunocompetent individuals, a single dose of yellow fever vaccine likely confers life-long immunity.

And, hepatitis A

endemic in many popular destinations such as the Caribbean, South Asia, sub-Saharan Africa, Central Asia, North Africa, Middle East, and the list goes on.

Protective concentrations of antibody against HA develop in 95% to 100% of vaccine recipients after 1 dose of HA vaccine, and nearly 100% seroconvert after receiving 2 doses of vaccine.

As well, the protective efficacy of HA vaccine when used within 1 week of exposure is approximately 80%.

Thank you again Dr. Melissa Power for peer-reviewing this show. Shout-out to Yarmouth, Nova Scotia!

Good seafood, better docs.

Sources

1. https://www.cdc.gov/vaccines/hcp/patient-ed/conversations/downloads/fs-child-sick.pdf
2. https://www.canada.ca/en/public-health/services/canadian-immunization-guide.html
3. https://cps.ca/en/clinical/immunization-and-vaccines
4. https://cps.ca/en/documents/position/vaccine-hesitancy-in-immunization-programs
5. https://immunizebc.ca/if-you-choose-not-vaccinate-your-child

Appendix/Show Notes

1. https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-2-vaccine-safety/page-3-contraindications-precautions-concerns.html#a2

2. https://www.canada.ca/en/public-health/services/publications/healthy-living/canadian-immunization-guide-part-1-key-immunization-information/page-13-recommended-immunization-schedules.html
3. https://travel.gc.ca/travelling/health-safety/vaccines
4. Premature infants exceptions vaccination exceptions
    a. The response to hepatitis B (HB) vaccine may be diminished in premature infants with birth weight less than 2,000 grams. In jurisdictions where the first dose of HB vaccine is routinely given at birth, routine HB immunization of infants should be delayed until the infant reaches 2,000 grams or upon hospital discharge if discharge occurs before the infant has reached 2,000 grams.
    b. A 4-dose pneumococcal conjugate vaccine schedule (at 2, 4, 6 and 12-15 months of age) is recommended for premature infants with chronic lung disease or other conditions resulting in high risk of invasive pneumococcal disease.
    c. RV vaccines are recommended for healthy premature infants starting at 6 weeks of chronological age, with the first dose administered before 15 weeks of chronological age. The vaccination series should be completed before 8 months of chronological age.
    d. May receive BCG vaccine any time after 31 weeks of gestational age, if indicated.