Travel Vaccines Update:
A Quick Summary of What’s New

Dr. Michael Payne
November 4th, 2016
Outline

• Routine Vaccinations
  – Measles, mumps and rubella (MMR)
  – Tetanus, Diphtheria, Pertussis (Tdap)
  – Polio
  – Influenza
  – Varicella Zoster Virus (VZV)

• Travel Vaccines
  – Hepatitis A
  – Hepatitis B
  – Typhoid vaccine
  – Japanese encephalitis
  – Meningitis vaccination
  – Yellow Fever (See Hot Topics by Dr. Suni Boraston)
## 2.0 Routine Schedules

### 2.1 Schedule A: Basic Immunization for Children Starting Series at 2 Months of Age

The following recommendations will guide the development of the schedule for healthy children and adolescents, and should be used in combination with the relevant Biological Product pages (see Section VII-Biological Products). Children with specific health conditions and/or risk factors should be immunized according to principles outlined in Section III-Immunization of Special Populations.

<table>
<thead>
<tr>
<th>Age</th>
<th>Vaccine</th>
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<tr>
<td>2 months</td>
<td>DTaP-HB-IPV-Hib (or DTaP-IPV-Hib and HB) A</td>
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<td>On or after 1st birthday</td>
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<td>Var</td>
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<td>PCV13</td>
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<td>Men-C-C C</td>
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<td>School Entry (4-6 years of age)</td>
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<td>Grade 9</td>
<td>Tdap G</td>
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<td>Men-C-ACYW-135</td>
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As of February 2015, 125 cases of measles occurred linked to travel, to the happiest place on earth
  • 10 were Canadians

Of the California residents, 49 (45%) were unvaccinated
  – 12 too young
  – 28, intentionally unvaccinated, due to beliefs
  – 1 on an alternative schedule
Sporadic cases of measles common for GeoSentinel sites

- 87% of cases in adults aged 18-45

Figure 1. Measles patients reported to GeoSentinel in 2000–2014, by year and geographic region of exposure (n = 89).
MMR Vaccination Schedule

• Children in BC routinely immunized at 12 months and 4-6 (MMRV) years of age
  – Infants (6 months – 1 year old) travelling outside of N. America should have dose of MMR (Still need 2 more doses after 12 months)

• Those born prior to 1970 (1957 for health care workers) require 1 dose of MMR
  – If born on or after 1970 require 2 doses of MMR
    • Includes travellers

• **Important** as people born in BC from 1970-1996 routinely only got 1 dose of MMR
  – 1992-1996 catch up dose of MR only
Mumps outbreak worsens

June 8, 2016

Vancouver – The number of people with mumps in the Vancouver Coastal Health region has grown to 46 with the illness now reported in Whistler, Squamish, Vancouver and North Vancouver.

“The average age of patients in this mumps outbreak is 33,” says Dr. Althea Hayden, medical health officer, Vancouver Coastal Health. “Due to their age, most of those infected with mumps likely only had one dose of mumps vaccine and so were not fully protected against the disease. That’s why we are encouraging everyone between the ages of 22 and 46, if you aren’t sure you’ve had two doses to get a second dose of the vaccine so that they are fully protected.”

If you were born after January 1, 1970, you need to have two doses of mumps-containing vaccine to be protected.

If you were born before 1970 or know that you have had mumps infection, you are considered protected from natural infection.

Mumps vaccine is usually given as MMR (Measles, Mumps, Rubella). Since a second dose of MMR was not added to routine vaccination schedule in B.C. until 1996, many adults born between 1970 and 1996 are not fully protected. If you are not sure if you have complete protection, it is safe for you to receive another dose of MMR vaccine.
3rd Dose?

- The median vaccine effectiveness against mumps has been estimated at 78% for 1 dose and 88% for 2 doses

Student 2 dose mumps vaccination coverage >97%
Pertussis

- Increasing cases in Canada, due to waning immunity of acellular vaccine
- 30 cases in GeoSentinel clinics (2007-2011)
- One time adult booster is recommended ($)

CCDR: Volume 40-3, February 7, 2014
Tetanus and Diphtheria

• Currently recommended to be given as a booster every 10 years, after primary series

• Diphtheria has been reported rarely in GeoSentinel surveys
  – 2 cases 2007-2011
  – Outbreaks reported recently in promed
    – Venezuela (Oct 2, 2016)
    – Pakistan (Sept 21, 2016)
    – Malaysia (July 5, 2016)

Polio Vaccine

• Due to increasing spread of polio, temporary WHO polio vaccine requirements effect the following countries:
  – **Afghanistan**, Burma (Myanmar), Guinea, Laos, Madagascar, Nigeria, **Pakistan**, and Ukraine
  – Long-term travelers (staying >4 weeks) may be required to show proof of polio vaccination when leaving these polio-infected countries

• To meet WHO requirements, long-term travelers should receive the polio vaccine between 4 weeks and 12 months before the date of departure from these polio-infected countries.

Children and adults need to first complete their primary series of polio vaccination.

A one time adult booster of polio vaccine is recommended for travellers.

Issue a certificate only for travel to countries with WHO exit recommendation.

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**INTERNATIONAL CERTIFICATE OF VACCINATION OR PROPHYLAXIS**

Certificat international de vaccination ou de prophylaxie

This is to certify that Jane Mary Doe, date of birth 22 March 1960, sex F, nationality United States, has on the date indicated been vaccinated or received prophylaxis against polio on 16 June 2014.

The vaccine or prophylaxis against polio (IPV) was administered by John M. Smith, MD, batch (or lot) #, from 14 July 2014 to 15 June 2015.

In accordance with the International Health Regulations, conformément au Règlement sanitaire international.
Varicella Zoster Vaccine

- Varicella zoster virus (VZV) causes:
  - Primary infection, Chickenpox
  - Reactivation, Herpes zoster (Shingles)
- Chickenpox is a rare, but important, infection in the traveller

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<th>Vaccine preventable disease</th>
<th>Total number</th>
<th>Median age (years), interquartile range</th>
<th>Number (%) pre-travel encounter</th>
<th>Number (%) hospitalized at initial encounter</th>
<th>Median trip duration (days), interquartile range</th>
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<td>37,542</td>
<td>34,26–46</td>
<td>18,508 (49)</td>
<td>3826 (10)</td>
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<td>All VPDs</td>
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<td>30(^b), 24–40</td>
<td>168 (29(^d))</td>
<td>317 (55(^e))</td>
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<td>Enteric Fever</td>
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<td>14(^f), 7–41.5</td>
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<td>Varicella</td>
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<td>8 (22)</td>
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<td>Measles</td>
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<td>8 (67)</td>
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<td>Bacterial Meningitis</td>
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<td>51(^c), 27–60</td>
<td>1 (10)</td>
<td>9 (90)</td>
<td>11, 8–11</td>
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</table>
Varicella Zoster Vaccine

• A live attenuated vaccine is high effective:
  – 1 dose 70-90% protective
  – 2 doses >98% protective

• BC started vaccinating in 2004, and also offered catch up dosing for susceptible children
  – Young adults born between 1993-2000 may need a second dose
Herpes Zoster (HZ) Vaccine

• HZ (shingles) occurs with reactivation of VZV
  – In Canada, 130,000 cases/year with 17,000 cases of post-herpetic neuralgia (PHN), and 20 deaths

• HZ vaccine (Zostavax) efficacy is ~50% for HZ and ~66% for PHN
  – Protection lasts from 5-7 years
  – Can give if previous HZ, wait 1 year
  – Caution if history of HZ ophthalmicus

• Recommended for those 60 years and older
  – Can be given to those 50 years and older
Efficacy of an Adjuvanted Herpes Zoster Subunit Vaccine in Older Adults

• New recombinant subunit vaccine containing VZV glycoprotein E and the AS01B adjuvant system (HZ/su)

• In phase 3 trail, efficacy for HZ was 97.2% at a mean of 3.7 years follow up
  – Efficacy for PHN for those >70 yo was 88%
  – Minimal decrease in response with age
  – 79% reported localized symptoms, with 12% having severe enough symptoms to limit activities

• Potentially a good option for immunocompromised patients
Influenza

- In a large GeoSentinel review, respiratory illness was common in travellers, 10% of those seeking post-travel medical attention
  - 367 cases of Influenza A/B (8% of respiratory illness cases)

- Influenza occurs:
  - Year-round in the tropics
  - November to March in the Northern Hemisphere
  - April to October in the Southern Hemisphere

Outbreak of Influenza A Infection Among Travelers -- Alaska and the Yukon Territory, May-June 1999

On June 18, 1999, CDC and Health Canada received reports from public health authorities in Alaska and the Yukon Territory about clusters of febrile respiratory illness and associated pneumonia among travelers and tourism workers. This report presents information about the outbreak. Laboratory evidence, including rapid influenza A antigen-detection tests and viral cultures from respiratory specimens, has implicated influenza A virus as the cause of illness.

As of June 29, CDC has received reports of 428 cases of acute respiratory infection (ARI) among tourists who traveled to Alaska and the Yukon Territory from May 22 through June 28 on seven separate week-long cruises. For 187 (48%) of the 386 ill persons whose dates of illness onset were known, illness occurred before or within 48 hours after boarding a cruise ship, suggesting that transmission occurred during a preceding land-based tour. The ARI incidence for the 386 cases was 3.8% among 10,110 passengers for a 7-day travel itinerary; the ARI attack rate was 5.5 per 1000 passenger-days. One hundred thirty-two (34%) cases met criteria for influenza-like illness (ILI) (i.e., fever or feverishness with cough or sore throat); four persons were hospitalized for pneumonia. No deaths have been reported. Among tourism workers, 104 cases of ARI have been reported.
Influenza

• It is recommended that all travellers older than 6 months should be vaccinated for influenza, with a focus on high risk patients

• Consider boosting of travellers to the Southern Hemisphere between April and October, if they had already been vaccinated in the preceding fall or winter based on:
  • individual risk assessment
  • the similarity or differences between the Northern and Southern Hemisphere’s vaccines

• Cruise ships to Alaska are a source of local influenza cases during the summer months in BC

Flu Vaccines – We expect to receive five publicly funded influenza vaccines this year

<table>
<thead>
<tr>
<th>Vaccine Type</th>
<th>Trivalent Inactivated Influenza Vaccine (TIIIV) for Adults</th>
<th>Quadrivalent Influenza Vaccines (QIV) for Children</th>
</tr>
</thead>
</table>
| Trade name            | • FluViral®: 18-64 years  
                       • Agriflu®: 18-64 years  
                       • Fluad®: 65 years and older                                                  | • FluLaval® Tetra (QIIV, Inactive): 6 months to 17 years  
                       • Flumist® (nasal spray, LAIV-Q, Live): 2-17 years                          |
| Strains               | • A/California/7/2009 (H1N1)  
                       • A/Hong Kong/4801/2014 (H3N2) *new this year  
                       • B/Brisbane/60/2008 *new this year (this B strain was available in last year’s quadrivalent vaccine) | • Trivalent strains and  
                       • B/Phuket/3073/2013-like virus                                              |
| Anaphylaxis to eggs   | • Since 2013, everyone with egg allergies, even if severe, can be offered any inactivated influenza vaccine (TIIIV,QIIV)  
                       • New this year: Egg allergic individuals, including those with anaphylaxis following egg ingestion, can also safely receive Live Attenuated Influenza Vaccine (LAIV-Q) |                                                                                                                                 |

Flumist® (LAIV-Q) for children: Will continue to be available in Canada, the UK, Finland and several other countries, though it will not be used in the US. The Canadian National Advisory Committee on Immunization (NACI) has reviewed Flumist study results conducted over a number of years and in multiple jurisdictions. NACI concluded that bulk of the evidence indicates protection offered by Flumist is comparable to the inactivated influenza vaccines. The US recommendations are based on the results of CDC Flu Vaccine Effectiveness network only which showed vaccine effectiveness confidence interval estimates spanning zero.
Travel Vaccines
Hepatitis A

- RNA virus of the *Picornaviridae* family, genus *Hepatovirus*
- Causes acute hepatitis, and is transmitted by the fecal-oral route
  - Long incubation period (15-50 days)
- For young children (<6 years old), most infections are asymptomatic or mild
- Older children and adults typically have symptoms, some groups are at higher risk of severe hepatitis:
  - Immunocompromised patients
  - Chronic liver disease
  - Elderly
Risk to Travellers

• In a GeoSentinel review from 2007-2011, there were 120 cases of acute hepatitis A – Pre-travel visit for 18.3% of cases

Is no where safe???
– 282 cases of HAV in Hawaii
Vaccine

• Protective concentrations of antibody to hepatitis A develop in 95-100% after 1 dose and nearly 100% after 2 doses
  – Give at 0 and 6-12 months
  – Due to long incubation, can be given up to the day of travel

• When used for pre-exposure, HA vaccine is 90-97% effective in preventing clinical disease

• There are multiple HA vaccines available in Canada
  – All contain, inactivated hepatitis A virus
    • 1 in combination with injectable Typhoid
    • 2 in combination with HBV

Canadian Immunization Guide. Hepatitis A Vaccine.
Recommendations

• In BC, publically funded for individuals with:
  – Hemophilia A or B
  – Chronic liver disease
  – HIV
  – HSCT
  – MSM
  – Illicit drug use
  – Inmates
  – Close contacts of hepatitis A case

• Recommended, not free for:
  – Food handlers
  – Travellers
Recommendations

• Previously vaccine, was only recommended for those ≥1 year

• New recommendations, now state that HA vaccine is safe and immunogenic in those ≥6 months of age
  – Infants travelling to HA highly endemic countries
  – Particularly if visiting friends/relatives

• Immunoglobulin only used for specific populations for post-exposure protection

NACI, Update on the Recommended use of Hepatitis A Vaccine. 2016.
Serology

Pre-Immunization
- Can be considered for populations with higher levels of pre-existing immunity
  - Canadians born prior to 1945 (71 years and older)
  - History of hepatitis or jaundice
  - From a HA-endemic area

Post-Immunization
- HA vaccine has excellent response rates, routine post-immunization serology is NOT recommended
  - Post-HA vaccine serologic testing has poor sensitivity, negative result does not mean not protected

• Order:
  - anti- Hepatitis A Virus (HAV) Total (Immune Status)
# PHSA Laboratories

Public Health Microbiology & Reference Laboratory

BC Centre for Disease Control, 655 West 12th Avenue, Vancouver, BC V5Z 4R4  www.phsa.ca/bccdcpublichealthlab

## Section 1 - Patient Information and Physician Information

## Section 3 - Test(s) Requested

(Note: Codes for PHSA Labs Use Only)

### PreNatal Screening (Prenat)

- HIV
- HIV Non-Nominal Reporting
- HBsAg
- Rubella IgG
- Syphilis Antibody
- Other Tests, specify:

### Hepatitis

**Acute - undefined etiology**

- HBsAg, Anti-HBc Total, Anti-HBs, Anti-HCV, Anti-HAV IgM
- HEPSB

**Chronic - undefined etiology**

- HBsAg, Anti-HBc Total, Anti-HBs, Anti-HCV
- DHEPCHE

**Hepatitis B Screen**

- HBsAg, Anti-HBs, Anti-HBc Total
- HBSAG

**Specific Hepatitis Markers**

- Anti-hepatitis A Total (Immune Status)
  - HAAT
- Anti-hepatitis A IgM (Acute Infection)
  - HAVMB
- HBsAg Only
  - HBVSA
- Anti-HBs (Immune Status)
  - HBSAB
- HBeAg (Therapeutic Monitoring)
  - HBXEA
- Anti-HBe (Therapeutic Monitoring)
  - HBXEB
- Anti-HCV
  - HEPCB

### Other Serology

- Measles IgG (Rubeola)
  - MIGB
- Mumps IgG
  - MUIGB
- Parvo B19 IgG
  - PARVGB
- Rubella IgG
  - RUBEB
- EBV IgG
  - EBGSB
- CMV IgG
  - CMVIGB

**Immunity**

- Measles IgM (Rubeola)
  - MEASPM
- Mumps IgM
  - MUMPS
- Parvo B19 IgM
  - PARVMP
- Rubella IgM
  - RUBPM
- EBV IgM
  - EBVSP
- CMV IgM
  - CMVSP

**Acute**

- Varicella IgG
  - VZIGB
- Herpes Simplex Virus IgG
  - HSVIGB
- Mycoplasma IgM
  - MYCOB
- H. pylori IgG
  - HELIB

### Other Tests (Specify)

### Comments

For other available tests and additional information, consult the Public Health Microbiology & Reference Laboratory’s Guide to Programs and Services at www.phsa.ca/bccdcpublichealthlab

For information on sample collection, please call the PHSA Client Services at 1-877-PHSA-LAB (1-877-747-2522)

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<td></td>
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<tr>
<td>1990</td>
<td>72</td>
<td>90</td>
</tr>
<tr>
<td>2005</td>
<td>72</td>
<td>90</td>
</tr>
</tbody>
</table>
Duration of Protection

• Protection from a 2 dose schedule likely lasts for 20 years, with mathematical models supporting protection for >25 years to life

• Immune memory is often present, conferring protection, even if antibodies are not detectable

• Therefore, routine booster doses are not recommended at this time in Canada

• Some reviews suggest performing serologic testing in immunocompromised patients and boosting if protective IgG not detected

Immunoglobulin (Ig)

• Historically, was an important part of protection from HA in travellers

• Can consider use of immunoglobulin (Ig) in patients:
  • <6 months old
  • History of anaphylaxis to vaccine
  • Immunocompromised patients

• However, as HA prevalence wanes in Canada, the protective levels of anti-HAV in this product will likely decrease effectiveness
Hepatitis A Key Messages

- Hepatitis A is common in developing countries.....outbreaks occur in Canada/US

- Two doses are likely protective for life

- Serology is only routinely needed for patients with a high likelihood of being immune to HA, prior to vaccination
Hepatitis B

• Hepatitis B virus (HBV) is a DNA virus of the *Hepadnavirdiae* family

• Common cause of chronic hepatitis (240 million people), can also cause acute hepatitis
  – Incubation period 45-160 days

• As opposed to HAV, spread by:
  – Blood and body fluid exposures (eg dialysis and injections)
  – IVDU
  – Sexual contact
  – Vertical transmission
MAP 3-4. PREVALENCE OF CHRONIC HEPATITIS B VIRUS INFECTION AMONG ADULTS


CDC. Yellow Book, 2016.
Risk to Traveller

- Risk to travellers is estimated to be 0.2 to 0.6/1,000 per month, but could be higher in health care workers or other high risk activities

- From 1997-2007, 51 cases were reported from GeoSentinel sites
  - Higher risk for males and age >30

A.K. Boggild et al. / Vaccine 28 (2010) 7389–7395
Vaccination

• In BC, free to all those:
  – Born in 1980 and after
  – Health care workers
  – Certain chronic medical conditions
  – IVDU
  – Chronic liver disease

• Recommended, but not free for travellers
Vaccine

- Composed of recombinant HBV surface antigen (HBsAg), inactive vaccine
  - Multiple products in Canada, also in combination with HAV

- Is 95-100% effective in preventing HBV
  - Having an anti-HBs titre $10 \geq$ IU/L correlates with protection
    - If obtain this at least once, marker for life long immunity
    - Does not apply to immunocompromised patients
Vaccine

- Standard series is 0, 1 and 6 months
  - Rapid 0, 7, 21 days and 12 months

- Once completed, patient is considered immune for life, unless:
  - Health care worker
  - HIV/Immunocompromised
  - Chronic renal disease/Dialysis patients
  - Alternate vaccine schedule

- If in these categories, serology 1-6 months after completion of primary series is recommended
Rapid Vaccine Schedules

• Patients often present less than 21 days before travel

• An alternative strategy is a double dose initial vaccine, followed by the standard dose vaccine 4-12 months after

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Patients Immune</th>
<th>Total (n)</th>
<th>Proportion (%)</th>
<th>Patients Immune</th>
<th>Total (n)</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20–29 years</td>
<td>2</td>
<td>3</td>
<td>66.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30–39 years</td>
<td>6</td>
<td>6</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40–49 years</td>
<td>19</td>
<td>20</td>
<td>95.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50–59 years</td>
<td>35</td>
<td>43</td>
<td>81.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60–69 years</td>
<td>30</td>
<td>38</td>
<td>78.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥70 years</td>
<td>5</td>
<td>7</td>
<td>71.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>97</td>
<td>117</td>
<td>82.9</td>
<td>97</td>
<td>117</td>
<td>82.9</td>
</tr>
</tbody>
</table>
Booster

• If patient does not have protective titre:
  – Give repeat doses, up to a full second series (3 doses)
  – Repeat serology 1-6 months after this

• Following this “periodic monitoring” can be considered in immunosuppressed patients to ensure continued protection
  – Give booster dose if falls below protective level
Key Message HBV

• Common worldwide, but is an uncommon cause of travel related infections
  – Vaccination is safe and highly effective
  – Consider for long term travellers and those who are more likely to require health care overseas
  – Consider rapid course of vaccination when no time for standard regimen

Serology is not routinely needed unless:
• Pre-Vaccination
  – Needed to document protection for health care worker
  – High likelihood of being infected (IVDU, endemic country) (All three HBV serology markers)
  – HCV positive patients or those with chronic liver disease (All three HBV serology markers)

• Post Vaccination
  – Health care worker
  – HIV/Immunocompromised
  – Chronic renal disease/Dialysis patients
  – Alternate vaccine schedule

• Only order: anti-HBs (Immune status)
Pre-vaccine, high risk HBV
Typhoid Fever

• Typhoid fever is caused by *Salmonella* Typhi (*Salmonella Paratyphi*), through ingestion of contaminated food or water
  – 10% case fatality rate (untreated, low income countries), this is <1% with appropriate treatment in high income countries
  – 2-5% of people can become asymptomatic chronic carriers

• The acute illness is characterized by:
  – prolonged fever, headache, nausea, loss of appetite, and constipation or sometimes diarrhea
  – Incubation period is typically 8-14 days

http://www.who.int/immunization/diseases/typhoid/en/
Canadian Immunization Guide. Typhoid Vaccine
Typhoid Fever

- 21 million cases worldwide annually, with 222,000 deaths
- Was the most common vaccine preventable disease in GeoSentinel database (2010)
- Approximately, 117 cases per year in Canada

Fig. 1. Magnitude of vaccine preventable diseases among a cohort of 37,542 ill returned travelers. Enteric Fever includes S. typhi and S. paratyphi. Bacterial Meningitis refers to that caused by meningococcus, pneumococcus, or Haemophilus influenzae b. TBE—tick-borne encephalitis.

A.K. Boggild et al. / Vaccine 28 (2010) 7389–7395
Fig. 2. Geographical distribution of typhoid fever

- High (>100 per 100,000 per year)
- Medium (10–100,000 per year)
- Low (<10 per 100,000 per year)
Risk to Traveller

• The estimated risk of developing travel associated typhoid is about:
  – 1/3,000 travellers for travel to the South Asia
  – 1/50,000–100,000 for travel to Sub-Saharan Africa, North Africa and the Middle East, or South America
  – < 1/300,000 for travel to the Caribbean and Central America

• Risk of infection/severe disease increased if:
  – Anatomical and functional asplenia
  – Children
  – Duration of travel (>2 weeks)
  – Visiting friends or relatives
  – Achlorhydia or use of acid suppression therapy
  – HIV or other immunocompromised patients
Vaccine

- There are 3 vaccine types available for S. Typhi in Canada:
  - *Salmonella* Typhi Vi capsular polysaccharide vaccine for injection (Typh-P)
    - Protection for 3 years
  - Typh-P combined with hepatitis A
  - Live, oral, attenuated TY21A typhoid vaccine (Typh-O)
    - Protection for 7 years

- Efficacy of all vaccines is ~50-60% for preventing Typhoid disease
  - Some cross protection for S. Paratyphi (Typh-O only)

Canadian Immunization Guide, Typhoid Vaccine.
Vaccine

• CATMAT recommends using the typhoid vaccine where risk to traveller exceeds 1 in 10,000

• Therefore, only travellers to South Asia would qualify
  – (Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka)

• For other destinations consider if:
  – children
  – visiting friends and relatives
  – longer duration of travel (>2 weeks)
  – achlorhydria or use of acid suppression therapy
  – Patient preference
Cannot give doxycycline, azithromycin or ciprofloxacin 3 days before or after vaccination.
Vaccine Boosting

• NACI recommends that the Typh-P have a booster dose every 3 years
  – Recent cochrane review found decreased efficacy after 2 years since immunization (Supported by previous reviews)
  – Therefore, could consider boosting every 2 years
  – Some data has shown that repeat Typh-P doses show a decreased serology response, significance uncertain, consider use of Typh-O if multiple previous Typh-P doses

• Typh-O is given by a 3 dose schedule in most of the world (4 dose US and Canada)
  – Makes extrapolation of results difficult
  – However, protection does wane, and a dosing schedule of 4 years may be more appropriate
Key Messages

• Typhoid fever is a serious illness, with 68-90% of cases in returning travellers requiring hospitalization
  – Indicated to for travellers to South Asia, perform risk assessment for other travellers

• Both Typh-P and Typh-O provide 50-60% protection

• Typh-O has a longer duration of protection, but must be balanced with increased adverse events, cost and contraindications
Japanese encephalitis virus (JEV)

• JEV is a single-stranded RNA virus that belongs to the genus *Flavivirus*

• JEV virus is transmitted by *Culex* mosquito

• The virus is maintained in an enzootic cycle between mosquitoes and primarily pigs and wading birds
Japanese encephalitis virus (JEV)

• Most people infected will not become ill, (1/25-1/1000)
  – If develop symptoms 20-30% will die
  – Of survivors, 30-50% will have longterm neurological or psychological sequelae

• Incidence in susceptible populations in endemic areas is ~5-50 cases/100,000 children/year
Japanese encephalitis virus (JEV)

• Risk in travellers is low!
  – From 1973- 2013, 68 JEV cases among travelers were published or reported to CDC
  – 2 cases were reported in a large GeoSentinel review (1 Cambodia, 1 Thailand)

• Inactivated mouse brain-derived JE vaccine JE-VAX® is no longer available in Canada (2011)

Japanese encephalitis virus (JEV)

- New(ish) vaccine for JEV (Ixiaro) was approved in 2011
  - Inactivated vero cell culture-derived
  - 2 doses at 0 and 28 days
    - Accelerated series at 0 and 7 days has also been studied
    - NACI states only approved for those 18 and older
    - In USA approved for those ≥ 2 months of age

- Little data on effectiveness, but after 2 doses, 96% of adults and 100% of children developed protective neutralizing antibodies
Japanese encephalitis virus (JEV)

• Booster dose (3\textsuperscript{rd} dose), if at continued risk, should be given at 1 year
  – Subsequent study has show protection likely last for 10 years after 1\textsuperscript{st} booster dose

• If patient received primary series of JE-VAX > 3 years ago, needs primary series of Ixiaro (NACI)
  – New data suggests that only 1 booster dose is needed after ≥2 years, and is protective for 2 years

JEV Key Messages

• Risk to traveller is low, consider if:
  – Travel during high transmission season (Summer to fall)
  – Long term stay (Longer than 30 days in rural areas)
  – Consider in shorter stays if spending time outdoors at night
  – Active JEV outbreak occurring

• Risk needs to be balanced with cost, can also use mosquito avoidance techniques

CATMAT, Japanese Encephalitis, 2011.
Meningococcal Meningitis

• Meningococcal disease is caused by *Neisseria meningitidis*

• The five major serogroups most commonly associated with invasive disease are A, B, C, Y and W135
  – Serogroup B and C most common in Canada
Figure 1. Incidence of IMD (per 100,000 population) in Canada by serogroup and year, 1995 to 2011

NACI. Advice for the use of the Multicomponent Meningococcal Serogroup B (4CMenB) Vaccine, 2014.
Map 3-11. Areas with frequent epidemics of meningococcal meningitis
Meningococcal Meningitis Vaccines

- **Monovalent conjugate meningococcal vaccines (Men-C-C)**
- **Quadrivalent conjugate meningococcal vaccines (Men-C-ACYW)**
  - Menactra® (meningococcal groups A, C, Y, and W-135 polysaccharides conjugated to diphtheria toxoid protein)
  - Menveo™ (meningococcal groups A, C, Y and W-135 oligosaccharides conjugated to CRM197 protein)
- **Multicomponent meningococcal vaccine (4CMenB)**
  - Bexsero® (meningococcal porin A [PorA], factor H binding protein [fHbp], neisserial antigen 2091 [GNA2091], heparin binding antigen [NHBA], neisserial antigen 1030 [GNA1030], and Neisserial adhesion A [NadA] surface proteins)
Meningococcal meningitis

Travellers to the Hajj and Umrah pilgrimages

– Large outbreaks of W-135 in 2000, 2001

– **Required** (Saudi Arabia) quadrivalent conjugate vaccination (A, C, Y, W-135) 10 days before arrival and within the last 3 years, need certificate
  • All travellers 2 years and older

– MenB not required, unless active outbreak occurring
Meningococcal meningitis

• Is recommended for travellers to the African meningitis belt
  – Particularly during high transmission season (Dec to June)

• Can be considered if traveller is going to be a student, living in confined areas
  – Not needed for clinicians
  – Needed for laboratory works

• Travellers do not need to receive 4CMenB vaccine unless there is evidence of an outbreak that is known to be caused by serogroup B that can be prevented by the vaccine

CATMAT. Statement on Meningococcal Disease and the International Traveller. 2015.
4CMenB

• Use in BC and Canada still being determined

• 66% of the overall proportion of Canadian serogroup B meningococcal strains are predicted to be susceptible to the 4CMenB vaccine

• A recent study looked at an outbreak of Men B at a US university outbreak
  – 66% of students developed a protective antibody response
  – Despite the outbreak strain having 2 shared antigens with vaccine

Meningococcal meningitis

Key Messages

• Severe illness, however is relatively rare in travellers

• Required for the Hajj and Umrah (Quadrivalent)
  – Recommended meningitis belt

• Future use of MenB vaccine is still being determined, however, recent studies have shown protection may be lower than initial trials
  – Is the most prevalent serogroup in BC/Canada
The End

• Thank you!
  – Dr. Monika Naus (Immunize BC)
  – Dr. Reka Gustafson (VCH Public Health)
  – Dr. Suni Boraston (VCH Travel Clinic)