Pregnancy and Shots! Shots! Shots!

An Update

Kelli D Barbour, MD

4 December 2015

Objectives

- Review recommended adult vaccinations and pregnancy
- Review recommended immunizations in pregnancy and the puerperium
- Review international travel reference resources

VACCINATIONS

So many immunizations…so little time…Bacterial

- Diphtheria toxoid*
- Measles*
- Mumps*
- Tetanus toxoid*
- Pertussis*
- Pneumococcal-7, -13
- *Typhoid*
- *Plague vaccine*
- *Japanese encephalitis*
- *BCG*
- *Anthrax*
- *Meningococcal**
  - *A, C, Y, W-135*
  - *B*

New vaccines

Articles

Safety of human immunisation with a live-attenuated *Mycobacterium tuberculosis* vaccine: a randomised, double-blind, controlled phase I trial

Dr François Spertini, MD[a], , †, , Régine Audran, PhD[a], Reza Chakour, MD[a], Olfa Karoui, MD[a], Viviane Steiner-Monard, MD[a], Anne-Christine Thierry, BS[a], Carole E Mayor, BS[a], Nils Rettby, MS[b], Katia Jaton, PhD[c], Laure Vallotton, MD[d], Catherine Lazor-Blanchet, MD[e], Juana Doce, PhD[f], Eugenia Puentes, PhD[f], Dessislava Marinova, PhD[g], Nacho Aguilo, PhD[g], Prof Carlos Martin, PhD[g, h, i, †]

So many immunizations…so little time…Viral

- Adenovirus
- Hepatitis A*
- Hepatitis B*
- Haemophilus B*
- HPV-4, -9
- Influenza
  - A, B, A+B
  - IM vs. intranasal
- Polio*
- Rotavirus
- Varicella
- Herpes Zoster
- *Yellow fever*
- *Rabies*
- *Smallpox*

Types of vaccinations

Components

- Live, attenuated
- Inactivated
- Subunit
- Toxoid
- Conjugate
- DNA
- Recombinant vector

Routes

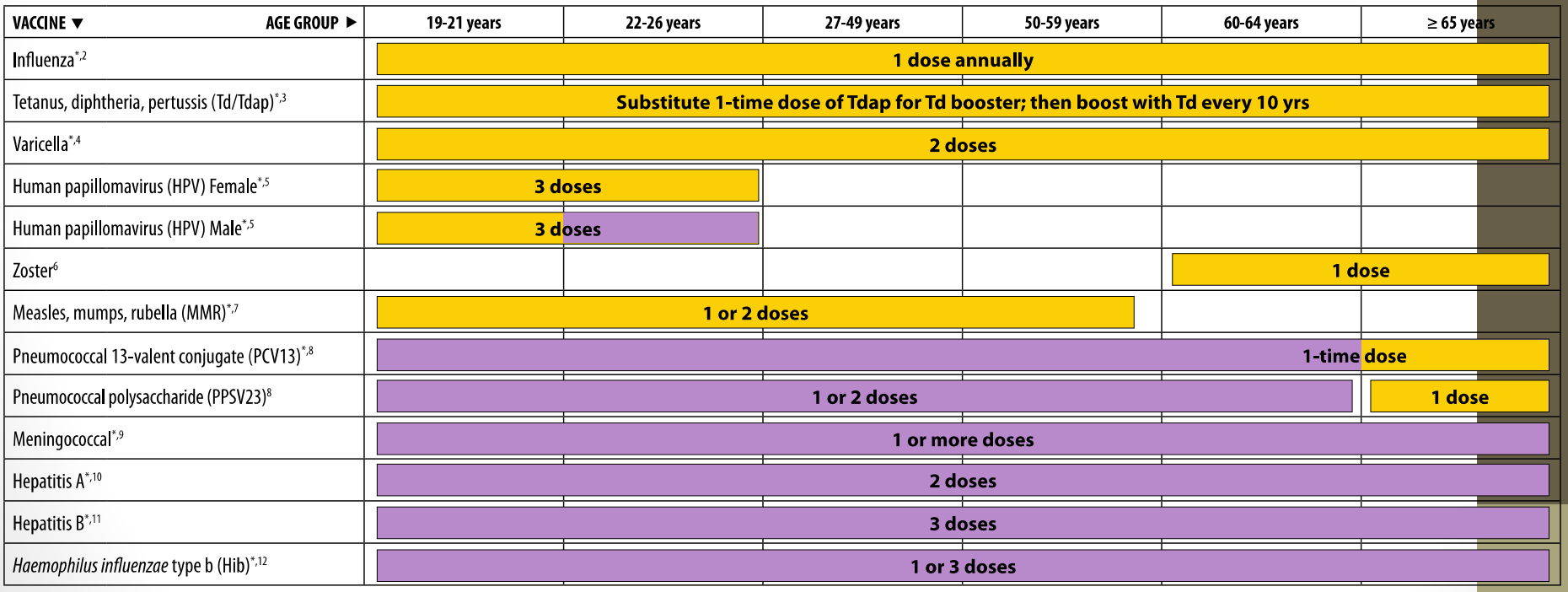
- IM
- SQ
- Intranasal
- PO

I need a shot? But I'm an adult!

- https://youtu.be/gAml98_mfFE

Vaccines for the young at heart

Figure 1. Recommended adult immunization schedule, by vaccine and age group[1]



*Covered by the Vaccine Injury Compensation Program

Special considerations

Figure 2. Vaccines that might be indicated for adults based on medical and other indications[1]

VACCINE ▼ INDICATION ►	Pregnancy	Immuno-compromising conditions (excluding human immunodeficiency virus [HIV]) [4,6,7,8,13]	HIV infection CD4+ T lymphocyte count [4,6,7,8,13]		Men who have sex with men (MSM)	Kidney failure, end-stage renal disease, receipt of hemodialysis	Heart disease, chronic lung disease, chronic alcoholism	Asplenia (including elective splenectomy and persistent complement component deficiencies) [8,12]	Chronic liver disease	Diabetes	Healthcare personnel
			< 200 cells/μL	≥ 200 cells/μL							
Influenza*,[2]	1 dose IIV annually				1 dose IIV or LAIV annually	1 dose IIV annually					1 does IIV or LAIV annually
Tetanus, diphtheria, pertussis (Td/Tdap)*,[3]	1 dose Tdap each pregnancy	Substitute 1-time dose of Tdap for Td booster; then boost with Td every 10 yrs									
Varicella*,[4]	Contraindicated			2 doses							
Human papillomavirus (HPV) Female*,[5]		3 doses through age 26 yrs				3 doses through age 26 yrs					
Human papillomavirus (HPV) Male*,[5]		3 doses through age 26 yrs				3 doses through age 21 yrs					
Zoster[6]	Contraindicated			1 dose							
Measles, mumps, rubella (MMR)*,[7]	Contraindicated			1 or 2 doses							
Pneumococcal 13-valent conjugate (PCV13)*,[8]		1 dose									
Pneumococcal polysaccharide (PPSV23)[8]		1 or 2 doses									
Meningococcal*,[9]	1 or more doses										
Hepatitis A*,[10]	2 doses										
Hepatitis B*,[11]	3 doses										
Haemophilus influenzae type b (Hib)*,[12]		post-HSCT recipients only		1 or 3 doses							

PREGNANCY AND THE PUERPERIUM

Resources

- http://www.immunizationforwomen.org/
- http://immunizationforwomen.org/patients/default.php

The American College of Obstetricians and Gynecologists
WOMEN'S HEALTH CARE PHYSICIANS

COMMITTEE OPINION

Number 566 • June 2013 *(Replaces No. 521, March 2012)*

Committee on Obstetric Practice

This document reflects emerging clinical and scientific advances as of the date issued and is subject to change. The information should not be construed as dictating an exclusive course of treatment or procedure to be followed.

Update on Immunization and Pregnancy: Tetanus, Diphtheria, and Pertussis Vaccination

- There is no evidence of adverse fetal effects from vaccinating pregnant women with an inactivated virus or bacterial vaccines or toxoids, and a growing body of robust data demonstrates safety of such use.
- Killed viruses preferred secondary to theoretical concern that inactivated viruses could become active

Clinical Expert Series

CME

Vaccinations for Pregnant Women

Geeta K. Swamy, MD, and R. Phillips Heine, MD

In the United States, eradication and reduction of vaccine-preventable diseases through immunization has directly increased life expectancy by reducing mortality. Although immunization is a public priority, vaccine coverage among adult Americans is inadequate. The Institute of Medicine, the Community Preventive Services Task Force, and other public health entities have called for the development of innovative programs to incorporate adult vaccination into routine clinical practice. Obstetrician–gynecologists are well suited to serve as vaccinators of women in general and more specifically pregnant women. Pregnant women are at risk for vaccine-preventable disease-related morbidity and mortality and adverse pregnancy outcomes, including congenital anomalies, spontaneous abortion, preterm birth, and low birth weight. In addition to providing direct maternal benefit, vaccination during pregnancy likely provides direct fetal and neonatal benefit through passive immunity (transplacental transfer of maternal vaccine-induced antibodies). This article reviews: 1) types of vaccines; 2) vaccines specifically recommended during pregnancy and postpartum; 3) vaccines recommended during pregnancy and postpartum based on risk factors and special circumstances; 4) vaccines currently under research and development for licensure for maternal–fetal immunization; and 5) barriers to maternal immunization and available patient and health care provider resources.

(Obstet Gynecol 2015;125:212–26)

DOI: 10.1097/AOG.0000000000000581

Published Jan 2015, Obstet Gynecol

Table 1. Current Vaccine Recommendations for Pregnant Women

Vaccine	Vaccine Type	Pregnancy Recommendation	General Adult Recommendation
Vaccines recommended for all pregnant women			
Influenza	Inactivated viral subunit or live attenuated viral recombinant	1 dose of inactivated vaccine administered during flu season, any gestational age	1 dose of inactivated or live attenuated vaccine administered annually during flu season
Tdap/Td	Tetanus and diphtheria—inactivated toxoids; acellular pertussis—inactivated subunit	1 dose Tdap after 20 wk, preferably approximately 28 wk, regardless of prior Tdap receipt	Substitute 1 lifetime dose of Tdap for Td booster; return to Td booster every 10 y or sooner if exposure occurs
Vaccines recommended for postpartum women (contraindicated during pregnancy)			
MMR	Live attenuated viral	1 dose immediately postpartum if rubella nonimmune or equivocal	1–2 doses, lifetime; additional 1 dose older than 55 y if risk factor present
Varicella	Live attenuated (viral)	1 dose immediately if varicella nonimmune	2 doses, lifetime
Vaccines recommended for pregnant women with risk factors or special circumstances			
Hepatitis A	Inactivated whole-cell viral	2 doses if risk of infection outweighs theoretical risk of vaccine	2 lifetime doses
Hepatitis B	Inactivated viral recombinant subunit	3 doses if previously unvaccinated or at high risk of exposure	3 lifetime doses
Pneumococcal	Inactivated bacterial polysaccharide	1 dose if risk factor present	1–2 doses if risk factor present; 1 dose for all individuals 65 y or older
Meningococcal	Inactivated bacterial polysaccharide	1 dose if risk factor present	Can be used for children younger than 2 y and adults older than 55 y and during epidemics
Yellow fever	Live attenuated viral	1 dose if travel to endemic regions and risk of infection outweighs theoretical risk of vaccine	1 dose for travel to endemic regions
Japanese encephalitis	Live attenuated viral	1 dose if travel to endemic regions and risk of infection outweighs theoretical risk of vaccine	1 dose for travel to endemic regions
Typhoid	Live attenuated bacterial recombinant	Not recommended owing to lack of data	For travel to endemic regions
Anthrax	Inactivated subunit	Postexposure prophylaxis for all pregnant women; preexposure prophylaxis is not recommended owing to lack of data	Preexposure prophylaxis if risk factor; postexposure prophylaxis for all adults
Rabies	Inactivated whole-cell viral	Postexposure prophylaxis; consider preexposure prophylaxis if risk of exposure is very high	Preexposure prophylaxis if risk factor; postexposure prophylaxis for all adults

Tdap, tetanus, diphtheria, acellular pertussis; Td, tetanus, diphtheria; MMR, measles, mumps, and rubella.

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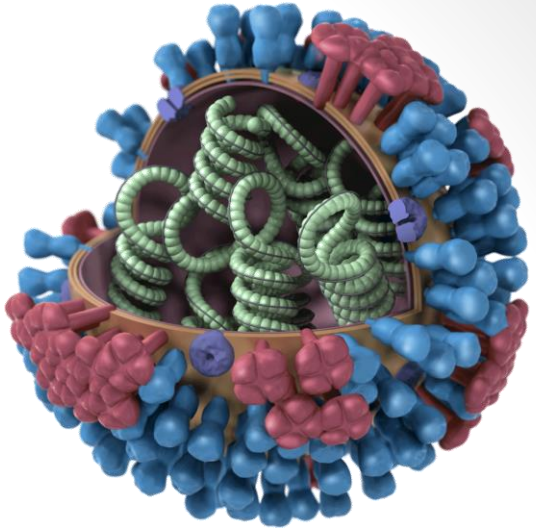
Influenza - What



- RNA virus with A and B serotypes
  - Both A and B cause endemic flu
  - A causes pandemics
- A serotype demonstrates antigenic drift of two surface proteins
  - **H**emagglutinin
  - **N**euraminidase
- Each flu season 20% of the US population contracts the current virus; this increases to 50% during pandemics
- Among pregnant women, 20% develop upper respiratory-like illness; 10% have laboratory-confirmed influenza

http://www.cdc.gov/flu/images/h1n1/3D_Influenza_transparent_no_key_pieslice_lrg.gif

Influenza + Pregnancy = Not good!

- Compared to the general population, pregnant women who contract influenza are at higher risk of:
  - Hospital admission
  - Cardiopulmonary complications
  - Death
  - Spontaneous abortion
  - Perinatal mortality
  - Preterm birth
  - Low birth weight
- In the setting of a pandemic, these risks are even higher
  - 2009 H1N1 –
    - 5% of deaths occurred in pregnant women (only 1% of the population infected)
    - Risk of preterm birth 3-fold higher

Influenza – how and when

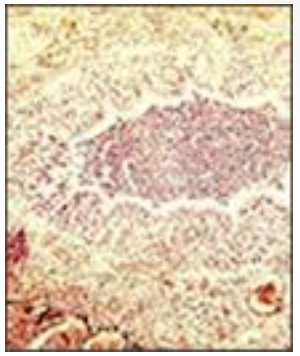
- No test for previous immunity
- Recommendation:
  - Every pregnancy, during influenza season
  - Gestational age not important
- IM ONLY!

- Benefits
  - Maternal
    - Decreased risk of illness between 36-70%
  - Perinatal
    - Reduction in low birth weight, preterm birth, fetal death
  - Neonatal
    - 29% reduction in respiratory illness
    - 63% reduction in influenza at <6 months
    - 90% reduced admissions for <6 months

Influenza immunization - Safety

- Vaccination
  - No associated risk of adverse pregnancy outcomes for inactivated virus
  - No evidence of risk in attenuated vaccine accidently given in the 1st trimester

Tdap - What



- Bordetella pertussis bacteria – whooping cough
- Highly contagious

- Pertussis is known to peak cyclically every 3–5 years, but the overall incidence has been steadily rising since the 1980s
  - < 5000 cases in early 1980s
  - 48,277 cases in 2012
  - 24,231 cases in 2013
- Unclear if the resurgence is due to
  - mutations in the B pertussis bacteria
  - Better awareness, identification, testing, reporting
  - Waning of post-acellular vaccination immunity

http://www.cdc.gov/pertussis/images/disease_pertussis2_iac.jpg

Tdap – Why?

- Pertussis-related morbidity and mortality disproportionately affects infants less than 12 months of age compared to other children or adults
- Infection occurs after exposure to a close contact (47-60% from parents)
  - Most adults are asymptomatic or only have common cold symptoms
- Infants do not have enough immunity until at least 6 months of age (after 2-3 vaccination injections)

http://www.cdc.gov/pertussis/images/people_pertussis2_iac.jpg

Tdap – How and When?

- No testing for immunity - % immunity into adulthood
- New recommendation
  - 2005- Cocooning strategy, focus on postpartum injection
  - 2011 – Vaccination antenatally
  - March 2012 – antenatal vaccination strongly endorsed by ACOG
  - goal of **stimulating maternal antibody production** and **transplacental passage** to the fetus - providing passive immunity into the neonatal period
  - **Works best in the 3rd trimester** because of quick decrease in maternal antibody if given earlier
- Give in *every* pregnancy between 27-36 weeks, at least 2 weeks before delivery

Tdap - Safety

- No adverse pregnancy outcomes noted, even with multiple inoculations over a few year time span

- “many questions regarding vaccine effectiveness, optimal timing of vaccine administration, infant antibody correlates of protection, and safety of repeated close-interval dosing in multiparous women remain unanswered”

Original Research

Pregnancy Outcomes After Antepartum Tetanus, Diphtheria, and Acellular Pertussis Vaccination

Jamie L. Morgan, MD, Sangameshwar R. Baggari, MBA, Donald D. McIntire, PhD, and Jeanne S. Sheffield, MD

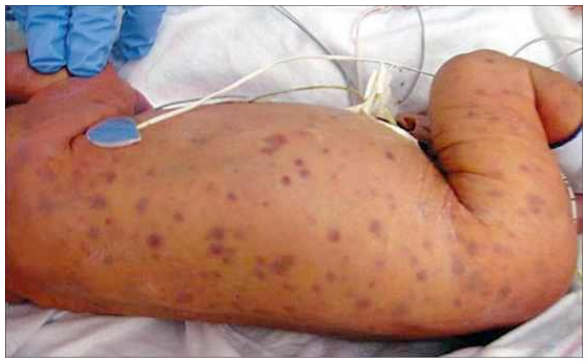
- No adverse pregnancy outcomes were identified in association with antepartum Tdap vaccination
- This remained true in women receiving more than one Tdap vaccine in a 5-year timeframe -

  this may be the result of a type II error

MM**R**

- Rubella (German measles, 3-day measles) titer drawn as part of prenatal panel
- MMR given for those who are equivocal or non-immune

- Benefits
  - Prevent possibility of infection in **subsequent** pregnancies, decreasing the risk of congenital rubella



Recommended based on presence of risk factors

- 23-valent pneumococcal polysaccharide vaccine
- Meningococcal
- Hepatitis A
- Hepatitis B

23-valent pneumococcal polysaccharide vaccine

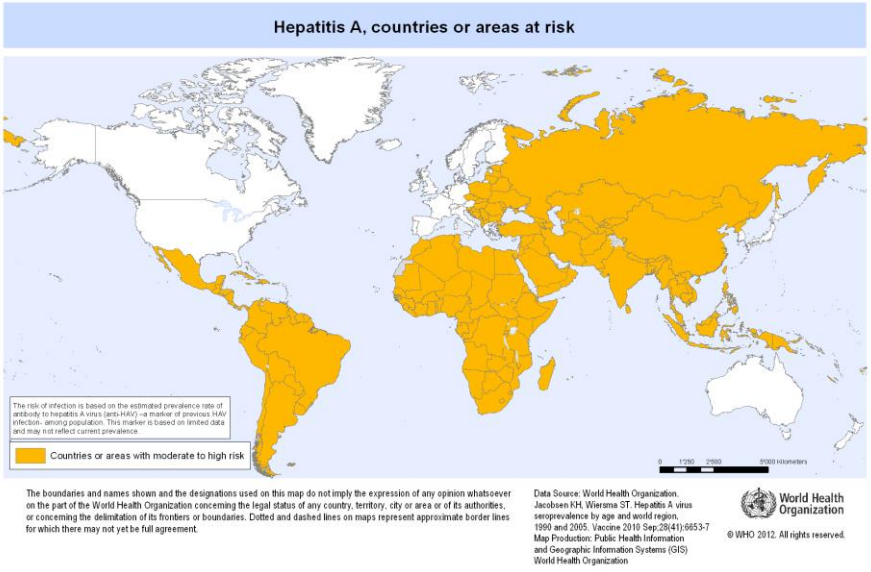
- Immunocompromised
- Anatomical or functional asplenia
- Cerebrospinal fluid leaks or cochlear implants
- Smoke cigarettes
- Reside in nursing home or long-term care facilities
- Chronic heart disease (including congestive heart failure and cardiomyopathies, excluding hypertension)
- Chronic lung disease (including chronic obstructive lung disease, emphysema, and asthma)
- Chronic liver disease (including cirrhosis)
- Alcoholism
- Diabetes mellitus

Meningococcal

- Anatomical or functional asplenia
- Persistent complement component deficiencies
- Microbiologists routinely exposed to isolates of *Neisseria meningitidis*
- Repeat Q5 years
- Military recruits
- First-year college students up through age 21 years who are living in residence halls
- Persons at risk during an outbreak attributable to a vaccine serogroup
- Persons who travel to or live in countries in which meningococcal disease is hyperendemic or epidemic

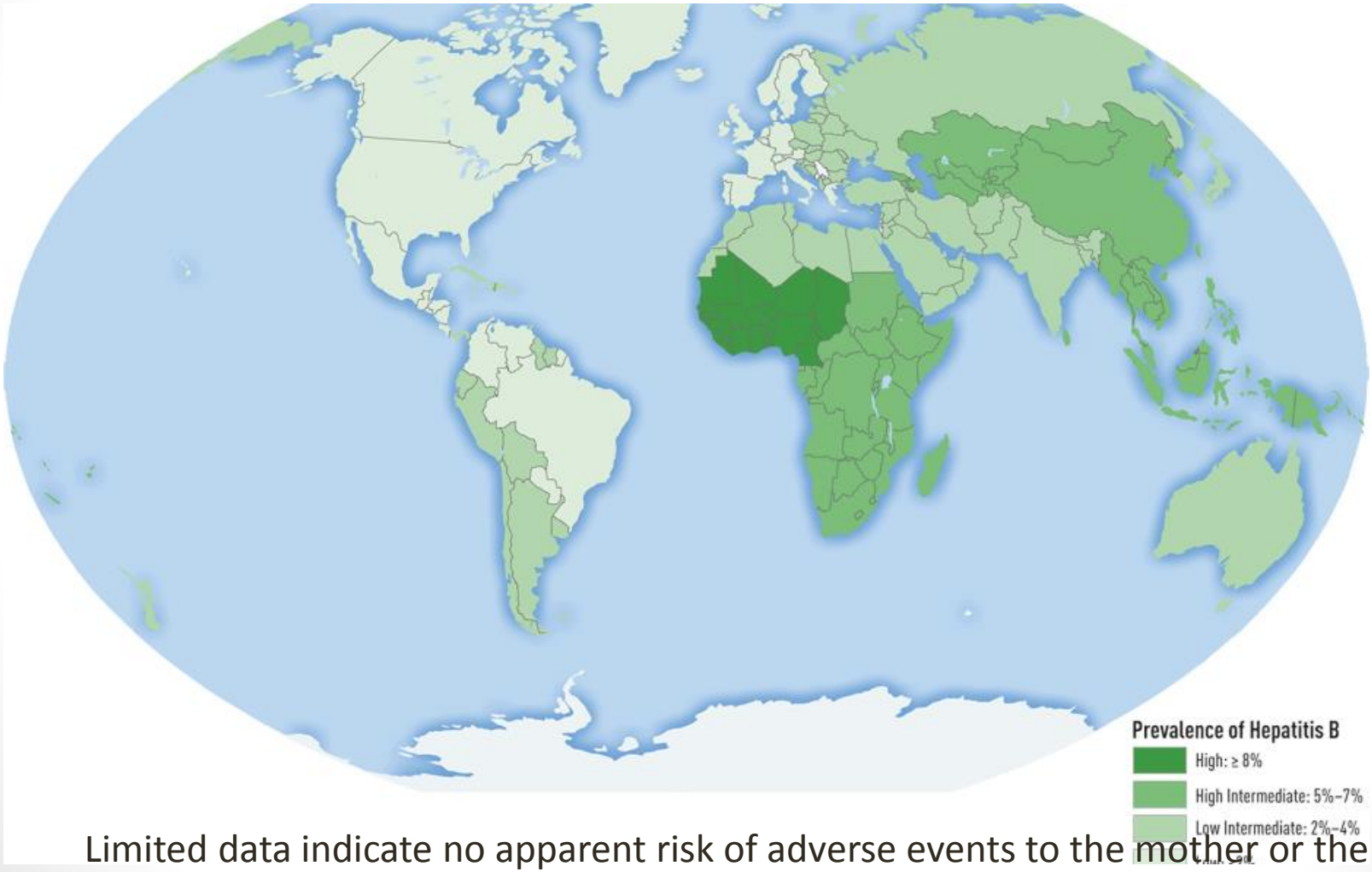
Hepatitis A

- persons working with HAV-infected primates or with HAV in a research laboratory setting
- Chronic liver disease
- Persons who receive clotting factor concentrates



- Persons traveling to or working in countries that have high or intermediate endemicity of hepatitis A
- Unvaccinated persons who anticipate close personal contact (e.g., household or regular babysitting) with an international adoptee during the first 60 days after arrival in the United States from a country with high or intermediate endemicity

Hepatitis B



Limited data indicate no apparent risk of adverse events to the mother or the developing fetus when hepatitis B vaccine is administered to pregnant women

Hepatitis B

- sexually active persons who are not in a long-term, mutually monogamous relationship
- persons seeking evaluation or treatment for a sexually transmitted disease (STD)
- Current or recent injection drug users
- End-stage renal disease
- HIV infection
- Chronic liver disease
- Diabetes
- Health care personnel and public safety workers who are potentially exposed to blood or other infectious body fluids
- Household contacts and sex partners of hepatitis B surface antigen–positive persons,
- Clients and staff members of institutions for persons with developmental disabilities
- International travelers to countries with high or intermediate prevalence of chronic HBV infection

REVIEW INTERNATIONAL TRAVEL AND PROPHYLAXIS OF VARIOUS INFECTIONS

Best source of info for patients and clinicians

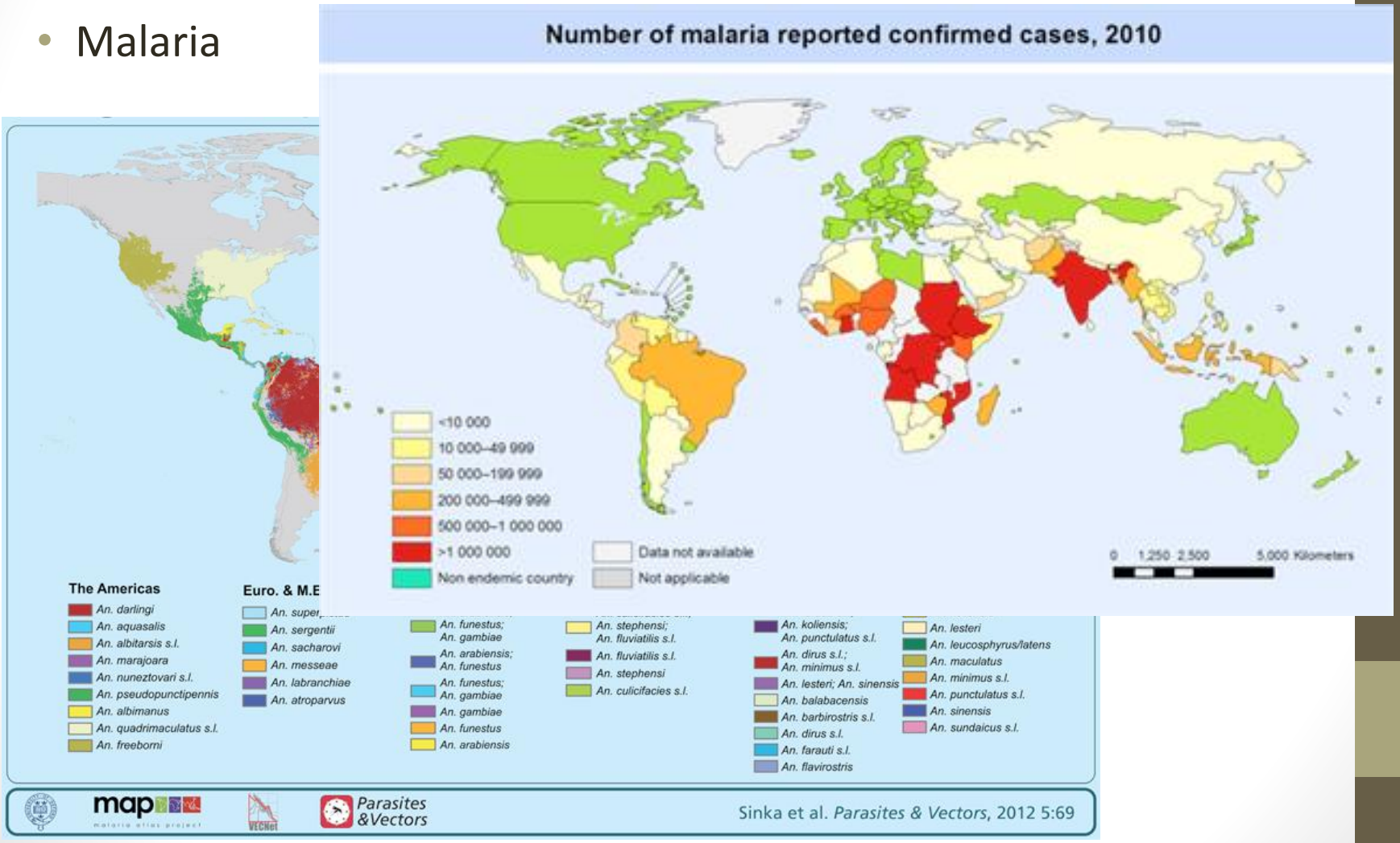
- http://wwwnc.cdc.gov/travel/
- http://wwwnc.cdc.gov/travel/destinations/list

Hygiene! Hygiene! Hygiene!

- Hand-washing
- Safe drinking water
- Avoiding sick contacts

A few other traveling thoughts…

- Malaria



Malaria prophylaxis/prevention

- Personal protection measures
- Bed nets
- Chemoprophylaxis
  - Chloroquine
  - Mefloquine (Lariam)
  - ~~Primaquine~~
  - ~~Doxycycline~~
  - ~~Atovaquone/Proguanil (Malarone)~~

Take Aways

- Utilize recommended vaccinations
- Give additional vaccinations as indicated
- Assess travel needs by country/countries
- Educate patients regarding hygiene, infection control

QUESTIONS