Pregnancy provides an excellent opportunity to enhance a woman's protection against disease and to provide protection to the neonate during the first 3 to 6 months of life. Women of childbearing age should be immunized against poliomyelitis, measles, mumps, rubella, varicella, diphtheria, and pertussis. (ACIP, 2013a)If the patient is not immunized for these diseases, a plan to administer vaccinations during and/or after pregnancy should be developed and implemented. Administering appropriate immunizations during and after pregnancy protects the mother from disease and provides the neonate protection for up to 6 months of life through acquired IgG antibodies from the mother. (Gall, 2010)

There is no data available proving harm to the fetus from non-live virus vaccines. Non-live virus vaccines can be given any time during pregnancy. Live, attenuated virus vaccines such as measles, mumps, rubella (MMR) or nasally delivered influenza, are not recommended in pregnancy. Vaccines with nonviable antigens, virus-like particles, or noninfectious yet immunogenic components of bacteria, such as the tetanus toxoid, reduced diphtheria toxoid and acellular pertussis (Tdap) vaccine and injectable influenza vaccine, are considered safe during pregnancy. (ACOG, 2013)Contraindications to immunizations in pregnant women include allergic reaction to previous vaccines with the same antigen; acute illness; egg allergy for influenza and yellow fever vaccines; neomycin allergy for MMR and varicella vaccines; and Guillian-Barré syndrome. (Gall, 2010)

The most effective way to increase patient acceptance of vaccinations is for the health care provider to directly recommend and provide the vaccine. (ACOG, 2013)Positive statements should be made regarding the importance of vaccinations to help protect the mother and her baby from disease. Counseling should include information about the safety of vaccinations, their use for over 50 years, and how the health benefits outweigh any potential risks of the vaccine. Reassurance should be given that thimerosal, a type of mercury used in some vaccines, does not cause autism. (ACOG, 2012b)

Federal law requires that patients be given the current Vaccine Information Statement (VIS) before each dose of certain vaccinations. A VIS is specific to an individual vaccine and explains both the benefits and risks of a vaccine to vaccine recipients. VISs can be found at www.immunize.org/vis/

Routine Vaccines

Tetanus-diphtheria and acellular pertussis (Tdap)

- Due to the increase in pertussis (whooping cough) in the US, in 2011, the CDC and the Advisory Committee for Immunization Practices (ACIP) recommend Tdap vaccination for pregnant women with each pregnancy.(ACIP, 2013b; ACOG, 2012b; CDC, 2013, 2014) Maternal Tdap offers increased protection for infants who are too young for vaccination but at highest risk for severe illness and death from pertussis.
- Tdap can be given anytime during pregnancy but should preferably be given between 27 weeks and 36 weeks gestation for neonate protection.

- 75% of infants with pertussis were exposed to the disease by family members.
- ACIP recommends all adolescents and adults who have close contact with an infant under 12 months of age (siblings, parents, grandparents, child care providers, and health care providers) who have not received Tdap previously, receive a single dose of Tdap to protect against pertussis and reduce the likelihood of transmission.
- Pertussis in infants < 4 months of age places them at high risk for serious morbidity and mortality.

Tetanus-diphtheria (Td)

- Pregnant women who have never been vaccinated against tetanus should begin the three-dose series containing tetanus and reduced diphtheria toxoids during pregnancy.
- Recommended schedule for vaccine series: after initial dose, give 2nd dose 4 weeks later, give 3rd dose 6-12 months after the 2nd dose.
- Tdap should replace one dose of Td, preferably given between 27 weeks and 36 weeks gestation.

Influenza (Flu)

- Influenza affects 10-20% of the population annually and is responsible for significant illness, hospitalization, and death.
- Pregnant women with influenza are at risk for severe sequelae, including death.
- CDC recommends all adults receive an annual influenza vaccine.
- ACIP and ACOG recommend all pregnant women be immunized annually with either trivalent or quadrivalent inactivated influenza vaccine (IIV). (ACOG, 2014) The 2013-14 influenza season was the first year that a quadrivalent vaccine was available. At this time, there is no recommendation to utilize quadrivalent over trivalent. Ongoing studies may result in such a recommendation at some point in the future.
- IIV provides protection to the pregnant woman and her newborn. Maternal influenza antibodies pass to the fetus transplacentally and provide neonatal protection during the first 6 months of life.
- IIV can be administered safely in pregnancy, anytime, during any trimester.
- Thimerosal, a mercury-containing preservative used in multi-dose IIV vials, has not been shown to cause any adverse events to mothers or their newborns. Thimerosal does not cause autism. (ACOG, 2013)Preservative free single-dose influenza vaccines are also available and can be utilized.

Hepatitis B

- All women should be screened for HBsAg early in pregnancy.

- HBsAg negative women who have never been vaccinated should receive the HBV vaccine 3 dose series: after initial dose, give 2nd dose 1 month later, and 3rd dose 2 months after the 2nd dose (but at least 4 months after the initial dose).
- HBV is a recombinant vaccine and is safe to administer during pregnancy.
- Infants born to HBsAg negative mothers should receive a birth dose of HBV while in the hospital, 2nd dose 1 month later, 3rd dose at 6-12 months.
- Infants of HBsAg positive mothers should receive HB immunoglobulin 0.5 mL IM and HBV vaccine at the same time but at different sites within 12 hrs of birth.

Measles, mumps, rubella (MMR)

- MMR vaccines are live-attenuated viruses which are **not recommended** for pregnant women.
- All pregnant women should be screened for rubella immunity during pregnancy.
- Rubella seronegative women should be given MMR postpartum.
- MMR vaccination is compatible with breastfeeding.

Varicella

- Varicella (chicken pox) vaccine is a live-attenuated vaccine that is **not recommended** during pregnancy.
- Pregnant women should be screened for varicella IgG early in pregnancy. (ACOG, 2012a).
- Seronegative women should receive the two-dose series postpartum: after initial dose, give 2nd dose 4-8 weeks later.
- Varicella vaccine is compatible with breastfeeding.

Special vaccines

Hepatitis A

- ACIP recommends hepatitis A vaccination for persons at high-risk for infection. At risk pregnant women include those with a family member ill with hepatitis A, daycare workers, and those exposed via sexual contact.
- Fecal-oral transmission is the most common route of hepatitis A disease transfer.
- Pregnant women can safely receive hepatitis A vaccine (killed virus) and hepatitis immune globulin.
- Recommended regimen is two-dose series: after initial dose, give 2nd dose 6 months later.
- Post-exposure prophylaxis: hepatitis A immune globulin 0.02 mg/kg IM.

Meningococcal

- Neisseria meningitis causes rare but serious infections in pregnancy.

- Routine administration is recommended for those at high-risk including all adolescents, adults with asplenia, international travelers, students living in dormitories, and military recruits.
- Meningococcal vaccine is a protein conjugate vaccine and is safe to administer during pregnancy.
- 1 or more doses 2 months apart.
- Meningococcal vaccine is compatible with breastfeeding.

Pneumococcal vaccine (PPV-23)

- Streptococcus pneumoniae infection is a major cause of pneumonia, meningitis, and otitis media. Maternal mortality associated with pneumococcal pneumonia in pregnancy is estimated to be 2-3% with fetal mortality ~30%.
- ACIP recommends pneumococcal polysaccharide vaccine (PPV) for all women including pregnant women, with high-risk medical conditions including but not limited to smokers; asplenia (including sickle cell disease); chronic metabolic (diabetes), renal, cardiac, liver or pulmonary (asthma) disease; and immune-suppression (HIV).
- PPV can be administered at any time during pregnancy.
- One dose only; repeat 5-6 years.
- Passive transfer of maternal pneumococcal antibodies to the fetus may reduce the risk of otitis media in the infant for the first 3-6 months of life.

Quality indicators/Benchmarks

- Tdap vaccine each pregnancy
- Influenza vaccine each season

Immunization Tables

	Vaccine	Recommendations	Dose	Safe in Pregnancy	Safe with Breast-feeding
Routine Vaccines	Tetanus-diphtheria (Td)	Women without vaccination series should get series during pregnancy.	3 doses with 2nd 4 weeks after 1st, and 3rd 6-12 months after 2nd Replace one Td with Tdap at 27-36 weeks.	YES	YES
	Tetanus, diphtheria, acellular pertussis (Td/Tdap)	All pregnant women with each pregnancy.	1 dose Tdap anytime but preferably between 27 and 36 weeks.	YES	YES
	Influenza (Flu)	1 dose IIV annually	1 dose IIV annually	YES	YES
	Hepatitis B	Screen all women; HBsAg negative who have never been vaccinated should get series during pregnancy.	3 doses with 2nd 4 weeks after 1st, and 3rd 2 months after 2nd (but at least 4 months after 1st).	YES	YES
	Measles, mumps, rubella (MMR)	Screen all pregnant women for rubella; MMR vaccine is **contraindicated during pregnancy**. Immunize rubella seronegative women during postpartum period.	**Contraindicated during pregnancy**; immunize postpartum if rubella seronegative.	**NO**	YES

	Vaccines	Recommendations	Dose	Safe in Pregnancy	Safe with Breast-feeding
Special Vaccines	Hepatitis A	For high-risk women: daycare workers; contact with a family member ill with hepatitis A; exposure via sexual contact.	2 doses with 2nd 6 months after 1st.	YES	YES
	Meningococcal	For high-risk women: adolescents; asplenia; international travelers; students living in dormitories; military recruits.	1 or more doses.	YES	YES
	Pneumococcal vaccine (PPV-23)	For women with high-risk medical conditions: smokers; asplenia including sickle cell disease; diabetes; renal disease; cardiac disease; pulmonary disease including asthma; HIV.	1 or 2 doses.	YES	YES
	Varicella	Screen for varicella IgG early in pregnancy. Vaccine **contraindicated during pregnancy**.	**Contraindicated during pregnancy;** immunize seronegative women postpartum: 2 doses with 2nd dose 4-8 weeks after 1st.	**NO**	YES

(CDC, 2015)

Resources

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