

Influenza and Pertussis in Pregnancy

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Disclosures

■ I have no industry affiliations.



Overview

Influenza and Pertussis

- Background/Epidemiology
- Clinical features in pregnancy
- Fetal and neonatal consequences
- Treatment
- Vaccination Recommendations

Opportunity for Immunization

- ~ 4 million live births each year in US
- >98% of women have at least 1 prenatal visit
 - Health care opportunity for vaccination!
 - Immunization effective in pregnant women
- Protection for
 - Pregnant woman
 - Fetus
 - Neonate
 - Young infant

Opportunity for Immunization

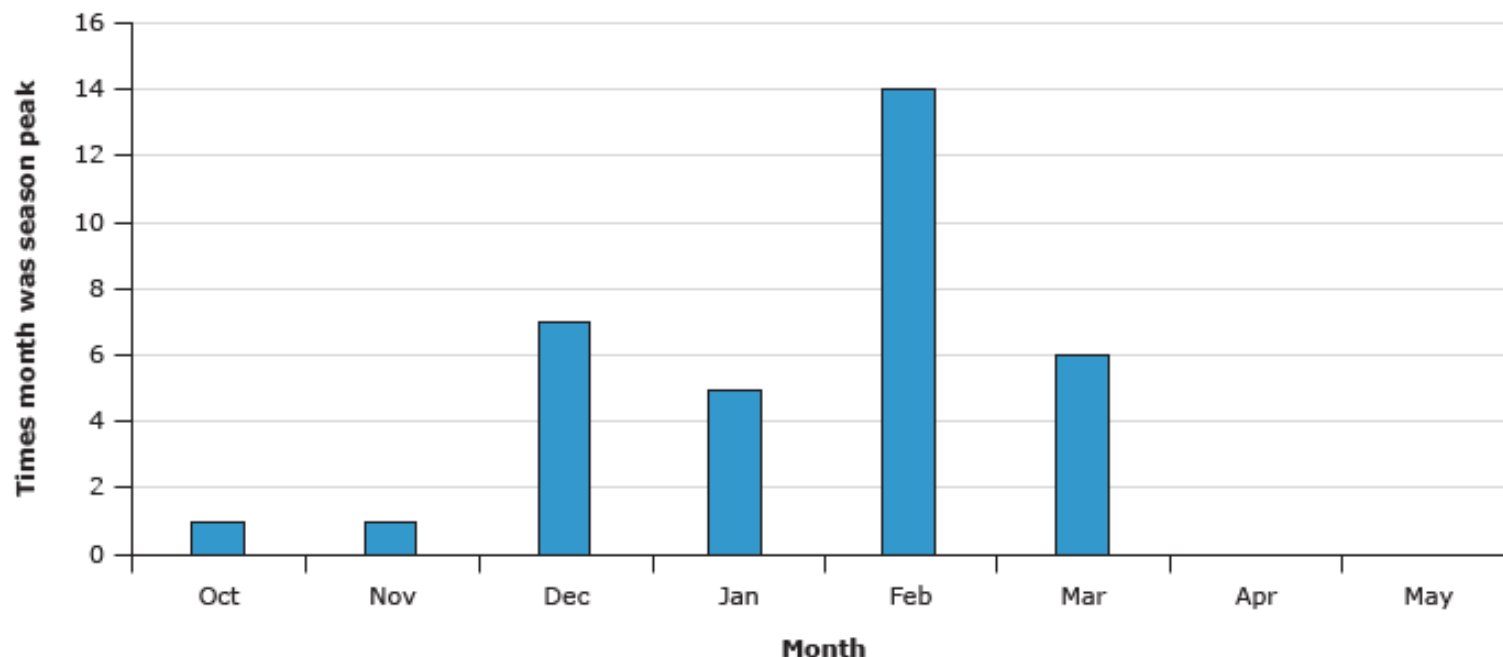
- Recommendation from provider is **single most important factor** for vaccination uptake in pregnancy
 - Sweden: recommendation from Ob/Gyn
 - 107-fold increase in the likelihood that a pregnant woman will agree to an influenza vaccination
 - Australia: recommendation from provider
 - 20-fold more likely to accept influenza vaccine
 - Australia: recommendation from provider
 - 7 times more likely to accept pertussis vaccine

INFLUENZA

Background and Epidemiology

Influenza Activity

Peak month of influenza activity 1982-1983 through 2015-2016, United States



Reproduced from: Centers for Disease Control and Prevention. Influenza: The flu season. Available at: www.cdc.gov/flu/about/season/flu-season.htm (Accessed on September 8, 2016).

Influenza Activity

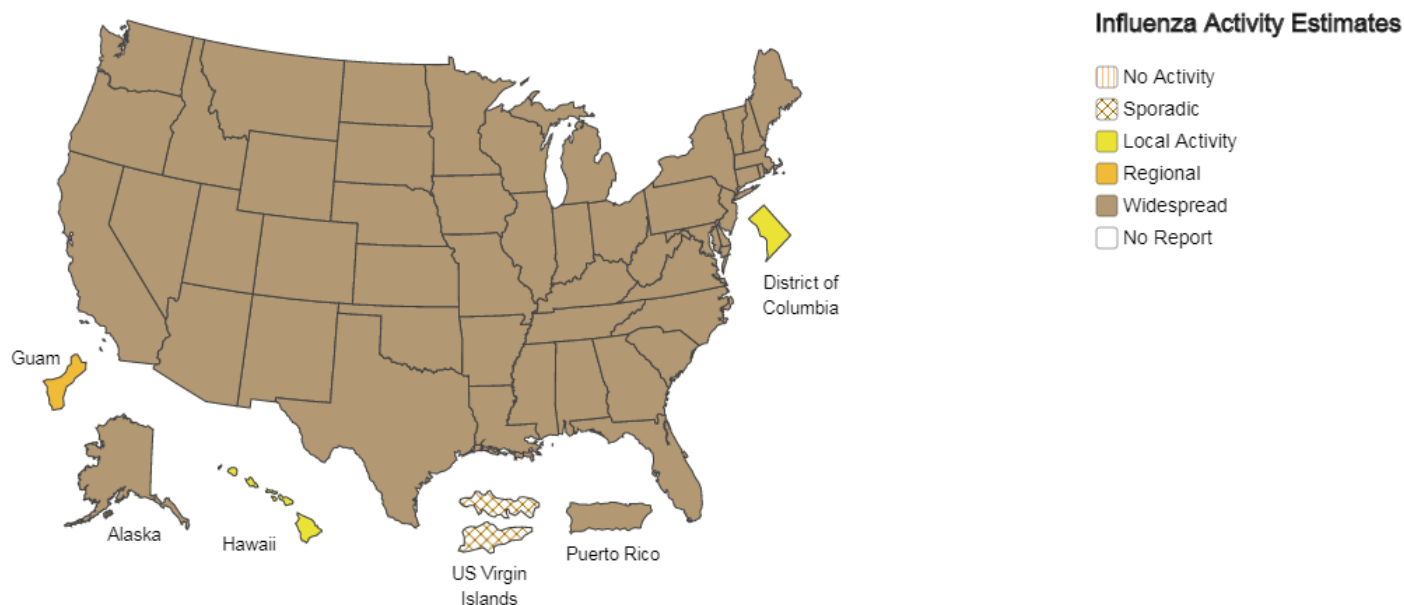
FLUVIEW



A Weekly Influenza Surveillance Report Prepared by the Influenza Division

Weekly Influenza Activity Estimates Reported by State and Territorial Epidemiologists*

Week Ending Jan 13, 2018 - Week 2



*This map indicates geographic spread and does not measure the severity of influenza activity.

Immune Considerations

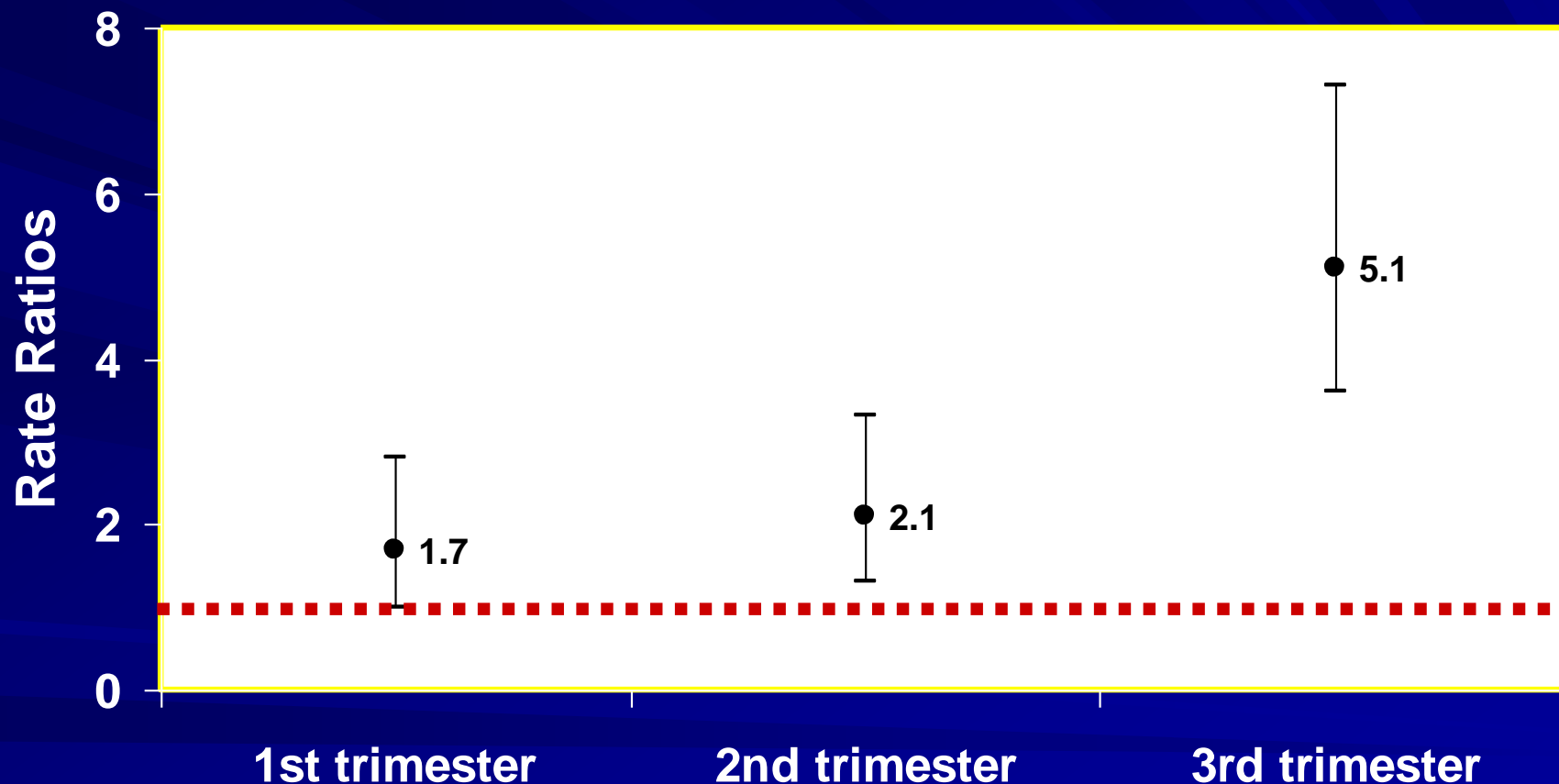
■ Pregnant women

- Altered immune response
- Increased risk of some infections
- Increased risk of severe outcomes of some infections

■ Fetus, newborn, infant

- Immature immune response
- Increased risk of some infections
- Increased risk of severe outcomes of some infections
- Infection sequelae can result in lifelong disability

Risk of Hospital Admission for Respiratory Illness during Influenza Season by Pregnancy Status* among *Women with No Comorbidity*, Nova Scotia, 1990-2002



*Compared to year before pregnancy

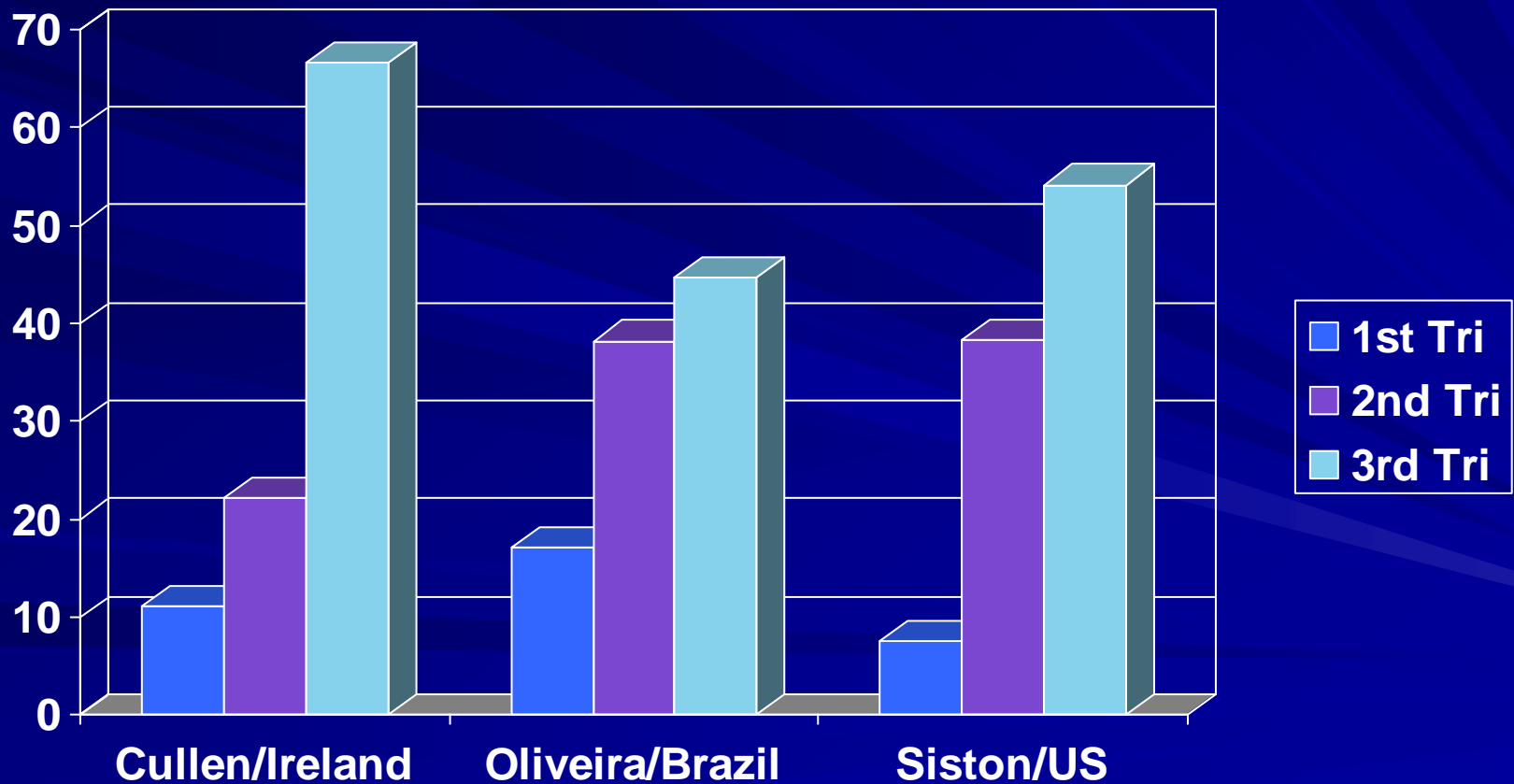
Dodds 2007

2009 H1N1 Influenza

Obstetric Epidemiology

Prevalence of H1N1 per Trimester

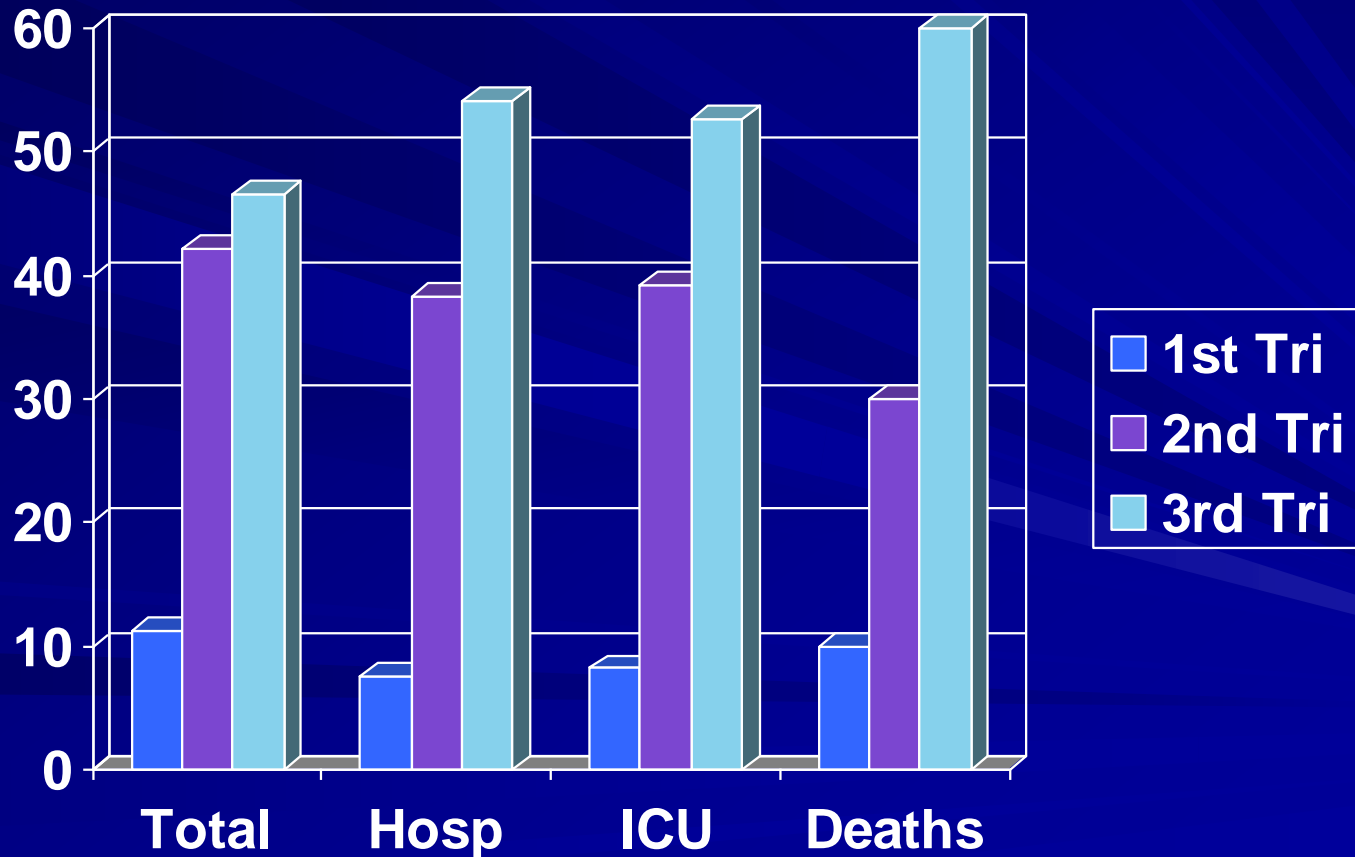
Total Hospitalized or Severe Acute Resp Infection



Cullen 2009, Jain 2009, Oliveira 2009, Siston 2010

2009 H1N1 Influenza and Pregnancy

April-August 2009 US Statistics



Clinical Manifestations

- Fever
- Cough
- Rhinorrhea
- Sore throat
- Headache
- Shortness of breath
- Myalgia

Presenting Manifestations in Pregnant Women with 2009 H1N1 Influenza

United States, April 15 to May 18, 2009

Presenting manifestations	N (%)
Fever	33 (97%)
Cough	32 (94%)
Rhinorrhea	20 (59%)
Sore throat	17 (50%)
Headache	16 (47%)
Shortness of breath	14 (41%)
Vomiting	6 (18%)
Diarrhea	4 (12%)

Fetal Effects

- **Effects of influenza on the fetus**
 - Unknown and difficult to predict
- **Viremia in seasonal influenza**
 - Believed to occur infrequently
 - Placental transmission appears to be rare
 - Case of fatal avian influenza (H5N1)
 - 2009 H1N1 novel influenza was similar
- **Hyperthermia**
- **Risk factor for some types of birth defects and other adverse outcomes**

CDC April 2010; ANZIC Influenza Investigators 2009 and 2010

Adverse Obstetric Outcomes

■ Systematic Review: congenital anomalies

- Influenza/influenza-like illness in 1st trimester
- Increased risk of congenital abnormalities [AOR] for any anomaly 2.00 (95% CI 1.62-2.48)
 - Cleft lip (OR 3.2)
 - Neural tube defects (OR 3.3)
 - Hydrocephaly (OR 5.7)
 - Congenital heart defects (OR 1.6)
- Risk attenuated by use of antipyretics

■ Other reported adverse events

- Increased risk SAB, PTD, LBW, fetal death

Clinical Diagnosis

- During influenza outbreak
 - Acute febrile respiratory illnesses can be diagnosed as influenza with a high likelihood by clinical criteria
 - Influenza testing is **not** needed in peak season
 - Testing is recommended in complex cases, cases where management will be affected, etc.

Laboratory Diagnosis

- Molecular assays (RT-PCR)
 - Highest sensitivity but longer processing time
- Rapid diagnostic tests
 - Sensitivities ~ 50-70% and specificities ~90-95
 - Compared with viral culture or reverse transcription polymerase chain reaction
 - **Limited sensitivity of the rapid antigen tests**
 - Negative result should be interpreted with caution given potential of false negative
 - Follow-up testing with conventional RT-PCR and/or viral culture should be considered in certain situations

Influenza Vaccination

- All pregnant women (ACIP 2004)
- Indication: Influenza season (October-May)
- Timing: Pregnancy (any trimester!)
- Dosing: Single-dose series
- Use inactivated vaccine for pregnant women
- **No adverse fetal effects or pregnancy outcomes!**
- Intranasal vaccine (LAIV, FluMist): live-attenuated
 - **NOT recommended for use in pregnant women!!!**
- California mandate of thimerosal-free vaccine for pregnant women

Influenza Vaccine Benefits

■ Maternal illness reduction

- Cochrane Database 2014 systematic review
 - H1N1 vaccines reduced risk influenza-like illness in pregnant women by 89% (95% CI 79-94)
 - Seasonal vaccine reduced risk influenza-like illness in pregnant women by 24% (95% CI 11-35)
- Randomized trial
 - 36% (95% CI 4-57) reduction in febrile respiratory illness in pregnant women who received vaccination
- Large case control
 - 44% (95% CI 5%-67%) reduction in lab-confirmed influenza in cohort who received vaccination

Influenza Vaccine Benefits

- Improved pregnancy outcomes
 - 2016 Systematic Review
 - Reduced risk of stillbirth (RR 0.73, 95% CI 0.55-0.96)
 - Others
 - Reduced risk for small for gestational age infants and preterm delivery
 - Increase in birth weight

Influenza Vaccine Benefits

- Infant protection: Passive Immunization
 - Anti-influenza-specific IgG actively transferred across the placenta to the fetus and anti-influenza-specific IgA in breast milk transferred to the infant during lactation

Influenza Vaccine Benefits

- Passive immunity declines over **several months** in infants born to vaccinated mothers
 - Maternal vaccine efficacy against PCR confirmed influenza illness was 86% in infants ≤ 8 weeks of age and 25-30% in infants 8-24 weeks of age
 - Maternally vaccinated infants
 - Overall cohort: 25% less likely to be hospitalized for an acute respiratory illness (AHR 0.75, 95% CI 0.56-0.99)
 - 3rd trimester maternal vaccinated infants: 33% less likely to be hospitalized (AHR: 0.67, 95% CI 0.47-0.95)

Influenza Vaccine Benefits

■ Infant protection

- Cochrane Database Sys Rev 2004
 - Infants born to vaccinated mothers had 41% (95% CI 6-63) reduction in laboratory-confirmed influenza
- Randomized Trial
 - Lab confirmed influenza reduced by 63% (95% CI 5-85) in infants of vaccinated mothers
- RCT secondary analysis
 - Reduced hospitalizations for acute lower respiratory tract infection < 3 months of age
 - 3.0% (95% CI 1.6-5.7) vs. 7.0% (95% CI 4.6-10.8)

2017-2018 Influenza Vaccine

■ Trivalent

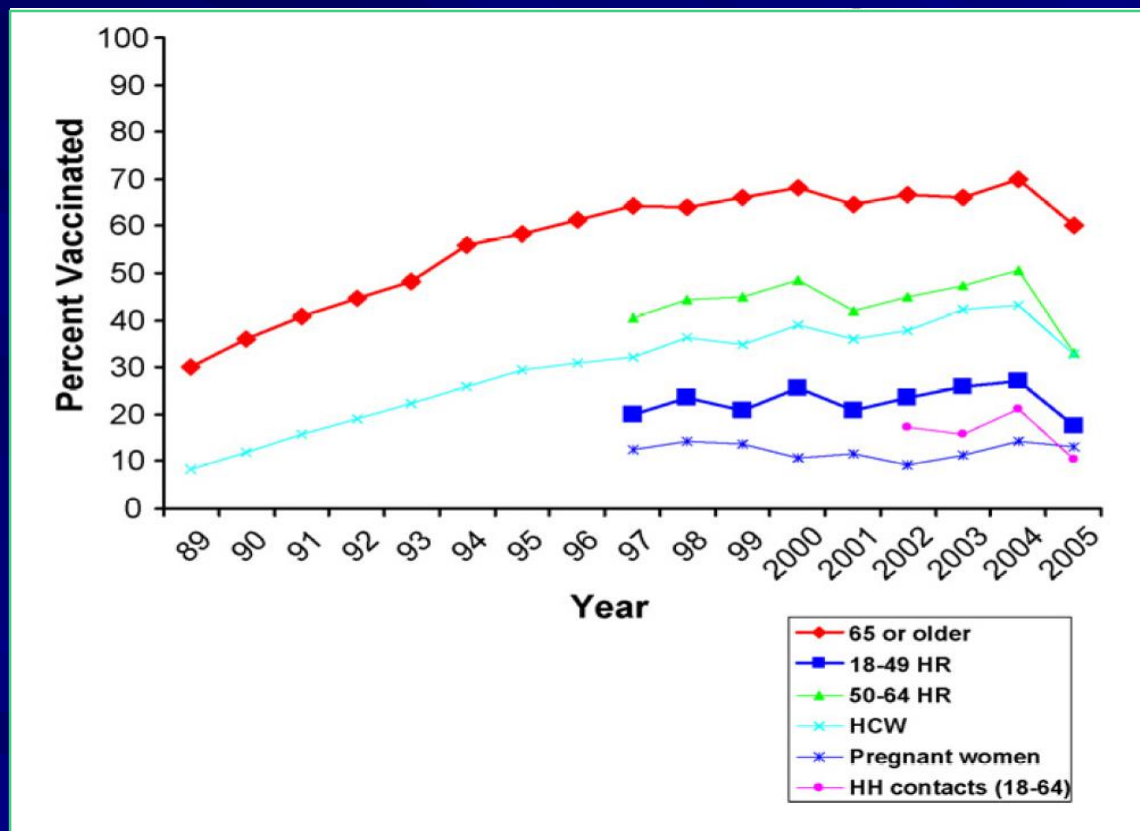
- A/Michigan/45/2015 (H1N1)pdm09-like virus (updated)
- A/Hong Kong/4801/2014 (H3N2)-like virus
- B/Brisbane/60/2008-like (B/Victoria lineage) virus

■ Quadrivalent (four-component) protect against a second lineage of B viruses

- B/Phuket/3073/2013-like (B/Yamagata lineage) virus

Influenza Vaccination Coverage among Recommended Adult Populations

National Health Interview Survey, 1989-2005



Lu 2008

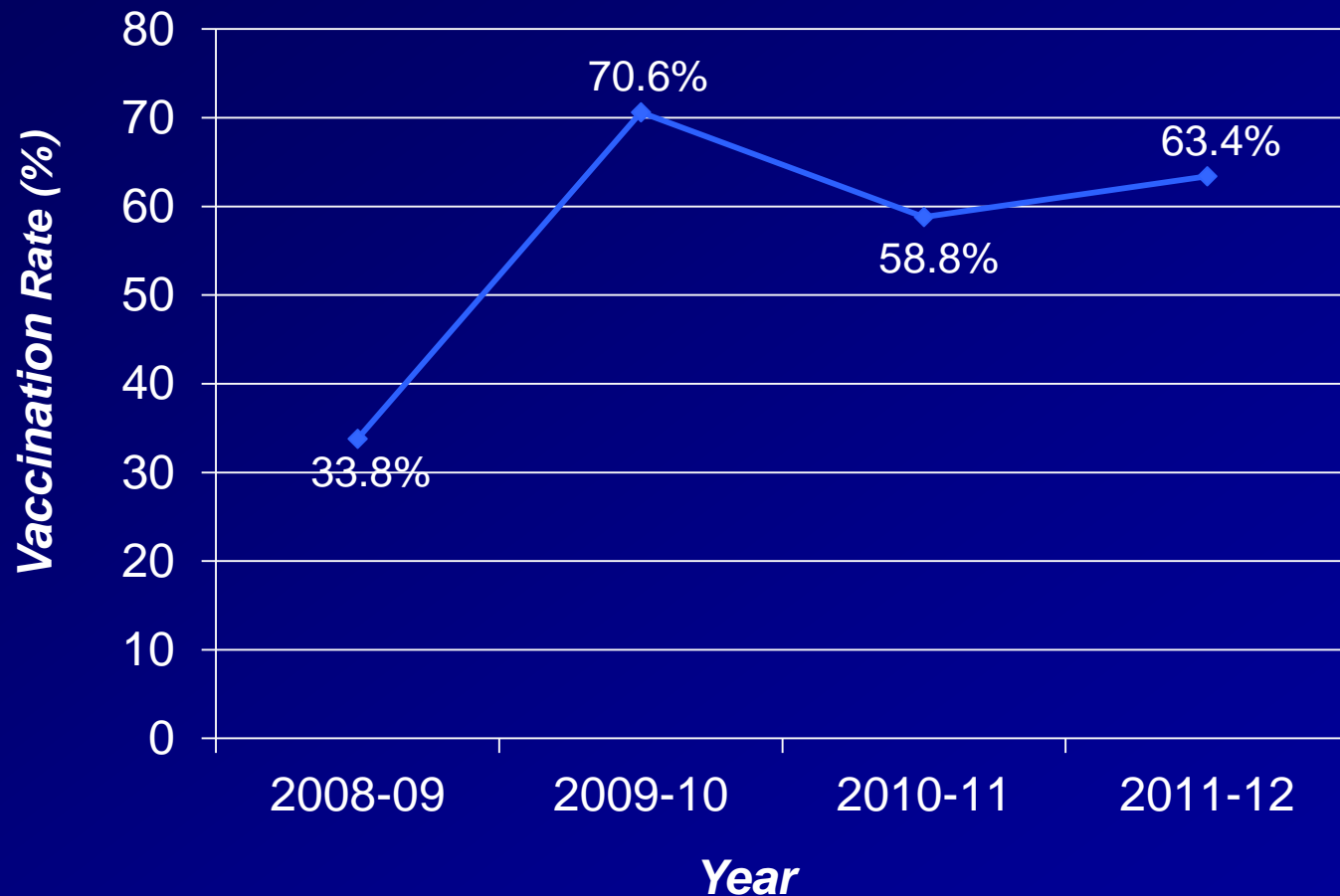
Vaccination in Pregnancy

- Coverage rates low for many years
- Following 2009 H1N1 pandemic and broad educational efforts → rates have increased
- 2016-2017 Season
 - 53.6% reported having received vaccination
 - Before (16.2%) pregnancy
 - During (37.4%) pregnancy
 - Providers influence on vaccination in pregnancy
 - 67.3% received a provider offer for vaccination → 70.5%
 - 11.9% received a recommendation but no offer → 43.7%
 - 20.7% received no recommendation → 14.8%

Stanford OB Clinic Vaccination Rates

	2008-09	2009-10 (H1N1)	2010-11	2011-12	
	N=610	N=659	N=650	N=678	p*
Pregnant Women who Received Influenza Vaccination, n (%)	206 (33.8%)	465 (70.6%)	382 (58.8%)	430 (63.4%)	<0.001

Stanford OB Clinic Vaccination Rates



Treatment

■ Prompt treatment

- Pregnant women and postpartum women who are within 2 weeks of delivery or pregnancy loss
- Suspected or confirmed influenza infection
- Treatment, when indicated, should **not** be delayed for diagnostic testing results
- Early treatment
 - Within 2 days of symptom onset
 - Associated with a lower risk for admission to an intensive care unit and death
 - Treatment >2 days after symptom onset has benefits

Treatment

■ Neuraminidase inhibitors

- **Oseltamivir** preferred for treatment
 - Pending resistance among circulating virus
 - Greater systemic absorption
 - Greater clinical experience using this drug in pregnancy
- **Zanamivir** possibly preferred for chemoprophylaxis
 - Limited systemic absorption
 - Respiratory complications due to inhaled route of administration (asthmatics)
- **Peramivir**- IV

■ Antipyretics and symptomatic therapy

■ Antibiotics for superimposed bacterial infection

Antiviral Summary

Agent	Treatment	Chemoprophylaxis
Oseltamivir	75 mg PO BID x 5 days	75 mg PO QD x 7-10 days
Oseltamivir (Acutely ill)	75-150 mg PO BID x 10 days	
Zanamivir	Two 5-mg inhalations (10 mg total) BID x 5 days	Two 5-mg inhalations (10 mg total) QD x 7-10 days
Peramivir (FDA approved 2014)	600 mg IV SINGLE DOSE	

Other Management

■ Inpatient management

- Private rooms (confirmed or suspected cases)
- Infection control precautions
 - Standard precautions for patients
 - Hand hygiene
 - Respiratory hygiene/cough etiquette
 - Mask patient during transport
 - Contact and droplet: health care workers
 - Gloves, gowns, masks, eye protection, as appropriate

■ Outpatient management

- Screen and triage ASAP (scheduling/check-in)
 - Masked
 - Seated in special area
 - Designated exam room

Infant Care/Feeding

- CDC guidelines developed during the 2009 H1N1 pandemic
 - Separate mother with 2009 H1N1 from infant until three criteria met
 - Mother received antiviral medications for 48 hours
 - Mother was afebrile without antipyretics for >24 hours
 - Mother was able to control cough/respiratory secretions
 - During temporary separation, all feedings provided by a healthy caregiver
 - Mothers who intended to breastfeed should be encouraged to express their milk

Infant Care/Feeding

- Once mother and infant able to initiate close contact, immediately prior to feeding and caring for the infant (including direct breastfeeding) in order to protect the newborn from droplet exposure mother recommended
 - Wash her hands with soap and water
 - Should put on a face mask
 - Observe all respiratory hygiene/ cough etiquette guidelines
- Precautions should be followed for 7 days after symptom onset or 24 hours after resolution of symptoms, whichever is longer

Infant Care/Feeding

■ CDC guidance 2017-2018

- **CONSIDER** temporary separation of a mother with suspected or confirmed influenza from her newborn
 - Length of temporary separation needs to be made on a case-by-case basis
 - During temporary separation, all feedings should be provided by healthy caregiver
 - Mothers who intend to breastfeed should be encouraged to express their milk
- If temporary separation is not feasible/acceptable
 - Environmental controls should be considered, such as physical barriers and keeping the newborn >6 feet away from the ill mother

Pertussis Background and Epidemiology

Pertussis

- Bacterial infection
 - *Bordetella pertussis*
- Highly contagious
- Acute respiratory illness
- Severe cough (whooping cough) x months
- Infants < 3 months of age at greatest risk for life-threatening cases of pertussis
 - Hence vaccination in pregnancy recommended
 - Infants may start DTaP vaccine series as early as 6 weeks of age

Pertussis

- Peak in incidence every 3-5 years
- Widespread throughout US and the world
- Prevalence of pertussis US increasing
 - Pertussis immunity after vaccination or disease wanes over time
- Specific outbreaks in California
- Child care facilities and schools with low vaccination rates
 - Increased risk for outbreaks

Pertussis

■ California

- 2010: >9,000 cases
 - Most cases in over 60 years
 - 10 infant deaths
- 2014: 10,831 cases
 - 2 infant deaths (<3 months of age)
 - Hundreds hospitalizations
- 2015: 4,707 cases
 - 1 infant death (<3 weeks of age)
- 2016: 1,830 cases
 - 2 infant deaths (< 3 months of age)
- 2017: 495 cases

Clinical Manifestations

- Coughing paroxysm
- Inspiratory whoops
- Nocturnal cough
- Post-tussive vomiting
- Low-grade fever
- Coryza
- Pharyngitis

NO EVIDENCE that disease is more severe during pregnancy.

Clinical Manifestations: Phases

■ Catarrhal phase

- Earliest phase of illness, lasting one to two weeks
- Generalized malaise, rhinorrhea, mild cough

■ Paroxysmal phase

- Begins second week of illness, last 2-3 months
- Paroxysmal cough (severe, vigorous)

■ Convalescent phase

- Lasts 1-2 weeks, reduction of symptoms

■ Total course: 3 months

Infant Considerations

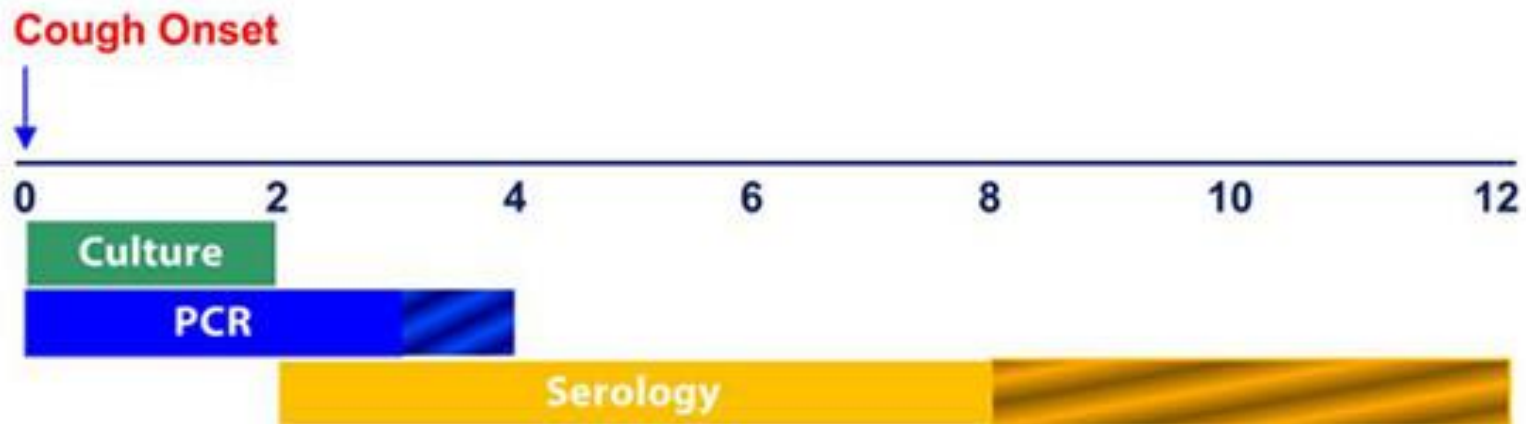
- Infants < 3 months
 - Highest risk of morbidity and mortality
- >50% of infants with pertussis contract the disease from family members, **mostly mothers**

Diagnosis

- Outbreak setting/close contact
 - Presence of cough lasting ≥ 2 weeks
- Laboratory diagnosis
 - < 2 weeks of cough: culture and PCR
 - Culture sensitivity highest in first 2 weeks
 - 2-4 weeks of cough: culture and PCR
 - Culture sensitivity decreases after 2 weeks
 - Accuracy of PCR not fully known
 - > 4 weeks: serology

Diagnosis

Optimal Timing for Diagnostic Testing (weeks)



Treatment

- Most individuals clear pertussis infection without antibiotic treatment within 6 weeks
- Antibiotic treatment in early (catarrhal) phase
 - May decrease duration and severity of cough
- Antibiotic treatment later in disease course
 - Likely does not affect the course of symptoms
 - May reduce the spread of the infection to others

Treatment

- Antibiotic therapy recommended for patients within 3 weeks of cough onset
- Persistent cough for 3-6 weeks
 - Antibiotic treatment may not reduce cough duration or severity but could reduce likelihood of pertussis transmission to others
- Pregnant women, healthcare workers, and individuals working with infants
 - Antibiotic therapy is appropriate for those with persistent cough for up to 6 weeks

Recommended oral antimicrobial treatment and postexposure prophylaxis for pertussis, by age group

Age group	Primary agents			Alternate agent*
	Azithromycin	Erythromycin	Clarithromycin	TMP-SMX
<1 month	Recommended agent; 10 mg/kg per day in a single dose for 5 days (only limited safety data available)	Not preferred; erythromycin is associated with infantile hypertrophic pyloric stenosis; use if azithromycin is unavailable; 40 mg/kg per day in four divided doses for 14 days	Not recommended (safety data unavailable)	Contraindicated for infants aged <2 months (risk for kernicterus)
1 to 5 months	10 mg/kg per day in a single dose for 5 days	40 mg/kg per day in four divided doses for 14 days	15 mg/kg per day in two divided doses for 7 days	Contraindicated at age <2 months; for infants aged ≥2 months, TMP 8 mg/kg per day, SMX 40 mg/kg per day in two divided doses for 14 days
Infants (aged ≥6 months) and children	10 mg/kg in a single dose on day 1 (maximum: 500 mg); then 5 mg/kg per day (maximum: 250 mg) on days 2 through 5 [¶]	40 mg/kg per day in four divided doses for 7 to 14 days (maximum: 2 g per day)	15 mg/kg per day in two divided doses for 7 days (maximum: 1 g per day)	TMP 8 mg/kg per day, SMX 40 mg/kg per day in two divided doses for 14 days (maximum TMP 320 mg, SMX 1600 mg per day)
Adults	500 mg in a single dose on day 1 then 250 mg per day on days 2 through 5 [¶]	2 g (base) per day in four divided doses for 7 to 14 days	1 g per day in two divided doses for 7 days	TMP 320 mg per day, SMX 1600 mg per day in 2 divided doses for 14 days

TMP-SMX: trimethoprim-sulfamethoxazole (cotrimoxazole).

* TMP-SMX can be used as an alternative agent to macrolides in patients aged ≥2 months who are allergic to macrolides, who cannot tolerate macrolides, or who are infected with a rare macrolide-resistant strain of *Bordetella pertussis*. One double strength (DS) tablet contains trimethoprim 160 mg with sulfamethoxazole 800 mg.

¶ A shorter course (ie, three days) of azithromycin for treatment or postexposure prophylaxis of *B. pertussis* has not been validated and is not recommended.

Data from:

1. American Academy of Pediatrics. Pertussis (whooping cough). In: Red Book: 2015 Report of the Committee on Infectious Diseases, 30th ed, Kimberlin DW, Brady MT, Jackson MA, Long SS (Eds), American Academy of Pediatrics, Elk Grove Village, IL 2015. p.611.
2. Centers for Disease Control and Prevention. Recommended antimicrobial agents for the treatment and postexposure prophylaxis of pertussis. 2005 CDC guidelines. MMWR 2005; 54:10.

Pertussis Vaccination

- Birth to 6 years
 - DTaP at 2, 4, and 6 months, at 15 through 18 months, and at 4 through 6 years
- 7-10 years
 - Tdap for children who are not fully vaccinated against pertussis
- 11-18 years
 - Tdap as a single dose for those 11 - 18 years of age (preferred 11 -12 years of age)
- 19 years and older
 - Tdap ASAP for any adult 19 years of age or older who has never received a dose of Tdap

Tetanus, Diphtheria, Pertussis (Tdap) Vaccine in Pregnancy

■ Indication:

- All pregnant women during **each** pregnancy
- Regardless of previous immunization history

■ Timing:

- Ideally 27-36 weeks
 - Preferably during the earlier part of this period
 - Do not repeat if administered earlier in pregnancy
- Postpartum if not administered during pregnancy

■ Dosing: Single-dose series

■ Tetanus and diphtheria toxoids

■ Acellular pertussis inactivated vaccine

Tdap Vaccine for Infant Caregivers

■ Tdap vaccine

- Recommended for individuals (such as family members and childcare providers) who are expected to have close contact with a newborn or infant younger than 12 months and have not received Tdap previously
- Pregnant women are the only population in whom repeated Tdap immunization is recommended
- Repeated immunization is not recommended for household contacts

Tdap Vaccine Benefits

- Infant protection: Passive Immunization
 - IgG actively transferred across placenta
 - Highly effective in providing passive protection against pertussis in infants in the first few months of life
 - Infant is not eligible for active immunization until six weeks of age
 - IgA possibly secreted in breastmilk

Tdap Vaccine Benefits

■ Retrospective 2010-2015

- 148 981 newborns
- Vaccine effectiveness of maternal Tdap
 - 91.4% (95% CI 19.5 to 99.1) during first 2 months of life
 - 69.0% (95% CI, 43.6 to 82.9) during first year of life.
- Vaccine effectiveness in relation to Dtap
 - 87.9% (95% CI, 41.4 to 97.5) before infants had any
 - 81.4% (95% CI, 42.5 to 94.0) between doses 1 and 2
 - 6.4% (95% CI, -165.1 to 66.9) between doses 2 and 3
 - 65.9% (95% CI, 4.5 to 87.8) after had 3 DTaP doses

Tdap Vaccine Benefits

- Women vaccinated ≤ 6 days before birth
 - Vaccine effectiveness in infants lower
- Women vaccinated remote from delivery
 - Before conception and within two years of delivery or in early pregnancy
 - Cord blood pertussis-specific antibody levels were often insufficient to protect the infant against infection in the first two to three months of life
- Women vaccinated between 27 and 31 weeks of gestation had higher cord blood pertussis IgG levels than those vaccinated at ≥ 31 weeks

ACIP: Administer at 27 and 36 weeks of gestation (and preferably during the earlier part of this period), intending to maximize both maternal antibody response and passive antibody transfer to the infant

Tdap Vaccine Safety

- Tdap is safe to use during pregnancy
- 2017 systematic review
 - Tdap administered to pregnant women
 - There was no increase in significant adverse maternal, infant, or pregnancy outcomes, even among women who had received Tdap or other tetanus-containing vaccine within the previous five years

Opportunity for Immunization

- ~ 4 million live births each year in US
- >98% of women have at least 1 prenatal visit
 - Health care opportunity for vaccination!
 - Immunization effective in pregnant women
- Protection for
 - Pregnant woman
 - Fetus
 - Neonate
 - Young infant

Opportunity for Immunization

Opportunity for Provider Impact

- Recommendation from and vaccination offer by YOU the provider is SINLE MOST IMPORTANT FACTOR for vaccination uptake in pregnancy!

Acknowledgements

Amy Pine, MPH

Alameda County Public Health Department
California Department of Public Health

Deborah Cohan, MD, MPH



Thank You!

Pager: 650-723-8222

Pager ID 23344

Resources

- Centers for Disease Control and Prevention
 - <https://www.cdc.gov/flu>
 - <https://www.cdc.gov/flu/professionals>
 - <https://www.cdc.gov/pertussis>
 - <https://www.cdc.gov/pertussis/clinical>
- California Department of Public Health
 - <https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Immunization/Influenza.aspx>
 - <https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/Immunization/pertussis.aspx>

Local DPH Resources

■ Santa Clara County

- Phone: 408-792-5040

■ San Mateo County

- SMC Communicable Disease Control Program

- Phone: 650-573-2346

■ Santa Cruz County

- Phone: 831-454-4882 (fax: 831-454-549)

■ Monterey County

- Phone: 831-755-4521 (fax: 831-754-6682)

California Immunization Registry

- **CAIR** = Statewide Immunization Information System
- CA statewide immunization registry network
- 10 multi-county regional immunization registries
- Computerized registry system for provider entered info
 - Assist providers to track patient records
 - Reduce missed opportunities
 - Fully immunize all children in California
- Schools, childcare centers, and WIC can link into regional registries
- Ultimate goal to integrate 9 regional district
- <http://www.ca-siis.org>

Antiviral Pregnancy Registry

- 1-800-258-4263
- <http://www.apregistry.com>
- Now on-line patient enrollment

Vaccine Registries

Immunizations During Pregnancy

- **All vaccinations (general)**
 - VAERS: Vaccine Adverse Event Reporting System
 - 800-822-7967; www.vaers.org
- **HPV Quadrivalent Vaccine**
 - **Gardasil/Merck**
 - 1-800-986-8999
- **Rubella Vaccine in Pregnancy Registry- discontinued in 1989**
- **Varicella**
 - VARIVAX Pregnancy Registry
 - 800-986-8999
- **Tdap**
 - BOOSTRIX/GlaxoSmithKline Biologicals (1-888-825-5249)
 - ADACEL/Sanofi Pasteur at (1-800-822-2463 or 1-800-VACCINE)
- **Smallpox**
 - Centers for Disease Control and Prevention
 - Smallpox Vaccine in Pregnancy Registry
 - 404-639-8253

EXTRA SLIDES

Vaccine Controversy

- Autism prevalence has increased
 - Changes in case definition and increased awareness
 - ?Actual increase in incidence of autism
- Multiple large, well-designed studies and systematic reviews have not demonstrated link between vaccines/MMR and autism
- Studies do not demonstrate association between vaccines and multiple sclerosis or type 1 DM

Vaccine Controversy

- Multiple large, well-designed epidemiologic studies and systematic reviews have not demonstrated association between thimerosal and autism or other developmental disorders
- No association b/w thimerosal and CV disease
- Mercury poisoning and autism **DIFFER**
- WHO advisory committee concluded it is safe to continue using thimerosal in vaccines

Obstetric Immunization Challenges

- Limited well-controlled studies in pregnant cohorts
- Theoretical concerns about efficacy
- Theoretical concerns about safety in pregnancy/BF
 - Vaccine type (e.g., live vaccines)
 - Additives/adjuvants/preservatives (e.g., thimerosal)
 - Timing of vaccination
- Interruption of breastfeeding
- Impaired newborn/infant immune response to childhood series concerns
- Lack of harmonization with FDA labels and indications
- Public perception/risks and legal liability
- Logistic issues for office-based practice

Infant Care/Feeding

- Breast milk is not thought to be a potential source of influenza virus infections
- Expressed milk from mothers with influenza can be safely fed to their newborn infants
- Feedings (expressed milk) during temporary separation should be provided by a healthy caregiver (family members or hospital personnel) until criteria are met for close contact
- Antiviral medication treatment or prophylaxis is not a contraindication for breastfeeding