# Adolescent Immunization: An Update

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Children's National

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- *Neither I nor any member of my immediate family have any disclosures relevant to this talk.*

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# Adolescent Immunization: An Update

**Learning Objectives: At the end of talk you will**

1) Understand the importance of vaccine preventable diseases in adolescents.
2) Identify which vaccines are particularly relevant for adolescents.
3) Be able to explain the importance of Meningococcal B vaccine and understand who should receive this vaccine
4) Understand some of the controversies surrounding the vaccines commonly used in adolescents

- This 15-year-old is in the office for an ankle injury that occurred during a soccer game
- You last saw him at age 6 when he moved to Washington state
- Mother says he was cared for by someone who “didn’t believe in vaccines”
- He has asthma
- What Vaccines is he likely to need?

This 15-year-old is in the office for an ankle injury that occurred during a soccer game. You last saw him at age 6 when he moved to Washington state. Mother says he was cared for by someone who "didn't believe in vaccines". He has asthma. What vaccines does he need?

- A. MCV4, HPV, TDAP, and Hep A
- B. TDAP, HPV, Flu, PCN 13, MCV4
- C. MCV4, Men B, Flu, Hep A
- D. MCV4, HPV, Flu, TDAP

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- C. MCV4, Men B, Flu, Hep A
- D. MCV4, HPV, Flu, TDAP

ACIP “Highly” Recommended and/or Required vaccines include:

- Tdap
- MCV
- Influenza
- HPV

# Clinical Preventive Services Recommended for Adolescents[1]

- Immunizations
  - MCV4
  - Tdap
  - HPV
  - Influenza
  - Pneumococcal[a]
  - Hepatitis A[a]
  - Men B[a]
  - Hepatitis B[b]
  - Inactivated poliovirus[b]
  - MMR[b]
  - Varicella[b]
- Health Guidance
  - Development
  - Nutrition
  - Sexual health
  - Physical activity
  - Injury prevention
  - Dental health
  - Skin protection
  - Self-performed exams (Testicular/breast)

[a] For certain high-risk groups; [b] If not previously completed.

**Reference: 1.** Broder KR, et al. *Pediatrics.* 2008;121(suppl 1):S25-S34.

# Vaccine-Preventable Diseases are Still a Problem for Adolescents…

**Pertussis epidemic in 2014-2015 was driven by substantially increased rates in adolescents**

**Measles Outbreak in California in 2014-2015 was focused on unvaccinated adolescents and young adults**

**Seven separate Meningococcal B outbreaks have occurred on college campuses in the past 7 years (2009-2016)**

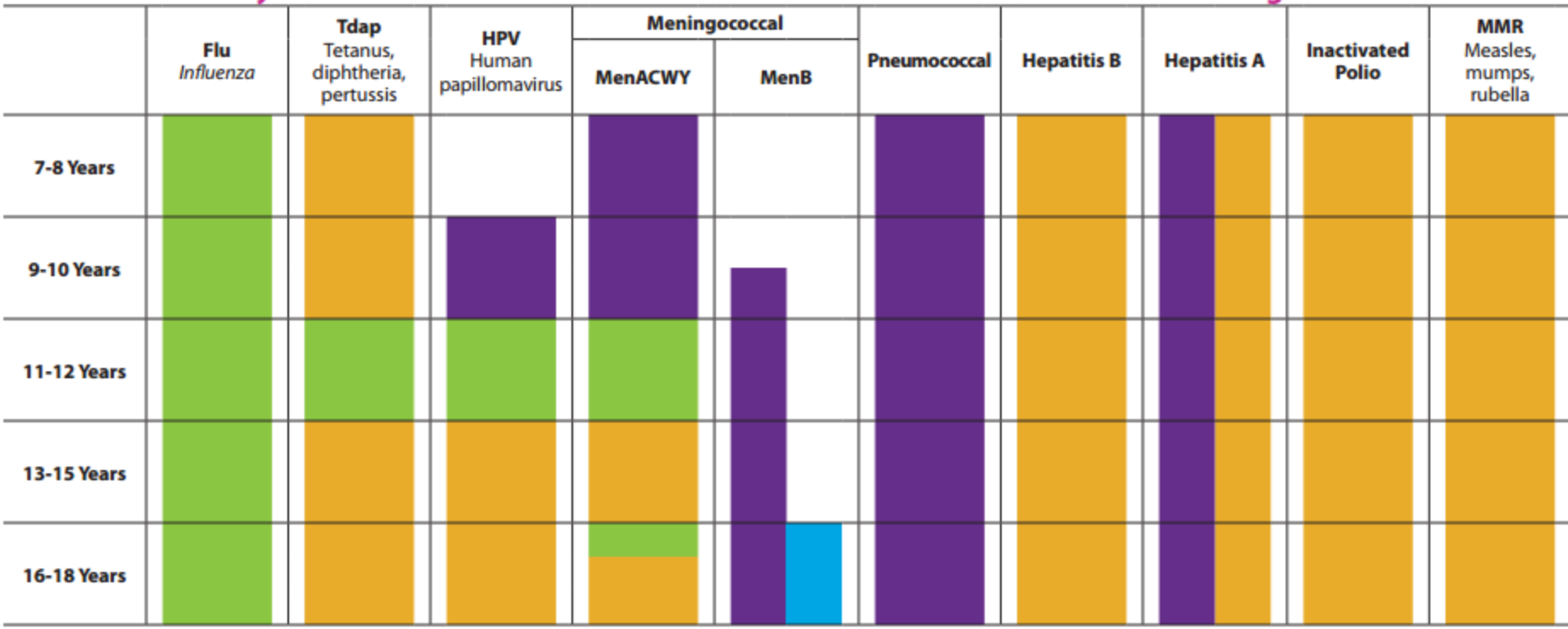
## …And More Diseases are now "Vaccine-Preventable"; in the past 10 years …

- New pertussis vaccine (Tdap) for adolescents
- New conjugate meningococcal vaccine (MenB)
- New human papillomavirus (HPV) vaccine
- New conjugate pneumococcal vaccine

INFORMATION FOR PARENTS

# 2016 Recommended Immunizations for Children 7-18

## Talk to your child's doctor or nurse about the vaccines recommended for their age.




| | Flu | Tdap | HPV | Meningococcal | | Pneumococcal | Hepatitis B | Hepatitis A | Inactivated Polio | MMR |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Influenza* | Tetanus, diphtheria, pertussis | Human papillomavirus | MenACWY | MenB | | | | | Measles, mumps, rubella |
| **More information:** | Preteens and teens should get a flu vaccine every year. | Preteens and teens should get one shot of Tdap at age 11 or 12 years. | Both girls and boys should receive 3 doses of HPV vaccine to protect against HPV-related disease. HPV vaccination can start as early as age 9 years. | All 11-12 year olds should be vaccinated with a single dose of a quadrivalent meningococcal conjugate vaccine (MenACWY). **A booster shot is recommended at age 16.** | Teens, 16-18 years old, **may** be vaccinated with a MenB vaccine. | | | | | |

These shaded boxes indicate when the vaccine is recommended for all children unless your doctor tells you that your child cannot safely receive the vaccine.

These shaded boxes indicate the vaccine should be given if a child is catching-up on missed vaccines.

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# MCV4, Tdap, and HPV Vaccination—How Are We Doing?

- *Healthy People 2020:* any new universally recommended vaccine for adolescents should be at a 90% coverage level within 5 years of the recommendation
  - Recommendations published in 2005 for MCV4, 2006 for Tdap, and 2007 for HPV

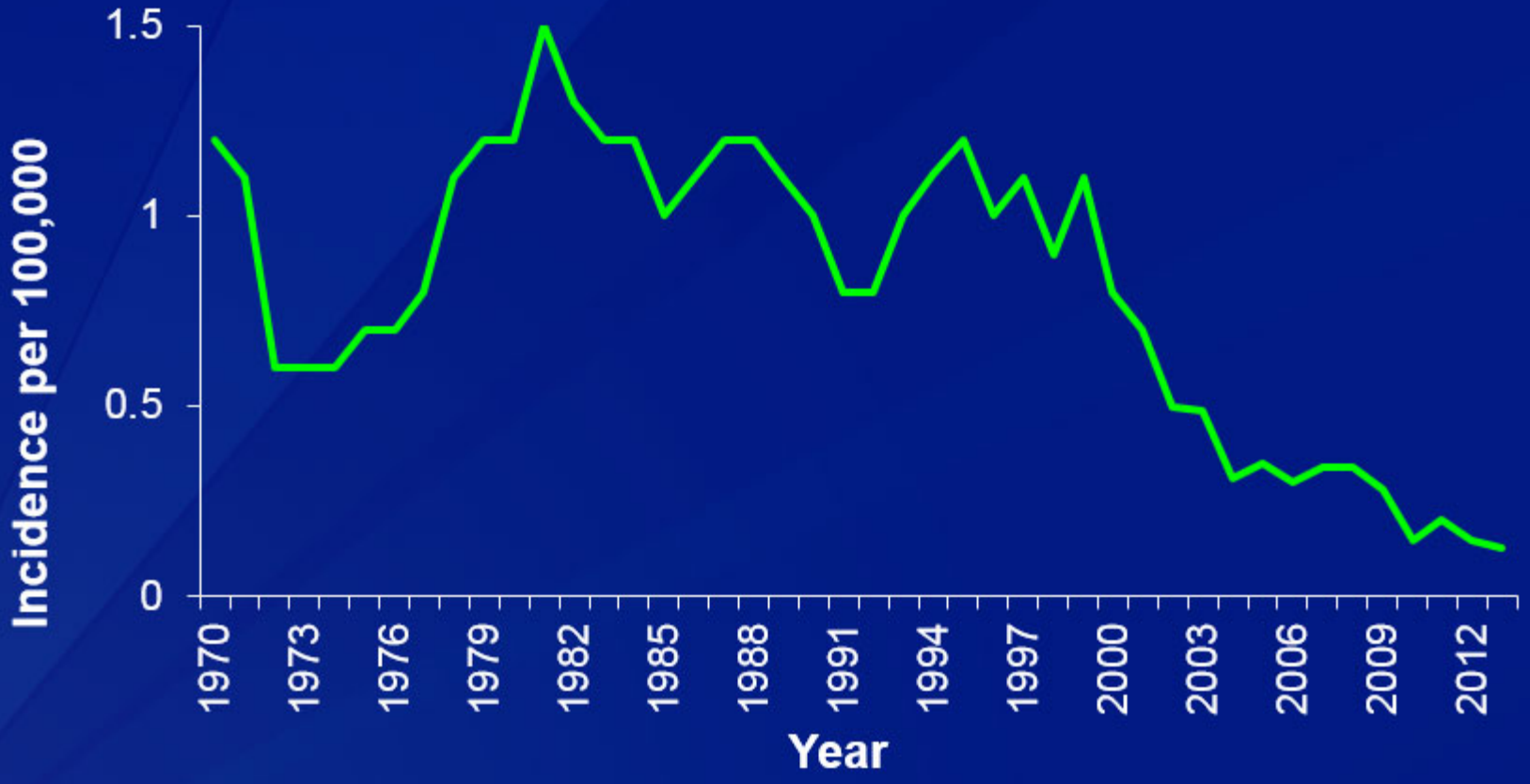
| Immunization | 2006 (%)[1] | 2009 (%)[2] | 2012 (%)[3] | 2014 (%)[4] |
|---|---|---|---|---|
| 1 dose MCV4 | 11.7 | 53.6 | 74.0 | 79.3 |
| 1 dose Tdap | 10.8 | 55.6 | 84.6 | 87.6 |
| ≥1 dose HPV | – | 44.3 | 53.8 | 60.0 |
| (3doses HPV) | | (26.7) | (33.4) | (39.7) |

**References:** **1.** CDC. *MMWR*. 2007;56(34):885-888. **2.**. CDC. *MMWR.* 2009;58(36):997-1001 **3.** CDC. *MMWR.* 2012; 62(34);685-693. **4.** CDC. *MMWR.2015;* 64 (29)

# What's new in terms of the "adolescent vaccines"?

- 1) Meningococcal B vaccine
- 2) A 9-Valent HPV Vaccine
- 3) Waning immunity from TDaP
- 4) New recommendation for using Pneumococcal vaccine

# Meningococcal Disease Incidence, United States, 1970-2013




SOURCE: CDC. 1970-1996 National Notifiable Diseases Surveillance System, 1997-2013 Active Bacterial Core surveillance estimated to U.S. population

# Clinically Significant *N meningitidis* Serogroups

| Serogroup | Characteristics |
|---|---|
| A | • Leading cause of epidemic meningitis worldwide<br>• Most prevalent serogroup in Africa and China<br>• Rare in Europe and the Americas |
| B | • A major cause of endemic disease in Europe and the Americas<br>• No vaccine commercially available in US |
| C | • A major cause of endemic disease in Europe, North America<br>• Multiple outbreaks in schools/community |
| Y | • Associated with pneumonia<br>• Increasing problem in the United States, affecting all age groups |
| W-135 | • Small percentage of infections worldwide<br>• Recent outbreaks associated with Hajj pilgrims |

Granoff DM, et al. In: *Vaccines*. 2004:959.

# *Neisseria meningitidis*
# Risk factors for invasive disease

- Host factors
  - Terminal complement pathway deficiency
  - Asplenia
  - Genetic risk factors
  - Immunosuppression (HIV)

- Exposure factors
  - Household exposure
  - Demographic and socioeconomic factors and crowding
  - Concurrent upper respiratory tract infection
  - Active and passive smoking
  - Living in a dormitory as a first year student!

# Estimated Average Annual Cases, Deaths, and Sequelae by Age Group and Serogroup, 2009–2013

| | Age Group | Cases[1] | Deaths[2] | Sequelae[3] |
|---|---|---|---|---|
| Serogroup B | <5 years | 74–94 | 7-14 | 7-19 |
| | 11-24 years | 54–67 | 5-10 | 5-13 |
| | All ages | 203–260 | 20-39 | 20-52 |
| Serogroups C & Y | <5 years | 34–43 | 3-6 | 3-9 |
| | 11-24 years | 62–77 | 6-12 | 6-15 |
| | All ages | 307–393 | 31-59 | 31-79 |

- The majority (~80%) of serogroup B cases that occur in 11–24 year olds occur in older adolescents and young adults aged 16–24 years

[1]Range in estimated cases: Low=NNDSS data supplemented with additional serogroup data from ABCs and state

# The Challenge of Creating a Serogroup B vaccine

- **Serogroup B bacterial capsule does not induce an immune response because it too closely resembles other human cell proteins.**
- **Finally isolated isolated protein fragments of the capsule of serogroup B bacteria capable of inducing immunity**
- **Present on a large enough percentage of B strains to make the vaccine effective for widespread use.**
- **Caveat: These vaccines appear to be effective against many, but not necessarily ALL strains of Men B.**

# Two MenB Vaccines For Persons Aged 10–25 Years in the United States

**Trumenba ® (Pfizer), 3-dose series (0, 2, 6 months)**

- Components: fHbp subfamily A/v2,3; subfamily B/v1
- Licensed in the U.S. on October 29, 2014

**Bexsero® (Novartis/GSK), 2-dose series (0, 1–6 months)**

- Components: fHbp subfamily B/v1, NhbA, NadA, Por A1.4
- Licensed in the U.S. on January 23, 2015
- Licensed in >30 countries for persons ≥2 months of age

# Recent University Based Serogroup B Clusters/Outbreaks†

| University | Outbreak Period | Number of c |
|---|---|---|
| University 1 | Feb – Mar 2009 | 4 |
| University 2 | Nov 2011 | 2 |
| University 3 | Jan 2008 – Nov 2010 | 13 |
| University 4 | Mar 2013 – Mar 2014 | 9 |
| University 5 | Nov 2013 | 4* |
| University 6 | Jan – Feb 2015 | 2 |
| University 7 | Jan – May 2015 | 7 |

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# Potential Cases and Deaths Prevented per 4M Cohort

| | Cases Prevented | Deaths Prevented | NNV* to prevent case | NNV to prevent death | Cost ($) per QALY |
|---|---|---|---|---|---|
| Series at 11 years | 15 | 2 | 203,000 | 1,512,000 | $8.700.000 |
| Series at 16 years | 28 | 5 | 107,000 | 788,000 | $4,100,000 |
| Series at 18 years | 29 | 5 | 102,000 | 638,000 | $3,700,000 |
| College students | 9 | 1 | 368,000 | 2,297,000 | $9,400,000 |

*Number needed to vaccinate
Source: Ismael Ortega-Sanchez

# Considerations for "All Adolescents" Rather Than "College Students Only"

- Approximately 30-60% of serogroup B cases in 18–23 year olds occur in persons not attending college
- Would be challenging to get students vaccinated with 2-3 doses before arriving on college campuses
- Vaccinating college students would prevent the fewest cases and deaths of options considered
- The Work Group acknowledges the impact that cases and outbreaks have on college campuses
  - Cost for vaccination campaigns
  - Public concern

# Challenges when Considering Routine Use of MenB Vaccines in Adolescents

- **Proportion of serogroup B cases that could be prevented with MenB vaccines is unknown**
  - Breadth of strain coverage estimated; actual breadth of strain coverage unclear
  - Available antibody persistence data suggests limited duration of protection
- **Effectiveness data are not available**
  - Licensure is based on bactericidal activity
  - Universal programs not implemented in any country to date
- **Impact on carriage unknown**
- **Potential impact of vaccine pressure on circulating strains unknown**

# Considerations for Timing of Administration of the MenB Series

- **Need to administer series in late adolescence in order for protection to last into the highest risk period**
  - Concern is that protection may not be long lasting
- **Young adults may still be under the care of a pediatrician at 16 years of age, but less likely at 18 years**
  - Receive booster at age 16 years for MenACWY
- **Majority of work group members prefer administration between 16–18 years**
  - For college-bound population, more likely to receive 2–3 doses before entering college and highest age-related risk period

# Guidance for Use

- MenB should be administered as either a 2-dose series of MenB-4C or a 3-dose series of MenB-FHbp
- The same vaccine product should be used for all doses
- Based on available data and expert opinion, MenB-4C and MenB-FHbp may be administered concomitantly with other vaccines indicated for this age, but at a different anatomic site, if feasible

# Standard Meningococcal Conjugate Vaccines

- Two licensed meningococcal conjugate vaccines
  - MCV4-D (Menactra®)
    - Licensed for persons 2-55 years
    - Serogroups A, C, Y, W-135
    - Diphtheria toxoid conjugate
  - MenACWY-$CRM_{197}$ (Menveo®)
    - Licensed for persons 2-55 years
    - Serogroups A, C, Y, W-135
    - Diphtheria $CRM_{197}$ conjugate

# ACIP Recommendations for Use of Meningococcal Conjugate Vaccine in Adolescents

- Adolescents at their 11- to 12-year health-care visit, with a booster dose at 16 years of age[1]
  - If primary dose not given until 13-15 years of age, then booster dose at 16-18 years of age[1]
- Adolescents 11-18 years of age who were not vaccinated previously[2]
- Previously unvaccinated college freshmen living in dormitories[3]
- Adolescents 11-18 years of age with human immuno-deficiency virus (HIV) infection[1]
  - Two-dose primary series, 2 months apart
  - Booster doses: same as for other adolescents

**Reference:** **1.** CDC. *MMWR.* 2011;60(3):72-76. **2.** CDC. *MMWR*. 2007;56(31):794-795. **3.** CDC. *MMWR.* 2005;54(RR-7):1-21.

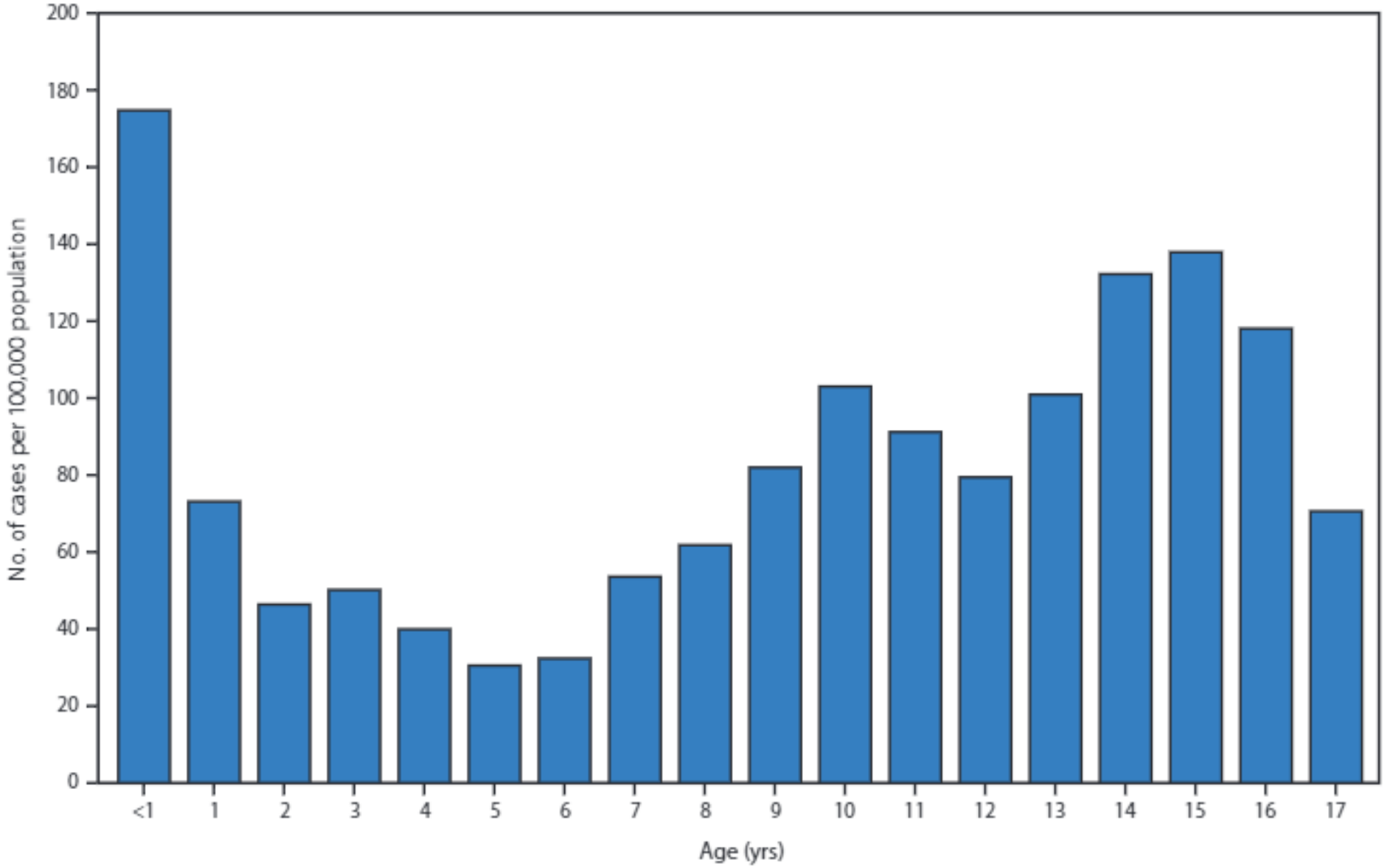
# Things to Remember: Meningococcal Vaccine for Adolescents

1) MCV4 and MenB can be administered at the same time
2) MCV4 and Men B can BOTH be administered with other vaccines; Shortest recommended intervals for boosters are 8 weeks for MCV4 and 4 weeks for Men B
3) Men B is also recommended for patients 10-25 years of age with asplenia, complement deficiencies
4) Adolescents who receive their first dose of MCV4 after age 16 do not need a booster dose
5) While the two MCV4 vaccines are “interchangeable” for adolescents, the Men B vaccines ARE NOT

# Pertussis

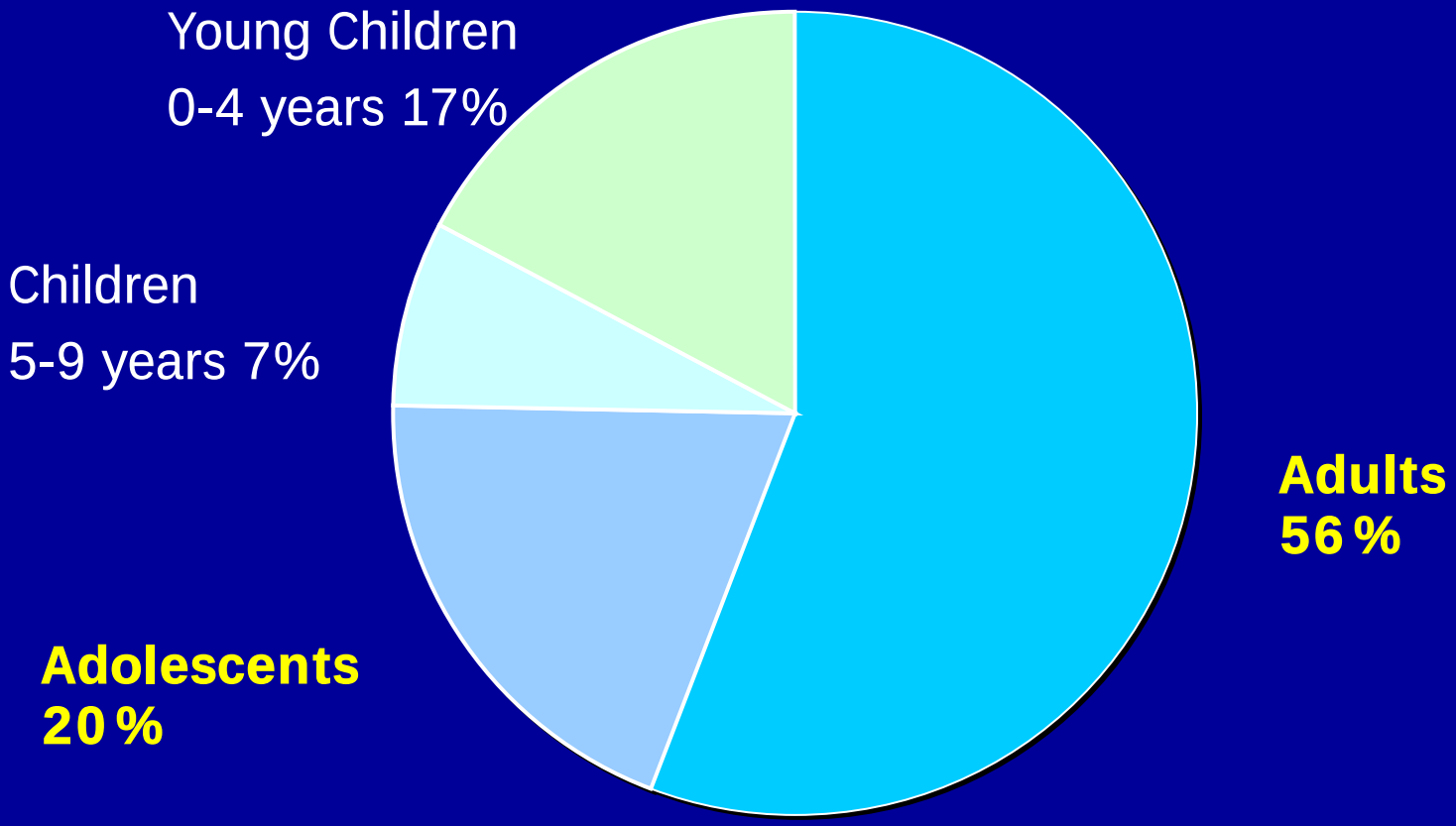
- Overall incidence increased dramatically between 2000 and 2005, decreased, and is now increasing again
- Major outbreak in 2014 in California and in Washington, DC (!)
- Has become common in adolescents and adults, causing significant morbidity and complications
- Adolescent and adult infections may be indistinguishable from other respiratory infections[3]
- Adolescents serve as a reservoir for infection of unimmunized patients
- Most cases in persons >10 years of age are due to waning immunity[4]

FIGURE. Incidence of pediatric pertussis, by age — California, 2014*




* Reported to the California Department of Public Health as of November 26, 2014.

# 76% of suspected sources* for infant pertussis cases were adolescents or adults



# ACIP Recommendations for Use of Tdap Among Adolescents

- Adolescents 11-18 years of age should receive a single dose of Tdap instead of Td as a booster if they have completed the childhood DTP/DTaP series and have not received Td or Tdap[1]
  - Preferable age of administration: 11-12 years[1]
- Adolescents 11-18 years of age who received Td, but not Tdap, may receive a single dose of Tdap if they have completed the childhood DTP/DTaP series[1]
  - Tdap can be administered regardless of the interval since the last tetanus and diphtheria toxoid–containing vaccine[2]

**Reference:** **1.** CDC. *MMWR.* 2006;55(RR-3):1-43. **2.** CDC. *MMWR*. 2011;60(1):13-15.

# Things to Remember: Tetanus/Diphtheria/Acellular Pertussis vaccine for Adolescents

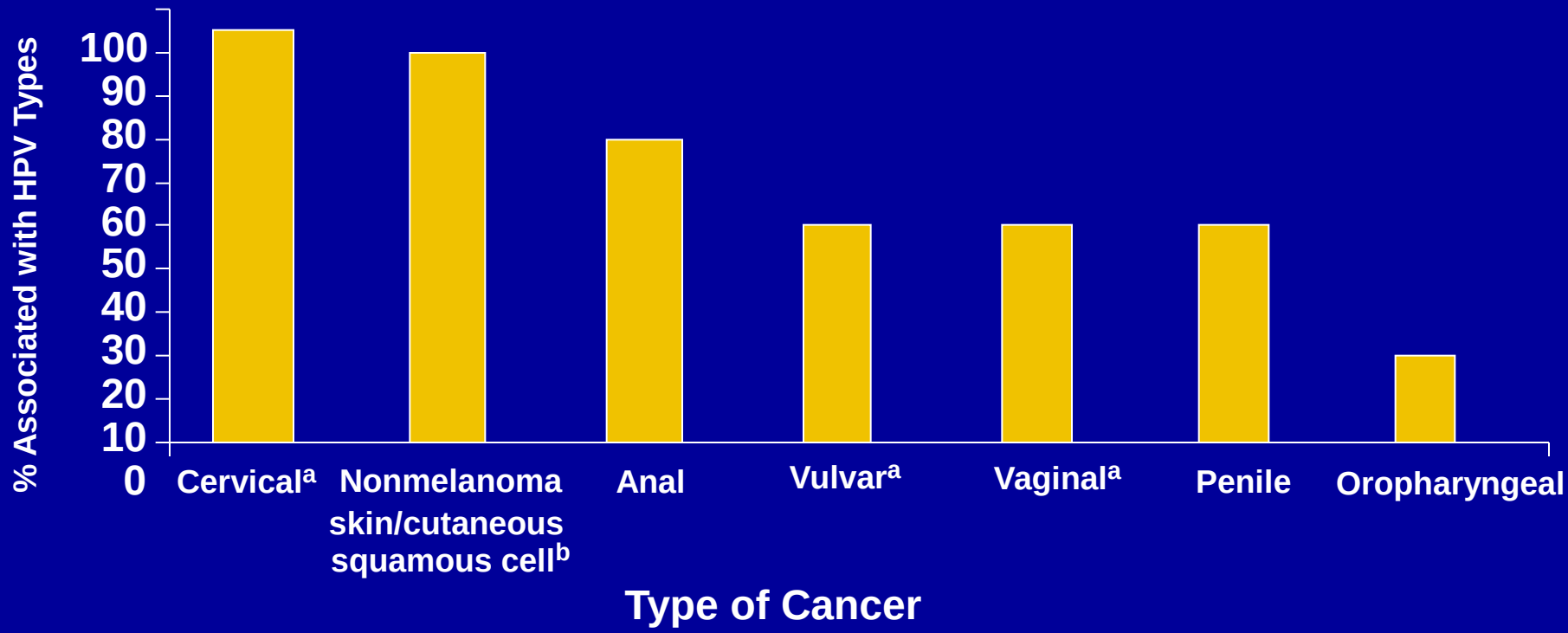
1) Tdap can be given regardless of the interval since the last Td was given. There is NO need to wait 2–5 years to administer Tdap following a dose of Td.
2) Adolescents should receive a single dose of Tdap (instead of Td) at the 11–12-year-old visit.
3) Adolescents and adults who have not received a dose of Tdap, or for whom vaccine status is unknown, should receive a single dose of Tdap as soon as feasible.
4) All healthcare workers, regardless of age, should receive a single dose of Tdap as soon as feasible if they have not previously received Tdap and regardless of the time since the last dose of Td.
5) Pregnant teens and women should receive Tdap during each pregnancy, preferably between 27 and 36 weeks' gestation. Women who have never received Tdap and who do not receive it during pregnancy should receive it immediately postpartum.
6) Vaccine efficacy is likely as low as 50% in adoelscents

# The Impact of HPV in the US

- The lifetime risk of HPV infection is 50% for sexually active men and women[1]
  - By 50 years of age, at least 80% of sexually active women will have acquired genital HPV infection[1]
- Estimated incidence: 6.2 million per year[1]
- Estimated prevalence: 20 million[1]
- Up to 75% of new HPV infections occur among persons 15-24 years of age[1]
- In studies of women ≤25 years of age, prevalence rates range from 27%-45%[2]

**References:** **1**. CDC. Human papillomavirus. In: Atkinson W, et al, eds. *Epidemiology and Prevention of Vaccine-Preventable Diseases.* (The Pink Book) 11th ed. Washington, DC: Public Health Foundation; 2009:123-134. **2.** CDC. *MMWR.* 2007;56(RR-2):1-24.

# Cancers Associated With HPV[1]




[a] Includes cancer and intraepithelial neoplasia; [b] Immunocompromised patients.

**Reference: 1.** González Intxaurraga MA, et al. *Acta Dermatoven APA.* 2002;11(3):95-99.

# HPV vaccines licensed in the US

| | Bivalent<br>2vHPV<br>(Cervarix) | Quadrivalent<br>4vHPV<br>(Gardasil) | 9-valent<br>9vHPV<br>(Gardasil 9) |
|---|---|---|---|
| L1 VLP types | 16, 18 | 6, 11, 16, 18 | 6, 11, 16, 18,<br>31, 33, 45, 52, 58 |
| Manufacturer | GlaxoSmithKline | Merck & Co. | Merck & Co. |
| Adjuvant | AS04:<br>500 µg aluminum hydroxide<br>50 µg 3-*O*-desacyl-4'-monophosphoryl lipid A | AAHS:<br>225 µg amorphous aluminum hydroxyphosphate sulfate | AAHS:<br>500 µg amorphous aluminum hydroxyphosphate sulfate |
| Schedule | 3-dose series | 3-dose series | 3-dose series |

# Licensed age groups for available HPV vaccines

| | Bivalent (Cervarix) | Quadrivalent (Gardasil) | 9-valent (Gardasil 9) |
|---|---|---|---|
| Licensure | Females 9-25 years | Females 9-26 years<br>Males 9-26 years | Females 9-26 years<br>Males 9-15 years |

- At the time of the first application to FDA, 9vHPV immunogenicity trials in males 16-26 years had not been completed
- Immunogenicity data for males 16-26 years were presented to ACIP and submitted to FDA
- In February 2015, ACIP recommended use of 9vHPV in the currently recommended age groups – through 21 years for males*
  - Use in males 16-26 years is off label at this time

*through age 26 for MSM and immunocompromised males and those with HIV infection

# ACIP Recommendations for Use of HPV Vaccine Among Adolescents

- **A 3-dose series of the HPV vaccine is recommended for females 11-12 years of age:[1,2]**
  - **1st dose: at elected date**
  - **2nd dose: 2 months after the first dose**
  - **3rd dose: 6 months after the first dose**
- **Vaccination is recommended for females 13-26 years of age who have not been vaccinated previously or have not completed the full series[1,2]**
- **Females may receive either the nonavalent, quadrivalent or bivalent vaccine to protect against HPV-related cervical cancers and precancers[2]**
  - **Nonavalent vaccine also protects against vulvar and vaginal cancers and precancers and genital warts[2]**
- **Nonavalent vaccine is approved as a 3-dose series for males 9-21(26) years of age to reduce the likelihood of genital warts[3,4]**

**References: 1.** CDC. *MMWR.* 2007;56(RR-2):1-24. **2**. CDC. *MMWR*. 2010;59(20):626-629. **3.** CDC. *MMWR.* 2010;59(20):630-632. **4.** CDC. MMWR.2015;64(11); 300-304.

- This 14-year-old has come in for a sports physical for camp. She is up- to-date on all of her vaccinations, except her mother has decided to “wait until there is more data” on the HPV vaccine.
- What data can you provide to reassure the mother that vaccination now is preferable?

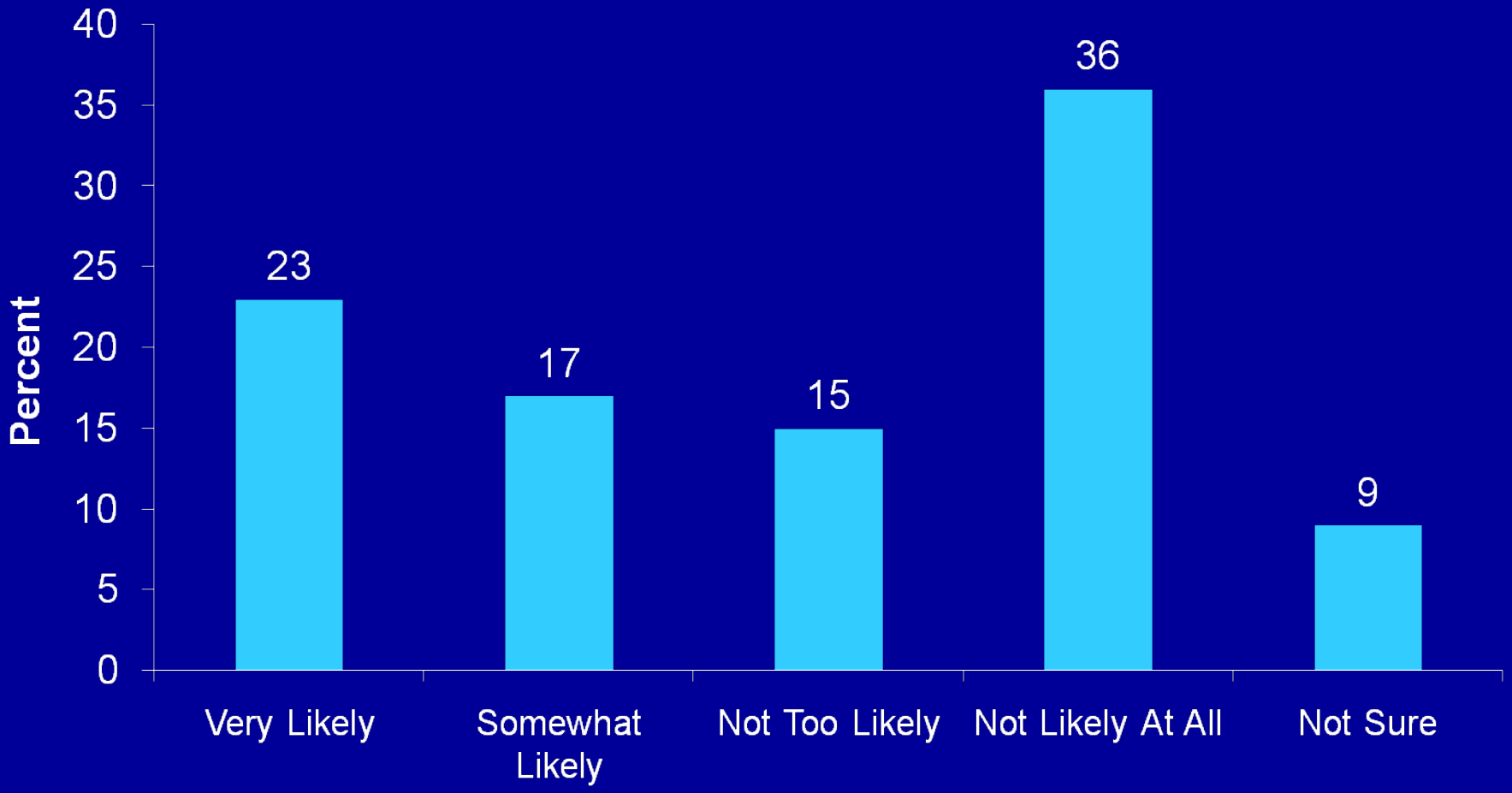
# HPV Vaccine Parental Concerns

- Parents discomfort with child sexuality
  - Great opportunity to start talking about sexuality issues
  - Communicate the importance of completing the 6-month immunization series *before* the adolescent becomes sexually active
  - Improved immunogenicity at younger ages
- **Emphasize cancer prevention**
- Communicate the universality of the vaccine recommendation
- **No evidence that vaccination supports sexual activity**
  - Not supported by other interventions such as free condom distribution, availability of emergency contraception
- **Provider recommendation is perhaps the most important factor in parent decision-making!**

# HPV Postlicensure Safety Data

- Vaccine Adverse Event Reporting System (VAERS)
  - HPV4
    - 6/1/06–8/31/10
    - 33 million doses in females
    - 16,442 VAERS reports; 8% serious
    - Ongoing monitoring
    - No new adverse event concerns or clinical patterns identified
  - HPV2
    - Licensed 10/16/09
    - Insufficient usage to date in US to assess AEs
    - Total US reports through 8/31/10: 9
- Vaccine Safety Datalink Rapid Cycle Analysis
  - HPV4
    - No significant increased risk for pre-specified AEs after vaccination
    - GBS, seizures, syncope, appendicitis, stroke, VTE, allergic rxns

# Intent to Vaccinate with HPV among Parents of Females Who Have Not Received Any HPV Vaccine; NIS–Teen 2009




ACIP. http://www.cdc.gov/vaccines/recs/acip/downloads/mtg-slides-oct10/08-3-hpv-Female.pdf. Accessed Nov 2010.

# Things to Remember: HPV Vaccine for Adolescents

1) Approved for BOTH males and females, but adolescent recommended time for administration STOPS at age 21 for males
2) If the HPV series has been started with 4vHPV, it can be finished with the 9vHPV
3) If a patient misses the recommended interval for HPV boosters (0, 1-2, and 6 months), there is no need to restart the series
4) The vaccine continues to be safe! 67 Million doses administered with 25,000 reports made to Vaccine Advserse Events Registry with 92% classified as minor
5) NO proven deaths from this vaccine
6) Your advice matters! Endorse the use of this vaccine if challenged

# Pneumococcal Vaccine

- 7 valent conjugate vaccine available since 2000; has significantly reduced invasive disease in children
- New 13 valent vaccine now available and recommended for all children 4-71 months
- Also recommended for “high risk” children 6-18 years (asplenia, immunocompromised, cochlear implant, CSF leak), regardless of prior PV7 or PPSV 23
- “High Risk” adults (including asthmatics!) should receive one dose of PCV 13 and PPSV23 no sooner that 8 weeks later
- Can improve antibody response by giving PPSV23 > 8 weeks

# Indications for Pneumococcal Vaccine by Age Group

**Ages 7-18 years**

- Cerebrospinal fluid (CSF) leaks
- Cochlear implant(s)
- Sickle cell disease and other hemaglobinopathies
- Functional or anatomic asplenia
- Congenital or acquired immunodeficiencies
- HIV infection

**Ages > 19 years**

- Chronic renal failure
- Nephrotic syndrome
- Leukemia
- Hodgkin disease
- Generalized malignancy
- Long-term immunosuppressive therapy
- Solid organ transplant
- Multiple myeloma
- Asthma

# Things to Remember: Pneumococcal Vaccine for Adolescents

1) For adolescents “vaccinated for a reason” PCV 13 ALWAYS proceeds PPSV 23 and interval between is at least 8 weeks
2) PPSV 23 is recommended for adolescents with asthma, but ONLY for those ≥ 19 years of age (insurance will not pay for younger adolescents)
3) If you are administering PPSV 23, you need to give a booster in 5 years
4) For patients needing BOTH PCV 13 and MCV4, preferably wait 4 weeks between vaccines and give PCV13 first

# "Catch-up" Schedule for Adolescents

**Minimum Interval Between Doses**

| Vaccine | Dose 1 to 2 | Dose 2 to 3 | Dose 3+ |
|---|---|---|---|
| **Tdap** | **4 wks** | **6 mos** | **5-10 yrs** |
| **IPV** | **4 wks** | **4 wks** | **4wks (if necessary)** |
| **Hep B** | **4 wks** | **8 wks (and 16 after #1)** | |
| **MMR** | **4 wks** | | |
| **Varicella** | **4 wks** | | |

# Future Vaccines for Adolescents and Young Adults

- Herpes simplex virus
- HIV
- Cytomegalovirus
- Chlamydia
- Group B streptococcus

# Summary

- Vaccine preventable diseases continue to pose clinical and public health challenges
- Adolescents are an important target for an increased immunization initiative
- The availability of new vaccines promises to significantly reduce morbidity and mortality in adolescents and young adults
- Vaccines in development will further improve the health of this and other age groups

# The Rationale for Emphasizing Adolescent Immunization

- Adolescent immunization:
  - Protects during a period of increased risk and increased chance to disseminate illness
  - Prevents lifelong complications of disease
  - Increases herd immunity for ***entire*** population
    - Example: Morbidity and mortality of the elderly could be reduced >40% with a 15% increase in immunization rates for those <19 years of age[1]
  - Promotes adolescent health-care visits
- New vaccines may be available soon!

[1]**Weycker D. *Vaccine*. 2005;23:1284.**

# National Immunization Survey-Teen

- Conducted by CDC since 2006 to estimate vaccination coverage from a national sample of adolescents aged 13-17 years
- Random-digit–dialing sample of telephone numbers of households
  - After parent/guardian respondents grant permission, surveys are mailed to the adolescents' vaccination providers to obtain vaccination histories

CDC. *MMWR*. 2008;57(40):1100-1103.

# Meningococcal Disease

Why?

- This is an often serious, rapidly progressing infection that leaves little time for diagnosis and treatment
- Early meningococcal disease can present with symptoms similar to common viral illnesses, making diagnosis difficult
- *Neisseria meningitidis* is now the most prevalent etiologic agent of bacterial meningitis among those 2 to 18 years of age in the US
- Adolescents and young adults are 5x more likely to die of meningococcal disease than younger children

1. **Granoff DM, et al. In: *Vaccines*. 4th ed. 2004:959. 2. Schuchat A, et al. *N Engl J Med.* 1997;337:970. 3. Harrison LH, et al. *JAMA.* 2001;286:694**