Adult and Adolescent Immunizations

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Outline

• Review current CDC recommendations on Adult and Adolescent vaccines
• Review general strategies to increase adult immunization rates
• Review advancements in Varicella Zoster vaccine
• Review work in Texas to increase HPV vaccination rates
Adult and Adolescents Immunization Schedule

https://www.cdc.gov/vaccines/schedules/hcp/adult.html
Influenza vaccination

• General information
  – All persons aged 6 months or older who do not have a contraindication should receive annual influenza vaccination with an age-appropriate formulation of inactivated influenza vaccine (IIV) or recombinant influenza vaccine (RIV).
  – In addition to standard-dose IIV, available options for adults in specific age groups include:
    • high-dose or adjuvanted IIV for adults aged 65 years or older,
    • intradermal IIV for adults aged 18 through 64 years,
    • and RIV for adults aged 18 years or older.

Influenza vaccination

Special populations

• Adults with a history of egg allergy who have only hives after exposure to egg should receive age-appropriate IIV or RIV.
• Adults with a history of egg allergy other than hives, e.g., angioedema, respiratory distress, lightheadedness, or recurrent emesis, or who required epinephrine or another emergency medical intervention, may receive age-appropriate IIV or RIV. The selected vaccine should be administered in an inpatient or outpatient medical setting and under the supervision of a healthcare provider who is able to recognize and manage severe allergic conditions.
• Pregnant women and women who might become pregnant in the upcoming influenza season should receive IIV.
**Tetanus, Diphtheria, and Acellular Pertussis Vaccination**

- **General information**
  - Adults who have not received tetanus and diphtheria toxoids and acellular pertussis vaccine (Tdap) or for whom pertussis vaccination status is unknown should receive 1 dose of Tdap followed by a tetanus and diphtheria toxoids (Td) booster every 10 years.
  - Tdap should be administered regardless of when a tetanus or diphtheria toxoid-containing vaccine was last received.
- **Adults with an unknown or incomplete history of a 3-dose primary series with tetanus and diphtheria toxoid-containing vaccines should complete the primary series that includes 1 dose of Tdap.**
  - Unvaccinated adults should receive the first 2 doses at least 4 weeks apart and the third dose 6–12 months after the second dose.
- **Special populations**
  - Pregnant women should receive 1 dose of Tdap during each pregnancy, preferably during the early part of gestational weeks 27–36, regardless of prior history of receiving Tdap.
Measles, Mumps, and Rubella Vaccination

- **General information**
  - Adults born in 1957 or later without acceptable evidence of immunity to measles, mumps, or rubella (defined below) should receive 1 dose of measles, mumps, and rubella vaccine (MMR) unless they have a medical contraindication to the vaccine, e.g., pregnancy or severe immunodeficiency.
  - Notes: Acceptable evidence of immunity to measles, mumps, or rubella in adults is: born before 1957, documentation of receipt of MMR, or laboratory evidence of immunity or disease. Documentation of healthcare provider-diagnosed disease without laboratory confirmation is not acceptable evidence of immunity.
Measles, Mumps, and Rubella Vaccination

Special populations

- Pregnant women who do not have evidence of immunity to rubella should receive 1 dose of MMR upon completion or termination of pregnancy and before discharge from the healthcare facility; non-pregnant women of childbearing age without evidence of rubella immunity should receive 1 dose of MMR.
- Adults with primary or acquired immunodeficiency including malignant conditions affecting the bone marrow or lymphatic system, systemic immunosuppressive therapy, or cellular immunodeficiency should not receive MMR.
- Adults with human immunodeficiency virus (HIV) infection and CD4+ T-lymphocyte count ≥200 cells/µl for at least 6 months who do not have evidence of measles, mumps, or rubella immunity should receive 2 doses of MMR at least 28 days apart. Adults with HIV infection and CD4+ T-lymphocyte count <200 cells/µl should not receive MMR.
- Adults who work in healthcare facilities should receive 2 doses of MMR at least 28 days apart;

Measles, Mumps, and Rubella Vaccination

Special populations

- Adults who are students in postsecondary educational institutions or plan to travel internationally should receive 2 doses of MMR at least 28 days apart.
- Adults who received inactivated (killed) measles vaccine or measles vaccine of unknown type during years 1963–1967 should be revaccinated with 1 or 2 doses of MMR.
- Adults who were vaccinated before 1979 with either inactivated mumps vaccine or mumps vaccine of unknown type who are at high risk for mumps infection, e.g., work in a healthcare facility, should be considered for revaccination with 2 doses of MMR at least 28 days apart.
Pneumococcal Vaccination

• General information
  – Adults who are immunocompetent and aged 65 years or older should receive 13-valent pneumococcal conjugate vaccine (PCV13) followed by 23-valent pneumococcal polysaccharide vaccine (PPSV23) at least 1 year after PCV13.

• Notes:
  – Adults are recommended to receive 1 dose of PCV13 and 1, 2, or 3 doses of PPSV23 depending on indication. When both PCV13 and PPSV23 are indicated, PCV13 should be administered first; PCV13 and PPSV23 should not be administered during the same visit.
  – If PPSV23 has previously been administered, PCV13 should be administered at least 1 year after PPSV23. When two or more doses of PPSV23 are indicated, the interval between PPSV23 doses should be at least 5 years. Supplemental information on pneumococcal vaccine timing for adults aged 65 years or older and adults aged 19 years or older at high risk for pneumococcal disease (described below) is available at [www.cdc.gov/vaccines/vpd/pneumo/downloads/pneumo-vaccine-timing.pdf](http://www.cdc.gov/vaccines/vpd/pneumo/downloads/pneumo-vaccine-timing.pdf).
  – No additional doses of PPSV23 are indicated for adults who received PPSV23 at age 65 years or older.
  – When indicated, PCV13 and PPSV23 should be administered to adults whose pneumococcal vaccination history is incomplete or unknown.

Pneumococcal Vaccination

Special Populations

– Adults aged 19 through 64 years with chronic heart disease; chronic lung disease; chronic liver disease; or diabetes mellitus; or who smoke cigarettes

– Adults aged 19 years or older with immunocompromising conditions or anatomical or functional asplenia

– Adults aged 19 years or older with cerebrospinal fluid leak or cochlear implant
Meningococcal Vaccine Recommendations

- All 11 to 12 year olds should be vaccinated with a meningococcal conjugate vaccine. Since protection wanes, a booster dose is recommended at age 16 years so adolescents have protection during the ages when they are at highest risk of meningococcal disease.
Meningococcal vaccination

• **Special populations**
  - Adults with anatomical or functional asplenia or persistent complement component deficiencies
  - Adults with human immunodeficiency virus (HIV) infection who have not been previously vaccinated
  - Microbiologists who are routinely exposed to isolates of Neisseria meningitidis
  - Adults at risk because of a meningococcal disease outbreak
  - Adults who travel to or live in countries with hyperendemic or epidemic meningococcal disease
  - Military recruits
  - First-year college students aged 21 years or younger who live in residence halls

Varicella Vaccination

**General information**

• Adults without evidence of immunity to varicella (defined below) should receive 2 doses of single-antigen varicella vaccine (VAR) 4–8 weeks apart, or a second dose if they have received only 1 dose.

• Persons without evidence of immunity for whom VAR should be emphasized are:
  - adults who have close contact with persons at high risk for serious complications, e.g., healthcare personnel and household contacts of immunocompromised persons;
  - adults who live or work in an environment in which transmission of varicella zoster virus is likely, e.g., teachers, childcare workers, and residents and staff in institutional settings; adults who live or work in environments in which varicella transmission has been reported, e.g., college students, residents and staff members of correctional institutions, and military personnel;
  - non-pregnant women of childbearing age; adolescents and adults living in households with children; and international travelers.

• Notes: Evidence of immunity to varicella in adults is: U.S.-born before 1980 (for pregnant women and healthcare personnel, U.S.-born before 1980 is not considered evidence of immunity); documentation of 2 doses of VAR at least 4 weeks apart; history of varicella or herpes zoster diagnosis or verification of varicella or herpes zoster disease by a healthcare provider; or laboratory evidence of immunity or disease.
Varicella vaccination

- **Special populations**
  - Pregnant women should be assessed for evidence of varicella immunity. Pregnant women who do not have evidence of immunity should receive the first dose of VAR upon completion or termination of pregnancy and before discharge from the healthcare facility, and the second dose 4–8 weeks after the first dose.
  - Healthcare institutions should assess and ensure that all healthcare personnel have evidence of immunity to varicella.
  - Adults with malignant conditions, including those that affect the bone marrow or lymphatic system or who receive systemic immunosuppressive therapy, should **not** receive VAR.
  - Adults with human immunodeficiency virus (HIV) infection and CD4+ T-lymphocyte count ≥200 cells/µl may receive 2 doses of VAR 3 months apart. Adults with HIV infection and CD4+ T-lymphocyte count <200 cells/µl should **not** receive VAR.

Shingles (Herpes Zoster)

- Almost 1/3 people in the US will develop shingles in their lifetime.
- About 1 million cases each year in the US
- Anyone who has recovered from chickenpox may develop shingles
- Risk increases as you get older.
- About half of all cases occur in people > 60 yrs old
- Increased risk in people who:
  - have medical conditions that keep their immune systems from working properly,
  - receive immunosuppressive drugs, such as steroids and drugs that are given after organ transplantation.
Zostavax

- Zoster vaccine contains a minimum of 19,400 PFU of Oka/Merck strain of varicella zoster virus.
- Zoster vaccine is administered subcutaneously as a single dose in the deltoid region.
- Licenses by the FDA in 2006 for people age 50 and over
- ACIP recommends for people age 60 and over
- Reduces the development of shingles by 51%
- Reduces the risk of Post–herpetic neuralgia by 67%
- One dose

Zostavax

- Zoster vaccine should not be administered to:
  - A person who has ever had a life-threatening or severe allergic reaction to gelatin, the antibiotic neomycin, or any other component of shingles vaccine.
  - A person who has a weakened immune system because of:
    - HIV/AIDS or another disease that affects the immune system,
    - treatment with drugs that affect the immune system, such as steroids,
    - cancer treatment such as radiation or chemotherapy, or
    - cancer affecting the bone marrow or lymphatic system, such as leukemia or lymphoma.
- Women who are or might be pregnant. Women should not become pregnant until at least 4 weeks after getting zoster vaccine.
Shingrix

- Non-live, recombinant subunit vaccine given intramuscular in two doses
- Not indicated to prevent chicken pox
- Clinical Trials
  - 38,000 people
  - 90% efficacy across all age groups in preventing shingles
  - The most common side effects are pain, redness, and swelling at the injection site, muscle pain, tiredness, headache, shivering, fever, and upset stomach.

Shingrix

- Approved by the FDA October 20, 2017
- ACIP October 25th, 2017
  - recommended for healthy adults aged 50 years and older to prevent shingles and related complications
  - recommended for adults who previously received the current shingles vaccine (Zostavax®) to prevent shingles and related complications
  - the preferred vaccine for preventing shingles and related complications
- Awaiting approval from CDC Director and publication in MMWR to become official policy
Efficacy of an Adjuvanted Herpes Zoster Subunit Vaccine in Older Adults

Himal Lal, M.D., Anthony L. Cunningham, M.B., B.S., M.D., Olivier Godeaux, M.D., Roman Chlibek, M.D., Ph.D., Javier Diez-Domingo, M.D., Ph.D., Shinn-Jang Hwang, M.D., Myron J. Levin, M.D., Janet E. McElhaney, M.D., Aini Poder, M.D., Joan Puig-Barberà, M.D., M.P.H., Ph.D., Timo Vesikari, M.D., Ph.D., Daisuke Watanabe, M.D., Ph.D., Lily Weckx, M.D., Ph.D., Toufik Zahaf, Ph.D., and Thomas C. Heineman, M.D., Ph.D.,
for the ZOE-50 Study Group*

Table 2. Vaccine Efficacy against the First or Only Episode of Herpes Zoster Infection.*

<table>
<thead>
<tr>
<th>Cohort and Age Group</th>
<th>HZ/su Group</th>
<th>Placebo Group</th>
<th>Vaccine Efficacy†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Confirmed Cases</td>
<td>Cumulative Followup Period ⊖</td>
<td>Rate of Herpes Zoster no./1000 person-yr</td>
</tr>
<tr>
<td>Modified vaccinated cohort</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All participants in cohort</td>
<td>7444</td>
<td>23,297.0</td>
<td>0.3</td>
</tr>
<tr>
<td>50–59 yr</td>
<td>3492</td>
<td>11,161.3</td>
<td>0.3</td>
</tr>
<tr>
<td>60–69 yr</td>
<td>2141</td>
<td>7,007.9</td>
<td>0.3</td>
</tr>
<tr>
<td>70 yr or older</td>
<td>1711</td>
<td>5,127.9</td>
<td>0.2</td>
</tr>
<tr>
<td>Total vaccinated cohort</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All participants in cohort</td>
<td>7698</td>
<td>25,584.5</td>
<td>0.4</td>
</tr>
<tr>
<td>50–59 yr</td>
<td>3645</td>
<td>12,244.9</td>
<td>0.2</td>
</tr>
<tr>
<td>60–69 yr</td>
<td>2244</td>
<td>7,674.1</td>
<td>0.7</td>
</tr>
<tr>
<td>70 yr or older</td>
<td>1809</td>
<td>5,665.5</td>
<td>0.2</td>
</tr>
</tbody>
</table>

* The total vaccinated cohort included all vaccinated participants for whom data related to efficacy end points were available. The modified vaccinated cohort excluded participants who died, were lost to follow-up, or who received a confirmed diagnosis of herpes zoster within 1 month after the second dose. Efficacy was calculated by means of the Poisson method.
Efficacy of the Herpes Zoster Subunit Vaccine in Adults 70 Years of Age or Older


Figure 2. Risk of Development of Herpes Zoster after Vaccination.

Shown are the Kaplan-Meier estimates of the cumulative incidence (expressed as the percentage of the participants at risk) of the development of herpes zoster during the period from 30 days after receiving the second dose of ZEOz to placebo to the end of follow-up. The number of cases of herpes zoster occurring at each month were calculated by subtracting the cumulative number of cases at the beginning of each month from the cumulative number at the end of the month. Cases occurring at the end of follow-up were censored at 48 months after the second dose of ZEOz. Some cases occurred after 48 months. In each panel, the inset shows the same data on an expanded y-axis.
Figure 3. Risk of Development of Postherpetic Neuralgia after Vaccination in the Trained Population.

Shown are the Kaplan-Meier estimates of the cumulative incidence (expressed as the percentage of the participants at risk) of the development of postherpetic neuralgia during the period from 30 days after receipt of the second dose of HZ-Jynx or placebo to the end of follow-up in the general 2006-09 and 2009-10 populations. Because of the declining number of participants at risk, the Kaplan-Meier curves have been truncated at 48 months after the second dose of HZ-Jynx. Some cases occurred after 48 months. In each panel, the line shows the same data on an expanded y-axis.
SUMMARIZING THE FINDINGS ON INCREASING APPROPRIATE VACCINATION

All Task Force findings and recommendations on improving vaccination rates are available online at www.thecommunityguide.org/vaccines. Some of the Task Force recommendations related to increasing vaccination coverage are below.

- **Enhancing access to services.** Interventions that make it easier for people to get vaccinated can increase the number of people vaccinated. Interventions that have proven successful include the following:
  - Reducing out-of-pocket costs by paying for vaccinations, providing insurance coverage, or reducing copayments.
  - Providing vaccinations in schools and organized child care centers.
  - Coordinating vaccination interventions in WIC, Infants and Children (WIC) settings, where assessment of children's immunization status and referral to a vaccination provider is combined with additional interventions or provision of vaccines on-site.
  - Frame sites can also increase vaccination rates, but may be expensive and labor-intensive.

- **Increasing community demand.** Programs and systems that encourage people to get vaccinated can increase coverage. Notifying people when they are due or late for a vaccination can remind them to follow through. These reminders and recalls can work in a range of settings, from individual healthcare centers to entire communities. Rewarding people with food vouchers, gift cards, and other prizes for keeping up with their immunizations can also boost rates. Laws and policies that require vaccinations as a prerequisite for attending child care, school, or college can increase coverage and reduce vaccine-preventable diseases in the community.

  - A coordinated approach that combines community-based interventions that enhance access to services, increase community demand, and reduce opportunities to vaccinate that are missed by providers can increase coverage for a community. Combined approaches can be particularly effective for children and older adults.

- **Using provider- or system-based interventions.** Putting systems, tools, or protocols in place in healthcare settings can improve use of vaccines. These may be particularly effective when combined with other vaccination interventions. Strong evidence supports the following healthcare-based interventions:
  - Establishing computerized immunization tracking systems.
  - Evaluating providers' vaccination records and giving feedback on their performance.
  - Using chart cues, computerized alerts, checklists, or other tools to remind providers when patients are due for vaccinations.
  - Establishing standing orders or policies that allow non-physician personnel to administer vaccines.
Human Papillomavirus

HPV causes:

- 99% of cervical cancers
- 95% of anal cancers
- 70% of throat and neck cancers
- 65% of vaginal cancers
- 50% of vulvar cancers
- 35% of penile cancers

Estimated ≥1 dose HPV vaccination coverage among adolescents aged 13–17 years

Data source: National Immunization Survey-Teen (NIS-Teen)

Up-to-date HPV vaccination coverage among adolescents aged 13–17 years (2016)

Data source: National Immunization Survey-Teen (NIS-Teen)
Estimated vaccination coverage among adolescents aged 13–17 years —2016

Data source: National Immunization Survey-Teen (NIS-Teen)

*Up-to-date includes those with ≥3 doses, and those with 2 doses when the first HPV vaccine dose was initiated before age 15 years and time between the first and second dose was at least 5 months minus 4 days.

Texas adolescent vaccination gap
Estimated up-to-date HPV vaccination coverage among adolescents aged 13–17 years — 2016

Data source: National Immunization Survey-Teen (NIS-Teen)

Estimated Up-to-Date HPV vaccination coverage among adolescents aged 13–17 years by Race/Ethnicity — 2016

Data source: National Immunization Survey-Teen (NIS-Teen)
Estimated Up-to-Date HPV vaccination coverage among adolescents aged 13–17 years by urbanicity — 2016

Data source: National Immunization Survey-Teen (NIS-Teen)

MSA = Metropolitan Statistical Area. An MSA must have at least one urbanized area of 50,000 or more inhabitants, as defined by the United States Office of Management and Budget.

Key Points

Texas adolescents are less likely than their peers in other states to have been vaccinated against HPV, but similarly likely to have received other adolescent vaccines.

In 2016, the proportion of adolescents who received at least one HPV vaccination was 36 percentage points lower than the proportion that received the other recommended adolescent vaccines.

Substantial variation in HPV vaccination coverage exists across the state.

El Paso’s HPV vaccine coverage level is on par with states with the highest coverage levels, while coverage in Dallas is below that of all other states. Data suggest that rural areas may have lower coverage than urban areas.
Texas State HPV Medicaid Healthcare Costs

Direct Costs
- Cases of HPV-associated cancer were identified by Medicaid ICD-9-CM dx codes.
- In 2013, the total direct cost to the State of Texas from HPV-associated cancers amounted to $77.7 million, including $51.4 million for diagnosis and treatments and $26.3 million for costs associated with consequences from treatment.

Indirect Costs
- Indirect costs were quantified using present value of lifetime earnings (PVLE) lost due to cancer mortality.
- In 2013, there were 362 deaths from cervical cancer in Texas.
- Losses per death were $543,277, which amounts to a total loss of $196.6 million to the economy.
### Figure 1: Fiscal Year 2013 Medicaid Costs Associated with Consequences of Cancer Treatment in Texas (HHSC Medicaid)

<table>
<thead>
<tr>
<th>HPV-Related Cancers</th>
<th>Number of Cases</th>
<th>Treatment Cost</th>
<th>Adjusted Cost</th>
<th>Consequences Cost</th>
<th>Adjusted Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anus</td>
<td>1,095</td>
<td>$4,538,176</td>
<td>$4,129,740</td>
<td>$1,714,297</td>
<td>$1,560,011</td>
</tr>
<tr>
<td>Rectal</td>
<td>3,649</td>
<td>$15,253,967</td>
<td>$13,881,110</td>
<td>$6,333,531</td>
<td>$5,763,513</td>
</tr>
<tr>
<td>Cervix</td>
<td>6,676</td>
<td>$15,719,639</td>
<td>$14,304,871</td>
<td>$8,286,408</td>
<td>$7,540,631</td>
</tr>
<tr>
<td>Oropharyngeal</td>
<td>6,715</td>
<td>$23,058,737</td>
<td>$16,561,116</td>
<td>$13,448,840</td>
<td>$9,414,188</td>
</tr>
<tr>
<td>Penis</td>
<td>335</td>
<td>$726,857</td>
<td>$457,920</td>
<td>$458,402</td>
<td>$288,793</td>
</tr>
<tr>
<td>Vulva and Vagina</td>
<td>1,353</td>
<td>$2,969,446</td>
<td>$2,078,612</td>
<td>$2,495,159</td>
<td>$1,746,611</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>19,823</strong></td>
<td><strong>$51,413,369</strong></td>
<td><strong>$26,313,747</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Figure 2: Fiscal Year 2013 Cervical Cancer Deaths and Present Value of Life-Time Earnings (PVLE) by Age in Texas (DSHS, Center for Program Coordination and Health Policy)

<table>
<thead>
<tr>
<th>Age</th>
<th>Number of Deaths</th>
<th>Total PVLE</th>
<th>PVLE Per Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 24</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25-44</td>
<td>87</td>
<td>$99,920,894</td>
<td>$1,148,516</td>
</tr>
<tr>
<td>45-64</td>
<td>184</td>
<td>$93,016,541</td>
<td>$505,253</td>
</tr>
<tr>
<td>65-74</td>
<td>48</td>
<td>$3,378,848</td>
<td>$70,393</td>
</tr>
<tr>
<td>75-84</td>
<td>32</td>
<td>$339,580</td>
<td>$10,612</td>
</tr>
<tr>
<td>85+</td>
<td>11</td>
<td>$10,359</td>
<td>$942</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>362</strong></td>
<td><strong>$196,666,222</strong></td>
<td><strong>$543,277</strong></td>
</tr>
</tbody>
</table>

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• “Barriers to Vaccine Coverage Both the 2014 NIS-Teen and the University of Texas MD Anderson’s HPV Vaccine Uptake in Texas Pediatric Care Settings: 2014-2015 Environmental Scan Report concur that the greatest barrier to HPV vaccination is a lack of provider recommendation. Only 53 percent of Texas adolescents received a recommendation. This can be attributed to several factors, including:
  – Limited provider knowledge of HPV-associated diseases
  – Lack of awareness of optimal immune response data (timing of vaccine administration)
  – Limited understanding of HPV recommendations (i.e., three-dose series, no STI testing required)
  – Limited time to discuss HPV vaccine due to competing priorities
• Other factors identified by the University of Texas MD Anderson environmental scan include lack of materials in languages other than English, cost concerns, and complex insurance rules.”

Methods to Increase Vaccine Coverage

• “In order to increase HPV vaccine coverage among the recommended population and address identified barriers to coverage, HHSC and DSHS have identified several strategies:
  – Educate clinicians about the best strategies for counseling and recommending vaccines to patients.
  – If a vaccination series has been started, the next dose should be scheduled before the patient leaves the office.
  – Reminder/recall strategies could be established to ensure that patients return for all remaining doses.
  – Improve the use of ImmTrac’s reminder/recall functionality to improve second and third dose rates.”
“While several strategies for increasing vaccination, screening, and treatment rates have been mentioned throughout the report, those listed below have been identified as key for preventing HPV and HPV-associated cancers statewide.

- Improve provider education through increased outreach and training
- Increase client access to programs that provide prevention, screening, diagnostic, and treatment services
- Improve public awareness through public and private partnerships
- Strengthen collaboration among state agencies, professional associations, academic institutions, coalitions, and others interested in reducing HPV-associated cancers in order to leverage resources and improve coordination"
You are the Key to HPV Cancer Prevention

Speaker Name
Speaker Title
Speaker Affiliation

{Updated October 12, 2017; Replace with date of Presentation}

HPV Types Differ in their Disease Associations

~40 Types
Mucosal sites of infection

High risk (oncogenic)
HPV 16, 18 most common

Cervical Cancer
Anogenital Cancers
Oropharyngeal Cancer
Cancer Precursors
Low Grade Cervical Disease

Cutaneous sites of infection

Low risk (non-oncogenic)
HPV 6, 11 most common

Genital Warts
Laryngeal Papillomas
Low Grade Cervical Disease

"Common"
Hand and Foot Warts

~ 80 Types
### Cancers Caused by HPV per Year, U.S., 2009-2013

<table>
<thead>
<tr>
<th>Cancer site</th>
<th>Percentage probably caused by any HPV type</th>
<th>Number probably caused by any HPV type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Cervix</td>
<td>91%</td>
<td>10,600</td>
</tr>
<tr>
<td>Vagina</td>
<td>75%</td>
<td>600</td>
</tr>
<tr>
<td>Vulva</td>
<td>69%</td>
<td>2,500</td>
</tr>
<tr>
<td>Penis</td>
<td>63%</td>
<td>0</td>
</tr>
<tr>
<td>Anus</td>
<td>91%</td>
<td>3,200</td>
</tr>
<tr>
<td>Rectum</td>
<td>91%</td>
<td>500</td>
</tr>
<tr>
<td>Oropharynx</td>
<td>70%</td>
<td>2,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>19,400</td>
<td>12,100</td>
</tr>
</tbody>
</table>

Based on Viens et al. MMWR 2016. [https://www.cdc.gov/cancer/hpv/statistics](https://www.cdc.gov/cancer/hpv/statistics)

### HPV-Associated Cancers per Year, United States, 2009–2013

Based on Viens et al. MMWR 2016. [https://www.cdc.gov/cancer/hpv/statistics](https://www.cdc.gov/cancer/hpv/statistics)
HPV-Associated Cancer Rates by Sex, Race and Ethnicity, United States, 2009–2013


HPV-Associated Oropharyngeal Cancer Rates by Sex, Race and Ethnicity, United States, 2009–2013

HPV-Associated Cervical Cancer Rates by Race and Ethnicity, United States, 2009–2013


HPV Prophylactic Vaccines

- Recombinant L1 capsid proteins that form “virus-like” particles (VLP)
- Non-infectious and non-oncogenic
- Produce higher levels of neutralizing antibody than natural infection
HPV Vaccine Comparison

Genital warts 63% of cancers in body parts where HPV DNA is often found

HPV Vaccine

HPV Types Included in Vaccine

6 11 16 18 31 33 45 52 58

Bivalent
Quadrivalent
9-valent

10% of cancers in body parts where HPV DNA is often found

Adapted from Petrosky et al. MMWR. 2015.

HPV Vaccine Recommendation

CDC recommends routine vaccination at age 11 or 12 years to prevent HPV cancers

- The vaccination series can be started at age 9 years
- Two doses of vaccine are recommended
- The second dose of the vaccine should be administered 6 to 12 months after the first dose.

Meites et al. MMWR. 2016.
HPV Vaccine Recommendations: Catch Up/Late

- Vaccination for females through age 26 years and for males through age 21 years who were not previously adequately vaccinated. Males aged 22 through 26 years may be vaccinated.
- Vaccination is also recommended through age 26 for gay, bisexual, and other men who have sex with men (MSM), transgender people, and people with certain immunocompromising conditions (including HIV infection).

Dosing Schedules

Starting the vaccine series before the 15th birthday

Recommended schedule is 2 doses of HPV vaccine
- Second dose should be administered 6–12 months after the first dose (0, 6–12 month schedule)
- Minimum interval between dose one and dose two in a 2-dose schedule is 5 months

Starting the vaccine series on or after the 15th birthday*

Recommended schedule is 3 doses of HPV vaccine
- Second dose should be administered 1–2 months after the first dose, and the third dose should be administered 6 months after the first dose (0, 1–2, 6 month schedule)
- Minimum interval between dose one and dose three in a 3-dose schedule is 5 months

*and immunocompromised persons 9–26 years
HPV Vaccination is Recommended at Age 11 or 12 Years

Girls & Boys can start HPV vaccination at age 9

Preteens should finish the HPV vaccine series before their 13th birthday

Plus girls 13-26 years old who haven’t started or finished HPV vaccine series

HPV VACCINE SAFETY
United States Vaccine Safety System

<table>
<thead>
<tr>
<th>System</th>
<th>Collaborators</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaccine Adverse Event Reporting System (VAERS)</td>
<td>CDC and FDA</td>
<td>Frontline spontaneous reporting system to detect potential vaccine safety issues</td>
</tr>
<tr>
<td>Vaccine Safety Datalink (VSD)</td>
<td>CDC and 9 Integrated Health Care Systems</td>
<td>Large linked database system used for active surveillance and research ~9.4 million members (~3% of US pop.)</td>
</tr>
<tr>
<td>Clinical Immunization Safety Assessment (CISA) Project</td>
<td>CDC and 7 Academic Centers</td>
<td>Expert collaboration that conducts individual clinical vaccine safety assessments and clinical research</td>
</tr>
<tr>
<td>Post-Licensure Rapid Immunization Safety Monitoring Program (PRISM)</td>
<td>FDA and 6 partner organizations</td>
<td>Large distributed database system used for active surveillance and research ~170 million individuals (~53 of US pop)</td>
</tr>
</tbody>
</table>

Over 10 Years of HPV Vaccine Safety Data

- HPV vaccine is safe
- Reactions after vaccination may include
  - Injection site reactions: pain, redness, and/or swelling in the arm where the shot was given
  - Systemic: fever, headaches
- HPV vaccines should not be given to anyone who has had a previous allergic reaction to the vaccine or who has an allergy to yeast (Gardasil/Gardasil 9)
- Brief fainting spells (syncope) and related symptoms (such as jerking movements) can happen soon after any injection, including HPV vaccine
- Patients should be seated (or lay down) during vaccination and remain in that position for 15 minutes

Evaluating and Monitoring 9-valent HPV Vaccine Safety in the United States

Monitoring of VAERS Reports
- Clinical review of deaths and other pre-specified adverse events
- Data mining to identify disproportional reporting

Vaccine Safety Datalink
- Near real time monitoring of 10 pre-specified outcomes
- Evaluation of spontaneous abortion

Sentinel System
- Near real time active surveillance and surveillance of serious, unexpected events
- Evaluation of spontaneous abortion

Manufacturer post-marketing commitments
- Two, 10-year studies to assess long term safety
- Observational study to further characterize the safety profile in 10,000 persons
- Pregnancy registry

HPV Vaccination is Safe

HPV vaccine safety studies have been very reassuring: HPV vaccine has a good safety profile. To date, we have not observed any signal that shows that HPV vaccination causes death, neurologic conditions, autoimmune conditions, or venous thromboembolism (VTE).

Clinicians can reassure parents who may have concerns, that HPV vaccination is safe.

HPV VACCINE IMPACT

HPV vaccine impact monitoring

- Post licensure evaluations are important to evaluate real world effectiveness of vaccines
- Population impact against early and mid outcomes have been reported:
  - **HPV prevalence**
    - Australia, Norway, Denmark, Sweden, UK, US
  - **Genital warts**
    - Australia, New Zealand, Denmark, Sweden, Germany, Quebec, US
  - **Cervical lesions**
    - Australia, British Columbia, Denmark, Sweden, US
Vaccine type prevalence, NHANES

**Early** vaccine era compared to pre-vaccine era

![Graph showing prevalence comparison between pre-vaccine era and early vaccine era.](image)

Markowitz et al. JID 2013;208:385-393

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Vaccine type prevalence, NHANES

**Later** vaccine era compared to pre-vaccine era

![Graph showing prevalence comparison between pre-vaccine era and later vaccine era.](image)

Oliver et al. JID 2017
Impact of HPV vaccination in Australia

Proportion of Australian born females and males diagnosed as having genital warts at first visit, by age group, 2004-11

Systematic Review and Meta-Analysis: Population-Level Impact of HPV Vaccination

- Review of 20 studies in 9 high income countries
- In countries with >50% coverage, among 13-19 year olds
  - HPV 16/18 prevalence decreased at least 68%
  - Anogenital warts decreased by ~61%
- Evidence of herd effects
- Some evidence of cross protection against other types
HPV Vaccine
Duration of Protection

- Studies suggest that vaccine protection is long-lasting
- No evidence of waning protection
  - Available evidence indicates protection for at least 10 years
  - Multiple studies are in progress to monitor

HPV Vaccination Is Safe, Effective, and Provides Lasting Protection

HPV Vaccine is SAFE
- Benefits far outweigh any potential risks
- Safety studies findings for HPV vaccination are reassuring and similar to MenACWY and Tdap vaccine safety reviews

HPV Vaccine WORKS
- Population impact against early and mid outcomes have been reported in multiple countries

HPV Vaccine Protection LASTS
- Studies suggest that vaccine protection is long-lasting
- No evidence of waning protection
Talking about HPV vaccine

FRAMING THE CONVERSATION

Adolescent Vaccination Coverage
United States, 2006-2016

* APD = Adequate provider data
Reagan-Steiner et al. MMWR 2016.
Impact of Eliminating Missed Opportunities by Age 13 Years in Girls Born in 2000

Reasons parents won’t initiate HPV vaccination for children

Stokley et al. MMWR. 2014.
Value Parents Place on the Vaccines

<table>
<thead>
<tr>
<th>Vaccines</th>
<th>Median Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meningitis</td>
<td>9.4</td>
</tr>
<tr>
<td>Hepatitis</td>
<td>9.5</td>
</tr>
<tr>
<td>Pertussis</td>
<td>9.5</td>
</tr>
<tr>
<td>Influenza</td>
<td>9.3</td>
</tr>
<tr>
<td>HPV</td>
<td>9.3</td>
</tr>
<tr>
<td>Adolescent</td>
<td>9.2</td>
</tr>
</tbody>
</table>

Adapted from Healy et al. Vaccine. 2014.

Clinician estimations

<table>
<thead>
<tr>
<th>Vaccines</th>
<th>Parent Median Value</th>
<th>Clinician's estimate Median Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meningitis</td>
<td>9.492</td>
<td>9.2</td>
</tr>
<tr>
<td>Hepatitis</td>
<td>9.592</td>
<td>9.2</td>
</tr>
<tr>
<td>Pertussis</td>
<td>9.593</td>
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</table>

Adapted from Healy et al. Vaccine. 2014.
Clinicians underestimate the value parents place on HPV vaccine

Adapted from Healy et al. Vaccine. 2014.

“\textit{The perceived and real concerns of parents influence how the clinician recommends and administers HPV vaccine.}”
Give an Effective Recommendation to Receive HPV Vaccine at Ages 11 or 12

- An effective recommendation from you is the main reason parents decide to vaccinate
- Many moms in focus groups stated that they trust their child’s doctor and would get the vaccine for their child as long as they received a recommendation from the doctor

What is an EFFECTIVE recommendation for HPV vaccination?

Same Way

Same Day

Make an Effective Recommendation

► Same way: Effective recommendations group all of the adolescent vaccines
Recommend HPV vaccination the same way you recommend Tdap & meningococcal vaccines.

► Same day: Recommend HPV vaccine today
Recommend HPV vaccination the same day you recommend Tdap & meningococcal vaccines.

Your preteen needs three vaccines today to protect against meningitis, HPV cancers, and pertussis.

Thank you!