Shots in Arms: Adolescent Immunizations

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Learning Objectives

After the session, learners will be able to:

• Restate the current Advisory Committee on Immunization Practices (ACIP) recommendations for adolescent vaccines
• Explain the benefits of adolescent vaccines
• Implement one new strategy to improve adolescent vaccination rates in the office

The Immunization Schedule: New Recommendation Highlights
TDAP

- Routinely recommended for those 11–18 yr of age, preferred age 11–12 yr
- For those 7–10 yr not fully vaccinated, first dose of any catch-up vaccines to be Tdap
- A person 19 yr or older who has not received Tdap should receive one dose
- Tdap should be administered to pregnant women with each pregnancy between weeks 27 and 36 gestation
- Tdap for new mothers not previously immunized
### Tdap Efficacy

<table>
<thead>
<tr>
<th>Year after Tdap Vaccination</th>
<th>Tdap Vaccine Efficacy (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>68.8 (59.7, 75.9)</td>
</tr>
<tr>
<td>Year 2</td>
<td>56.9 (41.3, 68.4)</td>
</tr>
<tr>
<td>Year 3</td>
<td>25.2 (−4.3, 46.4)</td>
</tr>
<tr>
<td>Year 4</td>
<td>8.9 (−30.6, 36.4)</td>
</tr>
</tbody>
</table>

Analysis included 1207 pertussis cases among 279,493 persons: 792,418 person years from Jan. 2006 to March 2015. All subjects had received exclusively DTaP in infancy/childhood.


From ACIP meeting, CDC, Atlanta, GA, October 19, 2016

### HPV Vaccine Recommendation

- All males and females age 11–12 years should receive a 2–dose series (0, 6–12 months). The series can start at age 9 yr.
- For those initiating the series at age 15 yr or older, a 3–dose series is indicated (0, 1–2, 6 months).
- Those with a history of sexual abuse should initiate the series at age 9 yr.
- Administer to all females who have not received vaccination to age 26 yr; males through age 21 or 26 years.
### Cancers Attributed to HPV, U.S.

<table>
<thead>
<tr>
<th>Cancer site</th>
<th>Average number of cancers per year in sites where HPV is often found</th>
<th>Percentage of cancers per year probably caused by HPV</th>
<th>Average number of cancers per year probably caused by HPV†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Both Sexes</td>
</tr>
<tr>
<td>Anus</td>
<td>1,549</td>
<td>2,821</td>
<td>4,370</td>
</tr>
<tr>
<td>Cervix</td>
<td>0</td>
<td>11,422</td>
<td>11,422</td>
</tr>
<tr>
<td>Oropharynx</td>
<td>9,074</td>
<td>2,443</td>
<td>12,417</td>
</tr>
<tr>
<td>Penis</td>
<td>1,046</td>
<td>0</td>
<td>1,046</td>
</tr>
<tr>
<td>Vagina</td>
<td>0</td>
<td>735</td>
<td>735</td>
</tr>
<tr>
<td>Vulva</td>
<td>0</td>
<td>3,588</td>
<td>3,588</td>
</tr>
<tr>
<td>Total</td>
<td>12,571</td>
<td>20,589</td>
<td>33,160</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>14–19 yrs of age</td>
<td>11.5%</td>
<td>4.3%</td>
</tr>
<tr>
<td>20–24 yrs of age</td>
<td>18.5%</td>
<td>12.1%</td>
</tr>
</tbody>
</table>

Markowitz L et al. Pediatrics 2016; e 20151968

### Relative Contribution of HPV Types in 9vHPV Vaccine to Cervical Cancers Worldwide

Follow-up through month 36
- 2 doses (0, 6 months) in 9 to 13 year olds
- 3 doses (0, 2, 6 months) in 9 to 13 year olds
- 3 doses (0, 1, 6 months) in 16 to 26 year olds
Antibody kinetics similar in 3 groups

Markowitz L. Presented at ACIP October 2016 Meeting.
HPV Products

- 4vHPV no longer available in the United States
- 2vHPV no longer available in the United States
- 9vHPV is the only product available in the United States

HPV vaccine received now in the United States is 9vHPV

Important Messages for HPV Vaccination

- It is time to get your adolescent vaccines: Tdap, HPV and meningococcal vaccines...
- The HPV vaccine PREVENTS CANCER!
- The immune response is more vigorous in younger adolescents.
- Nearly everyone gets the virus at some point in their lifetime.
- You don’t have to have sex to get the virus.
- I strongly recommend the vaccine – my child(ren)/nieces/nephews had this vaccine.
Announce versus Converse

- Pediatrics January 2017 (early release)
- Noel Brewer et al.; HPV vaccine
- Intervention practices – announced the vaccines and discussed vaccines if needed
- Conversation practices – discussed vaccines first, recommended HPV vaccine strongly
- Intervention clinic vaccination rates exceeded controls by 5.4%
- Conversation clinic vaccination rates same as controls

HPV vaccine is CANCER PREVENTION.
www.cdc.gov/vaccines/teens

Recommendations for Use of MenACWY

- Routinely recommended:
  - Adolescents age 11–12 yrs; booster dose age 16 yrs
  - For those receiving the first dose at age 16 years or older, a booster dose is not required
  - Routine vaccination not recommended after age 21 years
  - Provide 2-dose primary series to those at higher risk
- High-risk persons age 2 months through 55 yrs
  - Complement deficiency (including Eculizumab® users)
  - Functional / anatomic asplenia
  - HIV infection
  - Microbiologists routinely exposed; military recruits
  - Outbreak response
  - Appropriate dosing for those 2 months to 2 yrs
  - Boosting: q 3 yrs under age 7 yrs; q 5 yrs thereafter
**Decreasing Incidence of Serogroup C, W, Y Meningococcal Disease in 11–19 Year Olds**

<table>
<thead>
<tr>
<th>Year</th>
<th>Incidence per 100,000 (95% confidence intervals)</th>
<th>&lt;1 year</th>
<th>11–19 years</th>
<th>≥20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-2005</td>
<td>0.77 (0.33, 1.55)</td>
<td>0.27 (0.17, 0.39)</td>
<td>0.17 (0.14, 0.21)</td>
<td></td>
</tr>
<tr>
<td>2006-2007</td>
<td>1.20 (0.61, 2.11)</td>
<td>0.31 (0.21, 0.45)</td>
<td>0.23 (0.19, 0.28)</td>
<td></td>
</tr>
<tr>
<td>2008-2009</td>
<td>0.93 (0.46, 1.69)</td>
<td>0.15 (0.08, 0.26)</td>
<td>0.23 (0.19, 0.27)</td>
<td></td>
</tr>
<tr>
<td>2010-2011</td>
<td>1.37 (0.74, 2.33)</td>
<td>0.06 (0.02, 0.12)</td>
<td>0.14 (0.11, 0.18)</td>
<td></td>
</tr>
<tr>
<td>2012-2013</td>
<td>0.74 (0.39, 1.32)</td>
<td>0.06 (0.02, 0.10)</td>
<td>0.12 (0.10, 0.15)</td>
<td></td>
</tr>
</tbody>
</table>

* 80% decrease in serogroup C, W, Y meningococcal disease among 11–19 year olds

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**Incidence of Meningococcal Disease by Age and Serogroup, United States, 2005-2012**

Slide courtesy of Dr. Carol Baker

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**Annual Burden of Disease for 11–24 Year Olds**

<table>
<thead>
<tr>
<th></th>
<th>CASES</th>
<th>DEATHS</th>
<th>SEQUELAE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serogroup B</td>
<td>54–67</td>
<td>5–10</td>
<td>5–13</td>
</tr>
<tr>
<td>Serogroup C &amp; Y</td>
<td>62–77</td>
<td>6–12</td>
<td>6–15</td>
</tr>
</tbody>
</table>

* Majority (80%) of serogroup B cases occurred among those 16–24 years of age.

Presented at ACIP, June, 2015.
Recommendations for Use of Meningococcal Serogroup B Vaccines*

- Routinely recommended for high-risk persons age 10 years and older
  - Complement deficiency (including Eculizumab® users)
  - Functional / anatomic asplenia
  - Microbiologists routinely exposed
  - Outbreak response
  - No preference for 2 vs 3-dose vaccines
- Grade B (permissive) recommendation
  - May be given to 16-23 yr old to prevent disease; preferred age is 16-18 yr of age
  - May be given with other adolescent vaccines
  - No preference; start and complete using same product

* Approved at the February 26, 2015 and June, 2015 ACIP Meetings

MenB Vaccines

<table>
<thead>
<tr>
<th>Product</th>
<th>FDA License</th>
<th>Antigens</th>
<th>Dose Schedule</th>
<th>Immuno-</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Trumenba® (Pfizer)</td>
<td>Oct. 29, 2014</td>
<td>2 components: fHbp subfamily A/v2,3; subfamily B/v1</td>
<td>0, 2, 6 months for high risk; 0, 6 months for healthy adolescents</td>
<td>86-99% achieve protective titer (US/young adults) (~95% strain)</td>
<td></td>
</tr>
<tr>
<td>Bexsero® (Novartis)</td>
<td>Jan. 23, 2015</td>
<td>4 components: fHbp subfamily B/v1; NhbA; NadA; Por A1.4</td>
<td>0, 1 month</td>
<td>73-93% achieve protective titer (US/Polish adults/young adults) (~91% strain)</td>
<td></td>
</tr>
</tbody>
</table>

*Data not directly comparable between products; no data currently available for specific risk groups

One Comment About Safety...
Importance of High Coverage Rates

- Vaccination protects individuals from disease.
- When vaccination rates are low, disease outbreaks occur.
- High vaccination rates protect those who cannot receive/do not respond to vaccination.

NIS-Teen Coverage Results (%)

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Tdap after 10 yrs</td>
<td>40.8</td>
<td>53.6</td>
<td>68.7</td>
<td>78.2</td>
<td>84.6</td>
<td>86.0</td>
<td>87.6</td>
<td>86.4</td>
</tr>
<tr>
<td>≥3 HepB</td>
<td>87.9</td>
<td>89.9</td>
<td>91.6</td>
<td>92.3</td>
<td>92.8</td>
<td>93.2</td>
<td>91.4</td>
<td>91.1</td>
</tr>
<tr>
<td>≥2 MMR</td>
<td>89.3</td>
<td>89.1</td>
<td>90.5</td>
<td>91.1</td>
<td>91.4</td>
<td>91.8</td>
<td>90.7</td>
<td>90.7</td>
</tr>
<tr>
<td>≥2 Varicella (no dz hx)</td>
<td>34.1</td>
<td>48.6</td>
<td>58.1</td>
<td>68.3</td>
<td>74.9</td>
<td>78.5</td>
<td>81.0</td>
<td>83.1</td>
</tr>
<tr>
<td>≥1 MCV4</td>
<td>41.8</td>
<td>53.6</td>
<td>62.7</td>
<td>70.5</td>
<td>74.0</td>
<td>77.8</td>
<td>79.3</td>
<td>81.3</td>
</tr>
<tr>
<td>≥2 MCV4 (17 yr)</td>
<td>41.8</td>
<td>53.6</td>
<td>62.7</td>
<td>70.5</td>
<td>74.0</td>
<td>77.8</td>
<td>79.3</td>
<td>81.3</td>
</tr>
<tr>
<td>≥1 HPV</td>
<td>37.2</td>
<td>44.3</td>
<td>48.7</td>
<td>53.0</td>
<td>53.8</td>
<td>57.3</td>
<td>60.0</td>
<td>62.8</td>
</tr>
<tr>
<td>Among Males</td>
<td>(17.9)</td>
<td>(26.7)</td>
<td>(32.0)</td>
<td>(34.8)</td>
<td>(34.4)</td>
<td>(37.6)</td>
<td>(39.7)</td>
<td>(41.9)</td>
</tr>
</tbody>
</table>

Flu Vaccination Coverage by Age Group

<table>
<thead>
<tr>
<th>Age Group</th>
<th>2014–2015 Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>5–12 years</td>
<td>62%</td>
</tr>
<tr>
<td>13–17 years</td>
<td>47%</td>
</tr>
<tr>
<td>18–49 years</td>
<td>34%</td>
</tr>
</tbody>
</table>

http://www.cdc.gov/flu/fluvoxview/coverage-1415estimates.htm
Adolescent immunization platforms

Explore the use of alternative sites
- Schools
- Pharmacies

School requirements
- Eliminate non-medical school requirement exemptions

CDC has highlighted a 16 year column in the 2017 Immunization Schedule

SAHM – published in April, 2017: “SAHM supports the establishment of a 16-year-old immunization platform to ensure completion of all recommended vaccines, which has the added value of providing an opportunity for developmentally-appropriate adolescent health services.”
### School Requirements Significantly Affect Coverage Rates – 2010 NIS-Teen Data (13-17 year olds)

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Vaccination requirement</th>
<th>Education Requirement</th>
<th>No Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥1 MCV4</td>
<td>3 (70.5)</td>
<td>10 (51.0)</td>
<td>38 (53.4)</td>
</tr>
<tr>
<td>≥1 Td/Tdap</td>
<td>32 (79.8)</td>
<td>--</td>
<td>19 (69.5)</td>
</tr>
<tr>
<td>≥1 HPV</td>
<td>--</td>
<td>--</td>
<td>6** (45.0)</td>
</tr>
</tbody>
</table>

Red font indicates significantly lower (p<0.05) coverage compared to states with vaccine requirements.

*Status based on requirements for the 2008-2009 School Year

**Because of small sample size, one state with a vaccine requirement is included with the states with education only requirements.


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### Current State Legislation

**Secondary School Vaccination requirements through 2016-2017***

- Tdap: 47 states (+ DC)
- MCV4: 26 states (+ DC)
- HPV: 2 states (VA, RI) (+ DC)

*as of January, 2017, IAC

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**State Non-Medical Exemptions from School Immunization Requirements, 2016**

Source: Adapted from Immunization Action Coalition, June 2014.

* The existing statute in Mississippi and Louisiana does not explicitly recognize religion as a reason for claiming an exemption; however, as a practical matter, the non-medical exemption may encompass religious beliefs.

* In Arizona, the personal exemption is for school enrollees. In Illinois, it is for childcare enrollees only.
AAP Policy Statement: August 29, 2016

Medical Versus Nonmedical Immunization Exemptions for Child Care and School Attendance

The American Academy of Pediatrics (AAP) supports regulations and laws requiring certification of immunization to attend child care and school as a sound means of providing a safe environment for attendees and employees of these settings. The AAP also supports medically indicated exemptions to specific immunizations as determined for each individual child. The AAP views nonmedical exemptions to school-required immunizations as inappropriate for individual, public health, and ethical reasons and advocates for their elimination.

How to Improve Vaccination Rates: Provider

Adolescents Access Preventive Care

<table>
<thead>
<tr>
<th>National Survey</th>
<th>Adolescents (10 through 17 years): Percent (95% CI) who accessed preventive services in the past 12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011 National Health Interview Survey</td>
<td>74.4 (72.9–75.9)</td>
</tr>
<tr>
<td>2011–2012 National Survey of Children’s Health</td>
<td>81.2 (80.3–82.1)</td>
</tr>
<tr>
<td>2011 Medical Expenditure Panel Survey</td>
<td>43.0 (40.3–45.7)</td>
</tr>
</tbody>
</table>

“…provider recommendation is the strongest predictor of vaccination”

“The most common reason for nonvaccination reported by parents/guardians was never being offered the vaccine (44%); many stated they would have accepted the vaccine if offered…”
Educate office staff about:

- Importance of simultaneous administration of vaccinations (same day, different anatomic sites)
- True contraindications to vaccination
- Best practices (General Immunization Recommendations)
- Check immunization status of scheduled patients
- Establish practice immunization goals; AFIX www.cdc.gov/nip/afix

Standing orders
- Recommended by CDC (strong evidence) to increase adult immunization\(^1\)
- Would likely decrease missed vaccination opportunities in adolescents

Vaccination “quick visits”

Reminder/recall systems (can be part of IIS)
- Recommended (strong evidence) by CDC to increase adult, adolescent, and childhood immunizations\(^1\)


Benefits of Using Immunization Information Systems

- Recommended by National Vaccine Advisory Committee (NVAC) and National Immunization Program (NIP)
- Consolidates fragmented records
- Keeps track of patients needing recommended or catch-up vaccination
- Provides automated reminder and recall
- Assists in management of vaccine supply
- Generates vaccination records for parents, schools, other

Additional Benefits of Immunization Registries: Time, Travel, and Money

- Time – the use of EMRs have the potential to increase speed and accuracy of registry entries
- Travel – communication between registries due to unexpected travel for any reason (Hurricane Katrina) can save time and money
  - September, 2005, Houston-Harris County Immunization Registry connected to Louisiana Immunization Network for Kids
  - In 1 year, >18,900 immunization records accessed from LINKS
  - Estimated $1.6 million vaccine costs
  - Estimated $3.0 million for vaccine plus administration costs
Impact of Reminder and Recall on Vaccination Rates among Adolescents

Percentages of patients aged 11–18 years who received an additional needed adolescent vaccine at 4, 12, and 24 weeks: Text4Health—Adolescents, New York City, 2009.

*Text, email, phone or 2 of the three; implemented every 2 weeks for 6 weeks (or every week if 2 methods chosen), starting 9 weeks after dose 1 and 18 weeks after dose 2.

Effect of provider prompts on adolescent immunization rates: a randomized trial.

OBJECTIVE: Adolescent immunization rates are suboptimal. Experts recommend provider prompts at health care visits to improve rates. We assessed the impact of either electronic health record (EHR) or nurse- or staff-initiated provider prompts on adolescent immunization rates.

METHODS: We conducted a randomized controlled trial, allocating practices in 1 of 2 practice-based research networks (PBRN) to provider prompts or standard-of-care control. Ten primary care practices participated, 5 intervention and 5 controls, each matched in pairs on urban, suburban, or rural location and practice type (pediatric or family medicine), from a PBRN in Greater Rochester, New York (GR-PBRN); and 12 practices, 6 intervention, 6 controls, similarly matched, from a national pediatric continuity clinic PBRN (CORNET). The study period was 1 year per practice, ranging from June 2011 to January 2013. Study participants were adolescents 11 to 17 years attending these 22 practices; random sample of chart reviews per practice for baseline and postintervention year to assess immunization rates (n = 7,040 total chart reviews for adolescents with >1 visit in a period). The intervention was an EHR prompt (4 GR-PBRN and 5 CORNET practice pairs) (alert) that appeared on providers’ computer screens at all office visits, indicating the specific immunizations that adolescents were recommended to receive. Staff prompts (1 GR-PBRN pair and 1 CORNET pair) in the form of a reminder sheet was placed on the provider’s desk in the exam room indicating the vaccines due. We compared immunization rates, stratified by PBRN, for routine vaccines (meningococcus, pertussis, human papillomavirus, influenza) at study beginning and end.

RESULTS: Intervention and control practices within each PBRN were similar at baseline for demographics and immunization rates. Immunization rates at the study end for adolescents who were behind on immunizations at study initiation were not significantly different for intervention versus control practices for any vaccine or combination of vaccines. Results were similar for each PBRN and also when only EHR-based prompts was assessed. For example, at study end, 3-dose human papillomavirus vaccination rates for GR-PBRN intervention versus control practices were 51% versus 53% (adjusted odds ratio 0.96; 95% confidence interval 0.64-1.34); CORNET intervention versus control rates were 50% versus 42% (adjusted odds ratio 1.06; 95% confidence interval 0.68-1.88).

CONCLUSIONS AND RELEVANCE: In both a local and national setting, provider prompts failed to improve adolescent immunization rates. More rigorous practice-based changes are needed.
Summary

- Numbers of shots for teens are growing
- Disease and cancer rates are slowing
- New policies help us
- The key is to discuss
- Efforts to save must be ongoing.