Learning Objectives

After this presentation, participants will be able to:

1) List barriers to HPV vaccination

2) Describe direct and indirect benefits to HPV vaccine for males and females

HPV UPTAKE

How are we doing?

Estimated vaccination coverage among adolescents aged 13-17 years, NIS-Teen, U.S., 2010

<table>
<thead>
<tr>
<th></th>
<th>≥ 1 Tdap (%)</th>
<th>≥ 1 MenACWY (%)</th>
<th>≥ 1 HPV (%)</th>
<th>≥ 3 HPV (%)</th>
<th>HPV Completion* (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>69</td>
<td>63</td>
<td>49</td>
<td>32</td>
<td>70</td>
</tr>
<tr>
<td>NYS</td>
<td>83</td>
<td>71</td>
<td>56</td>
<td>40</td>
<td>77</td>
</tr>
</tbody>
</table>

*% females who received 3 doses among those who had ≥1 HPV dose and ≥24 wks between 1st dose and interview

www.cdc.gov/mmwr/preview/mmwrhtml/mm6033a1.htm?s_cid=mm6033a1_w#Fig
Estimated vaccination coverage among adolescents aged 13-17 years, NIS-Teen, NYS, 2008-2010

**HPV UPTAKE**

Why are we not doing better?

Is this the reason?????

Vaccination in the medical home

How is that working for teens?

Adolescent Medical Home

- 53% of 12–17 year olds have a medical home
- Not having a medical home associated with
  - Hispanic ethnicity
  - Family speaking a language other than English
  - lower income
  - lower maternal education level
  - living in the Western part of U.S.

Young people without medical homes

- Significantly more likely to have unmet health care needs
- Significantly less likely to have received comprehensive medical care visit in past year

Adolescent preventive care in the medical home

Challenges with teen preventive care in medical home

- Competing priorities in adolescent care
- Current medical infrastructure supporting adolescent health care is not able to support the volume of adolescents health services
  - newly recommended vaccines
  - recommended health care/risk reduction counseling
  - limited visit time

Many adolescents not seeking preventive care

Estimated vaccination coverage among adolescents aged 13-17 years, NIS-Teen, US, 2010

<table>
<thead>
<tr>
<th>HPV doses</th>
<th>NH White (%)</th>
<th>NH Black (%)</th>
<th>Hispanic (%)</th>
<th>NH AI/AN (%)</th>
<th>NH Asian (%)</th>
<th>Other (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥1</td>
<td>46</td>
<td>49</td>
<td>56*</td>
<td>63*</td>
<td>50</td>
<td>52</td>
</tr>
<tr>
<td>≥3</td>
<td>32</td>
<td>30</td>
<td>30</td>
<td>41</td>
<td>40</td>
<td>37</td>
</tr>
<tr>
<td>Series completion</td>
<td>75</td>
<td>65*</td>
<td>56*</td>
<td>64</td>
<td>86*</td>
<td>75</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HPV doses</th>
<th>Below Poverty Level (%)</th>
<th>At or Above Poverty Level (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥1</td>
<td>52</td>
<td>48</td>
</tr>
<tr>
<td>≥3</td>
<td>28*</td>
<td>33</td>
</tr>
<tr>
<td>Series completion</td>
<td>57*</td>
<td>73</td>
</tr>
</tbody>
</table>

http://www.adolescenthealth.org/Clinical_Care_Resources.htm

Recommended Immunization Schedule for Adolescents Ages 10–25 Years

Adolescent Primary Care Utilization

- Retrospective descriptive analysis of claims data
- Large Minnesota health plan with ~ 700,000 members
- Patients aged 11 to 18 yrs
- Outcome measure = rates of preventive and nonpreventive care visits
  - 13-17 yo with ≥4 yrs of continuous enrollment

Nordin JD, et al. Ann Fam Med 2010;8:511-516
Sparse preventive care

- 1/3 had no preventive care visits
- 40% had 1 preventive care visit
- Nonpreventive care visits more frequent
- Small differences in rates between govt and commercial insurance and gender

Alternative Strategies

- National Vaccine Advisory Committee, 2009
- Expansion of adolescent immunization infrastructure into settings complementary to the medical home
  - Schools/college, pharmacies, mobile vans and other venues

School Entry Mandates the “Rick Perry” Approach

- Dynamic, population-based, compartmental model to estimate HPV vaccine uptake among U.S. ♀ adolescents
  - Incorporated data on parental attitudes and adolescent health care utilization
- No mandate: 70% coverage in 23 years
- Mandate: 70% coverage in 8 years

New York State Immunization Requirements for School Entrance/Attendance

<table>
<thead>
<tr>
<th>VACCINES</th>
<th>Pre-kindergarten</th>
<th>School (K-12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polio</td>
<td>3 doses 0, 4, ≥6</td>
<td>1 dose 4/20, ≥6</td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>2 doses 0, ≥12</td>
<td>1 dose 4/20, ≥6</td>
</tr>
<tr>
<td>Measles</td>
<td>1 dose 0, ≥12</td>
<td>1 dose 4/20, ≥6</td>
</tr>
<tr>
<td>Mumps</td>
<td>1 dose 0, ≥12</td>
<td>1 dose 4/20, ≥6</td>
</tr>
<tr>
<td>Rubella</td>
<td>1 dose 0, ≥12</td>
<td>1 dose 4/20, ≥6</td>
</tr>
<tr>
<td>Diphtheria</td>
<td>3 doses 0, 4, ≥6</td>
<td>1 dose 4/20, ≥6</td>
</tr>
<tr>
<td>Pert 5</td>
<td>3 doses 0, ≥12</td>
<td>1 dose 4/20, ≥6</td>
</tr>
</tbody>
</table>

Estimated vaccination coverage among 13 - 17 yo, NIS - Teen, NYS, 2010

**SCHOOL-BASED IMMUNIZATION PROGRAMS**

The Australia Experience


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The Australia Experience: Background

- Australia school-based govt-funded HPV4 (i.e., cervical CA prevention) vaccination program
  - started April, 2007
  - aged 12–13 yrs
  - catch-up program for 13–26 yo ♀
    - school-based for ♀ enrolled in school (14–17 years),
    - GPs/community providers offered HPV4 to 18–26 yo ♀
  - All recommended childhood vaccines funded by national govt


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The Australia Experience: Outcomes

- High HPV4 acceptance
  - ≥70% 3 HPV4 doses school age cohort coverage
- 73% ↓ in STI clinics new genital wart cases among vaccine eligible-age ♀
- 44% ↓ of new genital wart cases in young ♂ (not a part of free program) in same time period
  - suggests significant herd immunity


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US PROVIDER HPV IMMUNIZATION PRACTICES

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Does age matter?
Estimated vaccination coverage among adolescents aged 13 - 17 yrs, by age at interview, NIS-Teen, 2010

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>76.7</td>
</tr>
<tr>
<td>14</td>
<td>80.4</td>
</tr>
<tr>
<td>15</td>
<td>84.2</td>
</tr>
<tr>
<td>16</td>
<td>87.5</td>
</tr>
<tr>
<td>17</td>
<td>90.0</td>
</tr>
</tbody>
</table>

What are providers recommending?

Provider HPV vaccination recommendations for 11–12 yo females

- **Goal:**
  - To determine physician recommendation of HPV for 11–12 yo, 13–17 yo, and 18–26 yo by physician specialty
  - To identify factors associated with HPV recommendation in 11-12 yo
- **Methods:**
  - Survey of nationally representative random sample of 1538 Family Physicians, Pediatricians, and OB/GYNs

Reasons for HPV Vaccine Acceptance

- **Goal:** To assess in area with cervical CA rates:
  - HPV uptake by adolescent girls
  - Their parents’ intentions to vaccinate them
  - Potential barriers to their vaccination

Logistic regression for HPV vaccine recommendation for early adolescents (“always” vs. “sometimes” or “never”)

<table>
<thead>
<tr>
<th>Predictor</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialty</td>
<td></td>
</tr>
<tr>
<td>Family Physician</td>
<td>1.6 (Reference)</td>
</tr>
<tr>
<td>Pediatricist</td>
<td>2.1 (1.3–3.2)</td>
</tr>
<tr>
<td>OB/GYN</td>
<td>1.6 (0.7–2.5)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>14-15 yrs</td>
<td>1.0 (Reference)</td>
</tr>
<tr>
<td>16-17 yrs</td>
<td>1.3 (0.7–2.5)</td>
</tr>
<tr>
<td>18-26 yrs</td>
<td>1.4 (0.6–2.3)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>1.0 (Reference)</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>2.4 (1.3–4.4)</td>
</tr>
<tr>
<td>Parental barriers to HPV vaccination</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>1.0 (Reference)</td>
</tr>
<tr>
<td>Medium</td>
<td>1.0 (0.5–1.6)</td>
</tr>
<tr>
<td>Low</td>
<td>1.1 (1.2–2.6)</td>
</tr>
<tr>
<td>Yes</td>
<td>1.0 (Reference)</td>
</tr>
<tr>
<td>No</td>
<td>0.5 (0.3–0.8)</td>
</tr>
<tr>
<td>Don’t know</td>
<td>0.7 (0.4–1.1)</td>
</tr>
</tbody>
</table>

Survey Methods

• Telephone survey of caregivers of 10-18 yo ♀ in 5 North Carolina counties with 1 cervical CA rates
  - conducted July to October 2007
  - ~ 1 year after HPV licensed and 1st recommended
  - probability sample of 1220 caregivers
• 73% (889) agreed to participate and completed interviews

Results (per parents’ reports)

• 92% of daughters had seen healthcare provider in last year
• 83% had preventive care visit in last year
• 21% of daughters recommended HPV by healthcare provider in last year
• 10% of parents reported their daughters had received ≥1 HPV dose
• Healthcare provider’s recommendation ↑↑ likelihood of initiating HPV by >12-fold

Main reasons caregivers reported for not initiating HPV vaccine

• needing more information (22%)
• never having heard of the vaccine (14%)
• believing daughter is too young (16%)
• not yet sexually active (13%)
• not having gone to the doctor yet (13%)
• 0.5% of parents cited concern about HPV making a teenage ♀ more likely to have sex

HPV Vaccination Practices

• National-based physician survey 18 mo after licensure
• 429 pediatricians and 419 family physicians
• Response rates ~ 80%
• 98% pediatricians and 88% of family physicians administering HPV vaccine

HPV vaccine uptake in high risk community

• Methods: Telephone surveys with randomly selected parents/guardians of 11–18 year old girls attending LA public schools in 2007-8
• Sample: 509 parents
  - 81% Hispanic
  - 16%African American
HPV vaccine uptake in high risk community

- 93% of daughters seen a doctor in past year
- 30% reported provider recommended HPV
- 23% reported daughter received ≥1 HPV
- Factors associated with initiated HPV
  - doctor recommendation (OR = 48.5)
  - belief in vaccine effectiveness (OR = 2.9)
  - heard of the vaccine (OR = 2.6)


Summary

- HPV not consistently offered to 11-12 yr olds
- Physician recommendation strongly influences HPV vaccination


ACIP HPV recommendations

- All 11 and 12 yo ♀ and ♂
  - Can begin as young as age 9 yrs
- Catch – up vaccines for all 13-21 yo ♀ and ♂ who not already vaccinated
- All 22-26 yo ♀, MSM and immunocompromised ♂
  - i.e., routine vaccination for 22-26 yo ♂ with risk factors
- Permissive recommendation for 22-26 yo ♂ without risk factors


HPV Cost Effectiveness

- Goal: estimate the cost-effectiveness of adding HPV of 12 yo ♂ to ♀-only vaccination program for ages 12–26 yo in US
- Methods:
  - CEA
  - The HPV-associated outcomes:
    - FDA-indicated: CIN; genital warts; cervical, vaginal, vulvar, & anal CA
    - nonFDA-indicated: oropharyngeal & penile CA; RRP


CEA Findings

- HPV immunization of 12 yo ♂ cost-effective, particularly if
  - HPV4 coverage is low
  - all potential HPV vaccine health benefits included in analysis
- ↑ ♀ coverage more efficient strategy than ♂ vaccination to ↓ overall HPV health burden


Cost-effectiveness of male vaccination*

<table>
<thead>
<tr>
<th>Cost per QALY gained by vaccinating 12 year-old boys</th>
<th>Indicated outcomes only</th>
<th>All outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0</td>
<td>$0</td>
<td></td>
</tr>
<tr>
<td>$20,000</td>
<td>$20,000</td>
<td></td>
</tr>
<tr>
<td>$40,000</td>
<td>$40,000</td>
<td></td>
</tr>
<tr>
<td>$60,000</td>
<td>$60,000</td>
<td></td>
</tr>
<tr>
<td>$80,000</td>
<td>$80,000</td>
<td></td>
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<td>$100,000</td>
<td>$100,000</td>
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<td>$120,000</td>
<td>$120,000</td>
<td></td>
</tr>
<tr>
<td>$140,000</td>
<td>$140,000</td>
<td></td>
</tr>
<tr>
<td>$160,000</td>
<td>$160,000</td>
<td></td>
</tr>
</tbody>
</table>

*Includes transmission effects to females

*Indicated outcomes include cervical outcomes, vaginal, vulvar, anal cancers, and genital warts. All outcomes include indicated outcomes plus oropharyngeal and penile CA, and non-indicated oropharyngeal and penile CA. Lower coverage scenario: 30% 3-dose coverage at age 12 and 50% 3-dose coverage by age 26. Higher coverage scenario: 50% 3-dose coverage at age 12 and 70% 3-dose coverage by age 26.

Number of lifetime cancer cases averted by vaccinating 1 million males in a birth cohort

Genital HPV Prevalence Rates in Males

Age-Specific Anal Canal HPV Prevalence Among Men Having Sex with Women

Estimated annual HPV and HPV 16/18-associated cancers, US, 2004-2007

<table>
<thead>
<tr>
<th>ANATOMIC AREA</th>
<th>AVG ANNUAL # of CASES</th>
<th>HPV-asstd</th>
<th>HPV 16/18 asstd</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEMALE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cervix</td>
<td>11,845</td>
<td>11,370</td>
<td>9000</td>
</tr>
<tr>
<td>Vagina</td>
<td>714</td>
<td>460</td>
<td>400</td>
</tr>
<tr>
<td>Vulva</td>
<td>3062</td>
<td>1560</td>
<td>1350</td>
</tr>
<tr>
<td>Anus</td>
<td>2977</td>
<td>2770</td>
<td>2590</td>
</tr>
<tr>
<td>Oropharynx</td>
<td>2306</td>
<td>1450</td>
<td>1380</td>
</tr>
<tr>
<td>TOTAL: FEMALE</td>
<td>20,903</td>
<td>17,610</td>
<td>14,720</td>
</tr>
<tr>
<td>MALE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penis</td>
<td>1000</td>
<td>360</td>
<td>310</td>
</tr>
<tr>
<td>Anus</td>
<td>1618</td>
<td>1500</td>
<td>1410</td>
</tr>
<tr>
<td>Oropharynx</td>
<td>8936</td>
<td>5630</td>
<td>5360</td>
</tr>
<tr>
<td>TOTAL: MALE</td>
<td>11,553</td>
<td>7490</td>
<td>7080</td>
</tr>
</tbody>
</table>
Estimated % of cancers associated with HPV in the U.S

<table>
<thead>
<tr>
<th>CANCER</th>
<th>ANY HPV type (%)</th>
<th>HPV types 16/18 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical</td>
<td>96</td>
<td>76</td>
</tr>
<tr>
<td>Vaginal</td>
<td>64</td>
<td>56</td>
</tr>
<tr>
<td>Vulvar</td>
<td>51</td>
<td>44</td>
</tr>
<tr>
<td>Anal</td>
<td>93</td>
<td>87</td>
</tr>
<tr>
<td>Penile</td>
<td>36</td>
<td>31</td>
</tr>
<tr>
<td>Oropharyngeal</td>
<td>63</td>
<td>60</td>
</tr>
</tbody>
</table>

- Genital warts: ~90% caused by HPV 6/11

Anal Cancer Affects Women and Men

- Estimated 5,820 ♂ and ♂ in US diagnosed with anal cancer in 2011
  - 3,680 in ♂ and 2,140 in ♂
- > 60% of anal CA cases and deaths occur in ♂
- Anal CA can occur in heterosexual ♂
  - 53% of male anal cancers occur in heterosexual ♂


Oral HPV transmission??!!

Unclear what types of oral contact are risk

The Burden of Anal Cancer is Increasing

Age standardized incidence rates of anal cancer in Denmark

† US anal cancer rates (~2.7%/year); Rates ♂ >> ♂

Nielsen et al, Int J Cancer In Press

Conclusion

- US vaccine delivery system is flawed
  - Many missed opportunities
- ACIP recommends HPV for ALL 11-12 yr olds
  - Gender is now non-issue
- HPV virus is smart and dangerous

Questions??????