OBJECTIVES

- Review current indications for vaccinations
- Provide update to most recent vaccination developments relevant to Primary Care IM
- Discussion points on legislative and other mandates related to vaccines
EVERYONE

- 70-80% efficacy in reducing severity of illness in healthy adults
  - High-risk patients 50%
  - Elderly response relatively poor (30-70%)
  - Elderly vaccination associated with:
    - 27% reduction in hospitalization for PNA and flu
    - 48% reduction in death from any cause

Influenza Vaccine

- Composition
  - 2 A strains and 1 B strain changed annually
  - Inactivated virus injectable form
  - Live attenuated virus in intranasal preparation
  - Administer in late September, October, November optimally

Vaccine Indications and Efficacy

- 70-80% efficacy in reducing severity of illness in healthy adults
  - High-risk patients 50%
  - Elderly response relatively poor (30-70%)
  - Elderly vaccination associated with:
    - 27% reduction in hospitalization for PNA and flu
    - 48% reduction in death from any cause

State-specific coverage varied widely, ranging from 25.2% (Nevada) to 53.1% (Hawaii). (http://www.cdc.gov/flu/professionals/vaccination/reporti1112/reporti/index.htm)

Overall Vaccination Rate

Table 3. Influenza Vaccination Coverage by Race/Ethnicity, Adults 18 years and older—United States, 2011-12 Season

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Weighted Sample Size</th>
<th>%</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>White only, non-Hispanic</td>
<td>395,450</td>
<td>41.9</td>
<td>±4.4</td>
</tr>
<tr>
<td>Black only, non-Hispanic</td>
<td>30,927</td>
<td>37.7</td>
<td>±5.0</td>
</tr>
<tr>
<td>Hispanic</td>
<td>25,216</td>
<td>41.8</td>
<td>±4.1</td>
</tr>
<tr>
<td>Other, non-Hispanic (Total)</td>
<td>21,105</td>
<td>36.7</td>
<td>±4.0</td>
</tr>
<tr>
<td>Asian</td>
<td>6,324</td>
<td>37.3</td>
<td>±0.4</td>
</tr>
<tr>
<td>American Indian Alaska Native</td>
<td>4,805</td>
<td>42.6</td>
<td>±4.9</td>
</tr>
<tr>
<td>Other and multiple race</td>
<td>9,783</td>
<td>33.9</td>
<td>±2.7</td>
</tr>
</tbody>
</table>

Footnotes (rate-estimates) Data Sources and Methods (details) Limitations (estimates)

http://www.cdc.gov/flu/professionals/vaccination/coverage_1112estimates.htm
Evidence for protection in adults aged 65 years or older is lacking.

LAIVs consistently show highest efficacy in young children (aged 6 months to 7 years).

New vaccines with improved clinical efficacy and effectiveness are needed to further reduce influenza-related morbidity and mortality.

Abbreviation: egg allergy.

Cake). Tolerance to egg-containing foods does not exclude the possibility of reactions to eggs and egg-containing foods, plus skin and/or other biologic reactions to egg proteins.

Egg-allergic persons might tolerate egg in baked products (e.g., bread or bagels) without reaction?

After eating eggs or egg-containing foods, does the person experience GRYV illness?

If so, refer to a physicians with an allergy consultation for further evaluation.

If no, refer to a physician with the allergic consultation for further evaluation.

LAIV IN HCW

Use of Live-Attenuated Influenza Vaccine for Healthcare Providers

A recent guidance statement from the Society for Healthcare Epidemiology of America supports the use of live-attenuated influenza vaccine for most healthcare workers.

The guideline endorses:

1. Use of LAIV as an alternative to the standard inactivated influenza vaccine for healthy, nonpregnant healthcare workers aged <60

2. Restriction on the use of LAIV for healthcare workers who, during the week following vaccination, will have frequent contact with patients receiving care in a protective environment (e.g., a bone marrow transplantation unit)

Egg Allergy and Flu Vaccine

FIGURE 2. Recommendations regarding influenza vaccination for persons who report allergy to eggs. – Advisory Committee on Immunization Practices, United States, 2012-13 influenza season

LAIV = live attenuated influenza vaccine

TIV = trivalent inactivated vaccine

Quadrivalent (MedImmune). This vaccine currently is not anticipated to be available until the 2013–14 influenza season, at which time it is expected to replace the currently available seasonal trivalent FluMist formulation. Inactivated quadrivalent influenza vaccines currently are in development. These vaccines will be addressed in the ACIP influenza statement as they are approved and become available commercially.

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6132a3.htm

Inactivated quadrivalent influenza vaccines currently are in development. These vaccines will be addressed in the ACIP influenza statement as they are approved and become available commercially.

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6132a3.htm

High Dose

- 4 fold higher antigen
- Higher mean antibody titers
- Only for > 65 y.o.
- Clinical benefit not yet established

Intradermal

- Equal efficacy, lower dose (requires 40% less antigen than the regular flu shot)

Quadrivalent Vaccine

- In February 2012, FDA approved a new seasonal quadrivalent LAIV, FluMist Quadrivalent (MedImmune). This vaccine currently is not anticipated to be available until the 2013–14 influenza season, at which time it is expected to replace the currently available seasonal trivalent FluMist formulation. Inactivated quadrivalent influenza vaccines currently are in development. These vaccines will be addressed in the ACIP influenza statement as they are approved and become available commercially.

Colorado Law

Policy Implementation Requirements for Hospitals, Hospital Units, Ambulatory Surgical Centers, and Long-Term Nursing Care Facilities [revisions 11 through 15 of the rule]

If a healthcare worker has a medical exemption, the facility must make sure that the worker wears a surgical or procedure mask during influenza season (November – March) when in direct contact with patients and in common areas of the facility.

If a general hospital, hospital unit, ambulatory surgical center, or long-term nursing care facility does NOT meet the criteria for an exemption from these sections (see explanation at the end of this document) they are required to implement an influenza vaccination policy for its healthcare workers to make sure that each of these workers has either been vaccinated or has a medical exemption.

If a healthcare worker has a medical exemption, the facility must make sure that the worker wears a surgical or procedure mask during influenza season (November – March) when in direct contact with patients and in common areas of the facility.

VACCINATION DEADLINES

- Quarters: September 15, 2012 (current quarter)
- Annual: October 1, 2012

<table>
<thead>
<tr>
<th>VACCINATION DEADLINES</th>
<th>REQUIRED TO COMPLY FOR EXEMPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUARTERLY</td>
<td>34% of all HCWs to qualify for exemption</td>
</tr>
<tr>
<td>ANNUALLY</td>
<td>50% of all HCWs to qualify for exemption</td>
</tr>
</tbody>
</table>

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6132a3.htm
Vaccine Future

• Universal Influenza Vaccine

Pneumococcal Vaccines

PPV 23
* Serotypes 1, 2, 3, 4, 5, 6B, 7F, 8, 9N, 9V, 10A, 11A, 12F, 14, 15B, 17F, 18C, 19A, 19F, 20, 22F, 23F, and 33F

PCV 7
* Serotypes 4, 6B, 9V, 14, 18C, 19F, and 23F

PCV13
* PCV7 strains and 1, 3, 5, 6A, 7F, and 19A

IPD Incidence

Figure 1. Changes in overall invasive pneumococcal disease (IPD) incidence rates by age group, 1998–2007. *Seven-valent pneumococcal conjugate vaccine (PCV7) was introduced in the United States for routine use among young children and infants in the second half of 2000.

Figure 2. Changes in invasive pneumococcal disease (IPD) incidence by serotype group among children aged <5 years (A) and adults aged ≥65 years (B), 1998–2007. *Seven-valent pneumococcal conjugate vaccine (PCV7) was introduced in the United States for routine use among young children and infants in the second half of 2000.

IPD in those Aged > 65

19A appears to be the most important increase of 2.6 to 6.5 cases/100,000
* 27% of isolates from some communities; increase of 40%
* Increase of PCN nonsusceptibility as well as 15% resistant to ceftriaxone

Increase of Non-PCV 7 Serotypes

MMWR 2007; 56(41):1077-80
PCV13

- FDA approved (02/10) for use in childhood
- Improved coverage, specifically covers serotype 19A
- Covers 64% of invasive pneumococcal strains
- Of this, 95% are related to the added strains

> FIGURE 2. Number of cases of invasive pneumococcal disease among persons aged ≥19 years, by PCV7* status of Streptococcus pneumoniae serotype — Massachusetts, October 1, 2001—September 30, 2005.

<table>
<thead>
<tr>
<th>SeroType</th>
<th>PCV7 or PCV7-related serotypes</th>
<th>Non-PCV7 serogroups</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 3, 7F</td>
<td>23, 33A, 39A, 4, 6A, 19A, 20A</td>
<td>3, 5, 6B, 9V, 14, 18C, 19F, 23F</td>
</tr>
</tbody>
</table>

† Non-PCV7 serogroups:
- PCV7-related serotypes include the same serotypes as PCV7 vaccine groups (4, 6B, 9V, 14, 18C, 19F, and 23F).

MMWR Oct 2007; 56:1077-1080

PCV 13 EFFECTIVE

- Rates of PCV6-type IPD had declined by nearly 90% among children <5 years old and by 45-64% among all adult age groups
- Reductions were driven primarily by declines in serotypes 19A and 7F.
- PCV13 introduction was followed by rapid and dramatic reductions in the incidence of IPD caused by the 6 new serotypes included in the vaccine. Indirect effects of PCV13 use in children are evident in all adult age groups

https://idaa.cdc.gov/idaa/2012/webprogram/Paper8569.html

USE OF PCV 13 IN ADULTS

<table>
<thead>
<tr>
<th>Risk group</th>
<th>Underlying medical condition or other indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immunocompetent person</td>
<td>Chronic heart disease excluding hypertension</td>
</tr>
<tr>
<td></td>
<td>Chronic lung disease</td>
</tr>
<tr>
<td></td>
<td>Congenital heart defects</td>
</tr>
<tr>
<td></td>
<td>Congenital abnormalities</td>
</tr>
<tr>
<td></td>
<td>Other genetic disease</td>
</tr>
<tr>
<td></td>
<td>Immunocompromised person</td>
</tr>
</tbody>
</table>

- Immunocompromised person:
  - Solid organ transplant
  - Chronic renal failure
  - Multiple myeloma
  - Diseases requiring treatment with immunosuppressive drugs, including long-term systemic corticosteroids and radiation therapy
  - Neutropenia from any cause
  - Chronic hepatic disease

Revaccination: 5 yrs after first dose

PCV13 introduction was followed by rapid and dramatic reductions in the incidence of IPD caused by the 6 new serotypes included in the vaccine. Indirect effects of PCV13 use in children are evident in all adult age groups.

PPV Administration

<table>
<thead>
<tr>
<th>Risk group</th>
<th>Underlying medical condition or other indication</th>
</tr>
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<tbody>
<tr>
<td>Immunocompetent person</td>
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<tr>
<td></td>
<td>Chronic lung disease</td>
</tr>
<tr>
<td></td>
<td>Congenital heart defects</td>
</tr>
<tr>
<td></td>
<td>Immunocompromised person</td>
</tr>
</tbody>
</table>

- Immunocompromised person:
  - Solid organ transplant
  - Chronic renal failure
  - Multiple myeloma
  - Diseases requiring treatment with immunosuppressive drugs, including long-term systemic corticosteroids and radiation therapy
  - Neutropenia from any cause
  - Chronic hepatic disease

Use of PCV 13 in Adults

TABLE. Medical conditions or other indications for administration of 13-valent pneumococcal conjugate vaccine (PCV13), and indications for 23-valent pneumococcal polysaccharide vaccine (PPSV23) among adults aged 19–64 years, by risk group — Advisory Committee on Immunization Practices; United States, 2012

<table>
<thead>
<tr>
<th>Risk group</th>
<th>Underlying medical condition or other indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immunocompetent person</td>
<td>Chronic heart disease excluding hypertension</td>
</tr>
<tr>
<td></td>
<td>Chronic lung disease</td>
</tr>
<tr>
<td></td>
<td>Congenital heart defects</td>
</tr>
<tr>
<td></td>
<td>Immunocompromised person</td>
</tr>
</tbody>
</table>

- Immunocompromised person:
  - Solid organ transplant
  - Chronic renal failure
  - Multiple myeloma
  - Diseases requiring treatment with immunosuppressive drugs, including long-term systemic corticosteroids and radiation therapy
  - Neutropenia from any cause
  - Chronic hepatic disease


Recommended for persons aged <65 years in these risk groups.

**Waning Immunity**

- Immunity after 5th dose of DTaP in kids wanes after 5 years
- Odds of acquiring pertussis increased on average by 42%/year, after 5th dose of DTaP


**Tdap Recommendations**

- Adolescents
  - 11-18 yrs should receive single dose instead of Td
  - If Td given an interval of 5 yrs recommended prior to revaccination
- Adults
  - Age 19-64 should receive in place of Td if 10 years elapsed (shorter intervals may be used)
  - Anticipated contact with those <12 months should be targeted for vaccination (interval as short as 2 years may be considered)
  - Women should receive Tdap before becoming pregnant. Women who have not previously received Tdap should receive a dose of Tdap in the immediate postpartum period

1. MMWR March 24, 2006 / Vol. 55 / No. RR-3
2. MMWR December 15, 2006 / Vol. 55 / No. RR-17

**Tdap for All Pregnant Women**

- ACIP recommends universal vaccination of all pregnant women
- Second or third trimester of each pregnancy
- Giving women a shot during pregnancy led to a 33% reduction in cases, a 38% drop in hospital admissions, and a 49% drop in deaths, compared with the "base case"

1. MMWR March 24, 2006 / Vol. 55 / No. RR-3
2. MMWR December 15, 2006 / Vol. 55 / No. RR-17

**Tdap in those > 65**

- Recommended to provide Tdap in all adults > 19
- Those > 65 now included in routine vaccination recommendation

Zoster

- More than 99 percent of Americans over age 40 have had chicken pox and are therefore at risk for shingles
- Vaccine reduces the odds of an outbreak by 55 percent in people over age 60
- Medical records of 193,083 people age 50 and older, following them for six weeks after getting the vaccine
- They found no increased risk for stroke, heart disease, heart attack, meningitis or encephalitis, Bell’s palsy or Ramsay Hunt syndrome
- The most common side effect was swelling or redness at the site of the injection

Shingles Prevention Study

- 38,546 adults > 60 placebo vs vaccine
- 95% completed follow-up over 3.12 years
- Vaccine with significant reduction of disease burden
  - 51.3% reduction of zoster
  - 66.5% reduction of PHN
- NNT to prevent 1 case zoster - 59
- NNT to prevent 1 case of PHN - 364

Safety Even in High Risk Groups

- Retrospective analysis of more than 460,000 Medicare beneficiaries, the herpes zoster vaccine was not associated with an increased rate of herpes zoster disease in the weeks after immunization, including those with rheumatoid arthritis, psoriasis, psoriatic arthritis, ankylosing spondylitis, or inflammatory bowel disease (diseases that increase risk of zoster 1.5–twofold)
- Multivariable analysis, the vaccine was associated with a 39% lower risk of herpes zoster disease after the 42 days – a risk window based on the incubation period of varicella zoster virus – immediately following vaccination
- 633 patients taking biologic agents, including 551 taking antitumor necrosis factor drugs
  - There were no cases of varicella or herpes zoster within the 42-day safety window
  - Incidence rate of 6.7 cases per 1,000 person-years contrasting sharply with the rate among those who did not receive the vaccine of 11.6 cases per 1,000 person-years (p<0.001)

Low Rates of Uptake

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Sample size</th>
<th>%</th>
<th>(95% CI)</th>
<th>Difference from 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herpes zoster (shingles) vaccination, ever³⁶⁶</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥60 yrs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7,290</td>
<td>14.4</td>
<td>(13.4–14.4)</td>
<td>4.4³⁶⁶</td>
</tr>
<tr>
<td>White, single race, not Hispanic or Latino</td>
<td>4,978</td>
<td>16.6</td>
<td>(15.4–17.8)</td>
<td>5.3³⁶⁶</td>
</tr>
<tr>
<td>Black, single race, not Hispanic or Latino</td>
<td>1,079</td>
<td>4.5</td>
<td>(3.4–5.9)⁶⁶</td>
<td>0.3</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>796</td>
<td>4.4</td>
<td>(3.2–6.2)⁶⁶</td>
<td>-0.4</td>
</tr>
<tr>
<td>Asian, single race, not Hispanic or Latino</td>
<td>349</td>
<td>12.7</td>
<td>(9.4–17.0)⁶⁶</td>
<td>5.8³⁶⁶</td>
</tr>
<tr>
<td>Other race/ethnicity</td>
<td>88</td>
<td>8.2</td>
<td>(3.8–16.6)⁶⁶</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Shingles Vaccine for 50-59 yr olds

- FDA Approved for use in adults > 50 yrs in March 2011
- ACIP reviewed and confirmed use in > 60 yrs in November 2011
- Lack of longitudinal efficacy
- Lack of cost-effectiveness
- Lack of adequate vaccine supply
**DM Increases HBV Risk**

Demographic and Risk Factor Characteristics of Cases and Comparison Group

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Cases (N=865)</th>
<th>Comparison group (N=90941*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (years)</td>
<td>44.2</td>
<td>48.8</td>
</tr>
<tr>
<td>Male</td>
<td>64.9%</td>
<td>48.0%</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic white</td>
<td>53.1%</td>
<td>72.7%</td>
</tr>
<tr>
<td>Non-Hispanic black</td>
<td>29.4%</td>
<td>12.6%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>10.8%</td>
<td>8.5%</td>
</tr>
<tr>
<td>Asian Pacific Islander</td>
<td>4.7%</td>
<td>2.8%</td>
</tr>
<tr>
<td>Other</td>
<td>2.9%</td>
<td>3.3%</td>
</tr>
<tr>
<td>“Other HBV risk factors”</td>
<td>32.9%</td>
<td>3.1%†</td>
</tr>
<tr>
<td>Diabetes (no “Other HBV risk factor” present)</td>
<td>1.89 (1.40 - 2.57)</td>
<td></td>
</tr>
<tr>
<td>Diabetes (“Other HBV risk factor” present)</td>
<td>1.10 (0.57 – 2.11)</td>
<td></td>
</tr>
</tbody>
</table>

*Controlling for age, gender, race/ethnicity

No observations deleted based on DF Beta results


---

**Cost Effectiveness of HBV Vaccination for DM**

Cost-Effectiveness of Vaccinating Adults with Diabetes (Private Vaccine Price)

<table>
<thead>
<tr>
<th>Age at vaccination</th>
<th>Number vaccinated with 10% take-up</th>
<th>Cost per QALY saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>20–69</td>
<td>528,047</td>
<td>$75,094</td>
</tr>
<tr>
<td>≥60</td>
<td>774,394</td>
<td>$2,760,753</td>
</tr>
<tr>
<td>&gt;20</td>
<td>1,302,441</td>
<td>$196,557</td>
</tr>
</tbody>
</table>


---

**HBV for DM: ACIP Recommendations**

On the basis of available information about HBV risk, morbidity and mortality, available vaccines, age at diagnosis of diabetes, and cost-effectiveness, ACIP recommends the following:

- Hepatitis B vaccination should be administered to unvaccinated adults with diabetes mellitus who are aged 19 through 59 years
- Hepatitis B vaccination may be administered at the discretion of the treating clinician to unvaccinated adults with diabetes mellitus who are aged ≥60 years


---

**Vaccination Rates Among Adolescents**

![Graph showing vaccination rates among adolescents](http://www.cdc.gov/vaccines/acip/meetings/downloads/slides-oct-2011/02-Hepatitis-Schillie.pdf)

---

**Not A License for Sex**

- Concerns about promiscuity are often cited as one of the main reasons for vaccine refusal
- No change in baseline sexual activity in those vaccinated compared to unvaccinated cohort

INFECTION REDUCTION AND HERD IMMUNITY

- Prevalence rate for vaccine-type HPV decreased substantially (31.7%–13.4%, P < .0001)
- The decrease in vaccine-type HPV not only occurred among vaccinated (31.8%–9.9%, P < .0001) but also among unvaccinated (30.2%–15.4%, P < .0001)
- Nonvaccine-type HPV increased (60.7%–75.9%, P < .0001) for vaccinated postsurveillance study participants
- Four years after licensing of the quadrivalent HPV vaccine, there was a substantial decrease in vaccine-type HPV prevalence and evidence of herd protection in this community


HPV IN MALES

- Approved for routine use in males up to age 21
- High-Risk including MSM up to age 26
- NNT??
- Cost-effective strategy??

Benefits: HPV vaccine for males per protocol efficacy

Men who have sex with men (MSM)

<table>
<thead>
<tr>
<th>Outcome</th>
<th>No. of subjects (# studies)</th>
<th>Incidence in controls</th>
<th>Incidence in vaccinated</th>
<th>Vaccine efficacy</th>
<th>Absolute risk difference per 1000 (95% CI)</th>
<th>Number Needed to Vaccinate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condyloma*</td>
<td>403 (1 RCT)</td>
<td>4.33% (9/208)</td>
<td>0.51% (1/194)</td>
<td>88.1 (80.1, 95.7)</td>
<td>-38 ( -45, -32)</td>
<td>26</td>
</tr>
<tr>
<td>ANI 1/2/3</td>
<td>402 (1 RCT)</td>
<td>11.0% (24/218)</td>
<td>2.6% (5/194)</td>
<td>77.5% (66.0, 87.3)</td>
<td>-99 (-107, -91)</td>
<td>11</td>
</tr>
<tr>
<td>ANI 2/3</td>
<td>402 (1 RCT)</td>
<td>6.5% (3/46)</td>
<td>1.5% (3/194)</td>
<td>76.5% (65.6, 86.5)</td>
<td>-68 (-76, -61)</td>
<td>21</td>
</tr>
</tbody>
</table>

Reference: Package insert, page 504 Table 13: Analysis of Efficacy of GARDASIL, for Anal Disease in the PPE Population of 16-through 26-year-old boys and men in the MSM Sub-Study for Vaccine HPV types, Follow-up period was 2.6 years.

*unpublished data from manufacturer. Follow-up period was 2.6 years.

Cost Effectiveness

Cost per QALY gained by age at vaccination*

- Vaccination at age 12
- Vaccination at ages 13-18
- Vaccination at ages 19-21
- Vaccination at ages 22-26

*Lower coverage scenario: 3-dose coverage 30% at age 12, 50% by age 26 (after 20 yrs).

Vaccination of all age groups is recommended to vaccination of younger age groups. Results for male vaccination are the cost-effectiveness of expanding male vaccination to include additional age groups, in the context of an existing vaccine program for females aged 12-26 years. Coverage effectiveness applies to males and females. *Indicated* outcomes include cervical outcomes, vaginal, vulvar, and anal cancers, and other anogenital outcomes. Plus non-epithelial cancer, penile cancer, and recurrent respiratory papillomatosis. QALY = quality-adjusted life year.

Cost Effective Vaccination Strategy

- Public-sector cost of fully vaccinating one person as recommended through adulthood (not including annual influenza vaccines) is roughly $1,450 for males and $1,800 for females, of which the HPV and meningococcal vaccinations alone account for more than 25% at current prices.
- CDC analysis showed that it would be more cost-effective to spend up to the purchase price of the HPV vaccine on improving vaccine uptake among girls than it would be to extend the program to boys.
- Make cost-effectiveness analysis a more practical tool, analysts should evaluate investments across multiple diseases and interventions and include the influences of nonmonetary constraints.

Vaccines of the Future

- Temperature stabilization and vaccine delivery
- Cancer (breast, ovarian, pancreatic)
- Hospital acquired infections (Staph, C diff, Pseudomonas)
- Type I DM
- Alzheimer’s
- Meningococcal Type B
- Hepatitis C
- HIV

Conclusions

- Vaccines remain effective strategies to prevent significant morbidity and mortality of certain diseases
- Yet they are underutilized by most adults, especially in our minority population
- Cost-effective infrastructures to provide wide-spread utilization should be encouraged