Vaccines: Across the Spectrum of Life

Jason Mohror, MD, FAAP • 04.21.2018

Overview

Influenza

- Disease
- Vaccine
- Barriers to Vaccination
- Exciting News

Human Papilloma Virus

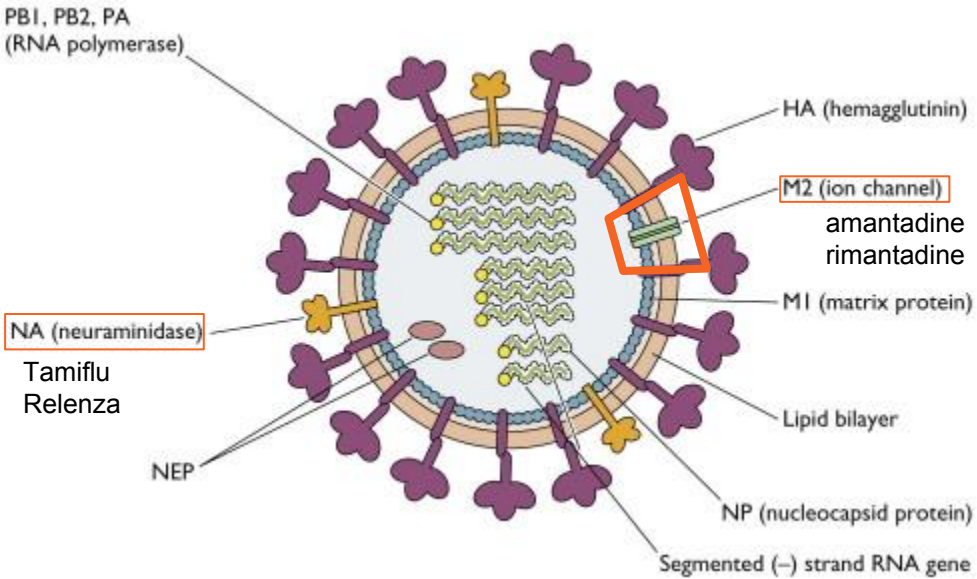
- Disease
- Vaccine
- Barriers to Vaccination
- Success

Shingles

- Disease
- Vaccine
- Barriers to Vaccination
- More Exciting News

Influenza

Influenza



The influenza virion is roughly spherical. The outer layer is a lipid membrane which is taken from the host cell in which the virus multiplies. Inserted into the lipid membrane are glycoproteins known as HA (hemagglutinin) and NA (neuraminidase). These are the proteins that determine the subtype of influenza virus (A/H1N1, for example).

Influenza

Sudden Onset

- Fever* or feeling feverish/chills
- Cough
- Sore throat
- Runny or stuffy nose
- Muscle or body aches
- Headaches
- Fatigue (very tired)

- Spread mainly by tiny droplets made when people with flu cough, sneeze or talk.
- Contagious for 1 day **before** symptoms develop and up to 5 to 7 days **after** becoming sick.
- Onset after exposure is about 1 to 4 days, with an average of about 2 days.

Influenza

Complications

Complications of flu can include bacterial pneumonia, ear infections, sinus infections, and worsening of chronic medical conditions, such as congestive heart failure, asthma, or diabetes.

High Risk for Complications

- 65 years and older
- people with certain chronic medical conditions (such as asthma, diabetes, or heart disease)
- pregnant women
- young children (<25 months)

Influenza Prevention

Everyday

- Avoid and limit contact.
- Your fever should be gone for 24 hours without the use of a fever-reducing medicine.
- Cover your nose and mouth.
- Wash your hands often with soap and water. If soap and water are not available, use an alcohol-based hand rub.
- Avoid touching your eyes, nose and mouth.
- Clean and disinfect surfaces.

Vaccine - Why? Kids!

- A yearly flu vaccine is the first and most important step in protecting against flu viruses.
- A flu vaccine protects against the viruses that research suggests will be most common. (2017-18, H3N2)
- Flu vaccination can reduce flu illnesses, doctors' visits, and missed work and school due to flu, as well as prevent flu-related hospitalizations.

www.cdc.gov

Influenza Vaccine

Vaccine - Who

- Everyone > 6 months of age should get a flu vaccine every year before flu activity begins in their community. (When - end of October)
- Vaccination of high risk persons is especially important to decrease their risk of severe flu illness.
- People at high risk of serious flu complications.

Vaccine - Who

- Vaccination also is important for health care workers, and other people who live with or care for high risk people to keep from spreading flu to them.
- Children younger than 6 months are at high risk of serious flu illness, but are too young to be vaccinated. People who care for infants should be vaccinated instead.
- Severe Allergies - NO!

Influenza Vaccine

Trivalent

- Standard-dose trivalent shots (IIV3) that are manufactured using virus grown in eggs.
- A high-dose trivalent shot, approved for people 65 and older.
- A recombinant trivalent shot that is egg-free, approved for people 18 years and older, including pregnant women.
- A trivalent flu shot made with adjuvant approved for people 65 years of age and older (new this season - 2017-18).

Quadrivalent

- Quadrivalent flu shots approved for use in different age groups, including children as young as 6 months.
- An intradermal quadrivalent flu shot approved for people 18 through 64 years of age.
- A quadrivalent flu shot containing virus grown in (canine kidney) cell culture.
- A recombinant quadrivalent flu shot approved for people 18 years of age and older, including pregnant women (new this season - 2017-18).

Barriers of Influenza Vaccination Intention and Behavior – A Systematic Review of Influenza Vaccine Hesitancy, 2005 – 2016

Philipp Schmid
Dorothee Rauber
Cornelia Betsch
Gianni Lidolt
Marie-Luisa Denker

Barriers to Influenza Vaccine Use

Lacking cues to action

- No direct recommendation from medical personnel.
- No recommendation from relatives.

Fewer previous flu vaccinations

Low perceived utility

Negative attitude towards flu vaccine

- Do not believe in the effectiveness.
- Lack of trust in authorities such as NHS (CDC).

Published: January 26, 2017 https://doi.org/10.1371/journal.pone.0170550

A single dose and long lasting vaccine against pandemic influenza through the controlled release of a heterospecies tandem M2 sequence embedded within detoxified bacterial outer membrane vesicles

Hannah C. Watkins
Catalina L. Pagan
Hannah R. Childs
Sara Posada
Annie Chau
Jose Rios
Cassandra Guarino
Matthew P. DeLisa
Gary R. Whittaker
David Putnamad

Future Influenza Vaccine

Problem

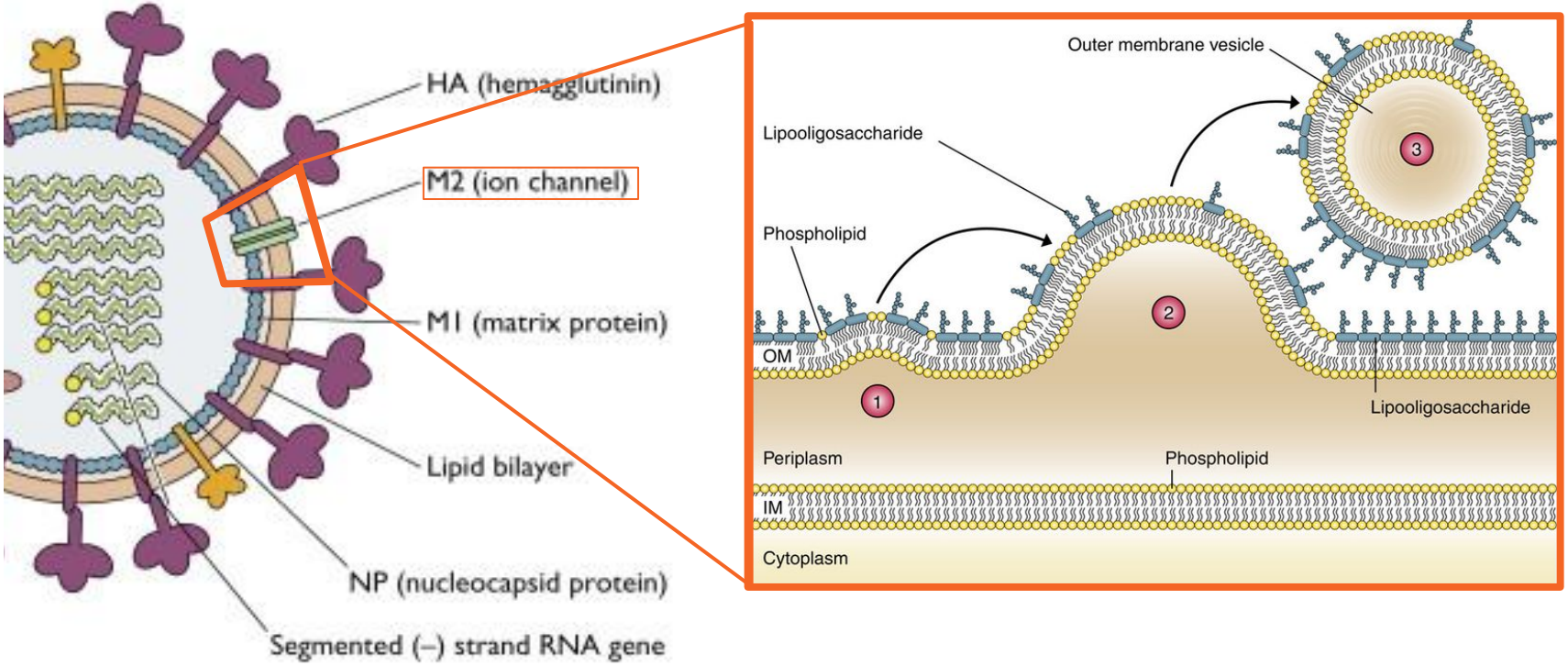
- "The influenza A virus undergoes genetic drift and shift, leaving the general population susceptible to emerging pandemic strains, despite seasonal flu vaccination."

Recombinant Outer Membrane Vesicles (rOMVs) next slide

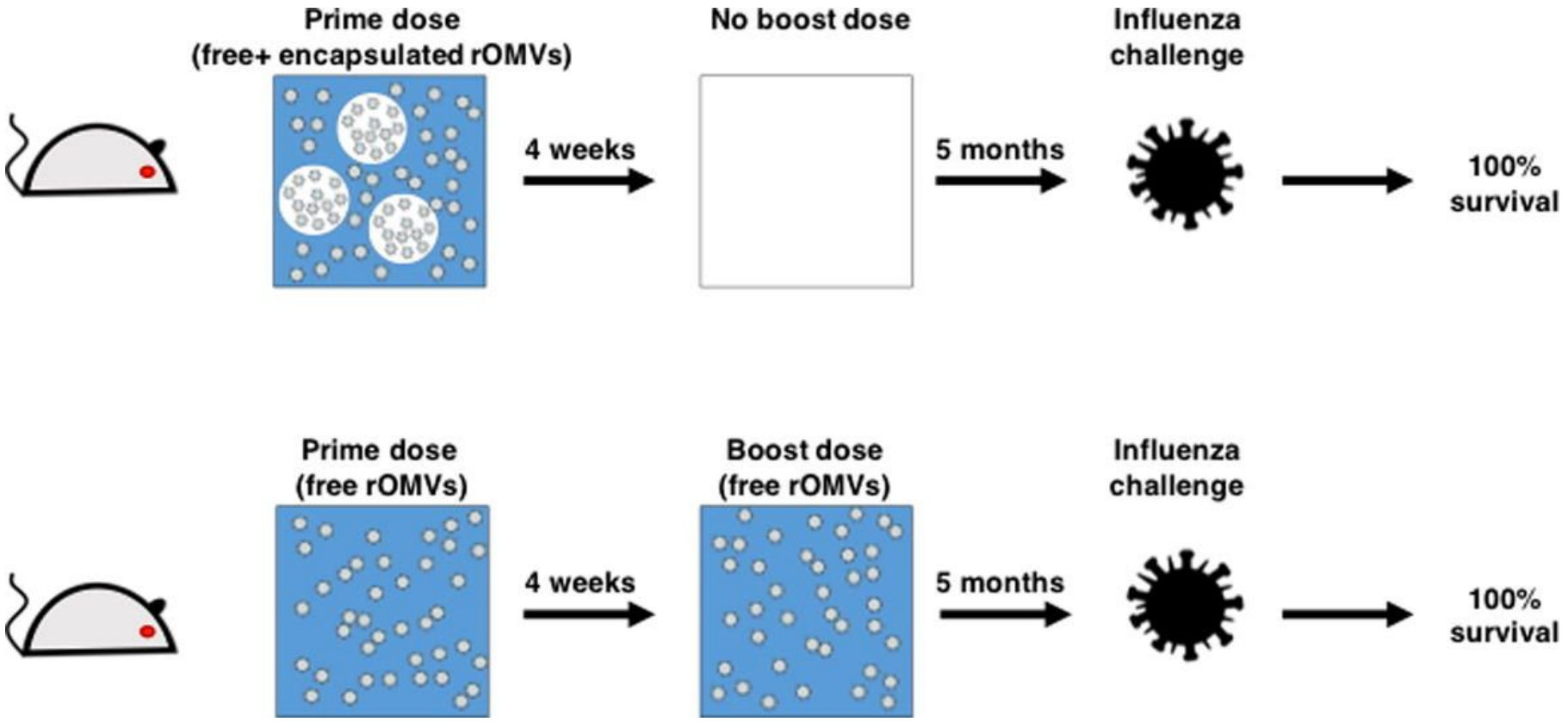
Did it work? Yes!

- "The protective immune response was long lasting, eliciting sustained antibody titers and 100% survival of mice challenged with a lethal dose ... six months post initial vaccination."

Vaccine, Vol. 35, Issue 40, 25 Sept 2017



Influenza virus → rOMV



Vaccine, Vol. 35, Issue 40, 25 Sept 2017

Brief interruption with important information

Pediatrics, Volume 138, number 3, 2016

Countering Vaccine Hesitancy

Evidence-based medicine advice from American Academy of Pediatrics Committee on Infectious Diseases and the Committee on Practice and Ambulatory Medicine

http://pediatrics.aappublications.org/content/early/2016/08/25/peds.2016-2146

A regret too frequent

“In 1736 I lost one of my sons, a fine boy of four years old, by the small-pox, taken in the common way. I long regretted bitterly, and still regret that I had not given it to him by inoculation. This I mention for the sake of parents who omit that operation, on the supposition that they should never forgive themselves if a child died under it; my example showing that the regret may be the same either way, and that, therefore, the safer should be chosen.” — Benjamin Franklin

Vaccine hesitancy is not a new phenomenon.

Vaccine Safety

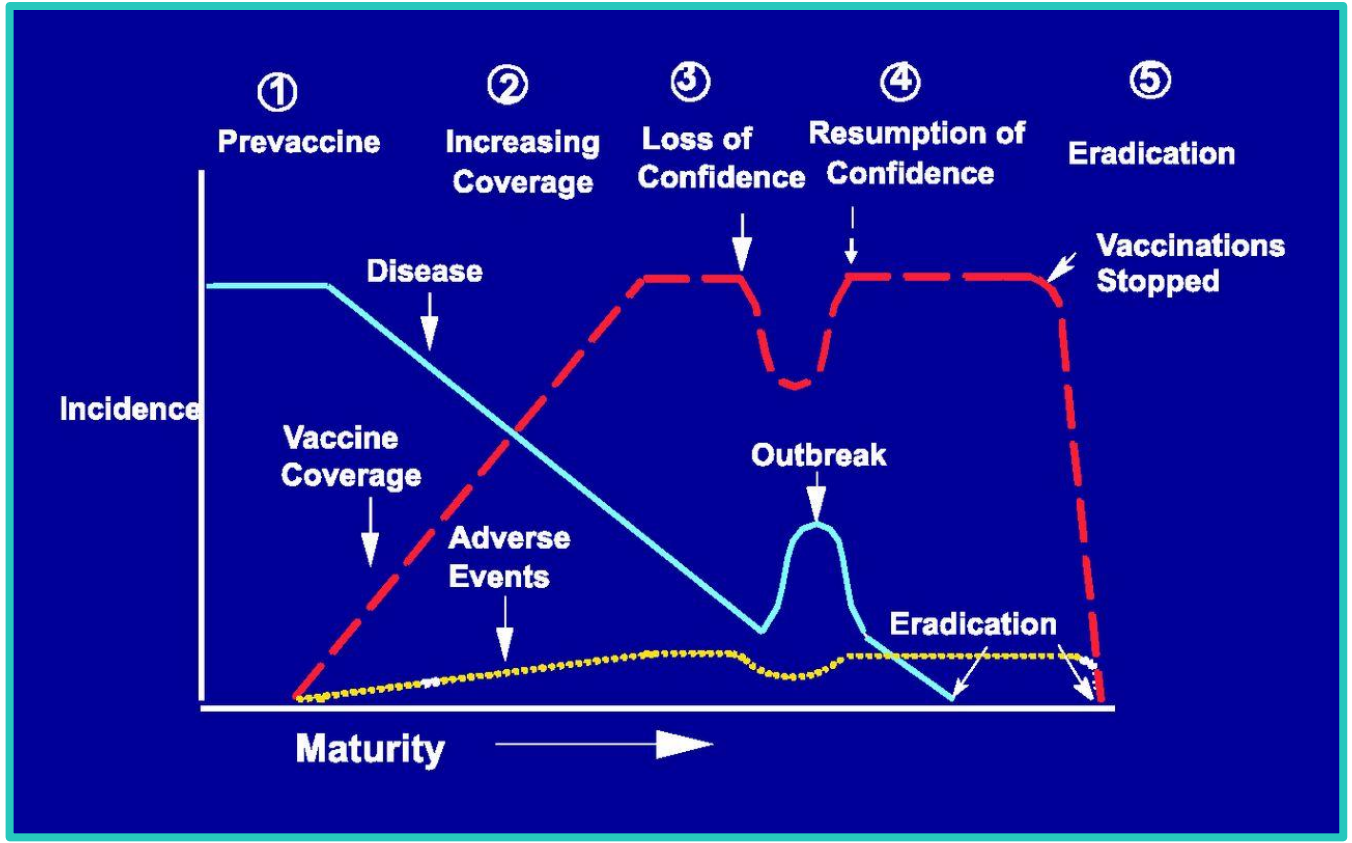
Tested Thoroughly

FDA Regulated

Carefully Monitored

- Vaccine Adverse Events Reporting System (VAERS)
  - RotaShield®
- Vaccine Safety Datalink
  - Guillain-Barre syndrome is not associated with meningococcal vaccine.
- Post-Licensure Rapid Immunization Safety Monitoring System
- Clinical Immunization Safety Assessment Project

1. Eager to accept new vaccine.
2. Eager to vaccinate.
3. Loss of confidence. (whether adverse events related or not)
4. Vaccine acceptance restored?
5. Eradication? (polio vs HPV)



Chen RT, Orenstein WA, Epidemiologic methods in immunization programs. Epidemiol Rev. 1996; 18(2):102.

Parental concern about vaccines

Vaccine safety

- Too many vaccines
- Development of autism
- Vaccine additives (thimerosal, aluminum)
- Overload the immune system
- Serious adverse reactions
- Potential for long-term adverse events
- Inadequate research performed before licensure
- May cause pain to the child
- May make the child sick

Necessity of vaccines

- Disease is more “natural” than vaccine
- Parents do not believe diseases being prevented are serious
- Vaccine-preventable diseases have disappeared
- Not all vaccines are needed
- Vaccines do not work

Freedom of choice

- Parents have the right to choose whether to immunize their child
- Parents know what’s best for their child
- Believe that the risks outweigh the benefits of vaccine
- Do not trust organized medicine, public health
- Do not trust government health authorities
- Do not trust pharmaceutical companies
- Ethical, moral, or religious reasons

Concerns should be individually identified and addressed.

A concern about aborted fetal tissues

"In the early 1960s, cells used to make vaccines were obtained from two elective abortions… These two sources of human fetal cells have been used to make vaccines against rubella, rabies, chickenpox, and hepatitis A."

We live in a world of sin. Whatever we participate in is part of that sinful world.

"Human history is filled with injustice. Acts of wrongdoing in the past regularly rebound to the benefit of descendents who had no hand in the original crimes. It would be a high standard indeed if we were to require all benefits that we receive in the present to be completely free of every immorality in the past."

-- National Catholic Bioethics Center

Offit and Moser, Vaccine Safety and Your Child: Separating Fact from Fiction, 2011

“Seek first to understand, then to be understood.”

Stephen Covey, 7 Habits of Highly Effective People - Habit 5

Summary

No data exist for best methods of overcoming hesitancy.

Vaccines are safe and effective.

Serious disease can occur if your child or family are not immunized.

Many hesitant parents are not opposed, just need guidance.

The current vaccine schedule is the only one recommended by the CDC and AAP.

Bottom Line Advice

“Emphasize that infants and children are the ones at greatest risk of disease. The on-time administration of vaccines is the most effective way to prevent what have in the past been severe and often fatal childhood illnesses. Delaying any vaccine past the recommended administration date greatly increases the period of time that a child remains susceptible to disease and also exposes even vaccinated children to additional risk.”

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Human Papilloma Virus

Human Papilloma Virus

Most Common STI

- 79 million Americans
  - Mostly teens and 20s
- 14 million newly infected people each year
  - ½ between ages 15-24

Disease

- Genital warts - 1 in 100 sexually active adults
- Cervical Cancer
  - 12,000 new diagnoses each year; 4000 die each year
- Other cancers

www.cdc.gov

HPV Prevention

Abstinence (last sentence of HPV factsheet)

- Monogamy
- Get vaccinated!
- Latex condoms
- Cervical cancer screening for women aged 21-65

Vaccine - Why?

- Most sexually active people will get HPV at some point in life, though most will never know it.
- ***Christians are sinners and can/will make extreme errors in judgement! We have all disappointed our Savior!***

www.cdc.gov

HPV Vaccine

Vaccine - Who

- All 11 to 12 year old males and females should receive 2 doses at least six months apart. (new recommendation - 10/19/16)
- Teens and young adults who start the series at age 15 or later need three doses.
- If already sexually active, give. Not likely to be inoculated with all covered HPV varieties.

Vaccine - Not Who

- Clinical trials have shown that women over the age of 26 got only limited or no protection against HPV-related diseases.
- Severe Allergies - NO!
- Wait until after pregnancy.

www.cdc.gov

HPV Vaccine

How is it made?

- The HPV vaccine is made using a protein that resides on the surface of the virus. The protein is grown in the lab in yeast cells (recombinant). Once the protein is grown, it assembles itself to look like the HPV virus; however, importantly, it does not contain HPV genetic material, so it can't reproduce itself or cause illness.

Safety

- Redness, tenderness, and small numbers of fever.
- Safety networks have continued to monitor reactions to the HPV vaccine since its licensure.

HPV Vaccine

Safety

- Despite concerns raised by the media and some citizen groups, **no** cause-effect links have been found between HPV vaccine and adverse events, including blood clots, allergic reactions, strokes, seizures, Guillain-Barré Syndrome (GBS, a rare cause of paralysis), birth defects, miscarriages, infertility or premature ovarian failure, or infant/fetal deaths.

Barriers to HPV Vaccine Use

Barriers to Human Papillomavirus Vaccination Among US Adolescents: A Systematic Review of the Literature

Dawn M. Holman, MPH
Vicki Benard, PhD
Katherine B. Roland, MPH
et al

No direct recommendation from medical personnel.

Cost/Lack of insurance

Parents report “Need information”/”Heard about bad side effects”

Effect on sexual behavior

Low perceived risk of HPV infection

Social influences

Irregular preventative care

JAMA Pediatr. 2014;168(1):76-82. doi:10.1001/jamapediatrics.2013.2752

HPV Vaccine Effectiveness

To be most effective, must be given before sexual activity starts!

Gardisil/Cervarix (6, 11, 16, 18)

- 100% protection against persistent cervical infections with HPV types 16 and 18 and the cervical cell changes that these persistent infections can cause.

Gardisil 9

- 100% protection against persistent cervical infections with HPV types 16 and 18 and the cervical cell changes that these persistent infections can cause.
- 97% effective in preventing cervical, vulvar, and vaginal disease caused by the five additional HPV types (31, 33, 45, 52, and 58) that it targets.

www.cancer.gov

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Shingles (Herpes Zoster)

Shingles (Herpes Zoster)

1 of 3 Americans

- 1 million cases each year
- Children and adults; risk increases with age, immunodeficiencies, immunosuppressive drugs.
- Usually 1 episode per lifetime; maybe 2 or 3

Disease

- Reactivates from dormant chickenpox (varicella zoster virus) infection
- No known cause of reactivation.
    - Stress and illness common.

Shingles

- **Painful** rash on one side of face or body.
- Blisters that scab over in 7-10 days; clears by 2-4 weeks.
- Prodrome of pain, itching, or tingling 1-5 days before rash appears.
- Fever, headache, chills, upset stomach.

www.cdc.gov

Shingles (Herpes Zoster)

Postherpetic Neuralgia

- 10-13% will get PHN - severe pain where the rash was, lasting even after the rash clears up.
    - Severe, debilitating for a few weeks to months; possible for many years.
    - More likely in older adults; longer lasting and more severe pain.

Other Complications

- Shingles in eye can cause vision loss.
- Rarely
    - Pneumonia
    - Hearing problems
    - Encephalitis
    - Death

Shingles (Herpes Zoster)

Prevent Transmission

- Direct contact with person with no chickenpox history.
    - Cover rash.
    - Avoid touching or scratching.
    - Wash hand often.
    - Until crusting, avoid contact with the pregnant, premature, LBW infants, immunosuppressed, immunodeficient.

Prevent Reactivation

- Vaccinate - the **only** way to reduce the risk of shingles and PHN.
- **New 2017** - CDC recommends healthy adults 50 yrs and older get two doses of Shingrix®.

www.cdc.gov

Efficacy of an adjuvanted herpes zoster subunit vaccine in older adults.

Lal H, Cunningham AL, Godeaux O, Chlibek R, Diez-Domingo J, Hwang SJ, Levin MJ, McElhaney JE, Poder A, Puig-Barberà J, Vesikari T, Watanabe D, Weckx L, Zahaf T, Heineman TC; ZOE-50 Study Group.

Shingrix®

Zostavax®

- Live-attenuated; contraindicated in immunosuppression.
- Lost efficacy after 4 years.
- Efficacy 69.8% between 50-59 years to 37.6% in those >69 years old.

Shingrix®

- **Recombinant** - Chinese hamster ovary cells.
- Adjuvanted - *Salmonella minnesota* lipid membranes and *Quillaja saponaria* Molina plant extract.
- Must be reconstituted, no preservatives.

N Engl J Med. 2015 May 28;372(22):2087-96

Barriers to the use of herpes zoster vaccine.

Hurley LP, Lindley MC, Harpaz R, Stokley S, Daley MF, Crane LA, Dong F, Beaty BL, Tan L, Babbel C, Dickinson LM, Kempe A.

Shingrix®

Efficacy

- Mean follow up was 3.2 years; long-term follow-up ongoing.
- 97.2% efficacy against herpes zoster.
- Local injection site adverse effects in 17%.

Barriers (based on Zostavax®)

- No direct recommendation from medical personnel.
  - ½ of those who strongly recommend influenza vaccine
- Cost!!!
  - Medicare part D

Ann Intern Med. 2010 May 4;152(9):555-60