Vaccines: Heroes or Villains?
(Hint: It’s the first one)

James W. Jarvis, MD, FAAFP
Senior Vice President/Senior Physician Executive
Northern Light Eastern Maine Medical Center
Vaccinations: A brief History
Vaccinations: A Brief History

OUR IMMUNE SYSTEM

ANTIBODIES VS ANTIGENS
Vaccinations: A Brief History

[Diagram showing the immune response process]

- Viral antigen
- MHC I
- MHC II
- APC
- Lymph node
- Th cell
- CTL
- IFN-γ
- Perforin
- Granzyme
- Memory T cell
- B cell
- Memory B cell
- Antibodies

Northern Light Health
Antibody vs Antigen
Vaccinations: A Brief History

- Smallpox - The First Vaccine
  - 1 in 3 people infected died
  - Those who survived were badly scarred
Vaccinations: A Brief History

- Edward Jenner
  - Witnessed milkmaids and dairy farmers had less severe symptoms of smallpox
  - In 1796 he showed inoculation with Cowpox Virus Protected against Smallpox
  - Coined the term ‘Vaccination’ from the Latin ‘Vacca’ or ‘from the cow.’
  - Prior to this it was common practice to voluntarily inoculate with Smallpox itself (Variolation).
Vaccines: A Brief History

- Vaccination grew in acceptance quickly
- Jenner shared his vaccine with medical providers, but not without controversy
- Anti-Vaxers existed in 1800s too
- They refuted the evidence by shaming Jenner for his refuted writings on Dodo Birds
- Jenner was later proven correct on both.
- In 1840 Variolation was made illegal in England in favor of vaccination.
Vaccines: A Brief History

Vaccinia Virus

Smallpox (Variola) Virus
Vaccines: A Brief History

- Success of mid to late 20th Century Smallpox eradication effort is considered one of humankind’s greatest accomplishments.
- It crossed science, geopolitics, and fear of both disease and technology.
- Why so successful?
Vaccines: A Brief History

- Humans are the only host
- It was so deadly people were willing to set aside differences
- The virus does not change over time
- The Vaccinia virus vaccine could be stabilized and transported
- The last natural case was in Somalia in 1977
- The WHO declared it eradicated in 1980.
Vaccines Today

- Mumps
- Measles
- Rubella
- Hepatitis A
- Hepatitis B
- Rotavirus
- Diphtheria
- Pertussis
- Tetanus
- Varicella
- Zoster
- Hib
- Influenza
- Pneumococcal
- Meningococcal
- HPV
- Yellow Fever
- Anthrax
- And More....
Vaccines Today

- **Live Attenuated Vaccines**
  - Altered in some way to prevent causing disease
  - (MMR, Chickenpox)

- **Inactivated/Killed Vaccines**
  - Remnants of a once living pathogen
  - (Polio, Hepatitis A)

- **Toxoid Vaccines**
  - Resemble the toxin produced by a pathogen
  - (Tetanus, Diphtheria)

- **Subunit/Conjugate Vaccines**
  - Contain parts of the pathogen to induce response
  - (Pertussis, Influenza, Pneumococcal)
Immunization in the United States Today

- Poliomyelitis

  - 1952 had 57,000 cases with 27,000 resulting paralysis

  - 1979 last case of naturally occurring polio paralysis in an unvaccinated religious community

  - Continue to attempt eradicate worldwide but not as feared as Smallpox
Immunization in the United States Today

- **Mumps, Measles, German Measles (Rubella)**
- Highly contagious and commonplace prior to vaccination
- Usually mild illnesses but can have severe consequences
- In 1964, 12 million Americans contracted Rubella
  - 11,000 miscarriages
  - 20,000 cases of congenital rubella
- Measles caused encephalitis in 1:1000
- Mumps was the number cause of viral meningitis/hearing loss in children
Immunization in the United States Today

- Pertussis outbreaks occur annually
  - Can be fatal to very young and very old

- Tetanus
  - Pathogen lives in soil and creates toxin
  - Serious illness and death occurs in under immunized
  - Immunity wanes over years since last immunization
Vaccines in the United States Today
Pneumonia, Meningitis, Cancer Prevention

- **Hib** was leading cause of bacterial meningitis in children
- **Meningococcus** remains a leading cause now with 13% of infected individuals dying.
- **Pneumococcus** was a leading cause pneumonia in children and adults
- **Human Papilloma Virus (HPV)** causes cancers in women and men that are prevented by vaccination
The Case of Influenza and the Yearly Vaccine

- There are many strains of viruses that cause Influenza
- They are highly contagious, respiratory viruses
- Illnesses can be very serious
  - 1918 100 million deaths (3-5% of population)
  - 2017-18 80,000 American deaths
  - 2016-17 31 million infections/300 thousand hospitalizations
The Case of Influenza and the Yearly Vaccine

- There are two Types that infect humans, A and B
- Each has many subtypes that are constantly changing
- Both made up of 2 components: Hemagglutinins and Neuraminidases (The H and N of type)
- These cause the antigenic response of our immune system....
- ...and cause us to need new immunizations.
The Case of Influenza and the Yearly Vaccine
Tale of the Holiday Sweater
Tale of the Holiday Sweater
Tale of the Holiday Sweater
Tale of the Holiday Sweater
Tale of the Holiday Sweater
Tale of the Holiday Sweater
Myths of the Influenza Vaccine

“I always get the flu when I get the shot.”

The flu shot is not a live vaccine and cannot cause illness.

“The flu will be worse next year if you get the shot.”

This year’s vaccine does not affect next year’s virus.

“I’m allergic to the flu shot.”

It is possible but unlikely now, even if allergic to eggs.

“I never get the flu.”

You probably have, but even so that does not protect you.

“The flu hasn’t killed me.”

Yes, but it may have killed someone you loved.

“The vaccine has side effects worse than the flu.”

Side effects include pain at injection site and not getting the flu.
Who Should Get the Influenza Vaccine

Anyone over 6 months of age of is eligible to receive the vaccine but especially:

The young and the elderly

Pregnant Women

Anyone with Respiratory or Cardiac Diseases

Healthcare Workers

Anyone who lives with anyone above
Controversies, Myths, and Rumors

• These diseases no longer occur so vaccine is unnecessary.
• Outbreaks of everything but smallpox continue to occur.
• Whooping cough (pertussis) and Hepatitis A in southern Maine recently. 2017 saw first case of Measles in 20 years.

• Natural immunity is better than immunization.
• Vaccine preventable diseases still are responsible for deaths where vaccines are not readily available.

• Herd Immunity is not our responsibility.
• Herd immunity protects those in whom vaccination is not ideal.
• We have an obligation to protect each other.
Controversies, Myths, and Rumors

• The Vaccine Schedule is too hard on children.
  • The vaccine schedule takes into account the immune response for the age of the child and the risk of diseases at specific ages.

• Vaccines can cause disease
  • Possibly but very, very, very, very unlikely.
  • Early Rotovirus vaccine associated with intussusception.
  • 1970’s flu vaccine associated with Guillain-Barré syndrome
  • Oral Polio can cause polio like disease

• The HPV Vaccine encourages sexual activity
  • Sexual activity by teens is on the decline, as is cervical cancer.
Controversies, Myths, and Rumors

- Vaccines and Autism.
  - History: In 1980’s due to better understanding of autism the number of cases increased.
  - Childhood vaccinations also increased during this time as technology improved.
  - In 1998, a now discredited paper discussed a possible link with the MMR vaccine. Based upon 12 children with flawed or fabricated data.
  - Thimeresol, a mercury based preservative also has received attention but no causal relationship has been proven. It was removed from many vaccines as a precaution, however.
Controversies, Myths, and Rumors

• The ‘Vaccine Court’ proves collusion between the Government and Big Pharma.
• History: In 1986 Congress passed the National Childhood Vaccine Injury Act.
• This act worked to efficiently and effectively manage claims cases—it includes oversight and appeals processes.
• It has found in favor of plaintiffs even where science does not agree, however these were for unique circumstances.

• Big Pharma makes billions on vaccines
• Possibly true, but that is a fraction of what they make on other drugs-Viagra alone is worth over a billion dollars per year.
Vaccines: Heroes or Villains

Questions

Comments