

Vaccines: History, Science, Ethics

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This Presentation is Approved for
1 CRCE Credit Hour

1

1

Learning Objectives

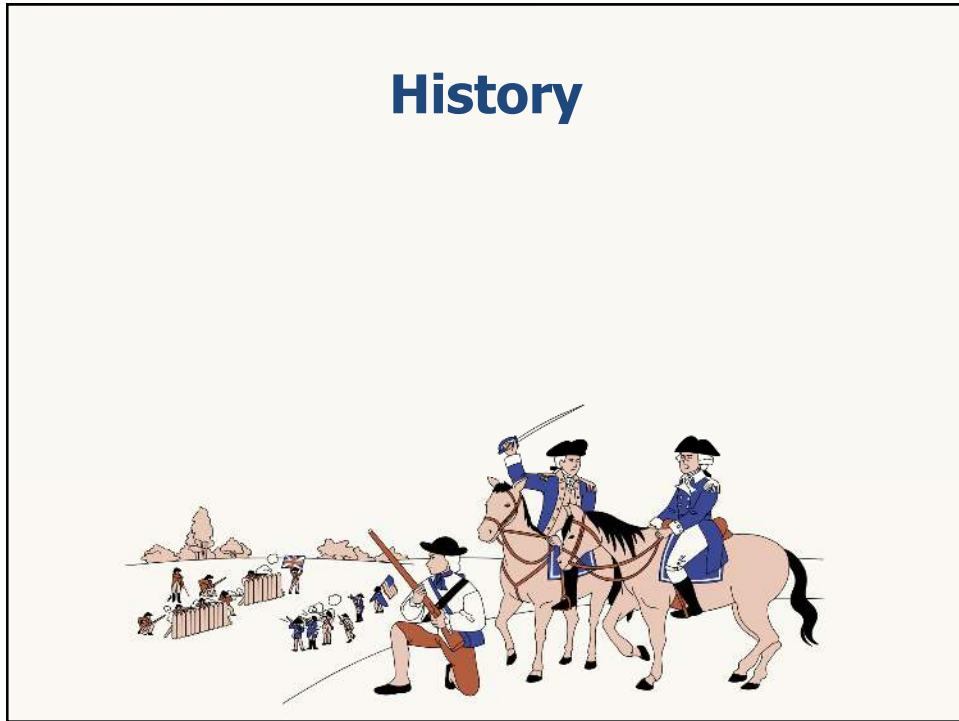
- Describe the history of vaccines
- Explain the science of vaccines
- Describe the ethical, legal, and psychosocial issues associated with vaccines

2

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4

Smallpox

- Variola Major
- Variola minor
 - Fever
 - Vomiting
 - Sores
 - Skin rash
 - Pox & scabs



5

5

History

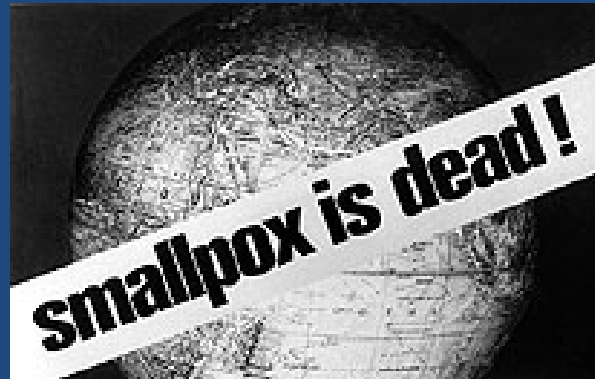
- 10,000 BC:** Believed to have appeared in Africa
- 180 AD:** Major epidemic coincides with fall of Roman empire
- 1500-1800 AD:** Introduction of smallpox to New World decimates native population
- 1600:** Chinese introduced variolation, an early vaccination
- 1796:** Jenner uses cowpox extract to vaccinate against smallpox

6

Recent History

1967: World Health Organization (WHO) campaign to eradicate smallpox

1980: WHO – Smallpox is Dead!



7

Pertussis Overview

- **Catarrhal Stage**
 - Mimics URI
- **Paroxysmal Stage**
 - Coughing 1-10 weeks
- **Convalescent Stage Diarrhea**
 - 2-3 weeks (maybe longer)

8

8

Typhoid Fever Overview

- Stomach Pain
- Headache
- Red Spots
- Diarrhea
- Weakness
- ABX
- Carriers

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9

Diphtheria Overview

- Sore throat
- Difficulty breathing
- Low grade fever
- Swollen neck glands
- Thick gray-white membrane

10

10

Measles

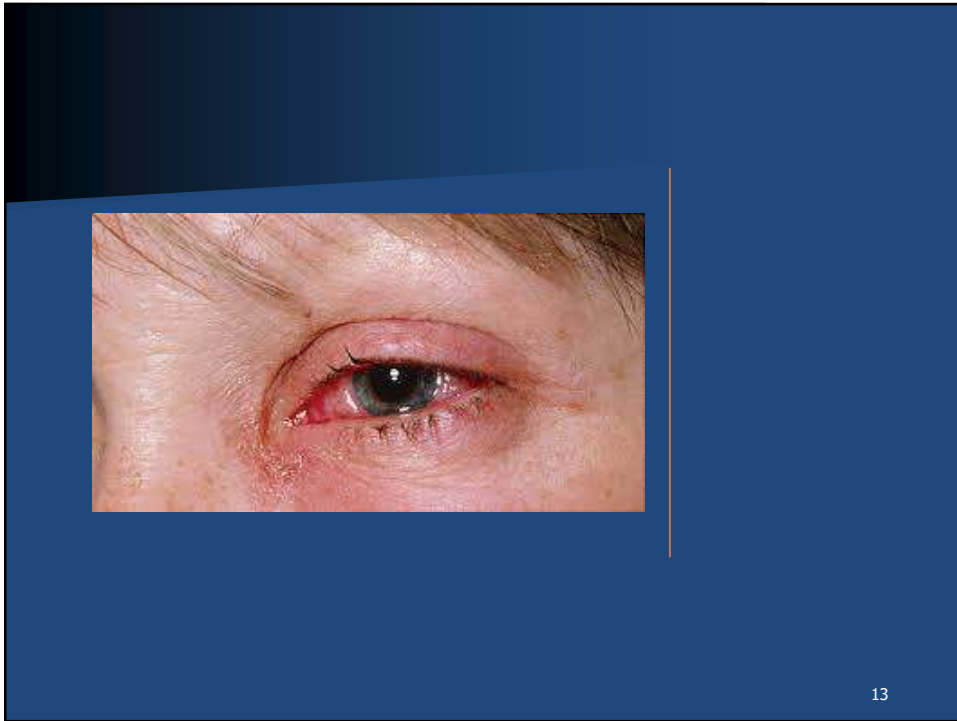
- Airborne Virus
- 90% infection rate

11

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12



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13

Measles

- 1713 Outbreak
- 1757 Infectious nature shown

14

14

Yellow Fever

- 1732 Charleston, South Carolina

15

15

Key Milestones in Vaccine History

- 1796 – Jenner develops first smallpox vaccine (cowpox extract)
- 1879 – Pasteur develops first lab-made vaccine (cholera in chickens)
- 1905 – Jacobson v. Massachusetts Supreme Court ruling on vaccine mandates
- 1955 – Polio vaccine introduced (Salk)
- 1977 – Last natural case of smallpox
- 1980 – WHO declares smallpox eradicated
- 2020 – COVID-19 vaccines developed within a year

16

16

Jenner's Breakthrough

17

17

Increasing Potency

- 1836 Edward Ballard

18

18

Mandatory Vaccination

- 1853 United Kingdom

19

19

Vaccine Laws

- 1855 Massachusetts

20

20

First Lab Vaccine

➤ 1879 Louis Pasteur



21

21

Anti-Vaccination Begins

➤ 1882

ANTI - VACCINATION LEAGUE.

“Evils of Vaccination”

BY

J. A. C. McCUAIG.

MASSEY HALL | Tues., 13th March

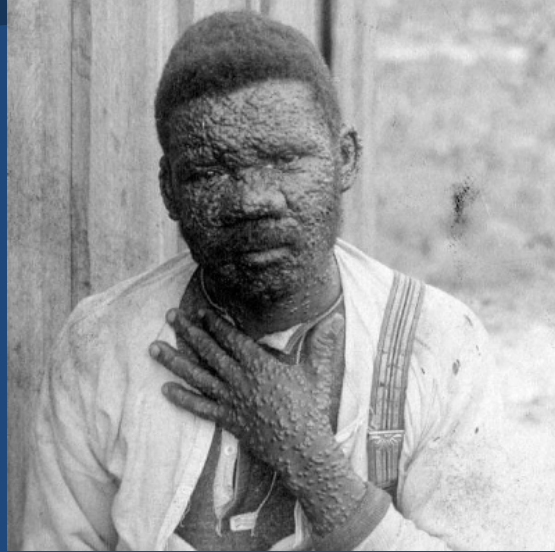
The stereopticon illustrations to be used on this occasion have been furnished by the celebrated Dr. Levenson of New York, and are taken from his book, “Vaccination: its Pathology and Relation to Biology,” now in press. It is not considered desirable that these illustrations be viewed by children or persons nervously inclined. Tickets 25 cents,

22

22

Outbreak

➤ 1893 - Smallpox



23

Polio

➤ 1894 – First U.S. epidemic



24

24

Exemptions

- 1898 – Britain allows exemptions

25

25

Contamination

- 1901 – Tetanus outbreak

26

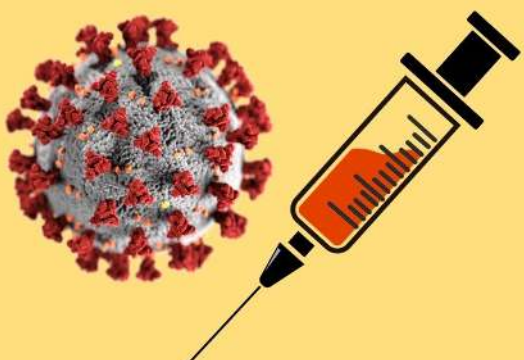
26

Supreme Court

➤ 1905 – Jacobson v. Massachusetts

Jacobson v. Massachusetts

Supreme Court Briefs



27

Accidents

➤ 1971 Aral Sea

➤ 1978 Janet Parker



28

Preventable Diseases

- Typhoid fever
- Cholera
- Whooping cough
- Smallpox
- Polio
- Measles
- Diphtheria
- More....

29

29

How Vaccines Work in the Immune System

Innate Immunity →
First line of defense (skin, mucosa, immediate response)

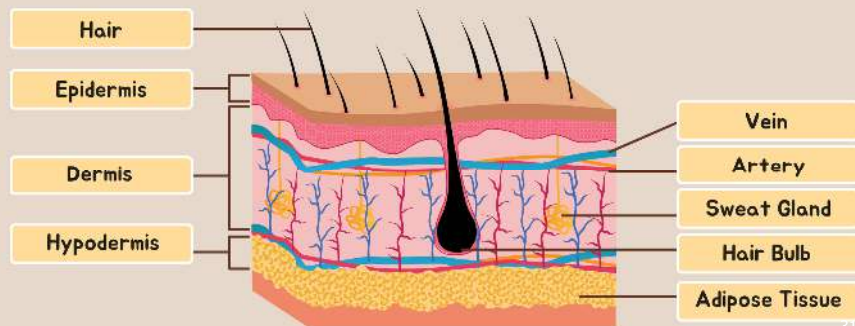
Adaptive Immunity → Activated by vaccines:
- B cells → Antibodies (IgG, IgA, etc.)
- T cells → Helper & Cytotoxic functions

Vaccines create memory cells → faster, stronger response upon exposure

30

Immune System

- **First line of defense**
 - Intact skin
 - Secretions



31

Immune System

- **Innate System**
 - Non-specific
 - Immediate
 - Response never changes
 - 10-14 days

32

32

Immune System

- **Complement System**
 - No memory

33

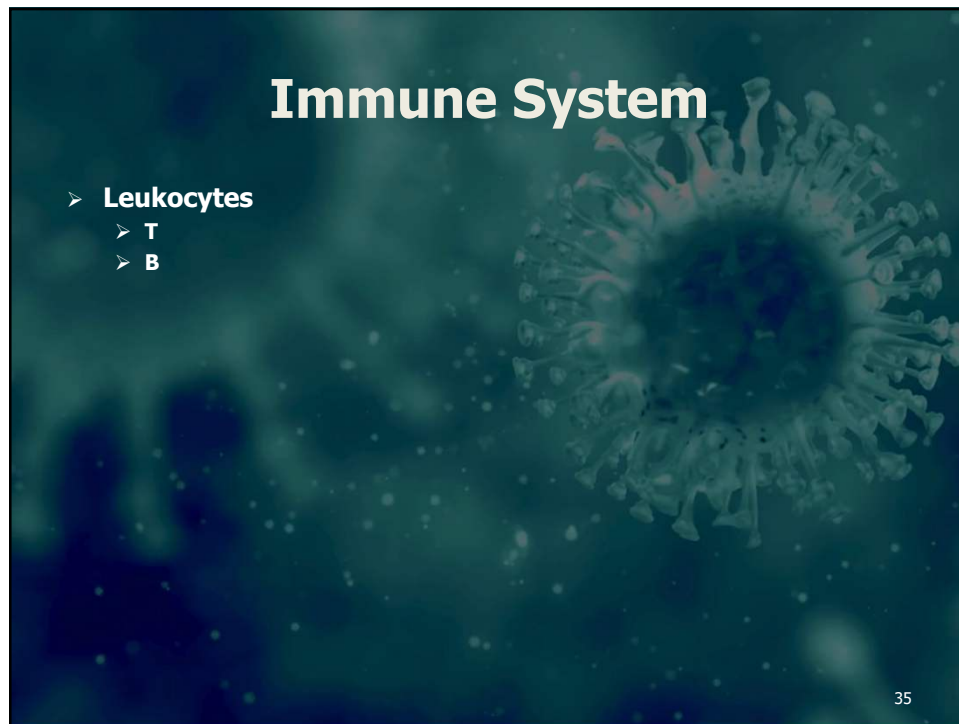
33

Immune System

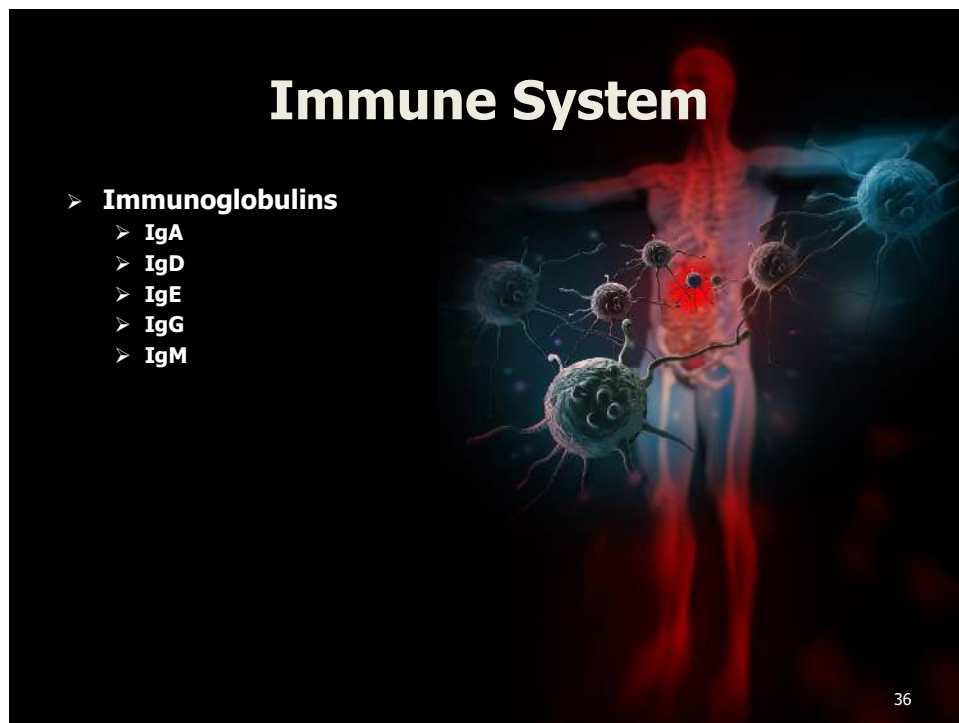
- **Adaptive System**
 - Cell Mediated
 - Humoral
- **Cell Types**
 - Neutrophils
 - Eosinophils
 - Basophils
 - Mast cells
 - Monocytes
 - Macrophages
 - Dendritic cells
 - Natural Killer Cells

34

34




35



36

Immune System

- Age
- Long term stress
- Chemo
- Radiation
- Toxins
- Autoimmune disorders



37

37

Types of Immunity

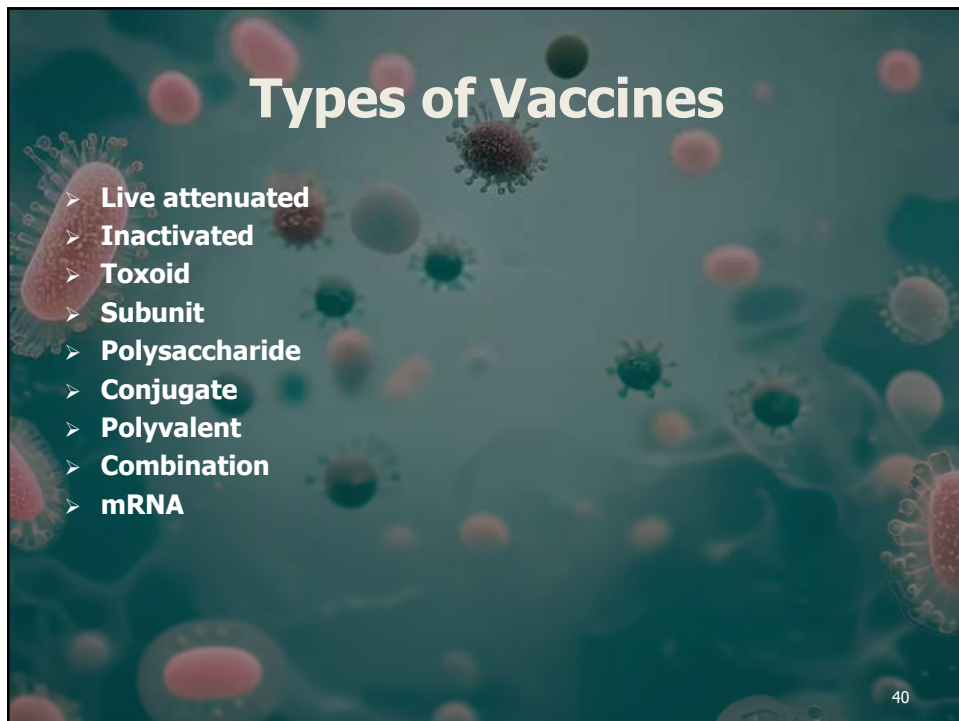
- Active
- Herd
- Cell-Mediated
- Humoral

38

38



39



40

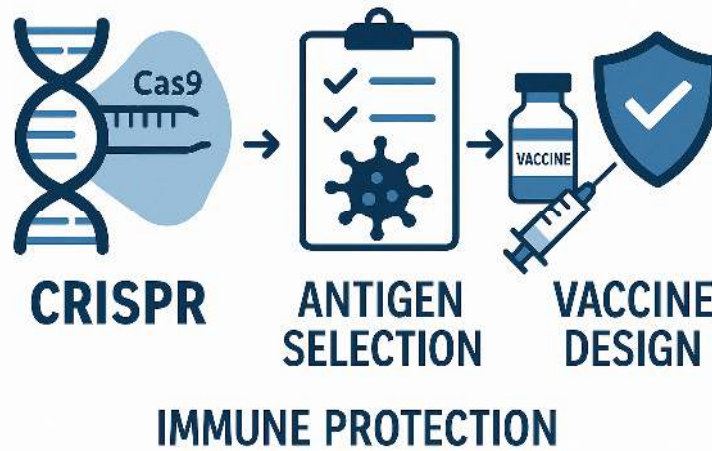
Do They Work?

- None are 100%
- Flu – only 40-70%

41

41

COVID/RSV Vaccines



2

42

COVID Vaccines Pre-Pandemic

- **Research not new**
 - 2003 Severe Acute Respiratory Syndrome (SARS-CoV-1)
 - 2012 Middle East Respiratory Syndrome (MERS)
- **mRNA Technology**
- **Global sequencing capacity**

43

43

COVID Vaccines Design Phase

- **mRNA (Pfizer-BioNTech, Moderna)**
- **Viral vector (AstraZeneca, J&J)**
- **Protein subunit (Novavax)**


 Moderna logo featuring the word "moderna" in a lowercase, sans-serif font with a blue dashed line underneath.

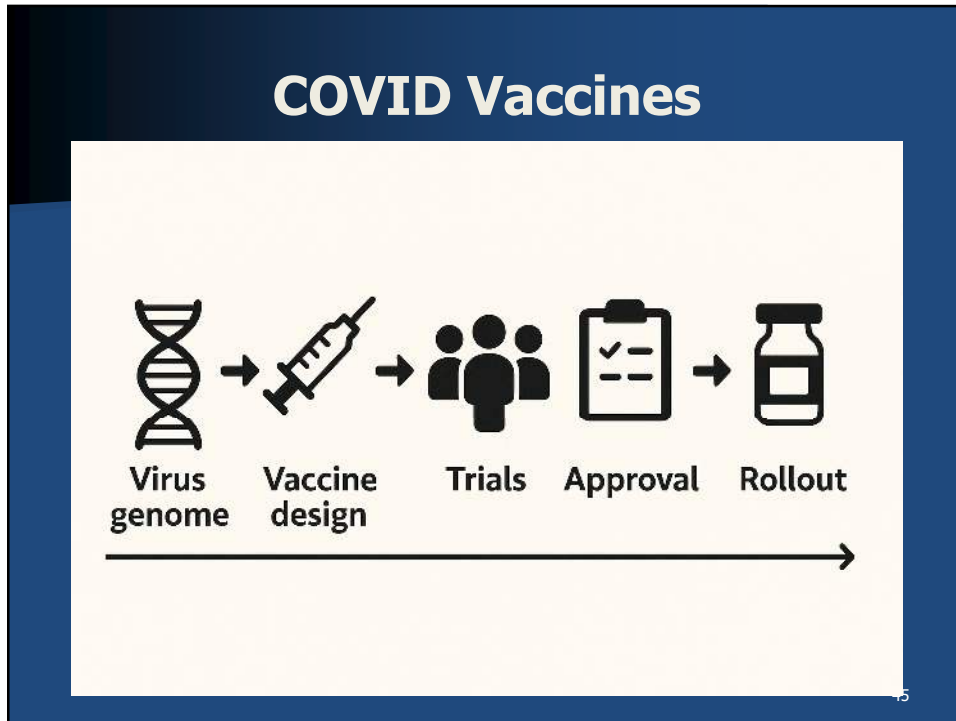

 Novavax logo featuring the word "novavax" in a lowercase, sans-serif font with a circular graphic of colored dots to the right.


 J&J logo featuring the letters "J&J" in a stylized, red, cursive font.


 AstraZeneca logo featuring the word "AstraZeneca" in a purple, sans-serif font with a yellow and blue geometric graphic to the right.

44

44






45

RSV Vaccines

- Most get it by 2 y/o
- Usually mild
- Can be severe

RSV DEATH RATE




| | | |
|--|--|---|
|  INFANTS AND YOUNG CHILDREN Worldwide estimate ~100,000 deaths annually <1% Death rate in |  OLDER ADULTS 6,000-10,000 deaths per year in the U.S. 5%-10% Mortality rate — in hospitalized older adults |  GENERAL POPULATION Rarely fatal |
|--|--|---|

46

RSV Vaccines FDA Approved

- > Pfizer's Abrysvo
- > Moderna mResvia
- > GSK Arexvy
- > Merck Enflonsia

Immunizations to Protect Against Severe RSV

| Who Does It Protect? | Type of Product | Who Is It Recommended For? | When Is It Available? |
|--|---|--|---|
|  Adults 50 and over | RSV vaccine | Adults ages 50-74 who are at increased risk of severe RSV AND Everyone ages 75 and older | Available any time, but best time to get vaccinated is late summer and early fall |
|  Babies | RSV antibody given to baby | All infants whose mother did not receive RSV vaccine during pregnancy, and some children ages 8-19 months who are at increased risk for severe RSV | October through March* |
| OR | | | |
|  Debies | RSV vaccine (Pfizer's ABRYSVO) given to mother during pregnancy | All pregnant women during weeks 32-36 of their pregnancy | September through January |

www.cdc.gov/rsv

*Recommended timing of administration in week of gestation shown. Actual dates should be determined by your healthcare provider. Some states, based on state laws, do not permit products.



47

47

Ethics of Vaccination

48

48



49

Statistical Risk

- > Adverse Events
- > Adverse Effects

50

50

Natural Optimism

- Optimism
- Familiarity

51

51

MMR Hypothesis

- 1998 – *Lancet* publishes Wakefield's paper.
- 2004 – Conflict of interest revealed (paid by lawyers suing vaccine companies).
- 2004 – 10 of 12 co-authors retract interpretation.
- 2010 – *Lancet* retracts the paper.
- 2010 – Wakefield banned from practicing medicine in the UK.
- 2011 – *BMJ* investigation shows fraudulent data (symptom timing, prior development misreported).

52

52

Thimerosal

- Methylmercury
- Ethylmercury



53

53

Other Hypotheses

- Number of vaccines
- Aluminum

54

54

The Hygiene Theory

- Just wash your hands?

55

55

Chiropractic Connection

- Daniel David Palmer

56

56

Vaccines Cause Diseases

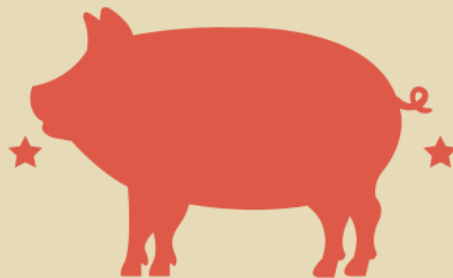
- Brain damage
- Development delays
- Allergies
- MS
- Gulf War Syndrome
- AIDS



57

Religion/Vegetarian

- God's wrath
- Porcine gelatin
- Pig-derived enzymes
- Halal & Kosher-certified



58

Too Many - Too Young

- **Overwhelming the immune system**
- **Hep B**
- **HPV**



59

59

Mandatory vs Personal Choice

- **Don't tell me what to do**
- **Florida's Surgeon General, Dr. Joseph Ladapo**
- **Community good vs personal choice**
- **GMO**
- **DNA Modification**



60

60

Dangerous Mishaps

- Potential lab leaks
- Smallpox could kill 30% of the entire world



61

61

Addressing Common Vaccine Myths

| Myth | Fact |
|---|---|
| "Vaccines cause autism" | Multiple large studies show no link (Wakefield study retracted). |
| "Too many vaccines overwhelm the immune system" | Children are exposed to far more antigens daily from the environment. |
| "Thimerosal is dangerous" | Ethylmercury in thimerosal is safe; removed from most vaccines since early 2000s. |
| "It's just a personal choice" | Community protection (herd immunity) protects vulnerable populations. |

62

The End



63