MEASLES

Clinical review and Up-date
A vaccine Preventable Disease

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Scientific Convention
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# Measles
Clinical review and Up-date:
A vaccine Preventable Disease

## SUMMARY

<table>
<thead>
<tr>
<th>Epidemic Measles In the United States eliminated 2000</th>
<th>Airport Measles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sporadic Measles Still a threat among Groups of Unvaccinated / non-immune</td>
<td></td>
</tr>
<tr>
<td>Measles is a highly contagious disease among the susceptible : 90% attack rate</td>
<td></td>
</tr>
<tr>
<td>Complications</td>
<td>Can be Serious</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Symptomatic treatment: Fever control (No aspirin) : Hydration: NO ANTIVIRALS</td>
<td></td>
</tr>
<tr>
<td>Suspect</td>
<td>Incubation 5-21 days</td>
</tr>
<tr>
<td></td>
<td>Out break with groups non-immune</td>
</tr>
<tr>
<td>Vaccine</td>
<td>Is safe and effective for protection</td>
</tr>
<tr>
<td></td>
<td>2 Shot series: Adults &amp; Children</td>
</tr>
<tr>
<td></td>
<td>MMR® Is Preferred vaccine (MMR-V)</td>
</tr>
</tbody>
</table>

ENCOURAGE VACCINATIONS
# Measles Re-emerges

5 things to remember

<table>
<thead>
<tr>
<th>Certain Patient Groups Are Most Vulnerable</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
</tr>
<tr>
<td>- Children &lt; 5 years of age</td>
</tr>
<tr>
<td>- Especially infants</td>
</tr>
<tr>
<td>- Adults older &gt;20 years</td>
</tr>
<tr>
<td>- Pregnant women</td>
</tr>
<tr>
<td>- Malnourished children</td>
</tr>
<tr>
<td>#2</td>
</tr>
<tr>
<td>Born before 1957</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

- Check vaccine records for administration of 2 doses of vaccine as evidence of immunity
- Alternatively, measuring measles IgG titers can demonstrate immunity
- Proof of immunity should be documented for all people working in the healthcare field.
- Proof of immunity is recommended for people living in or traveling to areas with ongoing measles transmission.
## Measles Re-emerges: 5 things to remember

### The Most Important Diagnostic Tool Is Your H&P

<table>
<thead>
<tr>
<th>#3</th>
<th>Diagnose measles quickly</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Allows for quarantine</td>
</tr>
<tr>
<td></td>
<td>Important for contact tracing</td>
</tr>
<tr>
<td></td>
<td>Vaccination of susceptible contacts</td>
</tr>
<tr>
<td></td>
<td>Other public health interventions</td>
</tr>
</tbody>
</table>

### History

<table>
<thead>
<tr>
<th></th>
<th>Patients vaccination status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Possible exposure to measles</td>
</tr>
<tr>
<td></td>
<td>Travel to areas of ongoing transmission</td>
</tr>
</tbody>
</table>

### Physical

<table>
<thead>
<tr>
<th></th>
<th>A careful history of disease progression &amp; symptoms is critical.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>After an incubation period of 8-12 (“3Cs”)</td>
</tr>
<tr>
<td></td>
<td>Prodromal symptoms: Fever, Cough, Coryza, Conjunctivitis</td>
</tr>
<tr>
<td></td>
<td>During this period, Koplik spots</td>
</tr>
</tbody>
</table>

### Labs

<table>
<thead>
<tr>
<th>#4</th>
<th>Labs</th>
<th>Highly contagious. (Aerosols). If patients need to go to a lab to have blood drawn, you should notify the lab and infection control to help prevent exposing other patients.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Serum IGM</td>
<td>1-2 day: after rash</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poor Specificity</td>
</tr>
<tr>
<td></td>
<td>PCR</td>
<td>Not generally available</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Throat and nasopharynx are the preferred</td>
</tr>
</tbody>
</table>
# Measles

Measles Re-emerging

5 things to remember

<table>
<thead>
<tr>
<th>#5</th>
<th>Infants an Children: MMR Vaccine Doses Can Be Given Earlier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routine Childhood vaccinations</td>
<td></td>
</tr>
</tbody>
</table>
- 1st dose: 12-15 months  
- 2nd dose: before school entry at age 4-6 years. |
| During outbreaks or before travel |  
- 2nd dose can be given 28 days after the first dose |
| High risk: 6-11 months |  
- MMR vaccine can be given  
- Providing reasonable short-term protection.  
- However, not considered a valid first dose:  
  Another dose must be given after the child's first birthday. |
| **Outbreak situation:** |  
- Second dose: aged 12 months or older  
- An early dose to children aged 6-11 months living in areas where transmission is ongoing or who will be traveling. |
Measles
Epidemiology
Comparison Of Morbidity-Mortality

<table>
<thead>
<tr>
<th>Diseases</th>
<th>Estimated Annual Cases (Average)</th>
<th>PEAK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated Annual Cases (Average)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cases</td>
<td>Deaths</td>
</tr>
<tr>
<td>Measles</td>
<td>530,217</td>
<td>440</td>
</tr>
<tr>
<td>Mumps</td>
<td>162,334</td>
<td>39</td>
</tr>
<tr>
<td>Rubella</td>
<td>47,745</td>
<td>17</td>
</tr>
</tbody>
</table>

Ecology
Measles
Defined: Epidemics Impact

US: How does being born before 1957 confer immunity to measles?

- People born before 1957 lived through several years of epidemic measles before the first measles vaccine was licensed in 1963.
- Surveys suggest 95% - 98% of those born before 1957 are immune to measles.

Therefore:
Persons born before 1957 can be presumed to be immune.
Measles ...
Defined

“Measles is one of the most important infectious diseases of humans....

Has caused millions of deaths since its emergence as a zoonotic disease thousands of years ago.....

For infectious disease epidemiologists...
measles has served as a model of an acute infectious disease, particularly for understanding the nature of epidemics”

-Kenneth Maxcy
Johns Hopkins University School of Public Health, 1948

*Ecology is the branch of biology which studies the interactions among organisms and their environment
“Highly contagious” viral illness characterized by Fever, Malaise, Rash, Cough, Coryza, and Conjunctivitis that occurs worldwide....

Natural measles infection is thought to confer lifelong immunity.

Immunity due to Measles vaccination is also highly protective against clinical infection.
Measles

Viral Human Ecology,

Measles Morbidity

<table>
<thead>
<tr>
<th>Condition</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitalized</td>
<td>1 : 4</td>
</tr>
<tr>
<td>Encephalitis</td>
<td>1 : 1,000 (0.1%)</td>
</tr>
<tr>
<td>Death</td>
<td>1-2 : 1,000</td>
</tr>
</tbody>
</table>

Prodrome*
- FEVER 104°F (40°C)
- COUGH
- RHINORHEA
- CONJUNCTIVITIS

Incubation
5-21 days Median (Asymptomatic)

Prodrome*
2-4 days
Koplik Spots

Exanthem
~3-5 days After fever
Resolves 5-6 days

Recovery
Cough may persist
1-2 weeks

Contagious ~4 days before
4 days after the rash appears
Measles Clinical Exanthems

Search carefully for **Koplik spots** in patients with suspected measles, since they can improve the accuracy of clinical diagnosis ..... However, this enanthem does not appear in all patients with measles.

**Measles Exanthem:**
- Arises approximately 2-4 days after onset of fever
- **Erythematous, Maculopapular, Blanching rash**
- Classically begins **face**
  - And **spreads cephalocaudally** and **centrifugally**
  - To involve the neck, upper trunk, lower trunk, and extremities
- Early on, the lesions are blanching;
- Later stages....they are not
- May include petechiae
- Severe cases, may appear hemorrhagic

**Children:**
- the **extent of the rash** and degree of confluence **generally correlate with the severity of the illness**.
- The palms and soles are rarely involved.

**MEASLES COMPLICATIONS**

- **Respiratory Infections***
  - Otitis Media
  - Mastoiditis
  - Bronchopneumonia
  - Laryngotracheobronchitis (croup)
  - Bronchiolitis
  - Giant cell pneumonia

- **Central Nervous System***
  - Febrile Convulsions
  - Guillain-Bare syndrome
  - Reye’s Syndrome
  - Transverse myelitis
  - Encephalitis
  - Acute Disseminated Encephalomyelitis
  - Subacute Sclerosing Panencephalitis

- **Immune System***
  - Reticuloendothelial or Macrophage system:
    - Dysfunction
    - Suppression
    - TTP
    - DIC
  - Myocarditis
  - Pericarditis

- **Gastrointestinal***
  - Diarrhea (Most common)
  - Mesenteric Enteritis
  - Appendicitis
  - Hepatitis
  - Pancreatitis

* **Bacterial Superinfections ~5%**

<table>
<thead>
<tr>
<th>S. pneumoniae</th>
<th>H influenzae</th>
</tr>
</thead>
<tbody>
<tr>
<td>S pyogenes</td>
<td>S. aureus</td>
</tr>
</tbody>
</table>

**Symptoms**

- Severity ranges from mild and less serious
- First 4–6 wks. after an acute phase (and upon the immune functions are disturbance)
- Complications are usually more severe in adults CASES
- And malnourished and immune compromised individuals.
In immunology, the mononuclear phagocyte system (also known as the reticuloendothelial system or macrophage system) is a part of the immune system that consists of the phagocytic cells located in reticular connective tissue.

<table>
<thead>
<tr>
<th>Measles Virus: IMMUNOSUPPRESSION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Multiple organ systems</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Targets</th>
<th>Epithelial tissues</th>
<th>Reticuloendothelial tissues*</th>
<th>Mononuclear phagocyte</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monocytes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Macrophages</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>T-Lymphocytes</td>
</tr>
</tbody>
</table>

Pathological studies of children dying during acute measles

- Multinucleated giant cells (typical of measles virus infection)
  - Respiratory
  - Gastrointestinal tract
  - Most Lymphoid tissues
MEASLES

VACCINATION IMPACT United States

Post MMR VACCINE 1969:
- Measles: Endemic Disease Elimination: 2000
- Rubella: Endemic Disease Elimination: 2004
- Mumps: 99% Endemic Disease Elimination
Measles
Virology
Measles morbillivirus

<table>
<thead>
<tr>
<th>Virus Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unranked</td>
</tr>
<tr>
<td>Realm</td>
</tr>
<tr>
<td>Phylum</td>
</tr>
<tr>
<td>Class</td>
</tr>
<tr>
<td>Order</td>
</tr>
<tr>
<td>Family</td>
</tr>
<tr>
<td>Genus</td>
</tr>
<tr>
<td>Species</td>
</tr>
<tr>
<td>synonyms</td>
</tr>
<tr>
<td>Measles virus</td>
</tr>
</tbody>
</table>

Classic measles infection in immunocompetent patients

- **Modified measles infection** in patients with pre-existing but incompletely protective anti-measles antibody

- **Atypical measles infection** in patients immunized with the killed virus vaccine

- **Neurologic syndromes** following measles infection, including acute disseminated encephalomyelitis and subacute sclerosing panencephalitis

- **Severe measles infection**

- **Complications of measles** including secondary infection, giant cell pneumonia, and measles inclusion body encephalitis

Measles virus:
- Single-stranded
- Negative-sense
- Enveloped
- Non-segmented RNA virus
<table>
<thead>
<tr>
<th>Measles Vaccination</th>
<th>Long-term benefits of Measles Vaccination:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>By preventing measles-associated immune memory loss:</td>
</tr>
<tr>
<td></td>
<td>❖ Vaccination protects polymicrobial herd immunity: Measle Infections; Secondary Infection Complications</td>
</tr>
<tr>
<td></td>
<td>❖ There-by preventing all-cause infectious disease</td>
</tr>
</tbody>
</table>
### Encephalitis

Acute measles encephalitis may also occur in the absence of rash

<table>
<thead>
<tr>
<th>CLINICAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence</td>
</tr>
<tr>
<td>Presentation</td>
</tr>
<tr>
<td>Signs &amp; Symptoms</td>
</tr>
<tr>
<td>CSF</td>
</tr>
<tr>
<td>Pognosis</td>
</tr>
</tbody>
</table>
# Acute Disseminated Encephalomyelitis

### Demyelinating Neuropathy

<table>
<thead>
<tr>
<th>CLINICAL Symptoms</th>
<th>Thought to be a postinfectious autoimmune response</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Incidence</th>
<th>~1 per 1,000 measles cases.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Presentation</th>
<th>Develops during the Recovery phase of Acute Disease: typically within 2 weeks of the exanthem</th>
</tr>
</thead>
</table>

### Signs & Symptoms

<table>
<thead>
<tr>
<th>GENERAL</th>
<th>Mental status changes:</th>
<th>Neurological</th>
<th>Myelitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>Confusion</td>
<td>Ataxia</td>
<td>Paraplegia / Quadriplegia</td>
</tr>
<tr>
<td>Headache</td>
<td>Somnolence</td>
<td>Myoclonus</td>
<td>Sensory loss</td>
</tr>
<tr>
<td>Neck stiffness</td>
<td>Coma</td>
<td>Choreoathetosis</td>
<td>Loss of bladder &amp; Bowel control</td>
</tr>
<tr>
<td>Seizures</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CSF

- Lymphocytic pleocytosis
- Elevated protein concentration.

### Prognosis

- MORTALITY: 10-20%
- Common Residual neurologic abnormalities among survivors
- Behavior disorders
- Mental retardation
- Epilepsy
MEASLES

Recovery and Complications

Neurological Complications: Subacute Sclerosing Panencephalitis

Subacute Sclerosing Panencephalitis

Progressive Fatal degenerative disease of the Central Nervous System

- Occurs 7-10 years after natural measles virus infection
- May involve persistent infection with a genetic variant of measles virus within the CNS

<table>
<thead>
<tr>
<th>CLINICAL Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Incidence</strong></td>
</tr>
<tr>
<td>Natural Measle Infection: 8.5 cases per million cases</td>
</tr>
<tr>
<td>Post Vaccination: 0.06 cases per million (Decrease Cases)</td>
</tr>
<tr>
<td><strong>Presentation</strong></td>
</tr>
<tr>
<td>- Age: onset ≤ 20 years</td>
</tr>
<tr>
<td>- Onset 7-10 years after natural measles infection</td>
</tr>
<tr>
<td>- ~50% had measles infection before the age of 2 years</td>
</tr>
<tr>
<td><strong>Stages</strong></td>
</tr>
</tbody>
</table>
| - Stage one
  - lasts 1-2 weeks - years
  - Personality changes
  - Lethargy
  - Strange behavior |
| - Stage two
  - lasts 3-12 months
  - Myoclonus
  - Worsening dementia |
| Stage three & four
  - Further neurologic deterioration
  - Flaccidity or decorticate rigidity
  - Symptoms & signs of Autonomic dysfunction
  - Myoclonus is absent |
| - Stage four
  - Vegetative state: Death |
# MEASLES

## Recovery and Complications

### Neurological Complications: Subacute Sclerosing Panencephalitis II

## Subacute Sclerosing Panencephalitis

<table>
<thead>
<tr>
<th>Progressive Fatal degenerative disease of the Central Nervous System</th>
</tr>
</thead>
</table>

## DIAGNOSTIC STUDIES AND FINDINGS

<table>
<thead>
<tr>
<th><strong>SERUM</strong></th>
<th>Serum anti-measles antibody concentration is elevated</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CSF</strong></td>
<td>Detectable anti-measles antibodies</td>
</tr>
<tr>
<td></td>
<td>Elevated protein</td>
</tr>
<tr>
<td><strong>EEG</strong></td>
<td>EEG findings are characteristic of SSPE and may be pathognomonic</td>
</tr>
<tr>
<td></td>
<td>Bursts of high-voltage complexes</td>
</tr>
<tr>
<td></td>
<td>Delta waves (slow waves) and sharp waves</td>
</tr>
<tr>
<td></td>
<td>Each complex is followed by a relatively flat pattern</td>
</tr>
<tr>
<td><strong>Brain Imaging</strong></td>
<td><strong>CT BRAIN</strong></td>
</tr>
<tr>
<td></td>
<td><strong>MRI BRAIN</strong></td>
</tr>
</tbody>
</table>

The relentless and fatal course of SSPE underscores the importance of measles vaccination, not only for prevention of measles but also for prevention of the severe neurologic sequelae that can ensue.
1920’s
The Measles death rate in the
was around 30%

Pre-antibiotics : Post-antibiotics
Measles can lead to serious complications and death
even with modern medical care
Measles Morbidity Mortality has declined in developed countries in association with economic development, improved nutritional status, and supportive care. And Vaccines particularly antibiotic therapy to control secondary bacterial pneumonia.

VIRAL ECOLOGY: Measles has been targeted for eradication given the favorable biologic characteristic that Humans are the only virus reservoir.

Global Vaccine Action Plan* Measles and rubella Targeted for elimination in five WHO Regions by 2020

However: Due to social and political factors high transmissibility, Local, Regional, and Global elimination of measles has been achieved in very few areas of the world...

And... Measles remains “Endemic” in areas with low vaccination rates, particularly in the developing world....
Measles
Attack Rates*

90%
Susceptible Non-immune Individuals

*Attack rate: is the biostatistical measure of frequency of morbidity, or speed of spread, in an at risk population. It is used in hypothetical predictions and during actual outbreaks of disease.
AIRPORT MEASLES

Infectious droplets from the respiratory secretions of a patient with measles can remain airborne for up to two hours ...

Therefore, the illness may be transmitted in public spaces, even in the absence of person-to-person contact.
Measles
Epidemiology:
Persons at risk

<table>
<thead>
<tr>
<th>Person</th>
<th>RISK</th>
</tr>
</thead>
<tbody>
<tr>
<td>❖ All Susceptible:</td>
<td>Unvaccinated: And/or: No history of clinical disease</td>
</tr>
<tr>
<td>❖ Infants:</td>
<td>Who lose passive antibody before the age of routine immunization</td>
</tr>
<tr>
<td>❖ Children:</td>
<td>Immunodeficiency due to HIV or AIDS, leukemia, or malnourished</td>
</tr>
<tr>
<td></td>
<td>regardless of immunization status.</td>
</tr>
<tr>
<td>❖ Susceptible</td>
<td>Travelers</td>
</tr>
<tr>
<td>Individuals</td>
<td>❖ Areas where measles is endemic....</td>
</tr>
<tr>
<td></td>
<td>❖ Contact with travelers infected...</td>
</tr>
<tr>
<td></td>
<td>from travel to endemic areas</td>
</tr>
</tbody>
</table>

*High risk person not vaccine eligible can be treated within six days of exposure.
U.S. MEASLES : Since 2000*

The majority of U.S measles cases
- Occur among “unvaccinated” travelers including citizens and visitors who Acquire infections while visiting endemic or epidemic outbreak areas of other countries

- Measles is more likely to spread and cause **out breaks in U.S. communities where**
  there are communities and groups of **unvaccinated individuals**
    - College campuses (Dormitories)
    - Close-knit religious communities

---

* The year 2000 Endemic Measles declared eliminated from the U.S ( “Endemic” end of endemic transmission for 12 months or more)
Measles Epidemic 2019
U.S. Measles Statistics

NUMBER OF MEASLES CASES REPORTED BY YEAR 2010-2019 (January 1 - April 26, 2019)

The states that have reported cases to CDC are Arizona, California, Colorado, Connecticut, Florida, Georgia, Illinois, Indiana, Kentucky, Maryland, Massachusetts, Michigan, Missouri, Nevada, New Hampshire, New Jersey, New York, Oregon, Texas, and Washington.
Measles

Measles Epidemiology

America’s biggest recent measles outbreaks: 2010-2019

- Orthodox Jewish Community: New York
- Amish Communities: Ohio
- Somali American Community: Minnesota

2019
- *Orthodox Jewish Community: Metro-Detroit

*Under-vaccinated community

Source: CDC
Michigan is one of 17 states that allows parents to opt out of vaccinating their children for religious or philosophical reasons. Although as of 2014, parents are required to “receive education regarding the benefits of vaccination and the risks of disease” before claiming a nonmedical waiver for their child.
“Scientists had predicted that Oakland County Mi, would be at high risk for a measles outbreak...

Scientists from Baylor College of Medicine Found that Oakland County had the 5th largest number of vaccination exemptions in the country....

So this outbreak was, sadly, predicted.”

- Abram Wagner
  Professor Epidemiology
  University of Michigan

2017 Vaccination Rates
- Wayne County: 92.4%
- Macomb County: 91.7%
- Oakland County: 90.3%
### Measles Epidemiology

**Michigan Measles 2019**

<table>
<thead>
<tr>
<th>Location</th>
<th>CASES</th>
<th>Demographics</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oakland County</td>
<td>40</td>
<td></td>
<td>8 months - 63 years</td>
</tr>
<tr>
<td>Wayne County</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detroit</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washtenaw County</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**April 26, 2019 (Since March 13, 2019)**

- **Cases**: 43

**Location**

- **Oakland County**: 40 cases
- **Wayne County**: 1 case
- **Detroit**: 1 case
- **Washtenaw County**: 1 case

---

**2019 MEASLES OUTBREAKS**

319 cases reported nationwide 2018

- **CDC has confirmed measles**
  - Arizona
  - Colorado
  - Connecticut
  - Georgia
  - Kentucky
  - Michigan
  - Missouri
  - New Hampshire
  - New Jersey
  - Oregon

**2018: 17 measles outbreaks : TOTAL 349 cases**

**SOURCE:** CDC
Measles

Cracks in the Wall

“Science and facts
Vs.
Superstition and Ignorance”*

Control of Vaccine Preventable Diseases

*Ollie Mace
Civil Engineer
Euchre Master & Scotch aficionado
Vaccination

Is the society's admission price to prevent human suffering and death by controlling pestilence and disease... Vaccine preventable Disease... To be shared by all?

Or

Should “some” be allowed free admission (No vaccines) ... placing the rest of society risk for vaccine preventable diseases?
Measles Vaccines
Control of Vaccine Preventable Diseases
Vaccination Exemptions by State

VACCINATION EXEMPTIONS BY STATE
ALL 50 STATES ALLOW FOR MEDICAL EXEMPTION FROM VACCINES. 3 STATES HAVE OTHER EXEMPTIONS

Medical Exemption Only
Religious Exemptions
Religious and Person Belief Exemptions

*Virginia and Missouri have Certain specific Exemptions
Measles Vaccines
Control of Vaccine Preventable Diseases
Vaccination Exemptions by State

2017 Oakland county population 1.251 million

Percentage of Kindergarteners with an Immunization Waiver by County, 2017 Final Data

Percentage of 7th Graders with an Immunization Waiver by County, 2017 Final Data

Prepared by the Michigan Department of Health and Human Services. Division of Immunization using data reported to the Michigan Care Improvement Registry. Vaccination requirements for school entry are implemented to protect children from vaccine-preventable diseases. High waiver rates can leave children vulnerable to these diseases.
### Pre-Vaccine Era: Antiquity to 1963

**Rhazes' book A Treatise on Smallpox and Measles**

<table>
<thead>
<tr>
<th>9th Century</th>
<th>Two forms of “Smallpox”:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Variola major: Mortality rate ~30%</td>
</tr>
<tr>
<td></td>
<td>Variola minor: Mortality rate ~1%</td>
</tr>
</tbody>
</table>

- Valuable information about diagnosis, therapy, and concepts of diseases during the Middle Ages.

*Rhazes, Avicenna* (Ibn Sina, 980-1037)*

---

*1970 His accurate description of measles was recognized by the World Health Organization is the first written account of the condition.*
“1757… attempted to produce mild measles by mimicking the variolation process….

This process involved taking blood from an infected patient and inoculating it through the skin of an uninfected person.…

In this way he was able to transfer measles to 10 of 12 patients.…

This experiment clearly demonstrated the presence of measles virus in human blood”…
Measles

History

Time Line: Landmark
Koplik Spots: 1896

“Koplik's spots“* 1896

The spots, which are considered pathognomonic for measles, occur in the mouth a few days before the skin rash appears, and before infectivity reaches its maximum.

This allows individuals incubating the disease to be isolated and helps to control epidemics.

*Some authors ascribe the first written description of these spots to Russian Nil Filatov (1847-1902) in 1895, who had observed equivalent phenomena. Koplik was aware of Filatov's work, thought his evidence insufficient and rejected his claim for priority.
Measles
Koplik Spots

“The first twenty-four to forty-eight hours of the invasion of measles is marked by a suffusion, slight or marked, of the eyes, and the conjunctiva at the nasal canthus is not only reddened but also slightly redundant. There is, at this stage, a slight febrile movement; there may be a cough or some little sneezing; the mother has noticed nothing except that the infant or child has a slight fever. At this period the eruption on the skin has not made its appearance. In the majority of cases there is no suspicion of any exanthema. In a few cases there is an indistinct spotting around the lips and alae nasi, but no eruption.

The mouth — If we look in the mouth at this period we see a redness of the faces; perhaps, not in all cases, a few spots on the soft palate. On the buccal mucous membrane and the inside of the lips, we invariably see a distinct eruption. It consists of small, irregular spots, of a bright red colour. In the centre of each spot, there is noted, in strong daylight, a minute bluish white speck. These red spots, with accompanying specks of a bluish colour, are absolutely pathognomonic of beginning measles, and when seen can be relied upon as the forerunner of the skin eruption”

- Dr Henry Koplik, MD

Prior to the introduction of the measles vaccine in 1963, the CDC admits there was massive underreporting of measles cases...

“because virtually all children acquired measles...
The number of measles cases probably approached 3.5 million per year”

An entire birth cohort!
Measles cases in the United States: 1944-2007

*2% - 5% of people do not develop measles immunity after the first dose of vaccine. The second dose is not a booster, but rather is intended to produce immunity in the small number of people who fail to respond to the first dose.
### MEASLES HISTORICAL TIME LINE

<table>
<thead>
<tr>
<th>PRE-VACCINE ERA</th>
<th>Antiquity to 1963</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1921</strong></td>
<td>Measles became a nationally notifiable disease in the United States</td>
</tr>
<tr>
<td></td>
<td>First decade of reporting, an average of 6,000 measles-related deaths were reported each year.</td>
</tr>
</tbody>
</table>
# Measles

## History
Timeline: Ecology: Pre-vaccines

<table>
<thead>
<tr>
<th>MEASLES HISTORICAL TIME LINE</th>
<th>Epidemiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 1912</td>
<td>No accurate data</td>
</tr>
<tr>
<td>1920</td>
<td>United States</td>
</tr>
<tr>
<td></td>
<td>469,924 cases 7,575 deaths</td>
</tr>
<tr>
<td>1958-1962</td>
<td>ANNUAL</td>
</tr>
<tr>
<td></td>
<td>503,282 cases 432 deaths</td>
</tr>
<tr>
<td>1960</td>
<td>3 years before the first measles vaccine marketed</td>
</tr>
<tr>
<td></td>
<td>Likely 3.5 – 5 million infected</td>
</tr>
<tr>
<td>1969</td>
<td>Measles deaths were estimated at 1 in 10,000 cases.</td>
</tr>
</tbody>
</table>

1960

1960

442,000 cases Reported

1960

380 Deaths
# Measles History

**Time Line Landmark**: Isolation Measles Vaccine Virus

<table>
<thead>
<tr>
<th>PRE VACCINE ERA</th>
<th>Antiquity to 1963</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Enders &amp; Thomas Peoples</td>
<td>Edmonston “Measles” Virus</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1954</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thomas Peebles, following a measles outbreak at a local school, succeeded in isolating a measles virus throat swab from an 11-year-old pupil, David Edmonston.</td>
</tr>
</tbody>
</table>

Enders had been skeptical about Peebles’s work, but once the virus had been isolated he and other researchers set about developing a vaccine.

- The virus continuously cultured until a live attenuated less virulent strain was isolated dubbed Edmonston B vaccine virus
- Licensed by the US Food & Drug Administration 1963.

**John Enders**
1897 - 1985

**Thomas Peoples**
1921 - 2010

---

*Children’s Medical Center at Boston*. In this laboratory much outstanding work on the viral diseases of man has been done under his direction and it was here that the work was done on the cultivation of the poliomyelitis viruses for which Enders was awarded, together with T. H. Weller and F. C. Robbins, the Nobel Prize for Physiology or Medicine in 1954.

**Early** Dr Peoples 1950’s, worked at the side of Dr John Enders whose “breakout” work on virus and tissue cultures led to the development of polio vaccines and a Nobel Prize in 1954.
# Measles History


<table>
<thead>
<tr>
<th>MEASLES HISTORICAL TIME LINE</th>
<th>1963 - 1967</th>
</tr>
</thead>
<tbody>
<tr>
<td>VACCINE DEVELOPMENT</td>
<td>1953 - 2005</td>
</tr>
</tbody>
</table>

**Two Vaccines Marketed**

<table>
<thead>
<tr>
<th>Merck</th>
<th>Pfizer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rubeovax®</strong></td>
<td><strong>Pfizer-Vax Measles-K®</strong></td>
</tr>
<tr>
<td>Attenuated (“Live”) vaccine</td>
<td>Inactivated (“killed”) virus vaccine</td>
</tr>
</tbody>
</table>

### 1963 To 1967

- Merck:
  - 95% effective at preventing measles
  - Protection ~ 3 years

- Pfizer:
  - No detectable levels of measles antibodies one year later
  - 1965: new and abnormal measles-like illness
  - Among children previously vaccinated with inactivated measles virus vaccine and exposed to measles.
  - Pfizer’s inactivated vaccine was taken off the market in 1968

- However:
  - 30-40%: children: fever of +103°F:
    - ~6th day (Lasting 2-5 days)
  - 30-60%: developed “modified measles rash”
  - Due to the high number of side effects
  - recommended co-administration measles immune globulin
# Measles

## History

**Time Line: Hall mark: Vaccine Development**

<table>
<thead>
<tr>
<th>MEASLES HISTORICAL TIME LINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>VACCINE DEVELOPMENT</td>
</tr>
<tr>
<td>1967</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>PRESENTLY</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Approved for Vaccine use in 1969</td>
</tr>
<tr>
<td>1969</td>
</tr>
<tr>
<td>2018</td>
</tr>
</tbody>
</table>
Vaccine Controversy
Can Vaccines Cause Autism?

Science and Facts Vs. Superstition and Ignorance
Vaccines
Myths and perceptions
What is Autism

Autism

Autism, or autism spectrum disorder (ASD):
Refers to a broad range of conditions characterized by challenges with social skills, repetitive behaviors, speech and nonverbal communication.

We now know that there is not one autism: but many subtypes, and each person with autism can have unique strengths and challenges....
Vaccines

Myths and perceptions

Andrew Jeremy Wakefield 1998

Andrew Jeremy Wakefield

- Discredited former British doctor who became an anti-vaccine activist.
- Gastroenterologist until he was struck off the UK medical register for unethical behaviour, misconduct and fraud.

1998

Authored a fraudulent “research paper” claiming that there was a link between the measles, mumps and rubella (MMR) vaccine, and autism and bowel disease.

- "Profile: Dr Andrew Wakefield". BBC. 27 January 2010.
- Fang FC; Steen RG; Casadevall A (October 2012). "Misconduct accounts for the majority of retracted scientific publications". Proceedings of the National Academy of Sciences. 109: 17028–17033. doi:10.1073/pnas.1212247109. PMC 3479492. PMID 23027971.-
- "Great Science Frauds". Time Magazine, 13 January 2012
AUTISM

Lack of evidence Vaccination for association:

No causal association between MMR vaccine and ASD is established

- Drutz JE, Duryea TK, Torchia MM. *Autism spectrum disorder and chronic disease: No evidence for vaccines or thimerosal as a contributing factor*. UpToDate® March 20, 2019
Unlike most other medical interventions, vaccines are given to healthy people, and people are far less willing to tolerate vaccines adverse effects than adverse effects of other treatments.
Measles Mump Rubella Vaccine
Vaccine Options

MEASLES VACCINATION

Post MMR VACCINE 1969:
- Measles : Endemic Disease Elimination: 2000
- Rubella : Endemic Disease Elimination: 2004
- Mumps : 99% Endemic Disease Elimination
Measles Mump Rubella Vaccine
Vaccine Options

**MMR®**
**MMRV* (Proquad®):** with Varicella: “Chicken Pox”
Live Vaccines

Unless the parent expresses a preference for MMRV vaccine:

Centers for Disease Control and Prevention recommends

**MMR® vaccine**
and varicella vaccine should be administered as separate injections for the first dose in children 12-47 months of age.
# Measles Mumps Rubella Vaccine

## Historically: Vaccine Availability

**MMR**

<table>
<thead>
<tr>
<th>VACCINE Characteristics</th>
<th>Available</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individual Vaccines</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Year</strong></td>
<td><strong>Vaccine</strong></td>
</tr>
<tr>
<td>1963</td>
<td>Measles</td>
</tr>
<tr>
<td>1967</td>
<td>Mump</td>
</tr>
<tr>
<td>1969</td>
<td>Rubella</td>
</tr>
<tr>
<td><strong>Incorporated Vaccines</strong></td>
<td></td>
</tr>
<tr>
<td>1969</td>
<td>Measles; Mumps; Rubella &amp; Varicella (MMRV)</td>
</tr>
<tr>
<td>1985</td>
<td>Measles; Mumps; Rubella &amp; Varicella (MMRV)</td>
</tr>
</tbody>
</table>
### Measles Mump Rubella Vaccine

**Immune Response**

#### MMR

**VACINATION:**

<table>
<thead>
<tr>
<th>Immune response</th>
<th>Induces both humoral and cellular immune responses......</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>❖ Induces measles virus-specific T lymphocytes</td>
</tr>
<tr>
<td></td>
<td>❖ Antibodies First appear between 12 -15 days</td>
</tr>
<tr>
<td></td>
<td>❖ Antibodies Peak at 21 to 28 days.</td>
</tr>
<tr>
<td></td>
<td>• IgM antibodies appear transiently in blood</td>
</tr>
<tr>
<td></td>
<td>• IgA antibodies are predominant in mucosal secretions</td>
</tr>
<tr>
<td></td>
<td>• IgG antibodies persist in blood for years</td>
</tr>
</tbody>
</table>

Both humoral and cellular responses can be induced by measles vaccine, lower magnitude and shorted duration compared to those following wild-type measles virus infection.
### MMR Vaccine Effectiveness and Duration of Protection

<table>
<thead>
<tr>
<th>MMR</th>
<th>U.S. vaccination schedule: considered protected for life against Measles &amp; Rubella. Mumps immunity may decrease over time: and may not be protected later in life.</th>
</tr>
</thead>
</table>
|     | **MEASLES**  
|     | Both serologic / epidemiologic evidence indicate: vaccine-induced measles immunity appears to be long-term and probably lifelong in most persons. |
|     | **MUMPS**  
|     | A third dose of MMR can provide added short term protection to a close contact with a mumps patient during an outbreak. |
|     | **RUBELLA**  
<p>|     | Studies indicate one dose of confers long-term, probably lifelong, protection against rubella |</p>
<table>
<thead>
<tr>
<th></th>
<th>Virus</th>
<th>Effective</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>One Dose</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measles</td>
<td>93%</td>
<td></td>
<td>(39-100%)</td>
</tr>
<tr>
<td>Mumps</td>
<td>78%</td>
<td></td>
<td>(49-92%)</td>
</tr>
<tr>
<td>Rubella</td>
<td>97%</td>
<td></td>
<td>(94-100%)</td>
</tr>
<tr>
<td><strong>Two Doses</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measles</td>
<td>97%</td>
<td></td>
<td>(67-100%)</td>
</tr>
<tr>
<td>Mumps</td>
<td>88%</td>
<td></td>
<td>(31%-95%)</td>
</tr>
</tbody>
</table>
MEASLES
Vaccine : MMR
(Measles, Mumps Rubella)
Indications Children

<table>
<thead>
<tr>
<th>MMR VACCINES: 2 Vaccinations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Children</strong></td>
</tr>
<tr>
<td>- Starting with the first dose at 12 - 15 months of age</td>
</tr>
<tr>
<td>- Second dose at 4 through 6 years of age.</td>
</tr>
<tr>
<td>- At least 1 month should elapse between a dose of a measles-containing vaccine such as M-M-R® and a dose of ProQuad®</td>
</tr>
<tr>
<td>- At least 3 months should elapse between a dose of varicella-containing vaccine and ProQuad®</td>
</tr>
</tbody>
</table>
# Measles

## Vaccine Schedule


<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Birth</th>
<th>1 month</th>
<th>2 month</th>
<th>4 month</th>
<th>6 month</th>
<th>12 Month</th>
<th>15 month</th>
<th>18 month</th>
<th>19-23 month</th>
<th>2-3 years</th>
<th>4-6 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatitis B</td>
<td>1st</td>
<td>2nd</td>
<td></td>
<td></td>
<td>3rd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotovirus</td>
<td></td>
<td>1st</td>
<td>2nd</td>
<td>3rd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diphtheria, Tetanus, Pertussis</td>
<td>1st</td>
<td>2nd</td>
<td>3rd</td>
<td></td>
<td>4th</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haemophilus Influenza B</td>
<td>1st</td>
<td>2nd</td>
<td>At risk</td>
<td>3rd or 4th</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumococcus Conjugate PCV 13</td>
<td>1st</td>
<td>2nd</td>
<td>3rd</td>
<td>4th</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inactivated Polio</td>
<td>1st</td>
<td>2nd</td>
<td></td>
<td>3rd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4th</td>
<td></td>
</tr>
<tr>
<td>Influenza</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Influenza Yearly</td>
</tr>
<tr>
<td>Measles, Mumps Rubella</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1st</td>
</tr>
<tr>
<td>Varicella</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2nd</td>
</tr>
<tr>
<td>Hepatitis A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HEP A 2 doses</td>
</tr>
<tr>
<td>Meningococcal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Certain High Risk Groups</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range of Recommended ages</th>
<th>1st live (VIRAL) Vaccine</th>
<th>*2nd Dose MMR / MMRV</th>
</tr>
</thead>
</table>

*2% - 5% of people do not develop measles immunity after the first dose of vaccine. The second dose is *not a booster*, but rather is intended to produce immunity in the small number of people who fail to respond to the first dose.

*Certain High Risk Groups*
**MEASLES**  
Vaccine: MMR  
(Measles, Mumps Rubella)

<table>
<thead>
<tr>
<th>MMR VACCINES: 2 Vaccinations</th>
<th>Adults*</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Evidence of Immunity*</td>
<td>High-risk people need 2 doses</td>
</tr>
<tr>
<td>One Dose</td>
<td>Healthcare personnel</td>
</tr>
<tr>
<td></td>
<td>International travelers</td>
</tr>
<tr>
<td></td>
<td>Students at post-high school educational institutions,</td>
</tr>
<tr>
<td></td>
<td>people exposed to measles in an outbreak setting</td>
</tr>
</tbody>
</table>

* Previously vaccinated with killed measles vaccine or an unknown type of measles vaccine during 1963 – 1967*.
** The killed vaccine was found to be not effective and people who received it should be revaccinated with live vaccine

*No evidence of immunity: “Defined”:
- Having historically documented receipt of 1 dose [or 2 doses: 4 weeks apart if high risk] of live measles virus-containing vaccine,
- OR Laboratory evidence of immunity or laboratory confirmation of disease,
- OR No Evidence of immunity having been born birth before 1957
MEASLES
Vaccine: MMR
(Measles, Mumps Rubella)

VACCINE SAFETY

- The MMRV vaccine is very safe, and it is effective at preventing measles, mumps, rubella, and varicella.

Vaccines, like any medicine, can have side effects.

- Most people who get MMRV vaccine do not have any serious problems. Getting MMR or MMR-V vaccine is much safer than getting measles, mumps, rubella, or varicella.
MEASLES
Vaccine : MMR
(Measles, Mumps Rubella
MMR Vs MMR(V)

### MMR vs. MMRV Varicella

<table>
<thead>
<tr>
<th>MMR®</th>
<th>Vs.</th>
<th>MMRV (Proquad®)</th>
<th>Varicella</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>First dose 12 months to 23 Month</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fewer Vaccine Injections</td>
<td></td>
</tr>
<tr>
<td>Fever*</td>
<td></td>
<td>Higher risks of fever within the 42 days after vaccination</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Highest risk occurs during the 5-12 days after vaccination</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Febrile seizures during the 5-12 days after vaccination.</td>
<td></td>
</tr>
</tbody>
</table>

- * Important to discuss febrile seizure risk with parents when considering using MMRV vaccine for the first dose in a child aged 12-47 months.
- A personal history of febrile seizures or a family history of either febrile seizures or epilepsy increases a child’s risk of having a febrile seizure.
- These children should generally be vaccinated with MMR and varicella vaccines instead of MMRV vaccine.
MEASLES
Vaccine: MMR
(Measles, Mumps Rubella
Vaccine Side effects)

<table>
<thead>
<tr>
<th>System</th>
<th>Description</th>
</tr>
</thead>
</table>
| **VARES** | Vaccine Adverse Event Reporting System  
  - An early warning system that helps CDC and FDA monitor problems following vaccination. Anyone can report possible vaccine side effects to VAERS. |
| **VSD** | Vaccine Safety Datalink  
  - Collaboration between CDC and nine health care organizations which allows ongoing monitoring and proactive searches of vaccine-related data. |
| **CISA** | The Clinical Immunization Safety Assessment Project:  
  - Partnership between CDC and several medical centers that conducts clinical research on vaccine-associated health risks |
Post Exposure prophylaxis
MEASLES
POST EXPOSURE
Non-immune Exposure
2013 MMR ACIP  post-exposure IG prophylaxis for measles.

<table>
<thead>
<tr>
<th>2013 MMR ACIP  post-exposure IG prophylaxis for measles.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there anything that can be done for <em>unvaccinated people</em> who have already been exposed to measles, mumps, or rubella?</td>
</tr>
<tr>
<td>❖ MMR</td>
</tr>
<tr>
<td>❖ Immune Globulin</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

## MEASLES POST EXPOSURE

### Non-immune Exposure

2013 MMR ACIP post-exposure IG prophylaxis for measles.

<table>
<thead>
<tr>
<th>Age</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>All infants &lt;12 months:</td>
<td>IGIM: 0.5 mL/kg of body weight; the maximum dose is 15 mL.</td>
</tr>
<tr>
<td>Infants age 6-11 months:</td>
<td>Alternatively: MMR vaccine (instead of IGIM) if it can be given within 72 hours of exposure.</td>
</tr>
<tr>
<td>&gt;12 months Post 1 dose MMR:</td>
<td>IG is NOT indicated for these individuals UNLESS they are severely immunocompromised.</td>
</tr>
<tr>
<td>Pregnant (Non-immune)</td>
<td>Intravenous IGIV dose of 400 mg/kg of body weight.</td>
</tr>
<tr>
<td>Severe Immunosuppressed</td>
<td>Intaveneous IGIV dose of 400 mg/kg of body weight.</td>
</tr>
</tbody>
</table>

**Immune Globulin should not be used to control measles outbreaks**

Vaccines:
Staying current with vaccines

Admittedly, some physicians aren’t well versed in the science or technology of vaccines....

This opens the attacks, and fuels the controversy upon vaccine medicine by opponents of vaccinations...

“Celebrity scientists”, “Free choice advocates”, Alternate Medical, and certain Religious groups...

But Vaccine technology does not function in a vacuum...

Vaccine science has come a long way since Edward Jenner and others first immunized people with the Cowpox virus to protect against Smallpox...
Today’s vaccines are created using modern technology, and involve many scientific disciplines including: Microbiology, Microbial Genetics, Biochemistry, Pharmacology, Pathophysiology, Computer Science, Epidemiology, Immunology Statistics and on and on….

AND…..The safety and effectiveness of vaccines are “time tested” and “clinically” validated by the Millions of vaccine recipients….

Vaccinations are scrutinized on a continuous basis (“VAERS”*) … and, I might add... by the most modern and most sophisticated system of statistical analysis ever developed....

*Vaccine Adverse Event Reporting System
Vaccines:
Staying current with vaccines

Random thoughts

Our patients and their families should feel confident that the “How to, and Wherefores” of vaccine administration is greatly understood....

...And the techniques involved, for safe and effective vaccination delivery, have been simplified for the average physician by consensus, of multiple, and an incredibly large, and diverse groups of Scientists, Physicians and Clinical Practitioners

- Anthony F. Ognjan, D.O., FACP

You are in good hands
Measles

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