Measles: 2019, US
How Did We Get Here?

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HCA Grand Rounds 6 2019
I have no conflicts of interest.
CDC confirms 981 measles cases in U.S., now highest count since 1992

The 981 cases reported Monday is the highest annual count since 1992, as well as since measles was declared eradicated in the United States in 2000.

Measles Cases in the U.S. Reach 981

The number of measles cases in the U.S. continues to climb, reaching the highest count since 1992.

THE CDC REPORTED THAT THE NUMBER OF MEASLES CASES NATIONWIDE IN U.S. SO FAR IN 2019 WAS 1,001 - DEPARTMENT OF HEALTH AND HUMAN SERVICES

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Measles: 2019, US How Did We Get Here?

Goals For Today

• Clinical Presentation/Complications
• Post exposure prophylaxis
• Infection Control
• Epidemiology of Measles US and Worldwide Post Vaccine
  – Why are there continuing outbreaks
  – What populations are getting infected with measles
• Role of Immunization:
  – What is adequate immunization for measles
    • For children
    • For adults
    • For High Risk Groups
  – What holds people back from immunization for measles
  – What is the BEST Way to prevent Measles transmission
What Is Measles ?
Measles (RNA virus)

• Acute febrile rash viral illness: 3 “C”s: cough, coryza, conjunctivitis with fever

• Most contagious of vaccine preventable diseases
  90% secondary attack rate in susceptible household contacts

• Transmitted by direct contact with infectious droplets or airborne spread
Measles: Clinical Presentation

- Enanthem preceding rash
- Rash from head to toe about 14 days after exposure
  - Need an intact immune system to have rash
- Incubation: 7-21 days, average 14d
- Infectious period 4 days prior through 4 days after rash onset
- Complications: 29% of pts will have some complication:
Measles Epidemiology

Reservoir

• Human

Transmission

• Respiratory - person to person, Airborne

Temporal pattern

• Peak late winter and spring

Communicability

• Maximum 4 days before to 4 days after rash onset

Measles Vaccination began use 1963: resulted in 99% decrease in reported incidence

2000: Interruption of Endemic disease transmission in the US.
## Measles Complications

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea</td>
<td>8%</td>
</tr>
<tr>
<td>Otitis media</td>
<td>7-9%</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>1-6%</td>
</tr>
<tr>
<td>Hospitalized</td>
<td>1 in 4 cases</td>
</tr>
<tr>
<td>Encephalitis</td>
<td>1 per 1,000 cases</td>
</tr>
<tr>
<td>Death</td>
<td>1-3 per 1,000 cases</td>
</tr>
<tr>
<td>Subacute Sclerosing Encephalitis (SSPE)</td>
<td>1 per 100,000 cases</td>
</tr>
</tbody>
</table>

Complications are more common in children <5 years and adults.
A few words on SSPE ...

- Rare, but fatal progressive neurologic disease
  - Higher incidence in children aged < 2 years
- Onset 7 years after infection, but could present decades after
- Clinical symptoms
  - Initially mild, mental deterioration (memory loss, behavioral changes)
  - Progression to myoclonic seizures, motor disability, and eventually to a persistent vegetative state
  - Death typically occurs within 1-3 years of diagnosis
Measles: What To Do If You Suspect Measles

• Mask, Isolate the Patient Airborne or Closed Room
• Testing for patients with clinical case definition:
  – Generalized rash > 3 days
  – Fever >101 F; 38.3
  – Cough, coryza, conjunctivitis
  – Consider for people who have travelled recently and have fever, rash illness.
  – ASK ABOUT IMMUNIZATION STATUS
• Blood specimen Serology
• Throat swab: Viral culture or PCR

Call Health Department or Infection Control
Measles: Post Exposure Prophylaxis
MMR, IMIG or IVIG

• Identify who was exposed and who might need post-exposure prophylaxis with either MMR vaccine or immunoglobulin

• Prioritize exposed persons who are at high risk for serious disease including:
  – Infants aged <1 year
  – Pregnant women
  – Persons with immunocompromising conditions
Measles: Post Exposure Prophylaxis

CDC recommendations have not changed:
https://www.cdc.gov/measles/hcp/index.html#prophylaxis

- MMR Vaccine: ≥ 6 mo of age, not contraindicated, within 3 days of exposure *
- IMIG 0.5 ml/kg Max dose 15 ml for **
  - Infants 0-6 mo within 6 days of exposure
  - Any susceptible, Immunocompetent, exposed (EXCEPT pregnant women): within 6 days of exposure, for whom MMR vaccination window has passed
- IVIG 400 mg/kg is recommended for:
  - Immunocompromised people
  - Pregnant women without evidence for measles immunity

* Infants who get MMR < 12 mo of age: 2 doses of MMR according to schedule
**Any nonimmune person who gets IG, MMR vaccine ≥ 6 mo after IMIG or 8 mo after IVIG, if no contraindication, and older than 12 mo.
Measles: Epidemiology in the Era of Vaccination
Measles Epidemiology U.S. Decade Before Vaccine 1963

- 48,000 people hospitalized;
  1,000 people chronic disability
- Average 549,000 measles cases
  495 measles deaths
- 3-4 million people infected annually, not reported

In Texas: 1958: > 85,000 cases of measles, until 2018 we had 1/year!
Measles Cases in 2019: 1/1-5/31/19

981 cases in 26 states
Most since 1992
Most since US Measles Elimination: 2000

Elimination: Interruption of year-round transmission
–Does not imply zero incidence
Number and Incidence of Reported Measles Cases – U.S., 2001-2019* (N=3470)

*Source: National Notifiable Diseases Surveillance System (passive surveillance); 2018 and 2019 data as of May 17, 2019
Measles outbreaks (defined as 3 or more cases) are currently ongoing in 2019 in the following jurisdictions:

- New York State, Rockland County
- New York City
- Michigan
- California, Butte County
- California, LA County
- California, Sacramento County
- Georgia
- Maryland
- Pennsylvania
- Washington

These outbreaks are linked to travelers who brought measles back from other countries such as Israel, Ukraine, and the Philippines, where large measles outbreaks are occurring.
Measles Cases US 2001-2019
Importation and Vaccination Status

- 3470 reported measles cases:
  - 20% International Importations
  - 80% US Acquired

- Vaccination Status:
  - Unvaccinated 69%
  - Unknown 19%
  - Vaccinated (> 1 dose MMR) 12%
Measles National Summary: 1/1/2019-5/17/2019

• 880 cases in 24 states
  – 6% International Importations
    • Top 3 countries: Phillipines, Ukraine, Israel
  – 94% US Acquired
  – Median age 6 y (Interquartile range 1.5-20 y)
  – 94% cases outbreak related
    • 75% NYC, NYS
  – 90% Unimmunized, or unknown status
  – 9% Hospitalized; 0 Deaths
  – Genotypes D8, B3: Included in Vaccine

Source countries for travel: Philippines, Ukraine, Israel, Thailand, Vietnam, Germany, Algeria, France, India, Lithuania, Russia, and the United Kingdom.

CDC COCA Measles May 21, 2019
Number and Vaccination Status of Measles Cases, by Age-Group-U.S, January – May 2019*

<table>
<thead>
<tr>
<th>Age-Group</th>
<th>No. of cases</th>
<th>IR per million population</th>
<th>Vaccination Status of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Unvaccinated</td>
</tr>
<tr>
<td>0-5 months</td>
<td>30</td>
<td>15.23</td>
<td>30 (100)</td>
</tr>
<tr>
<td>6-11 months</td>
<td>81</td>
<td>41.12</td>
<td>76 (94)</td>
</tr>
<tr>
<td>12-15 months</td>
<td>86</td>
<td>65.56</td>
<td>79 (92)</td>
</tr>
<tr>
<td>16 months-4 years</td>
<td>193</td>
<td>13.14</td>
<td>168 (87)</td>
</tr>
<tr>
<td>5-17 years</td>
<td>241</td>
<td>4.49</td>
<td>218 (90)</td>
</tr>
<tr>
<td>18-29 years</td>
<td>82</td>
<td>1.52</td>
<td>26 (32)</td>
</tr>
<tr>
<td>30-49 years</td>
<td>100</td>
<td>1.19</td>
<td>12 (12)</td>
</tr>
<tr>
<td>≥50 years</td>
<td>39</td>
<td>0.34</td>
<td>3 (8)</td>
</tr>
<tr>
<td>Overall</td>
<td>852</td>
<td>2.62</td>
<td>612 (72)</td>
</tr>
</tbody>
</table>
Measles Incidence Rate per Million (12M period)
Measles 2019: Texas

2017: 1 case
2018: 9 cases
2019: 15 cases

15 cases:
6 < 18 yo
9 > 18 yo
median age 26 yo

8/15 hospitalized

5 of cases were linked
4 cases international travel
6 cases unknown/unconfirmed exposure
Measles: The Role For Immunization
How Did We Get Here?

1912: Measles nationally reportable

1962: Vaccine Assistance Act

1963: 2 vaccines approved for use: Live, Killed

1967: CDC Campaign to eliminate measles begins

1965: Measles vaccine added to vaccine assistance act.

1968: Current live vaccine approved

1970s: Federal $ down

1978: Renewed CDC goal to eliminate measles widespread vaccination

1989: 2nd dose of MMR

2000: Measles declared eliminated
Measles Epidemiology US: Effect of Vaccine

Reported Measles Cases, United States, 1962–2019*
Measles Vaccine

- Combination Vaccine MMR licensed in US 1971
- Vaccine Effectiveness:
  - 1 dose 93%
  - 2-dose: 97%
- Excellent Safety Profile:
  - Fever, rash illness 5-15%: not contagious
  - Low risk of febrile seizures (1: 3000)
  - Arthralgias: adolescents
  - Self limited Thrombocytopenia (1: 30000)
  - NO EVIDENCE OF CAUSALITY FOR AUTISM
- Contraindications:
  - Anaphylaxis to components
  - Immunosuppressed

AAP Red Book 2019
Measles Vaccine Coverage


NIS data available at https://www.cdc.gov/vaccines/mz-managers/coverage/teendxview/data-reports/mmr/trend/index.html https://www.cdc.gov/vaccines/imm-
MMR Routine Recommendations

• Children and Adolescents:
  – 1 dose at 12-15 mo, 2nd dose at 4-6 years of age

• Adults: Without Evidence for measles immunity:
  – Most adults: 1 dose
  – High Risk Adults: 2 doses 28 d apart
    • HCW
    • International Travelers
    • Post HS Students

Presumptive Evidence For Immunity:
  Birth Before 1957
  Laboratory Evidence of Immunity
  Laboratory Disease Confirmation

2019 Adult Immunization schedule: [http://www.cdc.gov/vaccines/schedules/hcp/adult.html](http://www.cdc.gov/vaccines/schedules/hcp/adult.html)
Why is MMR vaccination important?

- Effective: even after exposure
- 90-95% of a population will need to have protection (herd immunity) to prevent ongoing measles transmission

**Herd immunity:** A population is protected from a disease after vaccination by stopping transmission between people. In this way even people who cannot be vaccinated can be protected. Highly contagious infections require more people to be vaccinated for effective herd immunity.
MMR Travel Recommendations

- Persons aged ≥ 12 mo without immunity should receive 2 dose of vaccine 28 d apart:
  - Includes 1-4 year old before they reach 4-6 yo; 2\textsuperscript{nd} dose counts
  - Includes adults (born after 1957) who may have had 1 dose of vaccine in past

- Children 6-11 mo of age: should receive 1 dose
  - If vaccinated early, still needs 2 doses ≥ 12 mo of age.

2019 Adult Immunization schedule: [http://www.cdc.gov/vaccines/schedules/hcp/adult.html](http://www.cdc.gov/vaccines/schedules/hcp/adult.html)
Measles and Adult Patients:

What adult providers need to know for their patients

- Providers do not need to actively screen adult patients for measles immunity
  - high population immunity and low risk of disease among adults in non-outbreak areas in the U.S.
- Providers should make sure patients have measles protection before international travel
  - U.S. residents traveling internationally are at high risk for acquiring measles abroad
  - Importations into the U.S. can lead to transmission to susceptible persons, such as infants, and outbreaks
  - Providers should vaccinate if the patient’s measles immunity status is unknown - serologic testing is not recommended.
- There is no adult catch-up program for adults born before 1989, or otherwise
90% of Measles Cases in Unimmunized/Underimmunized People

What Happened?

Why MMR?
What happened? MMR vaccine became linked with autism


   1. Hypothesis: the combination MMR causes autism by damaging the intestinal lining, which allows the entrance of encephalopathic proteins.
   2. The article was retracted 2010
   3. Wakefield was found guilty of professional misconduct and stripped of his medical license in Great Britain.

3. Several studies have disproven links between vaccines and autism…..but the myth lives on!

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**The Paper**

*Illeal-lymphoid-nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children*


**Summary**

We investigated a consecutive series of children with autism, gastrointestinal and regression-onset developmental disorders.

**Methods**

12 children (mean age 8 years (range 3–10); 11 boys) were referred to a paediatric gastroenterology unit with a spectrum of gastrointestinal symptoms between in terms of autism severity, including regression, with a diversity of additional symptoms. Children underwent gastrointestinal, neurocognitive, and developmental assessment and review of development records. Histology and biopsy sampling, magnetic resonance imaging (MRI), electromyography (EMG), and tumor punctures were done under sedation. Barium follow-through radiography was done where possible: bi-directional transanal, and gastrointestinal manometry were also used.

**Findings**

- Histologic abnormalities were associated with the patients, with mesenteric, mucosal, and cutaneous colonic abnormalities in eight of the 12 children, with more extensive inflammation in seven children while others had more specific findings.
- There was an increased stool output and diarrhea in seven children, but no diarrheal data were available.
- Autonomic abnormalities were consistent across all children.
- There were no neurodevelopmental abnormalities in the children, significantly lower in those with severe autism symptoms.
- The study concluded that the findings are consistent with the hypothesis that MMR vaccine causes autism by damaging the intestinal lining, which allows the entrance of encephalopathic proteins.

**Hypothesis**

The article was retracted 2010.

**Wakefield was found guilty of professional misconduct and stripped of his medical license in Great Britain.**

**Several studies have disproven links between vaccines and autism…..but the myth lives on!**

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*The Lancet* Vol 353, February 23, 1999

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*The Lancet* Vol 358, February 26, 1996
**Conclusion:** No difference in autism rates among vaccinated and unvaccinated children, or with a 2nd dose of Measles

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**Table 1. Studies that fail to support an association between measles-mumps-rubella vaccine and autism.**

<table>
<thead>
<tr>
<th>Source</th>
<th>Study design</th>
<th>Study location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taylor et al., 1999 [5]</td>
<td>Ecological</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Farrington et al., 2001 [6]</td>
<td>Ecological</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Kaye et al., 2001 [7]</td>
<td>Ecological</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Dales et al., 2001 [8]</td>
<td>Ecological</td>
<td>United States</td>
</tr>
<tr>
<td>Fombonne et al., 2006 [9]</td>
<td>Ecological</td>
<td>Canada</td>
</tr>
<tr>
<td>Fombonne and Chakrabarti, 2001 [10]</td>
<td>Ecological</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>DeWilde et al., 2001 [12]</td>
<td>Case-control</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Makola et al., 2002 [13]</td>
<td>Retrospective cohort</td>
<td>Finland</td>
</tr>
<tr>
<td>Madsen et al., 2002 [14]</td>
<td>Retrospective cohort</td>
<td>Denmark</td>
</tr>
<tr>
<td>DeStefano et al., 2004 [15]</td>
<td>Case-control</td>
<td>United States</td>
</tr>
<tr>
<td>Peltola et al., 1998 [16]</td>
<td>Prospective cohort</td>
<td>Finland</td>
</tr>
<tr>
<td>Patja et al., 2000 [17]</td>
<td>Prospective cohort</td>
<td>Finland</td>
</tr>
</tbody>
</table>

Gerber JS, Offit PA Vaccines and Autism, CID 2009;48: 456-460
But It Still Goes On.
Vaccine Exemptions

Where the exemptions are

Four Texas counties — including Harris County — are among the top 15 U.S. counties for having kindergarteners with non-medical exemptions for vaccinations.

Source: Public Library of Science Medicine
Texas: Non-medical Vaccine Exemptions on the Rise


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Rates among Kindergarteners in Texas, by School, 2017-2018

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Facility Name</th>
<th>Facility Address</th>
<th>County</th>
<th>DTP/DTaP/DT/Td</th>
<th>Hepatitis A</th>
<th>Hepatitis B</th>
<th>MMR</th>
<th>Polio</th>
<th>Varicella</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
<td>AUSTIN DISCOVERY SCHOOL</td>
<td>8509 FM 969 STE 200, AUSTIN, TX, 78724</td>
<td>TRAVIS</td>
<td>68.32%</td>
<td>64.36%</td>
<td>63.37%</td>
<td>67.33%</td>
<td>65.35%</td>
<td>64.36%</td>
</tr>
<tr>
<td>Public</td>
<td>AUSTIN ISD</td>
<td>1111 W 6TH ST, AUSTIN, TX, 78703</td>
<td>TRAVIS</td>
<td>95.81%</td>
<td>94.80%</td>
<td>96.77%</td>
<td>96.40%</td>
<td>96.24%</td>
<td>95.06%</td>
</tr>
<tr>
<td>Private</td>
<td>Austin Montessori School</td>
<td>5677 Oak Blvd., Austin, TX, 78735</td>
<td>TRAVIS</td>
<td>83.33%</td>
<td>91.67%</td>
<td>87.50%</td>
<td>79.17%</td>
<td>83.33%</td>
<td>79.17%</td>
</tr>
<tr>
<td>Private</td>
<td>Austin Peace Academy</td>
<td>5110 Manor Road, Austin, TX, 78723</td>
<td>TRAVIS</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>Private</td>
<td>Austin Waldorf School</td>
<td>8700 South View Road, Austin, TX, 78737</td>
<td>TRAVIS</td>
<td>51.72%</td>
<td>55.17%</td>
<td>51.72%</td>
<td>44.83%</td>
<td>48.28%</td>
<td>34.48%</td>
</tr>
</tbody>
</table>

Measles required 90-95% herd immunity for prevention of spread.
The Man in the White House Has Had a LOT To Do With Measles

• 1962: Kennedy:
  – Vaccine Assistance Act: to address disparities in vaccine preventable disease

• 1965: Johnson:
  – Measles added to VAA
  – Campaign to Eliminate Measles

• 1970s: Nixon: Federal $ declined for Vaccines

• 1978: Carter: Renew Campaign to Eliminate Measles
Healthy young child goes to doctor, gets pumped with massive shot of many vaccines, doesn't feel good and changes - AUTISM. Many such cases!
Measles: Conclusion

• US remains in elimination status: HOWEVER ongoing outbreaks and increased global measles activity puts our country at risk.

• Of the > 3400 cases reported since 2001-2019, 1/3 cases have occurred in past 18 months.

• Nearly 90% of cases since 2001 occur in unimmunized or under immunized persons

• Of imported cases: US travelers account for 2/3 of cases
Measles: Conclusions

- Risk of complication including death; high rates of hospitalization in children, certain populations
- Vaccination BEST preventative:
  - TAKE EVERY OPPORTUNITY TO KEEP ALL YOUR PATIENTS CURRENT WITH MEASLES VACCINE
- To Report:
My Own View:

• “Ultimately, society must recognize that science is not a democracy in which the side with the most votes or the loudest voices gets to decide what is right.”

Thank You!

Questions?
Measles References

4. CDC COCA Call Title: Most Measles Cases in 25 Years: Is This the End of Measles Elimination in the United States?, May 21, 2019
5. Measles, AAP Red Book 2019