Measles resurgence: what you should know

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Disclosures

- I have no relevant financial relationships with the manufacturer(s) of any commercial products(s) and/or provider(s) of commercial services discussed within this CME activity.

- I do NOT intend to discuss an unapproved or investigative use of a commercial product/device in my presentation.

Objectives

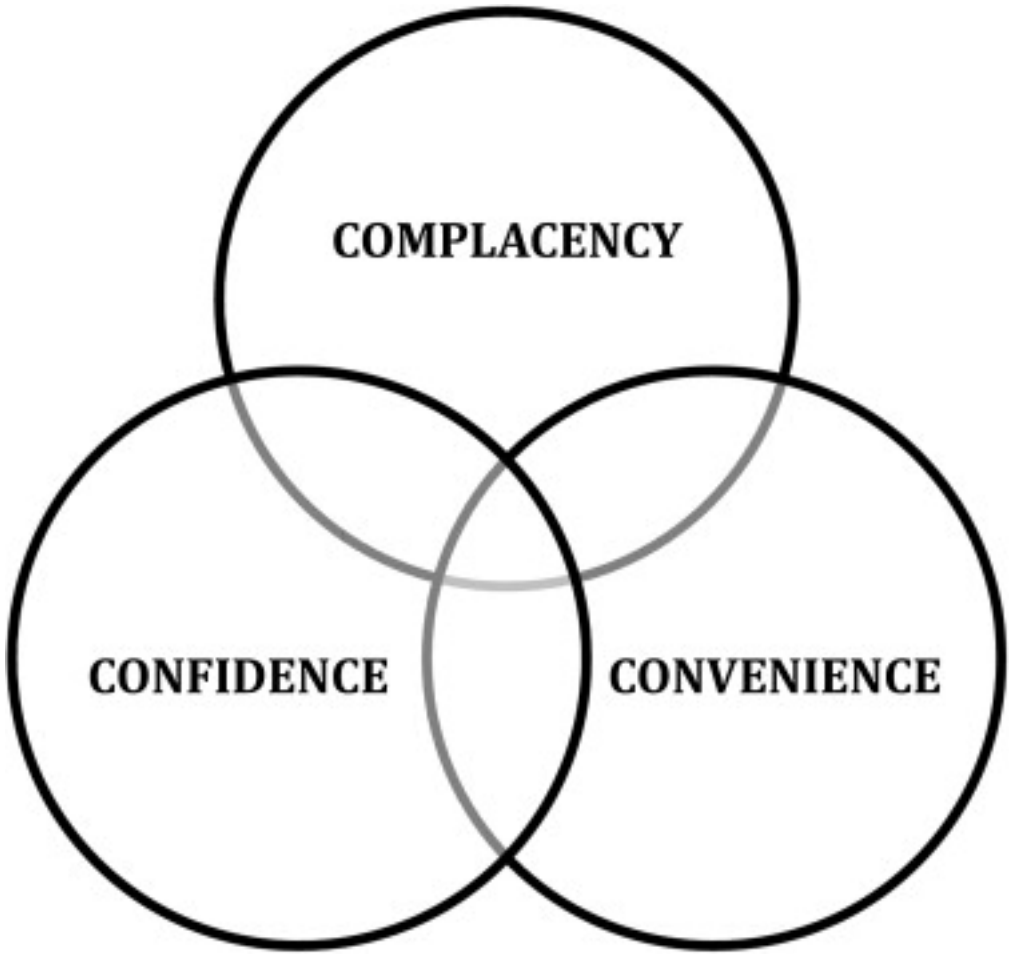
- Review recent epidemiology of measles in the U.S. and Illinois
- Review clinical presentation and diagnostic approaches
- Review role of public health in measles outbreaks / control

These are the 10 biggest threats to global health in 2019

Based on rankings from the World Health Organization

1. Air pollution and climate change
2. Noncommunicable diseases
3. Global influenza pandemic
4. Fragile and vulnerable settings
5. Antimicrobial resistance
6. Ebola and other high-threat pathogens
7. Weak primary healthcare
8. Vaccine hesitancy
9. Dengue fever
10. HIV

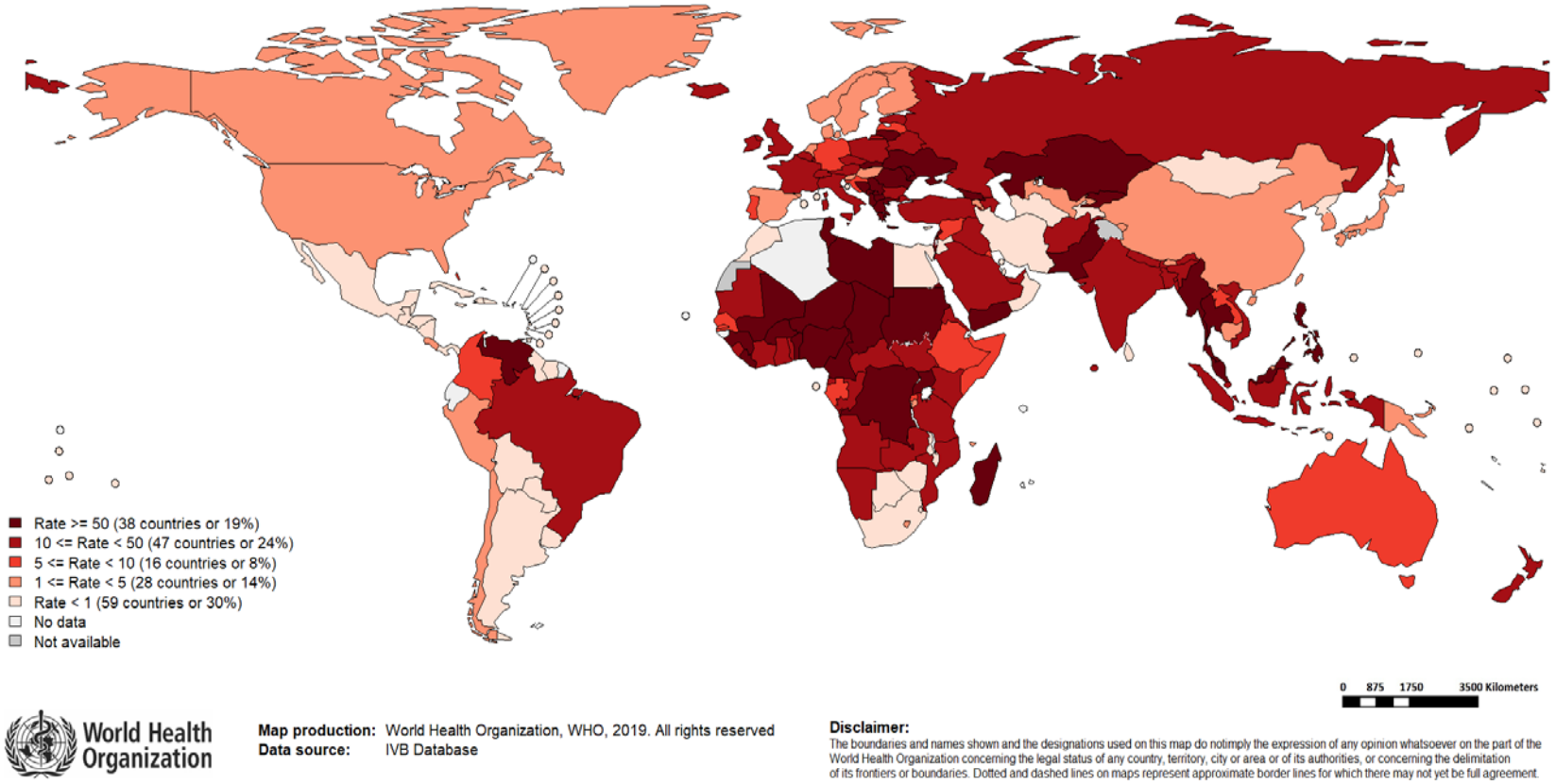
Source: World Health Organization



WHO: Measles Incidence Rate per Million (12 month period)

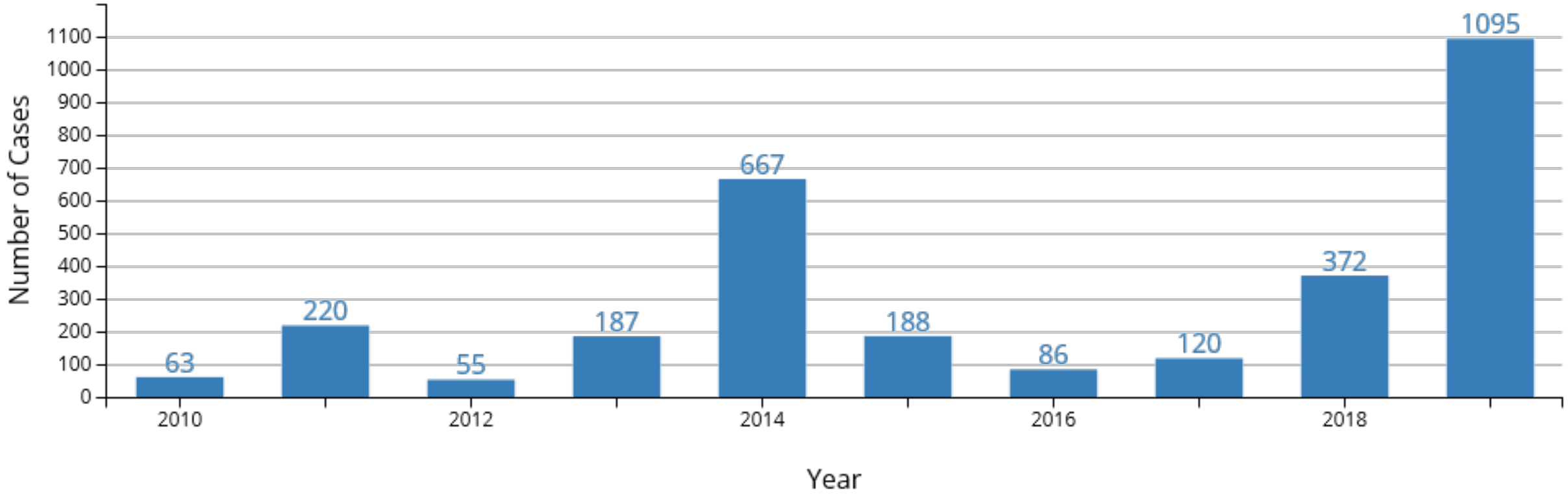
Top 10**		
Country	**Cases**	**Rate**
Madagascar	84804	3406.53
Ukraine	78659	1770.06
India****	53170	40.15
Pakistan	22693	117.46
Philippines	16898	163.55
Yemen	13639	494.45
Nigeria	12745	68.53
Brazil	10316	49.68
Thailand	6914	100.4
Kazakhstan	5908	328.45

Other countries with high incidence rates***		
Country	**Cases**	**Rate**
Georgia	4678	1191.72
Liberia	2367	513.02
Israel	3755	458.38
Kyrgyzstan	2534	425.47
The Republic of North Macedonia	885	425.23
Albania	1169	399.47



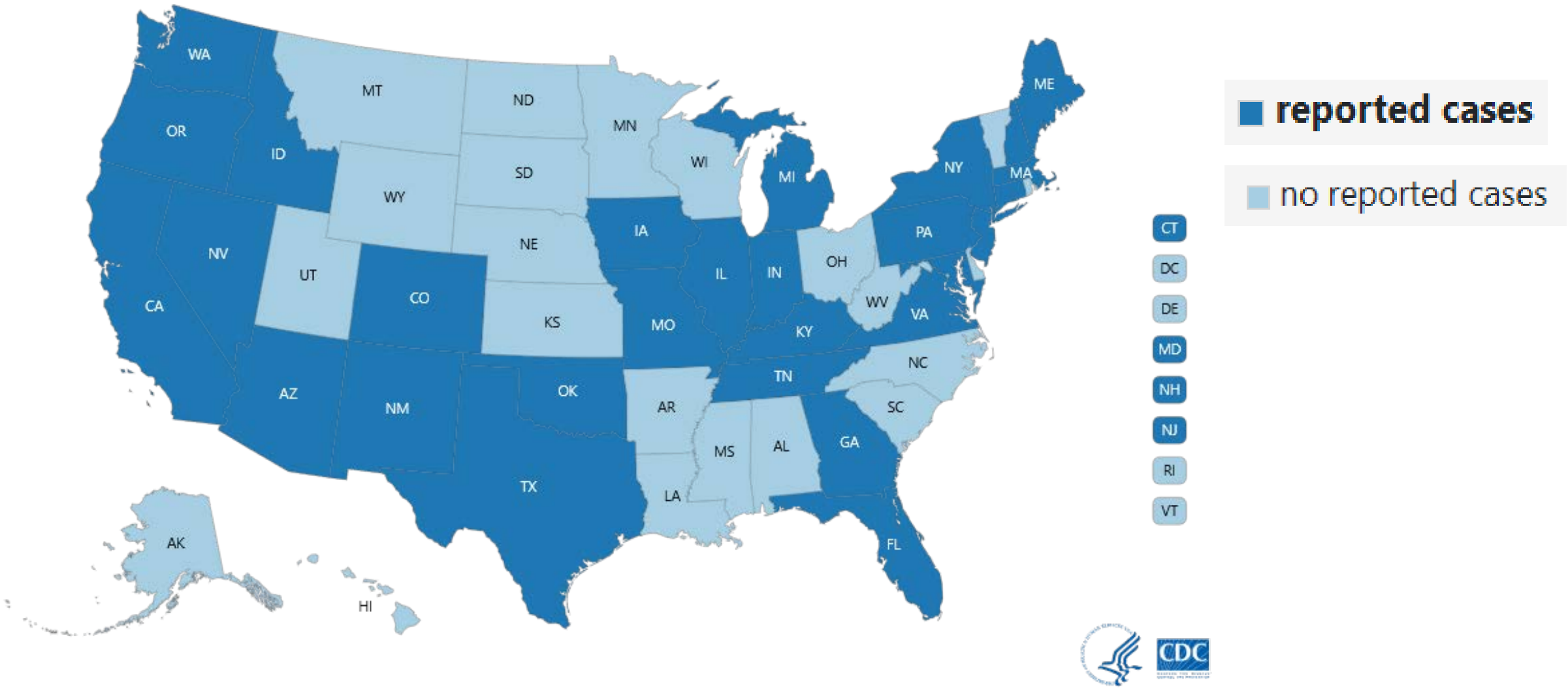
Notes: Based on data received 2019-05 and covering the period between 2018-04 and 2019-03 - Incidence: Number of cases / population* * 100,000 - * World population prospects, 2017 revision - ** Countries with the highest number of cases for the period - *** Countries with the highest incidence rates (excluding those already listed in the table above) ****WHO classifies all suspected measles cases reported from India as measles clinically compatible if a specimen was not collected as per the algorithm for classification of suspected measles in the WHO VPD Surveillance Standards. Thus numbers might be different between what WHO reports and what India reports.

Number of Measles Cases Reported by Year 2010–2019 (As of June 27, 2019)



The states that have reported cases to CDC are Arizona, California, Colorado, Connecticut, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kentucky, Maine, Maryland, Massachusetts, Michigan, Missouri, Nevada, New Hampshire, New Jersey, New Mexico, New York, Oklahoma, Oregon, Pennsylvania, Texas, Tennessee, Virginia and Washington

States That Have Reported Measles Cases in 2019



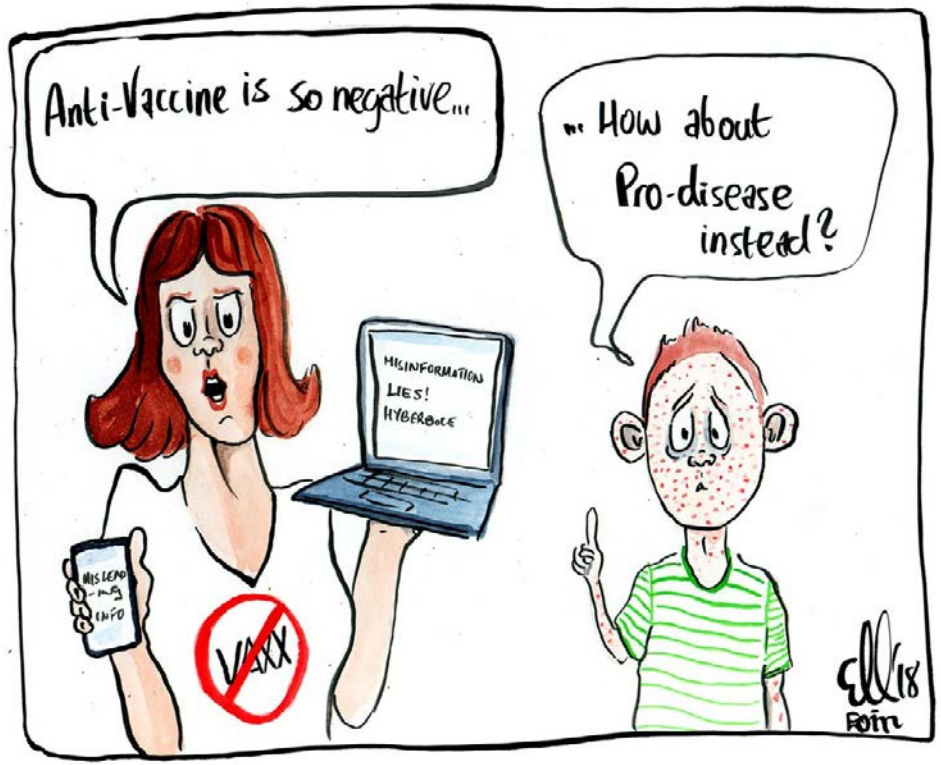
Source: Centers for Disease Control as of 6/27/19 https://www.cdc.gov/measles/cases-outbreaks.html

Measles Cases Reported to CDC in 2019, selected areas

County/State	Number of cases	Date last updated
Rockland Co, NY	276	7/2/19
NYC, NY	619	7/1/19
Washington	82	7/1/19
Michigan	44	5/17/19
California	56	7/2/19
Oregon	14	5/24/19
New Jersey	15	6/18/19
Illinois	9	7/1/19

What is contributing to these outbreaks in the U.S.?

- U.S. residents traveling abroad to areas of high endemic regions
- Increase in measles globally
- Vaccine hesitancy
- Community pockets of low vaccine coverage



Recent Measles Outbreaks in the U.S.

- Rockland County, New York (231 cases):
  - International traveler
  - Orthodox Jewish Community
  - Vaccine coverage:
    - 78.6% unvaccinated, 12.7% unknown, 5.4% 1 MMR; 3.3% 2 MMRs
  - Age of cases (as of 7/1/2019):
    - <1 year of age: 11.6%
    - 1–3 years: 26.4%
    - 4–6 years: 13.4%
    - 7–18 years: 27.2%
    - 19+ years: 21.4%

- Washington State (number of cases):
  - Community with low vaccine coverage rates: 78% for school age children
  - Vaccine coverage of Cases:
    - 78.0% unvaccinated, 14.6% unknown, 4.9% 1 MMR; 2.4% 2 MMRs
  - Age of cases:
    - <1 year of age: 1.2%
    - 1–10 yrs of age: 63.4%
    - 11–18 yrs of age: 19.5%
    - 19+ yrs: 15.9%

Recent Measles Outbreaks in the U.S.:
Understanding how/where we are seeing outbreaks

- Michigan: Individual raising money for Jewish organization in NYC traveled to Michigan mid-March
- Developed measles in transit to Michigan
  - In Michigan, stayed at people's homes and attended Synagogues 3x/day and large, crowded events
  - Had been in over 30 public spaces during infectious period
  - 44 total cases as of latest update on 5/17/2019
  - Infected individuals range in age from 8 months to 63 years; a majority of the cases involve adults.

Measles in Illinois: 2019

2019 to date: 9 cases

- Champaign region (4 cases)
  - First case: unclear exposure
  - Other cases: unvaccinated college students
- Dekalb county (2 cases)
  - Unvaccinated college age student returning from mission trip
- Cook County (2 cases)
  - First case: Vaccinated adult in 50s; travel to Israel
    - Upon return: over 15 public exposure areas in NE Illinois
  - Second case: Individual traveling from O'Hare to Conference at UIC reported on 5/18/19
- Kane County (1 case)
  - Traveler out of state

Measles Transmission

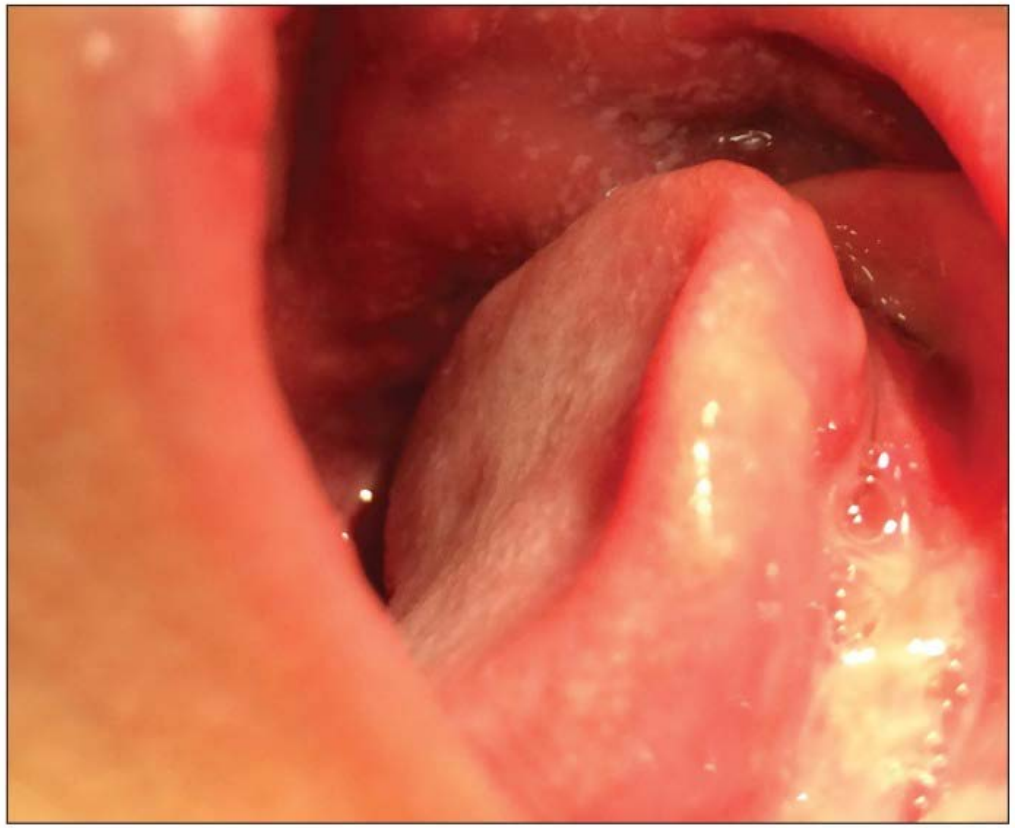
- Acute, febrile rash viral illness
- Transmitted by direct contact with infectious droplets or airborne spread when an infected person breathes, coughs, or sneezes
- Most contagious of the vaccine preventable diseases; exposed, susceptible individuals have a 90% chance of acquiring disease
- Measles virus can remain infectious in the air for up to two hours after an infected person leaves an area

Clinical Presentation of Measles

- Incubation period: 10–14 days after exposure (range 7–21 days)
- Presenting symptoms:
  - High fever
  - 3 C's: Cough, coryzya, conjunctivitis
  - GI symptoms
- Infectious period 4 days prior through 4 days after rash onset

Clinical Presentation of Measles

Koplik spots: 2–3 days after symptoms start



Measles rash

- 3–5 days after symptoms start
- Flat, red spots on the face at the hairline
- Spread down neck, trunk, arms, legs, and feet
- Small raised bumps may appear on top of the flat red spots and join together

Measles Complications

- 1 in 4 children with measles require hospital admission.
- 1 per 1,000 measles cases will develop acute encephalitis, which often results in permanent brain damage.
- 1–2 per 1,000 children infected with measles will die from respiratory and neurologic complications.
- 1 per 100,000 cases develop subacute sclerosing panencephalitis (SSPE), a rare, but fatal degenerative disease of the central nervous system that generally develop 7 to 10 years after measles infection and is characterized by behavioral and intellectual deterioration, seizures, and death.

Measles on your differential diagnosis

- Unvaccinated against measles
- Recent international travel or exposed to someone who traveled internationally within 21 days before onset of rash
- Is living or visiting a community where a measles outbreak has occurred

Management of a suspect measles case

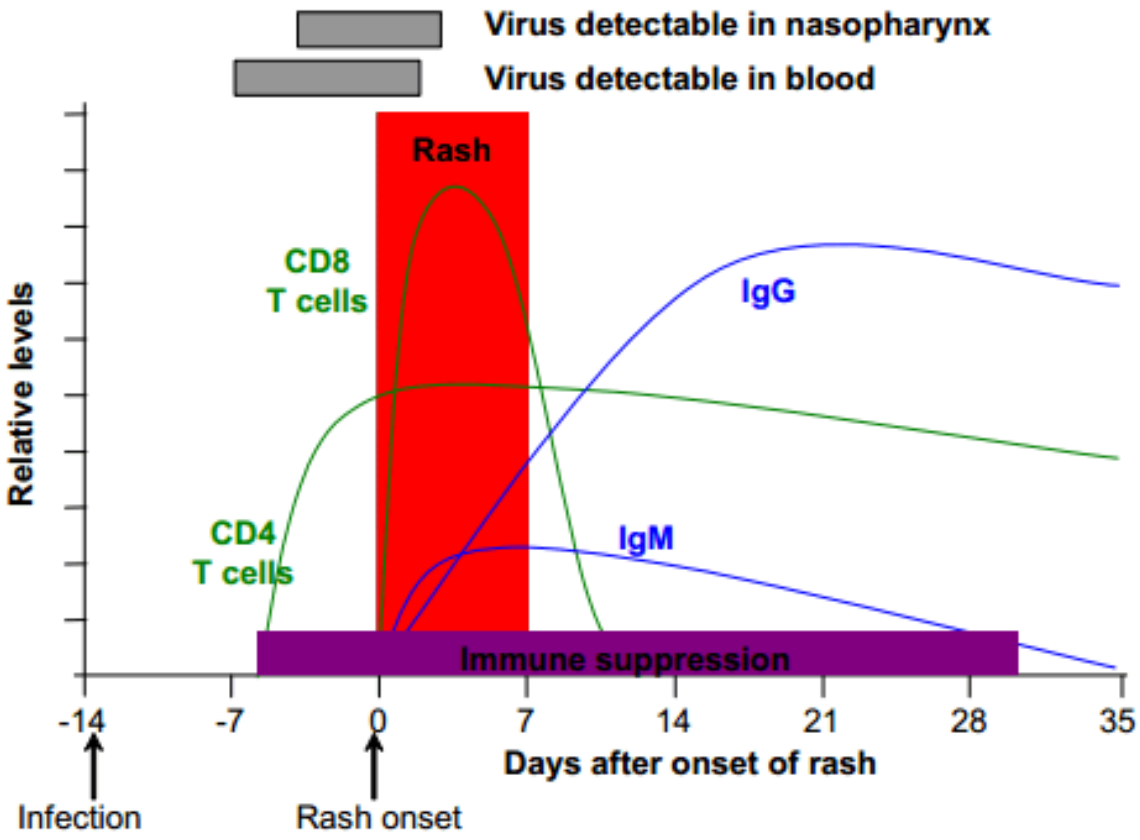
- Promptly mask and place patient in airborne isolation OR a room with a closed door
- Collect blood for serology (IgM) and nasopharyngeal swab for molecular testing using real-time polymerase chain reaction (RT-PCR)
- Suspect cases should be reported to your local health department or infection control team
  - Provide instructions on where to send specimen
  - Identify exposed and those needing post-exposure prophylaxis (MMR vaccine or immunoglobulin)
- Providers should have evidence of immunity

Diagnosing measles

Unvaccinated individuals:

- IgM:
  - usually appears within 3 days of rash
  - False negatives occur if collected <72hrs after rash onset, repeat if high suspicion
  - Typically IgM is positive for ~30 days after acute illness

- PCR:
  - Usually present around time rash occurs
  - Declines within 7-10 days
  - Possible false negatives if collected after rash onset



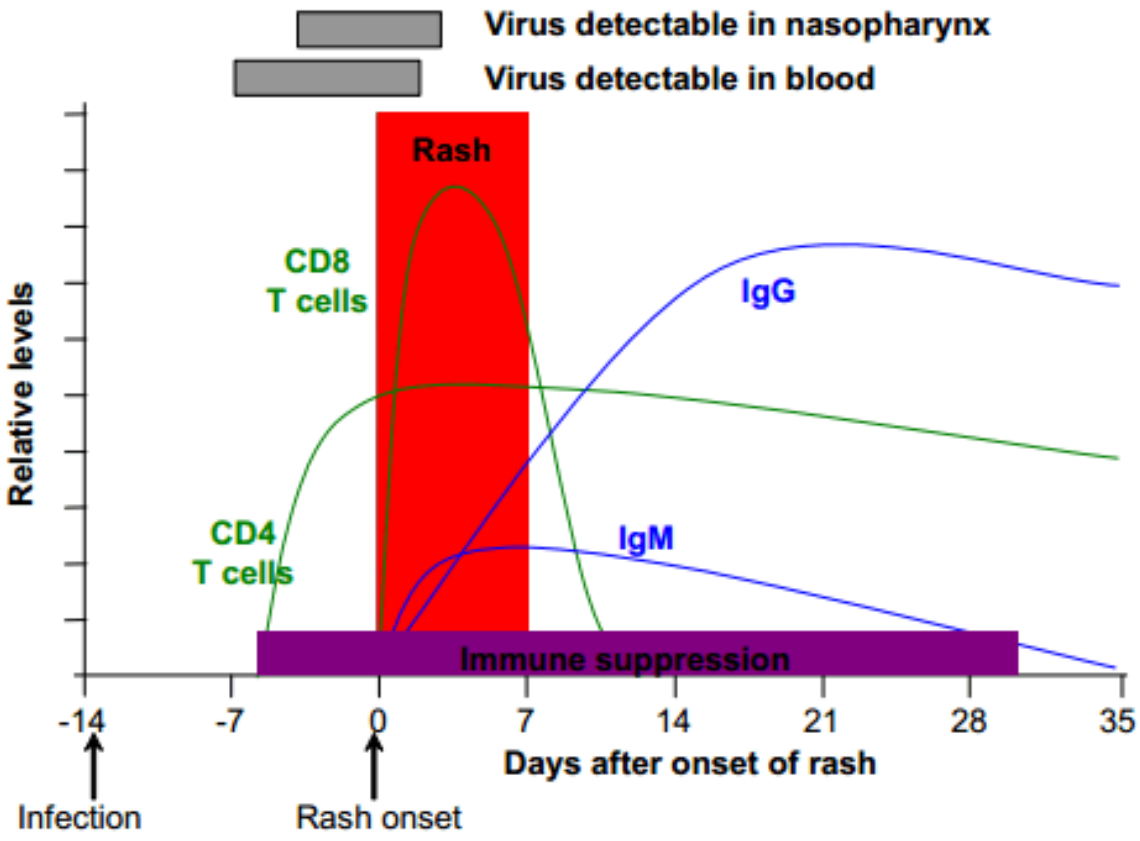
Diagnosing measles

<u>Recently vaccinated individuals:</u>

- IgM:

  Can have false positives due to vaccine response (IgM appears 7–14 days after vaccine)

- PCR:
  - Can have false positives due to shedding from live virus
  - CDC can molecularly type to identify if wild vs. vaccine type



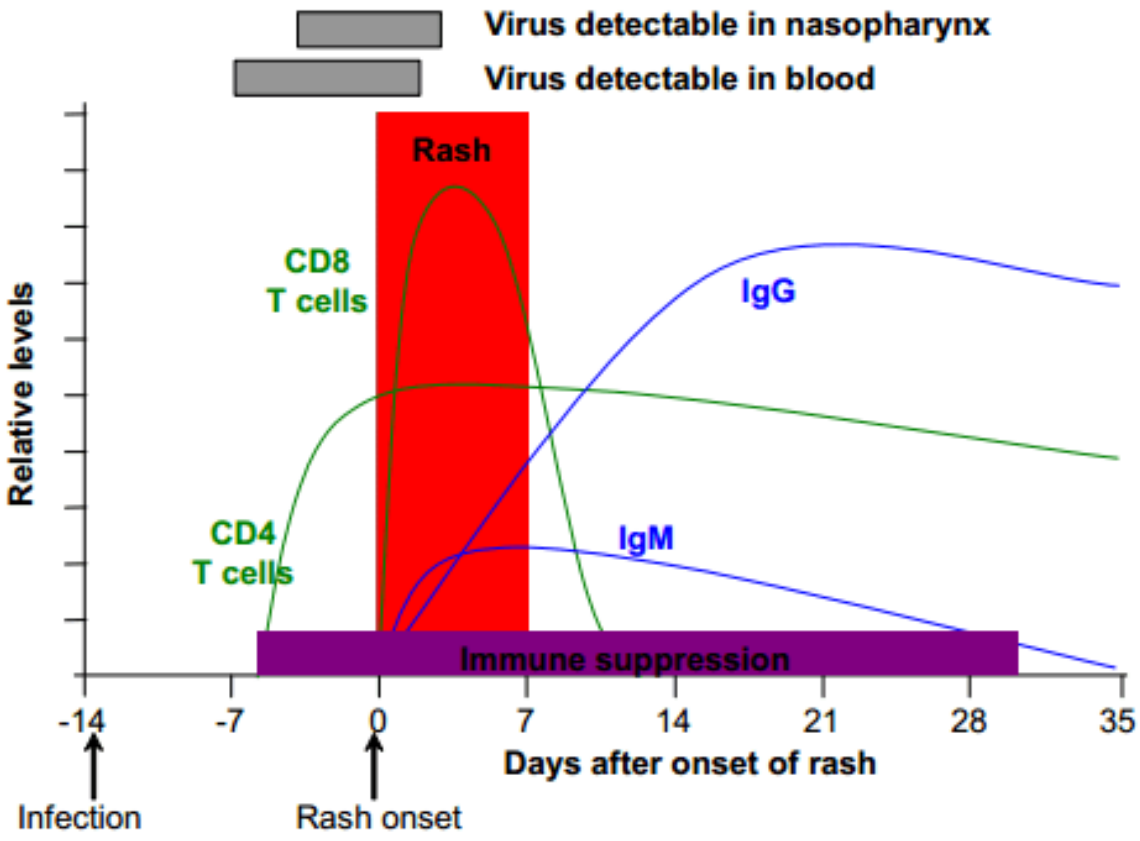
Diagnosing measles

<u>Previously vaccinated individuals: can have a modified presentation</u>

- IgM:
  - May not develop
  - Thus, if high suspicion, can not use a negative IgM to rule out disease

- PCR:

  More likely to have a positive result, but again may not be definitive



Key Points to remember

- Serology done at most reference labs
- RT-PCR done at IDPH and CDC
- Collect serum and nasopharyngeal swab
- Alert local health department and/or infection control team
    - Help with isolation/patient monitoring
    - Local health department will approve for samples to be sent to IDPH for testing, if warranted
    - Facilitate shipment of sample to IDPH labs

Management of measles

- Symptom management
- Some patients require hospitalization
  - Dehydration
  - Pneumonia or other complications
- Isolation and case management to reduce exposure to others

Public Heath approach to measles

- Prevention
- Case investigations
- Contact control

Prevention strategies for healthcare settings

- Ensure that healthcare personnel have presumptive evidence of immunity
- Rapidly identify, mask, and isolate patients (known or suspected) with measles
- Minimize potential exposure before arrival (i.e., ask about measles symptoms by phone and provide instructions to limit clinic exposure)
- Place masked patient in airborne isolation room or private room with closed door (avoid room where exhaust is recirculated)
- Healthcare personnel should don N95 filtering respirator
- Limit visitors

Community prevention

The best strategy to prevent measles

is to get vaccinated!

MMR vaccine recommendations

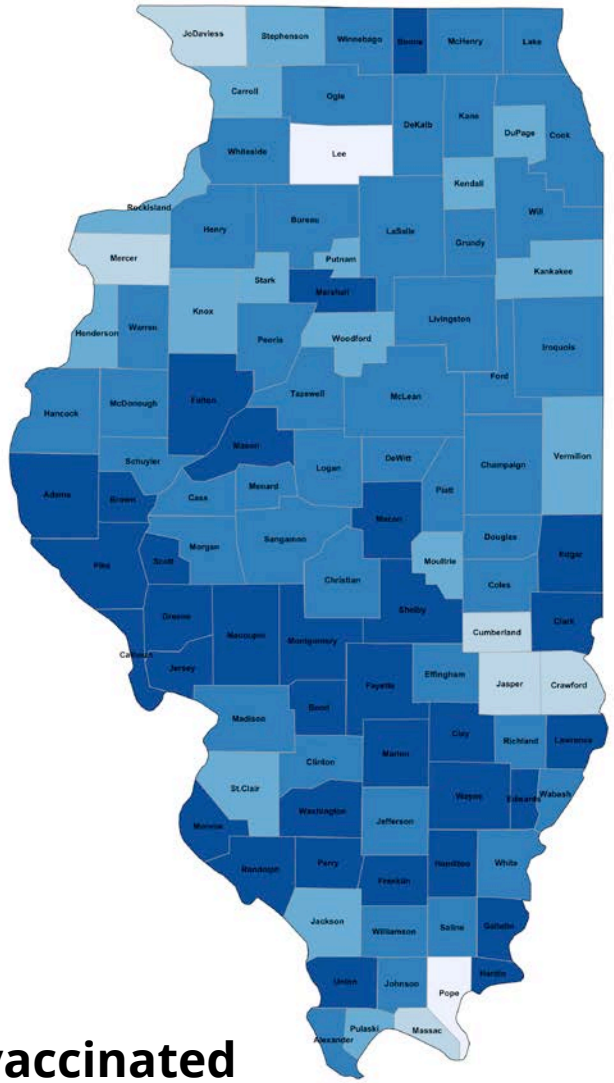
- Vaccine effectiveness: 1 dose (93%), 2 doses (97%)
- Children (2 dose series)

  One dose at 12–15 months of age, second dose at 4–6 years of age
- Adults with no evidence of immunity to measles
  - Most adults need 1 dose
  - Two doses for high risk adults, at least 28 days apart
    - Healthcare personnel
    - Post-high school students
    - International travelers
- Presumptive evidence of immunity: Born before 1957 (except health care personnel), documentation of receipt of MMR, laboratory evidence of immunity or disease (diagnosis of disease without laboratory confirmation is not evidence of immunity)

MMR vaccine Travel recommendations

- **International Travel:**
  - For infants 6 through 11 months of age, one dose of MMR vaccine should be given.
  - These children will still need their regularly scheduled 2 MMR vaccine doses.
  - Individuals ≥12 months of age should have two doses of MMR, separated by at least 28 days.

The overall student vaccination rate is 98.2%



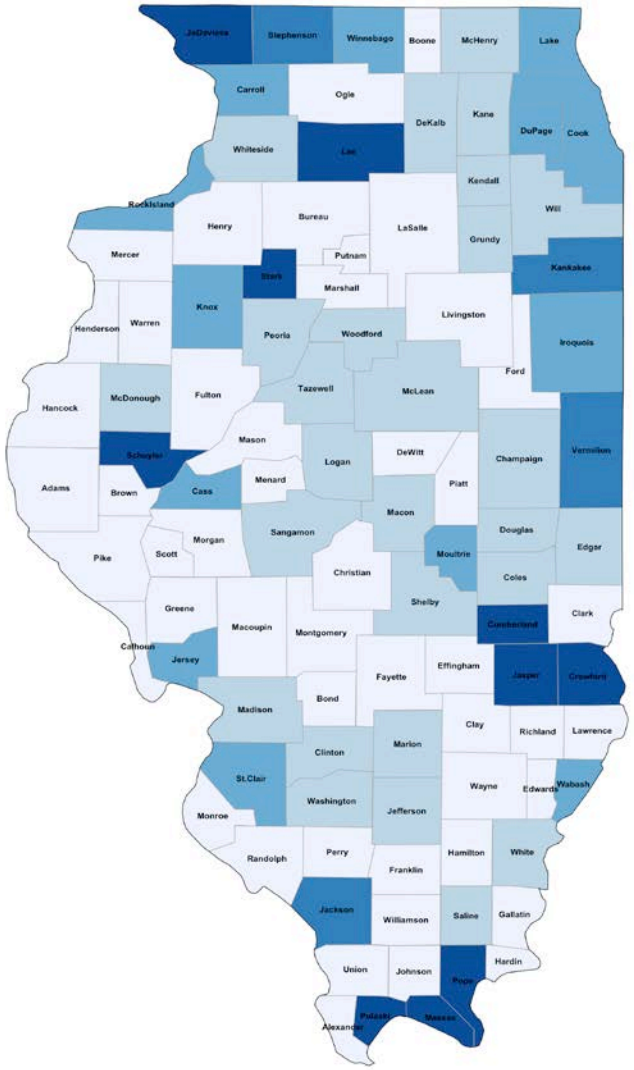
% Vaccinated

- [**95** to 96
- [**96** to 97
- [**97** to 98
- [**98** to 99
- [**99** to **100**

Intervals inclusive of **bold number**

% of all students in county that are vaccinated

9.2% of schools are high risk (School Vaccination Rate <95%)



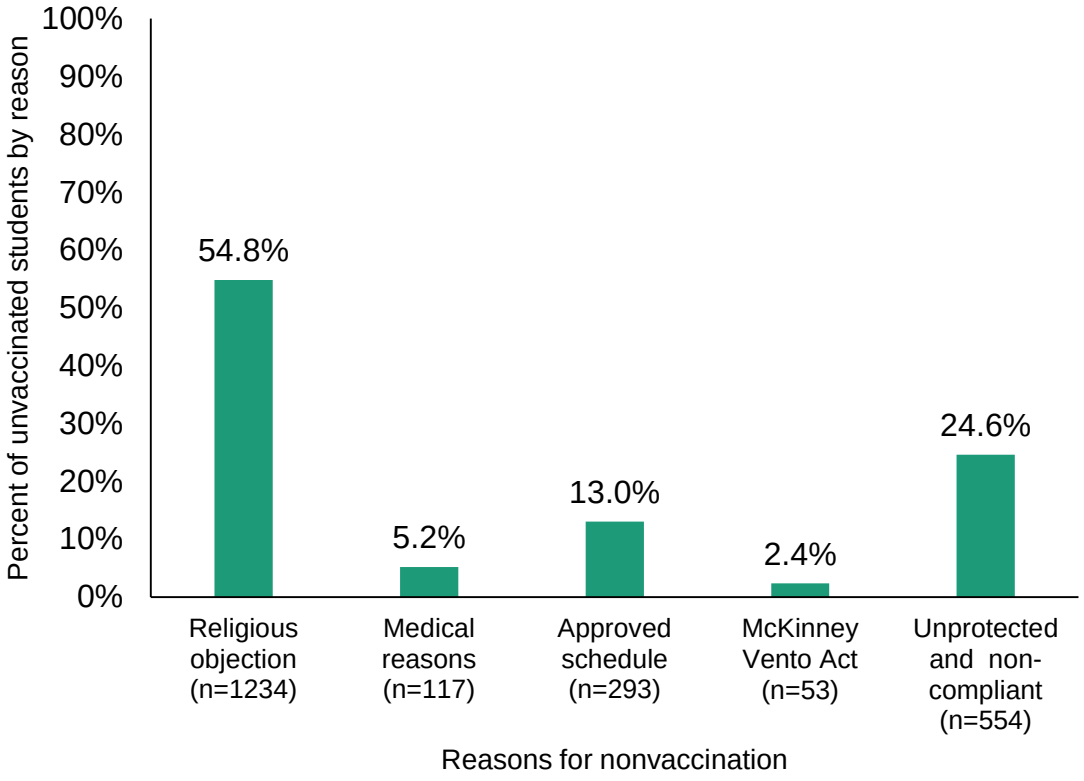
% Schools High Risk

- [**0** to 5
- [**5** to 10
- [**10** to 15
- [**15** to 20
- [**20** to **50**

Intervals inclusive of **bold number**

Religious Exemptions are the most common reason for non-vaccination

Proportion of vaccine-exempt students, by reason, Lake County 2018-2019



Lake County non-public schools found to have lower vaccination rates

Characteristics of School immunization	Public & Public Partnership Schools	Private: Religious & Independent schools	Private: Early Childhood, Montessori & Waldorf schools	All schools in Lake County
No. of schools, n	200	34	20	254
No. of MMR-eligible students, n	131,548	8,075	1,292	140,915
Students vaccinated with MMR, n(%)	129,566 (98.5%)	7,928 (98.2%)	1,170 (90.6%)	138,664 (98.4%)
Religiously exempted students, n(%)	1,043 (0.8%)	109 (1.3%)	82 (6.3%)	1,234 (0.9%)
Schools at <95% measles vaccination rate, n(%)	9 (4.5%)	8 (23.5%)	11 (55.0%)	28 (11.0%)
Schools at <90% measles vaccination rate, n(%)	1 (0.5%)	1 (2.9%)	4 (20%)	6 (2.4%)

Vaccine Hesitancy – Myths

- Vaccines cause autism
  - Andrew Wakefield’s 1997 study was discredited.
  - Many other studies have disproven the link between vaccines and autism.
- Infant immune systems can’t handle so many vaccines
  - Based on the number of antibodies present in the blood, a baby can theoretically take ~10,000 vaccines at one time.
  - The immune system can never truly be overwhelmed because the cells in the system are constantly being replenished.

Vaccine Hesitancy - Myths

- Vaccines aren’t worth the risk
  - Babies are constantly exposed to countless bacteria and viruses every day. Immunizations are negligible in comparison.
- Ingredients in vaccines are harmful
  - Only tiny trace amounts of chemicals such as mercury or aluminum are found in vaccines.
  - Studies show that the low levels cause no harm.
  - The concerns over formaldehyde are also unfounded since our bodies naturally produce it at a higher rate through our metabolic systems.
- Natural immunity is better than vaccine-acquired immunity
  - The danger of this outweighs any type of benefit.
  - If you catch measles, you have a 1 in 500 chance of dying vs. the risk of having a severe allergic reaction to MMR vaccine being lower than one-in-one million.

How to talk to vaccine hesitant parents

- Listen to parents' concerns and acknowledge them in a non-confrontational manner
- Stress the number of lives saved by immunization, as a positive approach, rather than focusing on the number of deaths from not immunizing
- Discuss the state laws for school entry and the rationale for them
- Promote partnership with parents in decision-making and personalize these relationships. Help to modify misconceptions
- The majority of parents believe immunization is important and trust their health care providers as a reliable source of immunization information
- **Be a strong advocate for vaccines!**

Public Health Case investigations

- Report of suspect case received by the local health department
- Case investigation:
  - Identifying all potential contacts, areas of exposure during infectious period
- Not uncommon to have a measles case visit numerous clinical and public settings prior to diagnosis
- Risk of spread depends on level of susceptibility of exposed population, and level of contagiousness of individual

Public health investigations

- Identification of contacts to determine immunity status:
  - Identify who warrant post-exposure prophylaxis
  - Monitoring , isolation, and restriction of susceptible individuals from school, work etc. for 21 days since last exposure
- Post-exposure prophylaxis
  - Vaccination within 72 hours of exposure
    - Can be used as young as 6 months of age
    - Not to be used in individuals with contraindications to live vaccine
  - Immunoglobulin for high risk individuals (i.e., pregnant, infants, immunocompromised) within 6 days
  - Susceptible healthcare personnel should receive post-exposure prophylaxis **AND be excluded from duty from day 5 after first exposure to day 21 after last exposure regardless of post-exposure vaccine**

Summary

- Measles is on the rise, in the U.S., and globally
  - Over 3400 cases reported in the U.S. from 2001 to May 2019, one-third of cases occurred in the past 18 months
- Vaccine hesitancy
  - Complacency, convenience, confidence
- Vaccine
  - Highly effective
  - Safe
- Case Management
  - Isolate a patient with febrile rash illness
  - Identify risk factors
  - Obtain blood and nasopharyngeal swab
  - Call the local health department!

Questions

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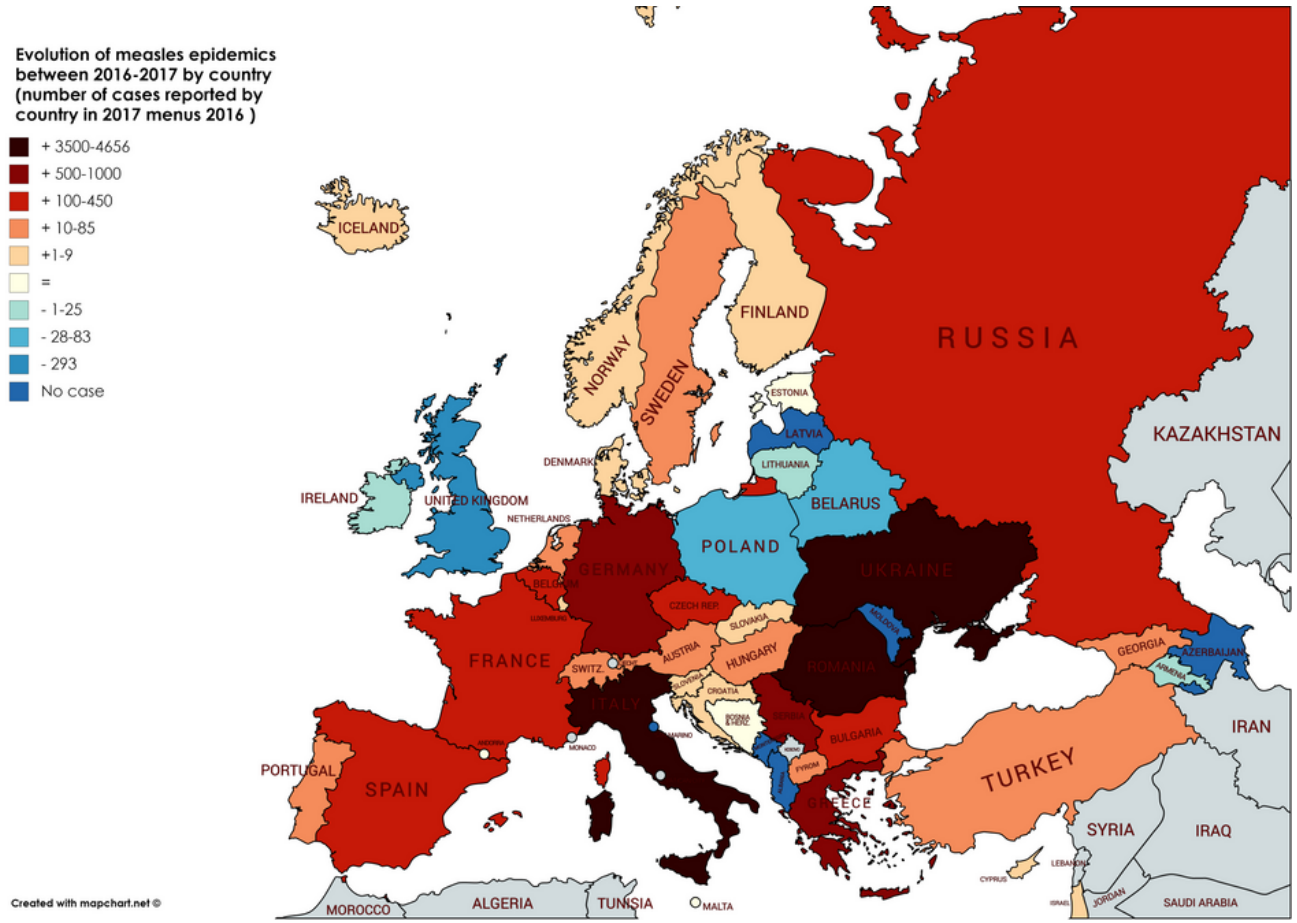
Health Department and
Community Health Center

Extra slides


Evolution of measles epidemics between 2016-2017 by country (number of cases reported by country in 2017 menus 2016)
+ 3500-4656
+ 500-1000
+ 100-450
+ 10-85
+1-9
=
- 1-25
- 28-83
- 293
No case
ICELAND
NORWAY
SWEDEN
FINLAND
RUSSIA
ESTONIA
LATVIA
LITHUANIA
KAZAKHSTAN
DENMARK
IRELAND
UNITED KINGDOM
NETHERLANDS
BELARUS
POLAND
GERMANY
UKRAINE
BELGIUM
LUXEMBURG
CZECH REP.
SLOVAKIA
MOLDOVA
AUSTRIA
HUNGARY
FRANCE
SWITZ.
ROMANIA
GEORGIA
AZERBAIJAN
ARMENIA
SLOVENIA
CROATIA
ITALY
SAN MARINO
BOSNIA & HERZ.
SERBIA
BULGARIA
IRAN
ANDORRA
MONACO
KOSOVO
FYROM
PORTUGAL
SPAIN
TURKEY
GREECE
SYRIA
IRAQ
CYPRUS
LEBANON
ISRAEL
JORDAN
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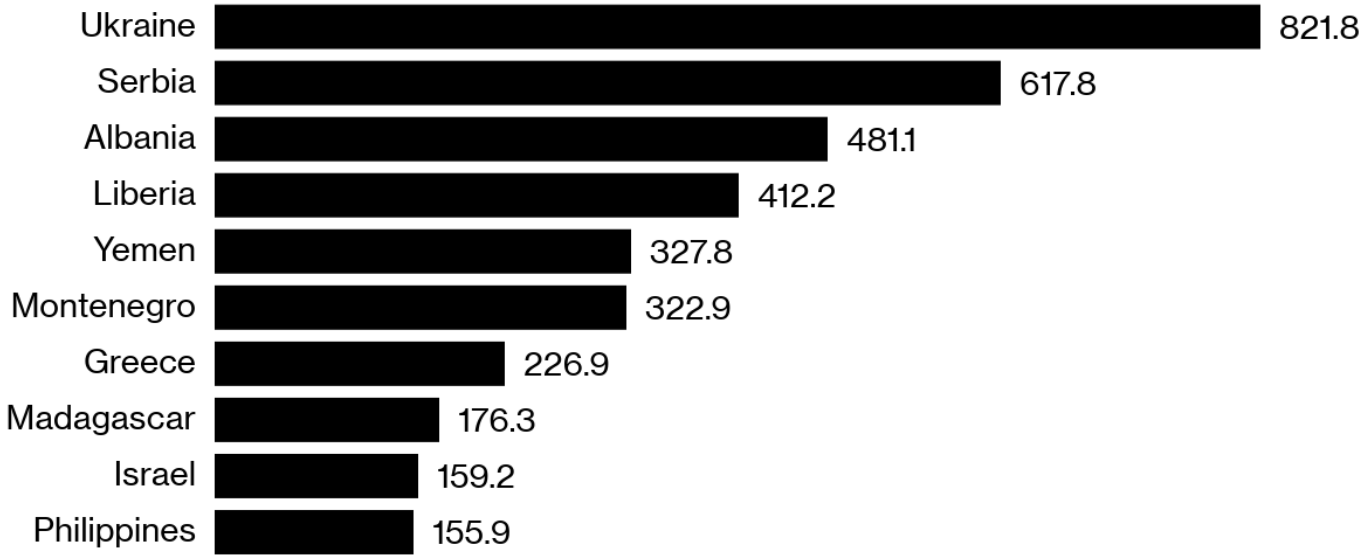
Big Measles

Countries with the highest incidence per million people



Source: World Health Organization, 2019

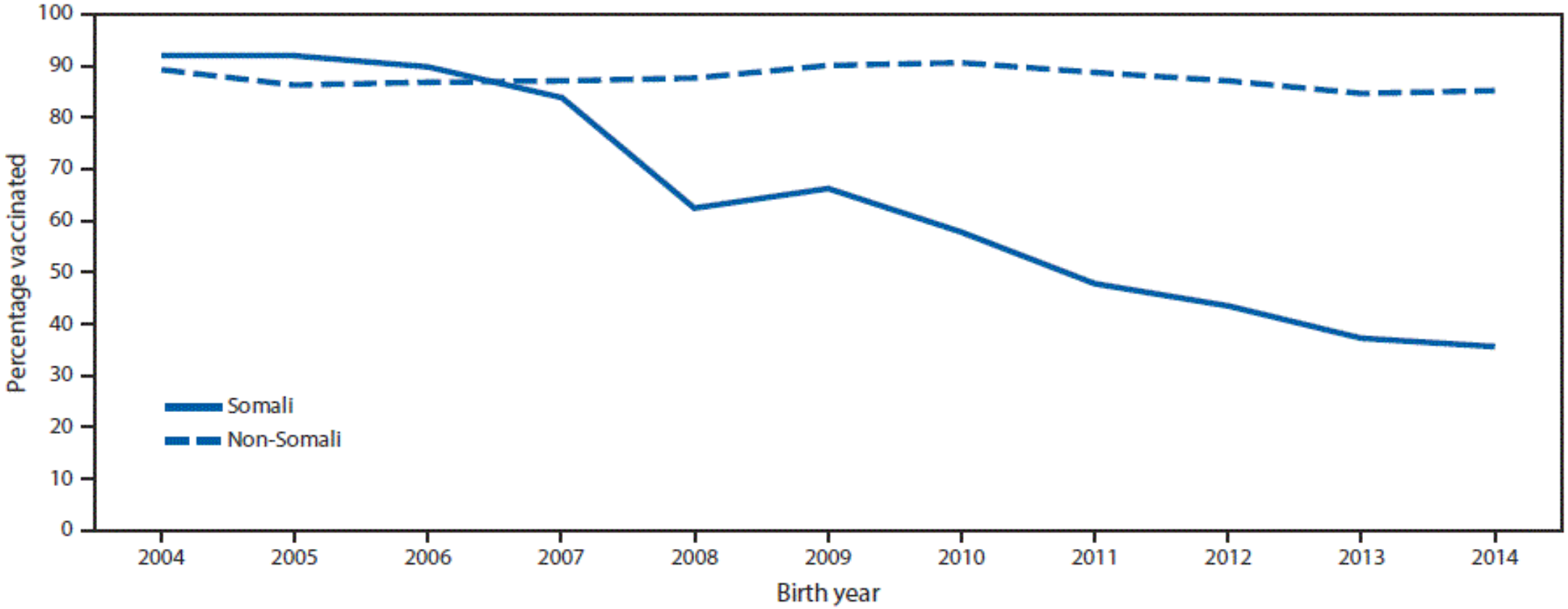
Bloomberg

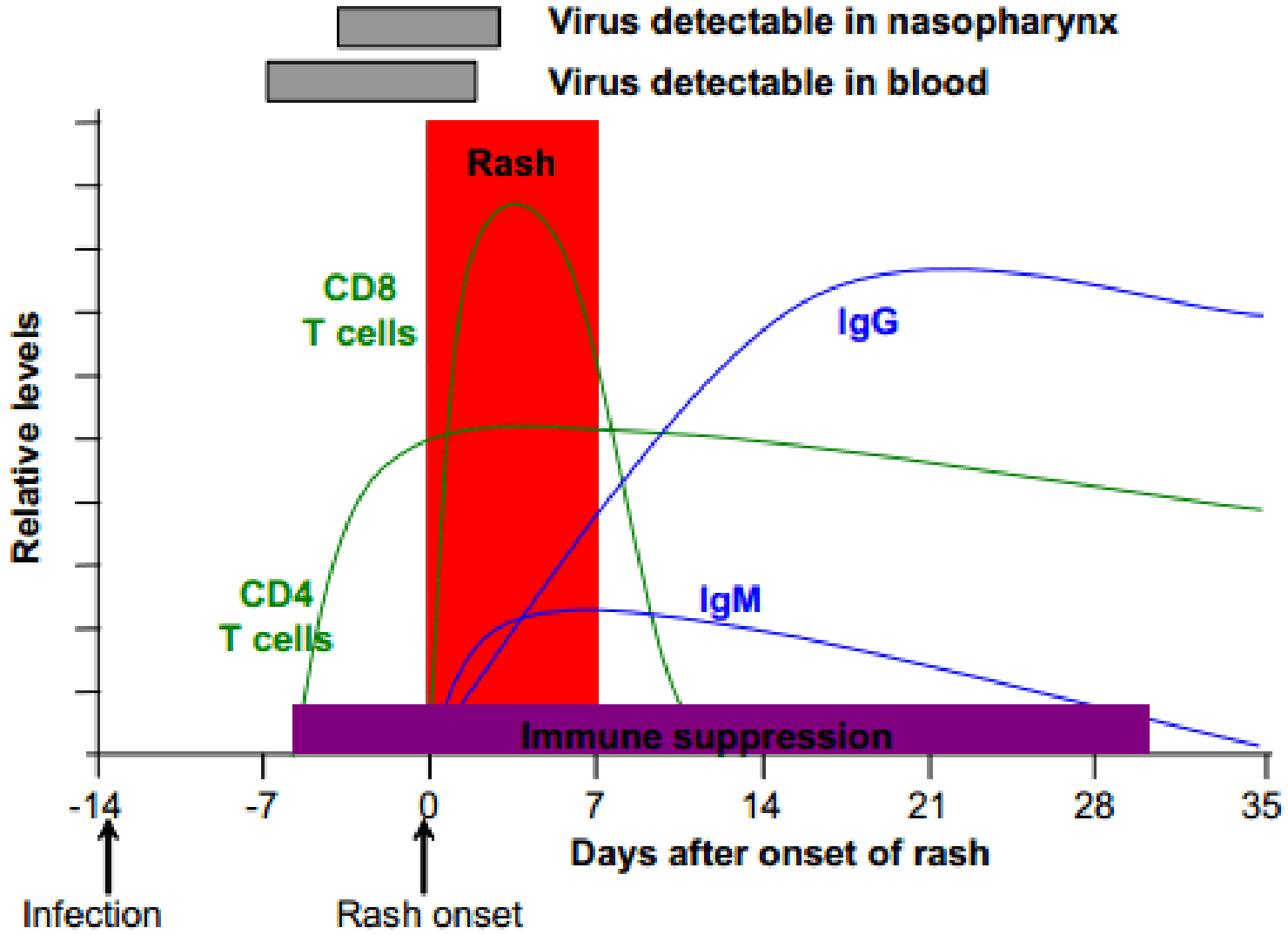
Recent Measles Outbreaks in the US:

Minneapolis, MN: 2017: 75 cases. Somali-American community

95% cases unvaccinated

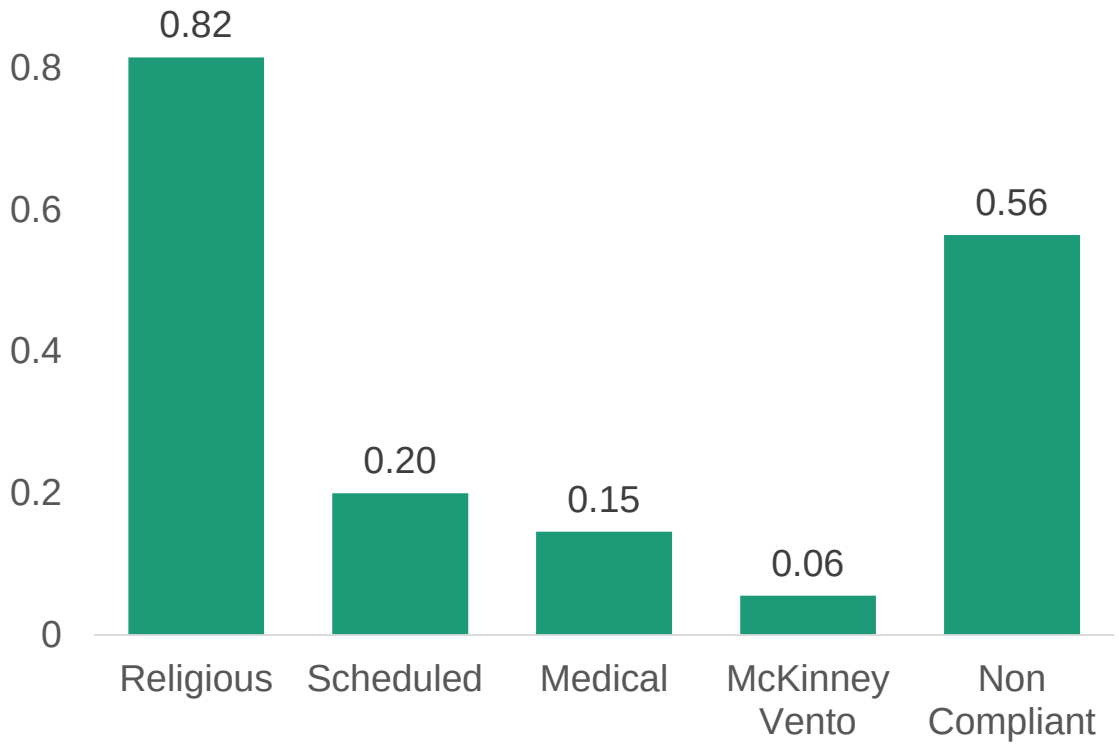
77% <12 months of age




Virus detectable in nasopharynx
Virus detectable in blood
Rash
CD8
T cells
IgG
Relative levels
CD4
T cells
IgM
Immune suppression
-14
-7
0
7
14
21
28
35
Days after onset of rash
Infection
Rash onset

Religious Exemptions are the most common reason for non-vaccination

Reasons for non-vaccination (% of students)



Religious Schools are more likely to be High Risk

School Type	Protected (% Students)	Religious Exemption (% Students)	High Risk (% Schools)
All	**98.2**	**0.41**	**6.9**
Charter	98.1	0.82	9.2
Religious	97.4	1.32	21.9