Measles

It isn't just a minor rash

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Alternate Titles

- Around the world in 80 days
- Just a plane ride away
- The gift that keeps on giving

Goals of Presentation

- Review the clinical illness and complications caused by measles
- Increase our awareness of recent transmission of measles in U.S.
- Provide an overview of the current recommendations and requirements for vaccination against measles
- Draw our attention to the current measles vaccination rates in Arkansas

It's Friday Afternoon at 4pm

A 4 y.o. boy presents with 3 day history of runny nose, red eyes, poor PO intake and a 1 day history of 103 fever, cough, fussiness, and a salmon red maculopular rash on his face, neck, shoulders and superior chest.

- What do you do immediately? What should you do as soon as feasible?
- What do you want to know?
- What test(s) should you consider

Measles

- History of Disease / Agent
  - One of the most contagious diseases known to man
  - First described in 7th century, “rubeola”
  - Near universal infection of childhood in prevaccination era
  - Frequent and occasionally fatal in developing areas

Measles Virus

- Biologic Characteristics
  - Paramyxovirus
    - Single-stranded, enveloped RNA virus
  - One antigenic type

- Environmental Persistence
  - Extremely sensitive to UV light, heat, and acid pH. Vaccine strains will be deactivated if stored in direct light

Epidemiological Characteristics

- Transmission
  - Respiratory transmission of virus in droplets and aerosol
  - Replication in nasopharynx and regional lymph nodes
  - Primary viremia 2-3 days after exposure. Secondary viremia 5-7 days after exposure with spread to tissues
  - Infective dose – low. Typical 2^{o} attack rate of >=90%

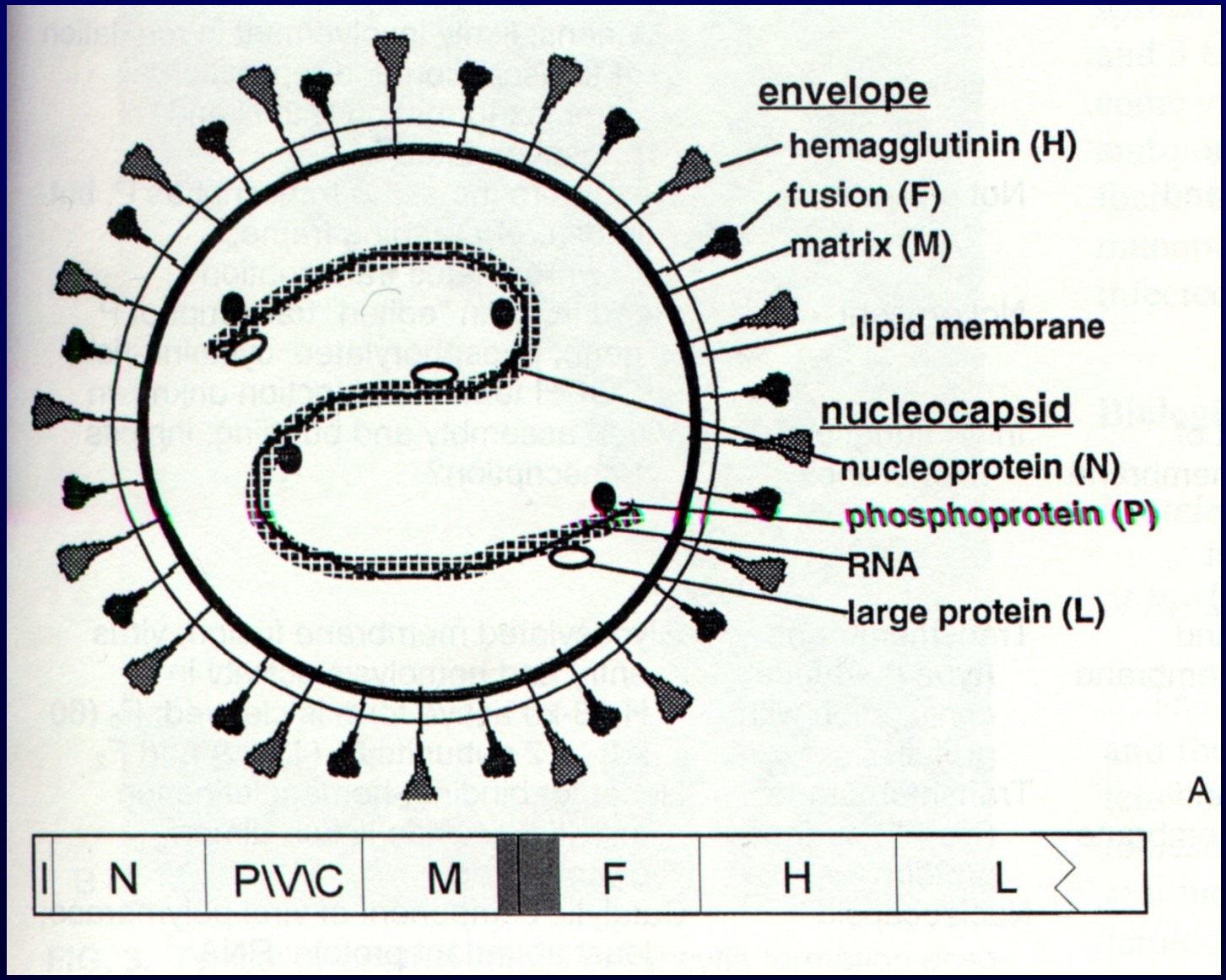
Epidemiological Characteristics

- Reservoir
  - Only man
- Communicability
  - From 4 days prior to 4 days after rash onset in normal hosts.
  - Immunocompromised persons may be contagious for duration of illness
- Incubation period
  - Typically 10-12 days but ranges from 7-21. Rash onset usually around day 14

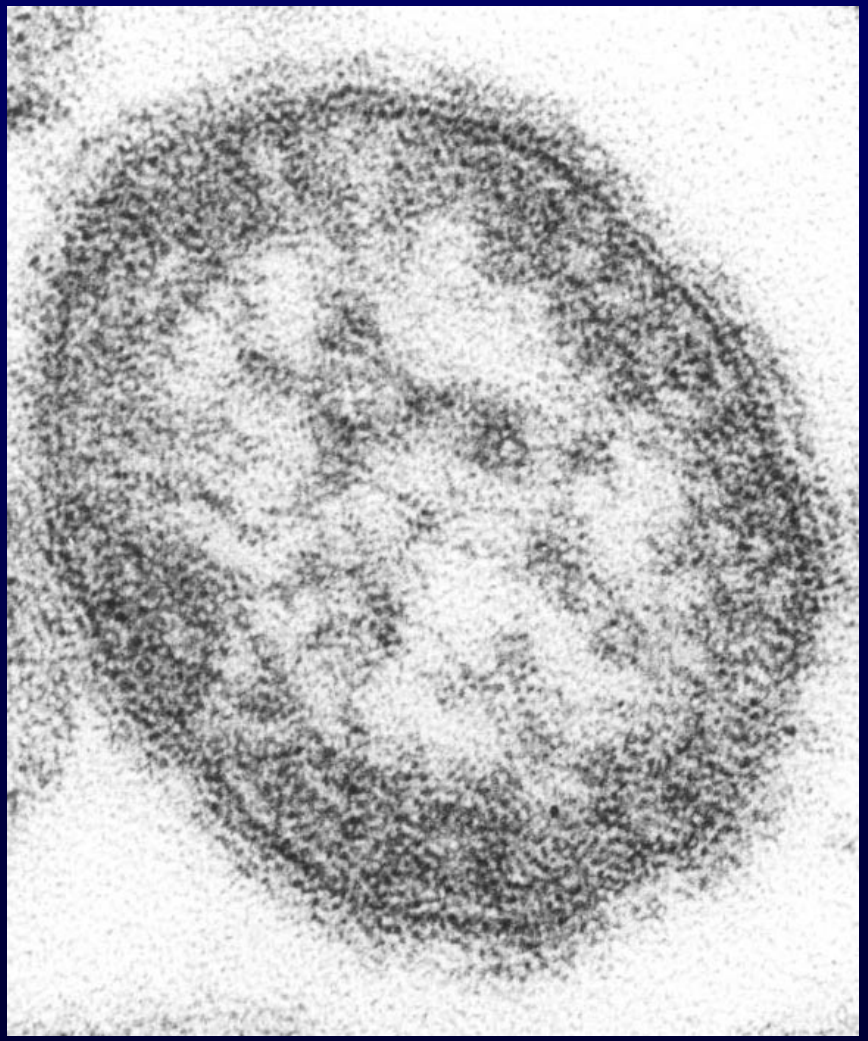
Epidemiological Characteristics

- High risk groups:
  - College students
  - Institutionalized persons
  - International travelers
  - Health-care personnel
- Epidemic Potential:
  - Exceedingly high
- Challenges
  - Imported cases, vaccine not perfect
    - 93% after one dose, 97% after two if vaccinated on schedule
    - If vaccinated 6-<12 months of age, 1st dose is <=85% effective

Measles Virus



Measles Virus



CDC/PHIL

Measles Clinical Features

- Prodrome
  - Stepwise increase in fever to 103 F or higher
  - Cough, coryza, conjunctivitis
  - Koplik spots (days 2-3)
- Then rash 3-5 d later

CDC/PHIL

http://www1.lf1.cuni.cz/~hrozs/skin1.htm

Measles Clinical Case Definition

- Generalized rash lasting ≥3 days, and
- Temperature >38.3 C (101 F), and
- Cough, coryza, or conjunctivitis

Children With Characteristic Measles Rashes

CDC Public Health Image Library

Measles Differential Diagnosis

- Drug reaction
- Other infection
  - Roseola, chicken pox, coxsackie virus, enterovirus, parvovirus, scarlet fever, mononucleosis, rubella, meningococcemia, RMSF, syphilis, hiv, typhus, typhoid fever, dengue, relapsing fever, west nile virus, and others.
- Allergic rash
- Transfusion reaction

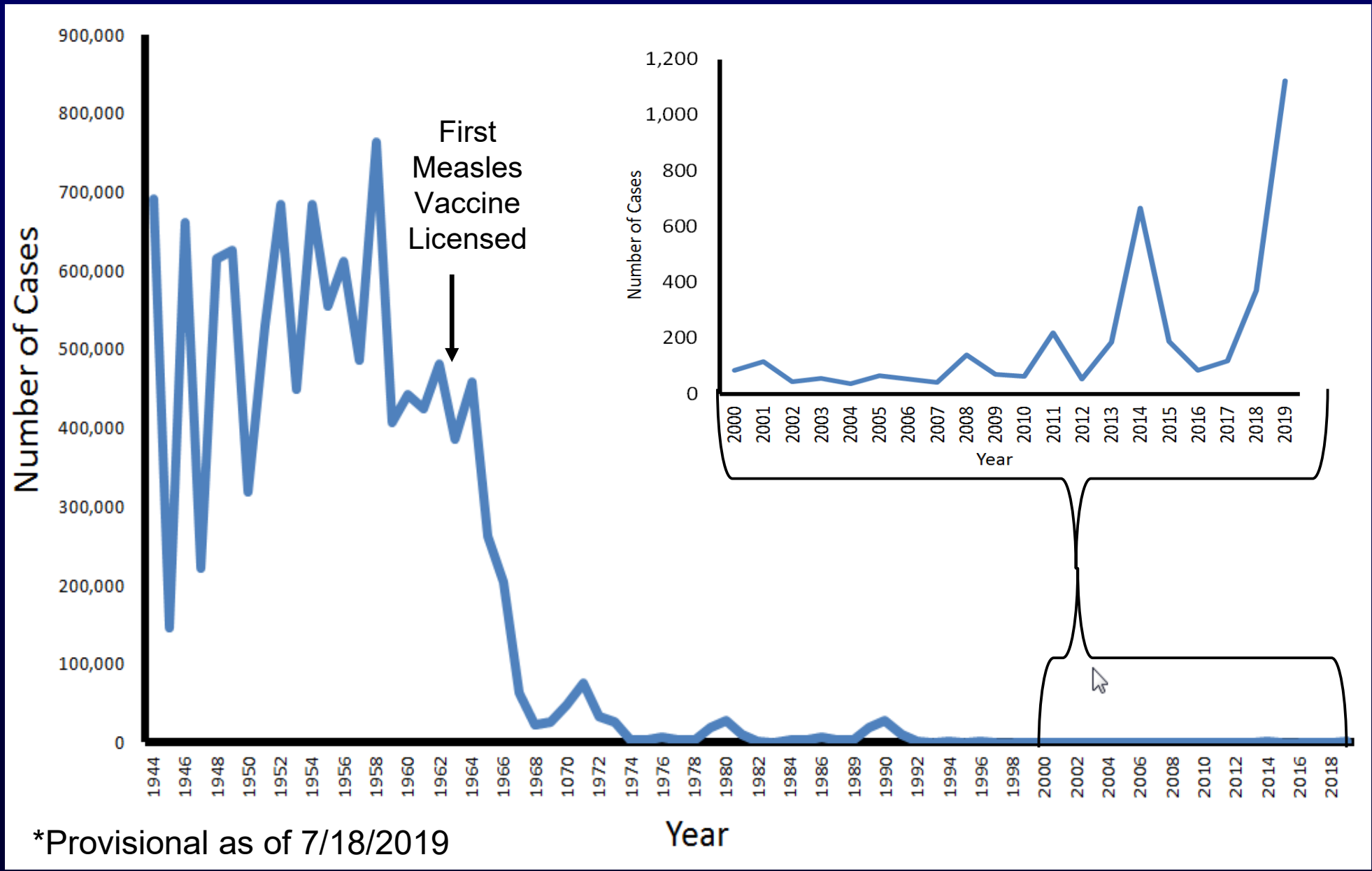
What distinguishes this rash illness from others?

- 2-3 d after symptoms: Koplik spots (i.e.: enanthem)
- 3-5 d after symptoms: rash starts on hairline of neck or face and progresses downward
- Can involve hands and feet
- Usually occurs with high fever (103-105 is common)
- Rash usually flat, but can be papular. Usually coalesces and lasts ~1 week
- Patient is clearly ill
- The epidemiology is key: Exceptionally uncommon in AR in persons without obvious epidemiological risk factors

Measles Laboratory Diagnosis

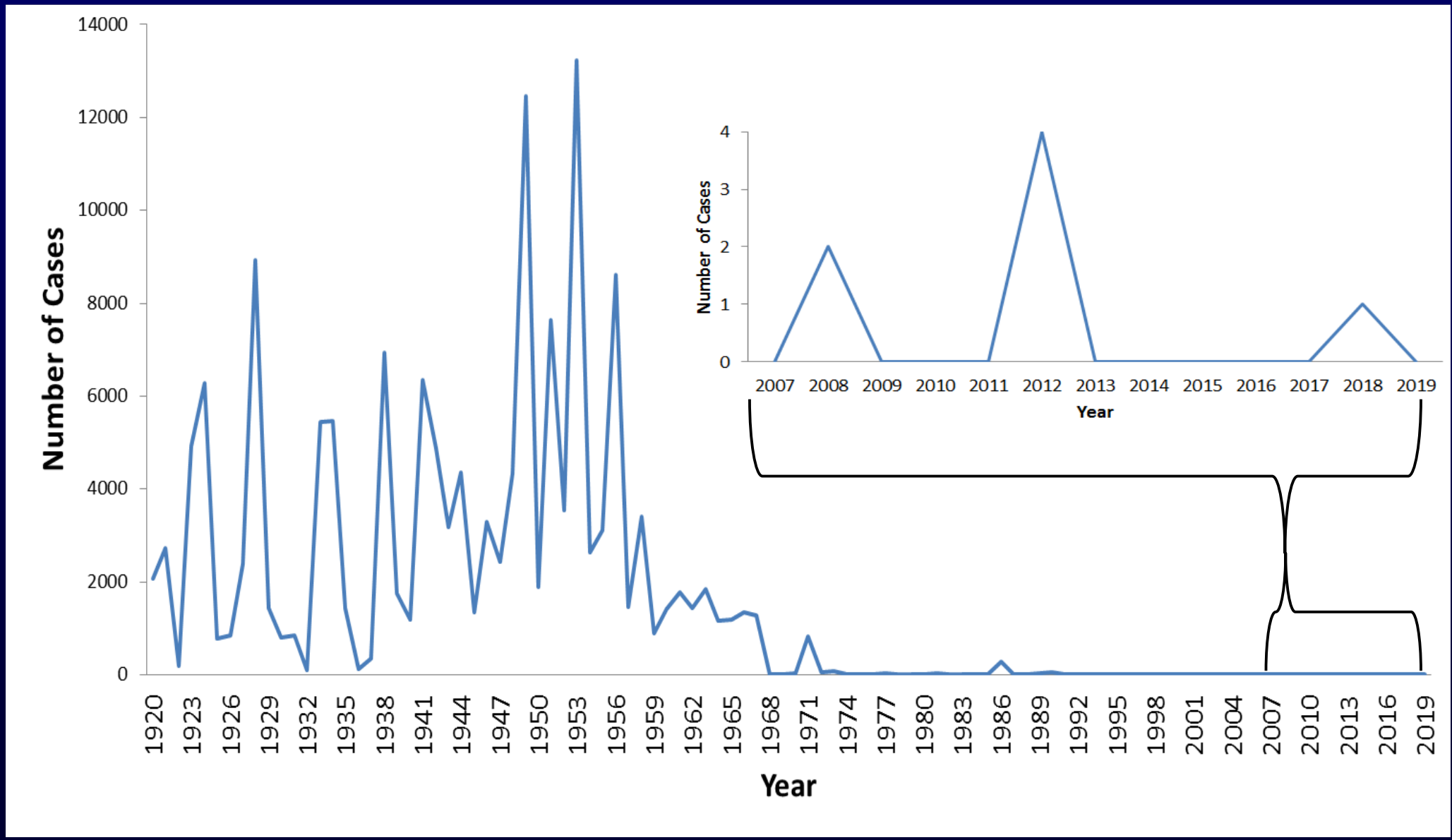
- Isolation of measles virus from a clinical specimen (e.g., nasopharynx, urine)
- Detection of measles RNA by PCR
- Significant rise in measles IgG by any standard serologic assay (e.g., EIA, HA)
- Positive serologic test for measles IgM antibody

Measles Cases in the U.S., 1944-2019*



*Provisional as of 7/18/2019

Measles Cases, Arkansas 1920-2019*



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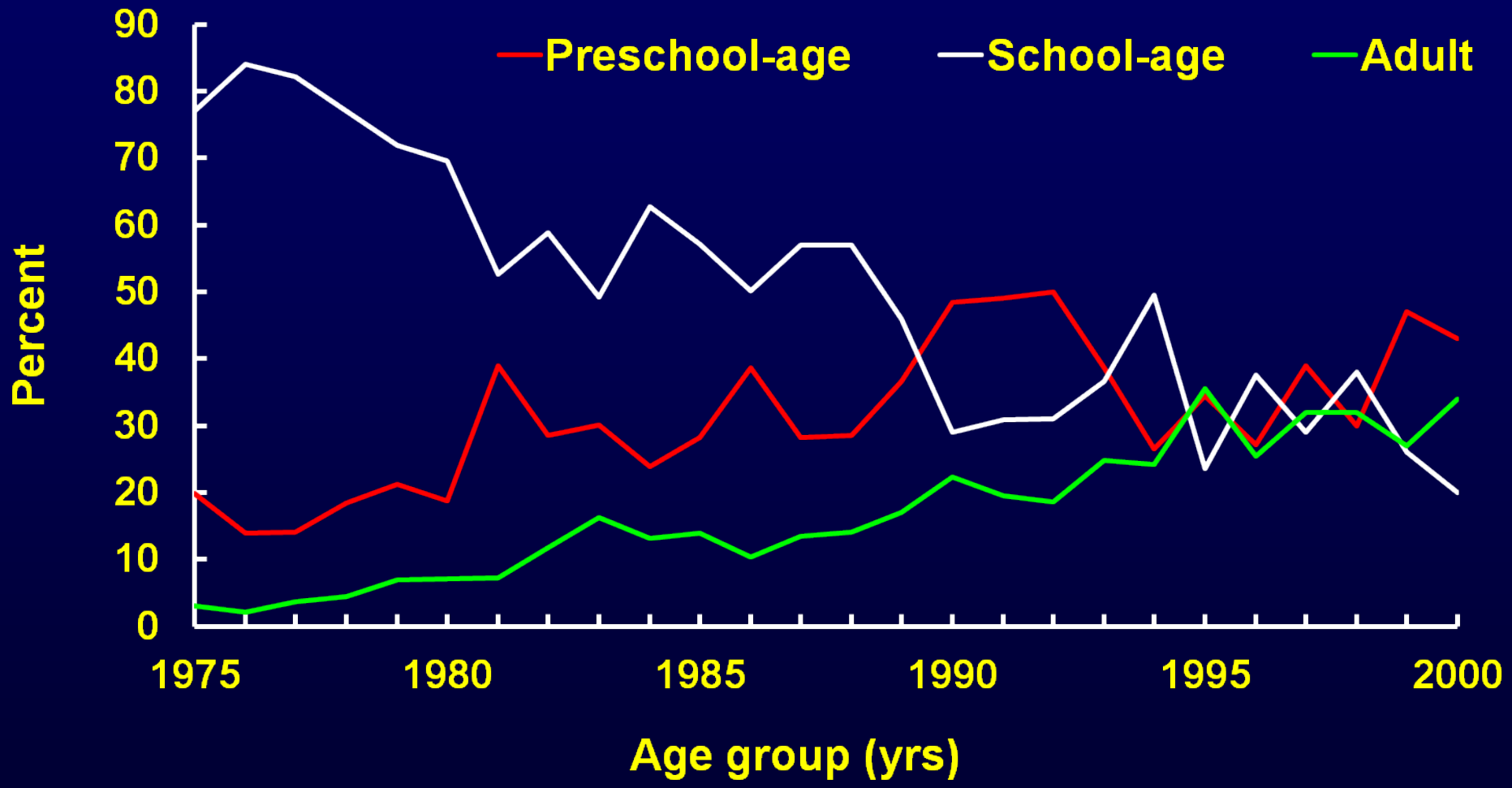
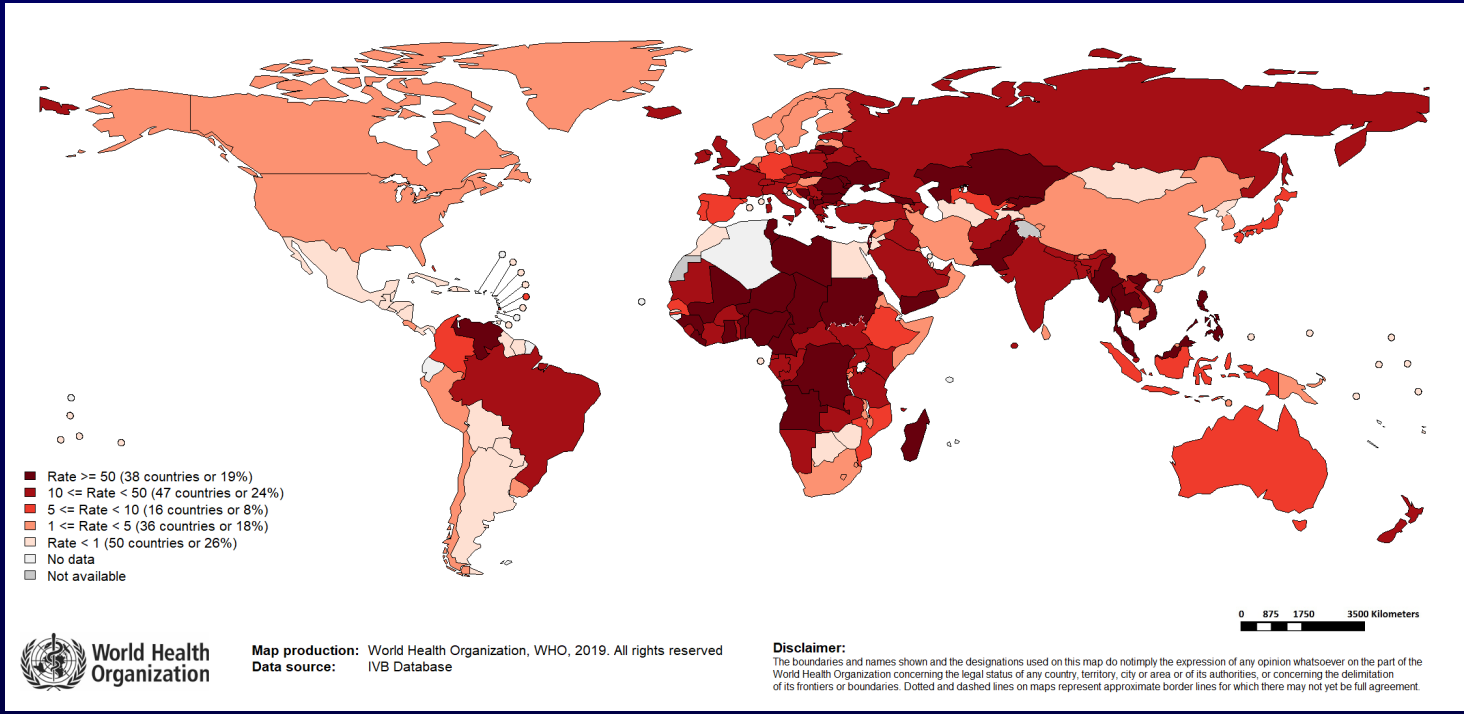
Age Distribution of Reported Measles, 1975-2000



Worldwide Measles Incidence

(Rates per Million from June 2018-May 2019)

Top 10**		
Country	**Cases**	**Rate**
Madagascar	92181	3702.86
Ukraine	85833	1931.5
India****	41264	31.16
Philippines	32821	317.66
Nigeria	25044	134.65
Pakistan	11247	58.21
Yemen	10562	382.9
Brazil	9983	48.08
DR Congo	8971	113.94
Kazakhstan	8476	471.21



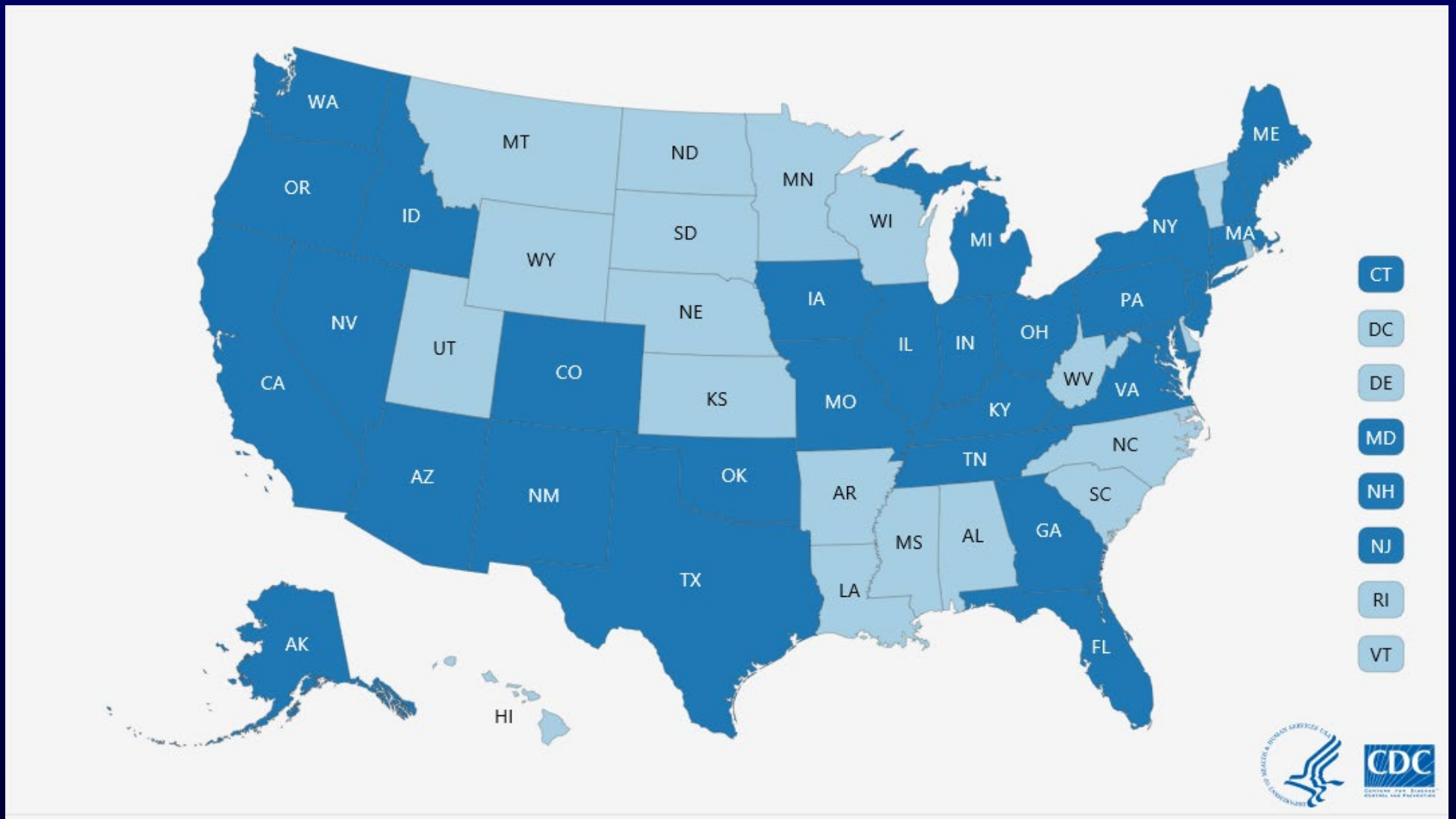
Other countries with high incidence rates***		
Country	**Cases**	**Rate**
Georgia	5024	1279.87
The Republic of North Macedonia	1369	657.79
Kyrgyzstan	2982	500.69
Israel	4011	489.63
Bosnia and Herzegovina	1150	327

Source: WHO

Measles cases from countries with known discrepancies between case-based and aggregate surveillance, as reported by country				
Country	**Year**	**Cases in Case-based**	**Cases in Aggregate**	**Data Source for aggregate #s**
DR Congo	2018	5597	67072	SITUATION EPIDEMIOLOGIQUE DE LA ROUGEOLE EN RDC, Week of 09/07/2019
	2019	6138	118,647	
Somalia	2018	131	9135	Somali EPI/POL Weekly Update Week 26
	2019	28	1967	

- Notes: Based on data received 2019-07 and covering the period between 2018-06 and 2019-05 - Incidence: Number of cases / population* * 100,000 - * World population prospects, 2019 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.

Measles Cases in 2019



Measles Complications

Condition	Percent reported
Diarrhea	8
Otitis media	7
Pneumonia	6
Encephalitis	0.1
Hospitalization	18
Death	0.2
SSPE*	.01-.16

Based on 1985-1992 surveillance data

*** Wendorf, K, et. al.** Subacute Sclerosing Panencephalitis: the Devastating Measles Complication is More Common than We Think. IDWeek, New Orleans, LA . Oct 26-30, 2016/

Measles Vaccine

- Composition — Live virus
- Efficacy — 93% on first dose (range, 90%-98%)
- Duration of Immunity — Lifelong
- Schedule — 2 doses
- Should be administered with mumps and rubella as MMR or MMRV
- Can even be given <=3 days post exposure to prevent illness

Vaccination Mandates / Recommendations

- Two MMR doses for school children
  - In process of requiring 2 doses for all college students (full and part time)
- Two MMR doses for HCWs
- Travelers should be UTD or have single dose prior to travel
- Post exposure down to 6 months of age

Measles Immunity

- Born before 1957
- Laboratory evidence of immunity
- Laboratory confirmation of prior infection
- Documentation of receipt of two measles-containing live vaccines

MMR Adverse Reactions

• Fever	5%-15%
• Rash	5%
• Joint symptoms	25%
• Thrombocytopenia	<1/30,000 doses
• Parotitis	rare
• Deafness	rare
• Encephalopathy	<1/1,000,000 doses

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Detailed History

- Travel to out of state or the country
- Visitors from out of state or the country
- Known contact with ill individuals
- Vaccination status
- Disease history
- Underlying medical conditions
- Current medicines

Necessary steps

- Put in droplet (ideally airborne) isolation
  - Don a N95 mask
- Inform care team and infection control
  - Assemble contact lists
    - HCWs
    - Patients in waiting room
    - Close contacts
- Inform ADH
- Vaccinate eligible and undervaccinated contacts promptly

Treatment

- Largely supportive
- Vitamin A (qday x 2 d)
  - 50,000 IU for infants aged <6 months
  - 100,000 IU for infants aged 6–11 months
  - 200,000 IU for children aged ≥12 months

The good news

- We have the tools to keep measles at bay
- We just need to use them

Ten Great Public Health Achievements — United States, 1900-1999

Vaccination

Motor-vehicle safety

Safer workplaces

Control of infectious diseases

Decline in deaths from coronary heart disease and stroke

Safer and healthier foods

Healthier mothers and babies

Family planning

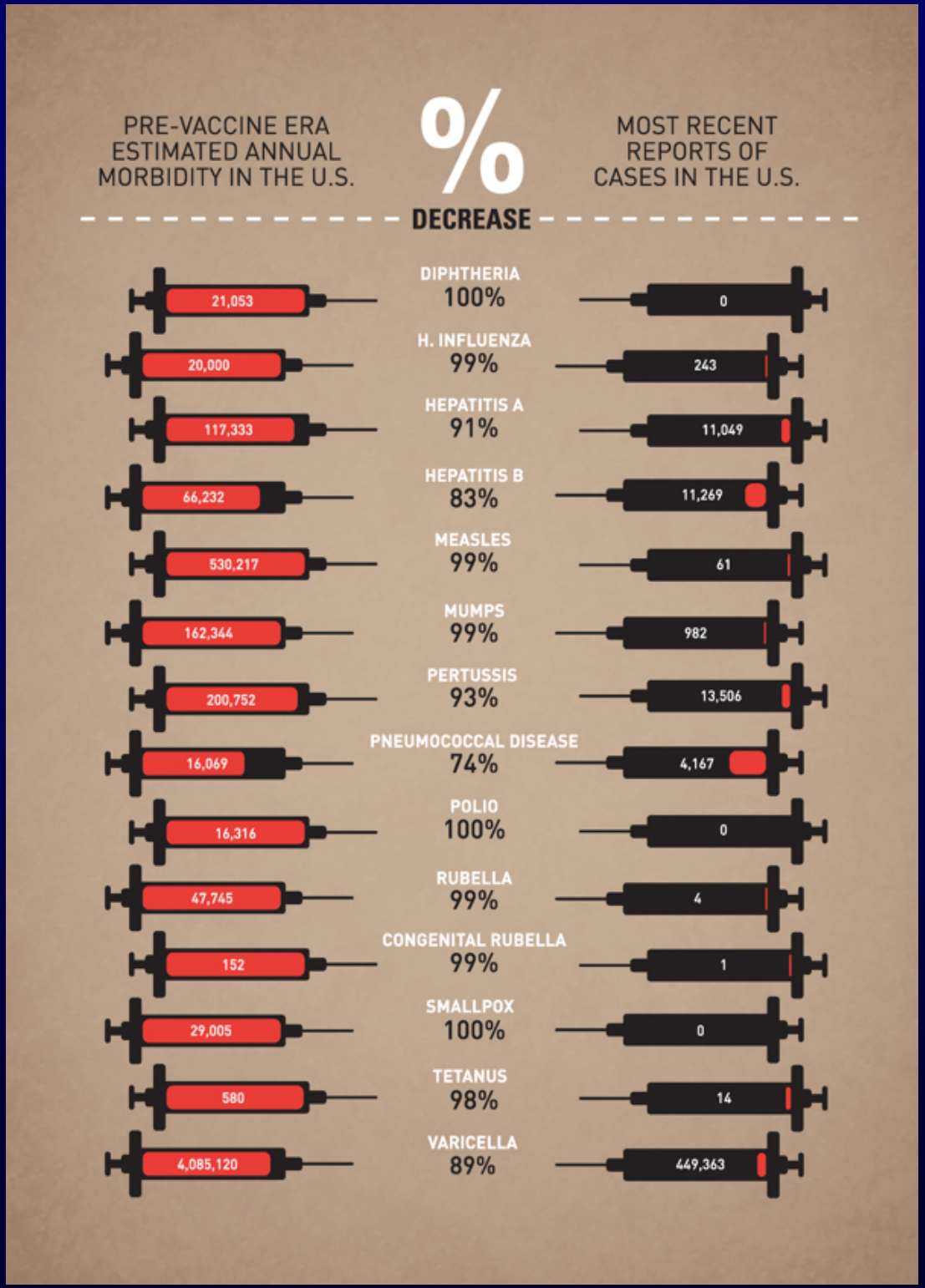
Fluoridation of drinking water

Recognition of tobacco use as a health hazard

Comparison of Maximum and Current Reported Vaccine-Preventable Diseases, United States

Disease	Pre-vaccine Era*	2017	% change
Diphtheria	175,885	0	-100
Measles	503,282	120	-99
Mumps	152,209	6,109	-96
Pertussis	147,271	18,975	-88
Polio (wild)	16,316	0	-100
Rubella	47,745	7	-99
Cong. Rubella Synd.	19,177	5	-99
Tetanus	1,314	33	-98
Invasive Hib Disease	24,856	5,548	-78
Varicella	4,000,000 (est)	8,875	-99
Smallpox	48,164	0	-100
Total	>5 million	39,672	-99

Immunization works!



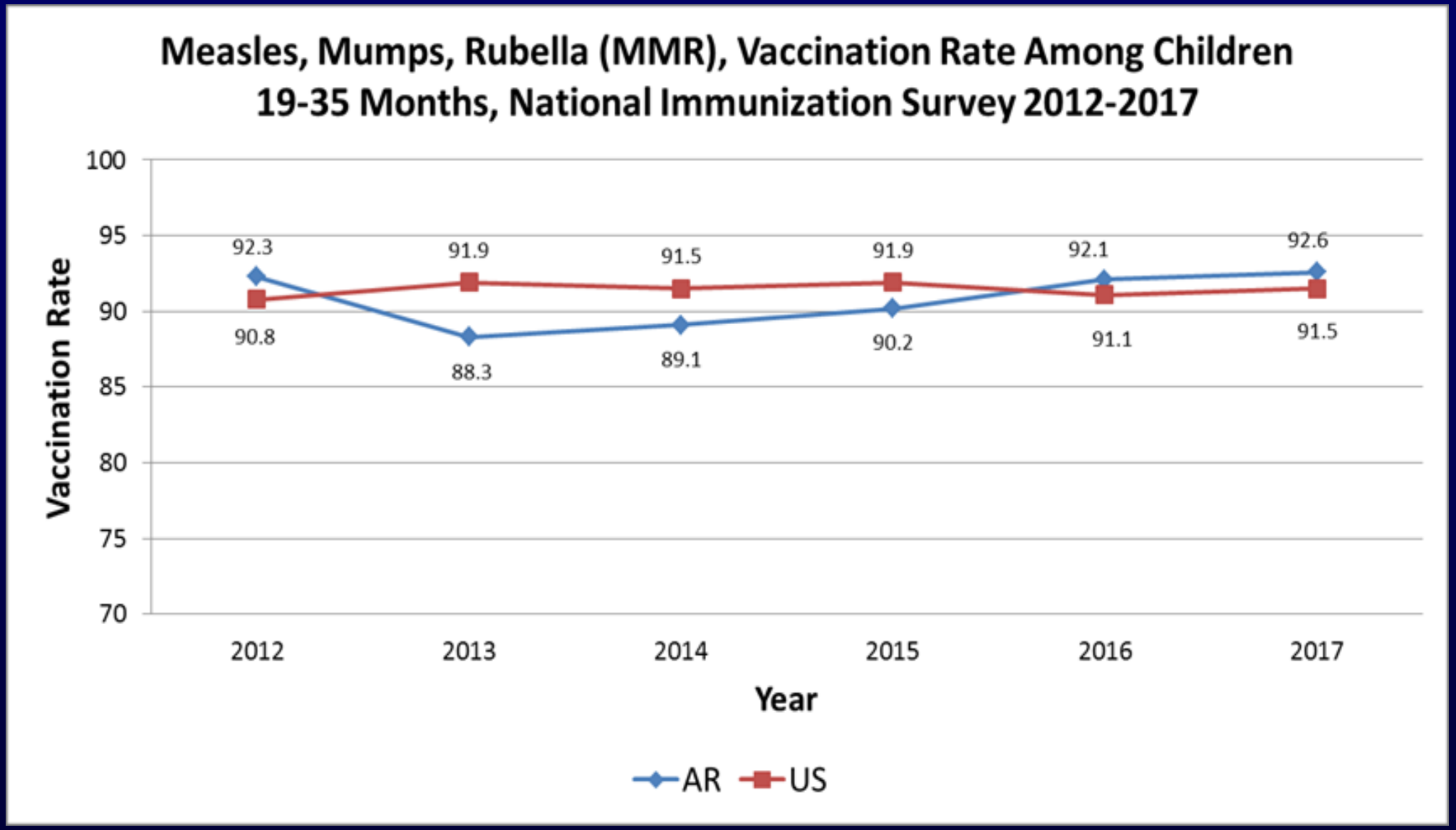
Vaccine infographic created by Leon Farrant in 2004

Cost-Benefit Analysis of Common Vaccines (Saving per $ invested)

Vaccine	Medical Dollars Saved	Societal* Dollars Saved
•DTaP	8.50	24.00
•MMR	10.30	13.50
•Hib	1.40	2.00
•Polio vaccine	3.03	6.10
•Varicella	0.90	5.40
•Hepatitis B	2.30	19.80
•Entire Series	>2	>10

*Includes work loss, disability and death

•Source: CDC


Measles, Mumps, Rubella (MMR), Vaccination Rate Among Children 19-35 Months, National Immunization Survey 2012-2017
Vaccination Rate
100
95
90
85
80
75
70
92.3
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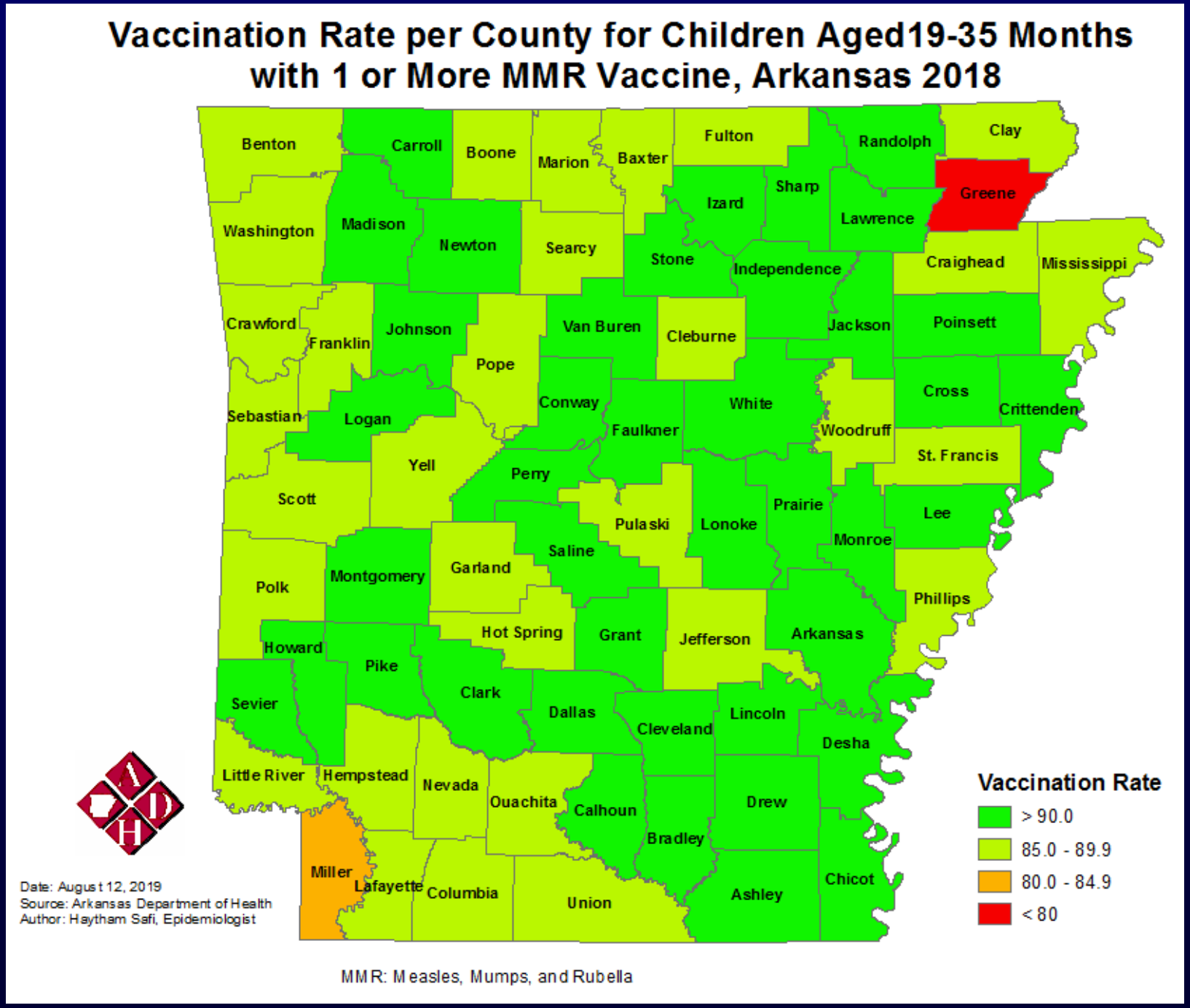
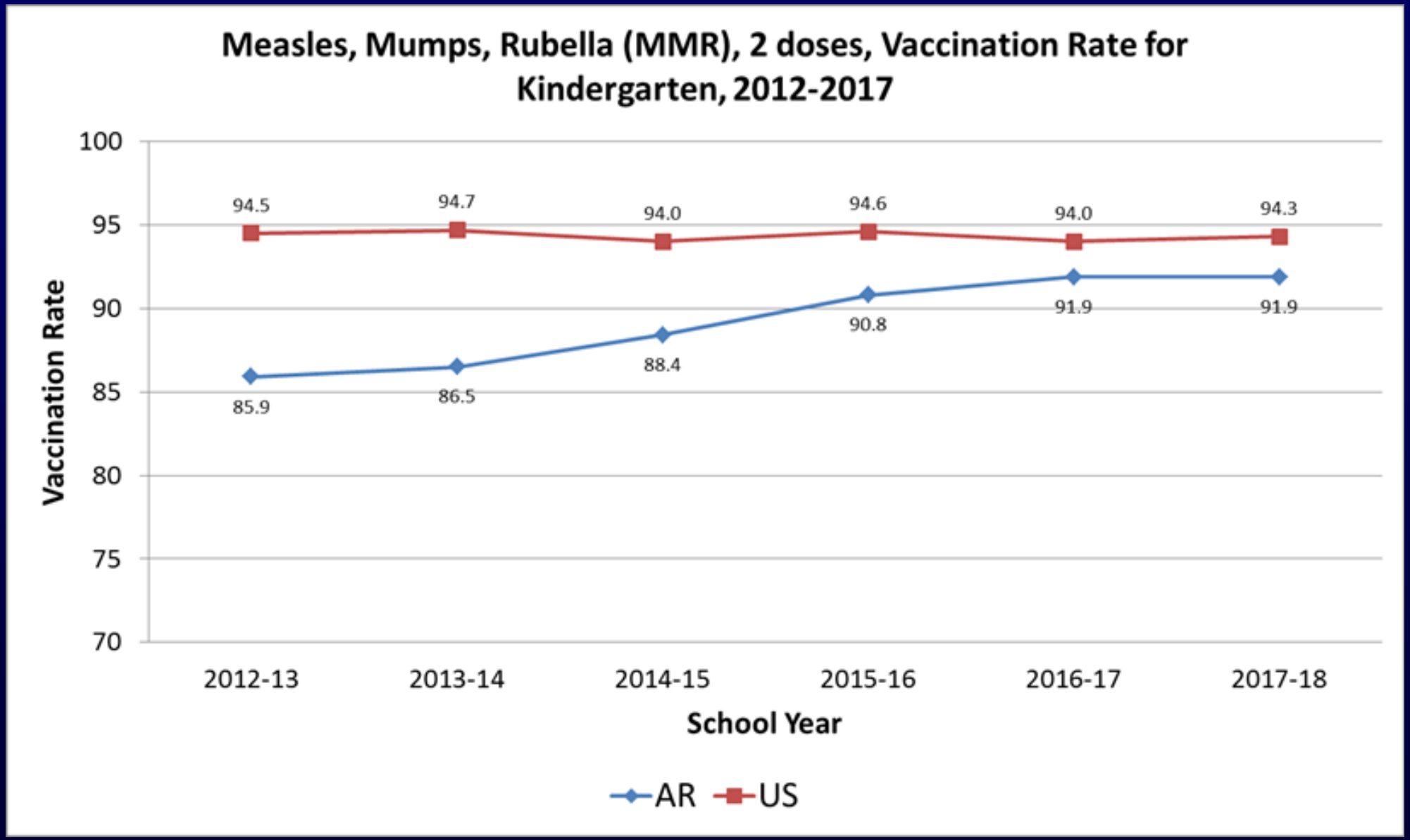
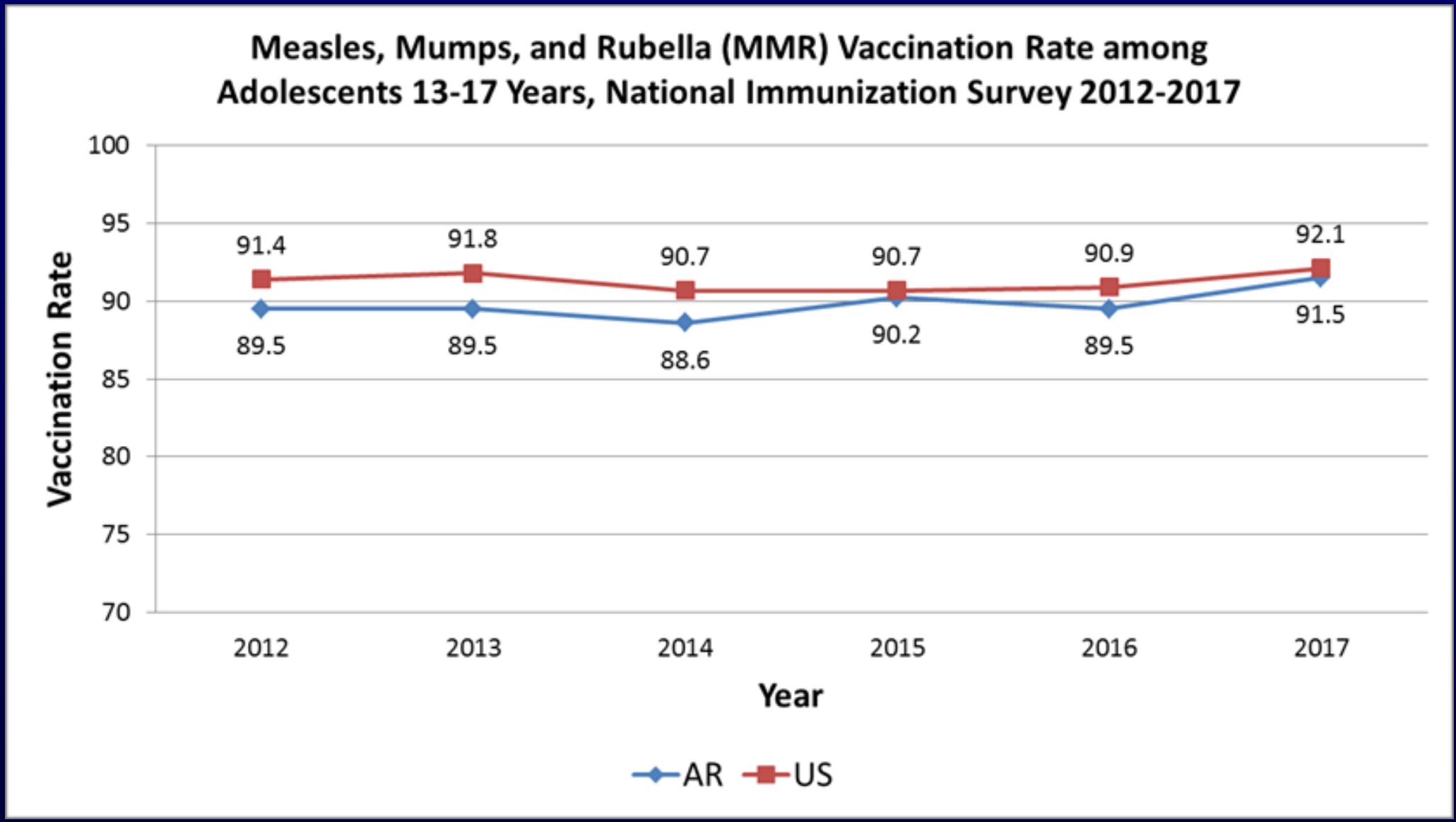


From ADH's Web IZ immunization system



From Arkansas Department of Education


Measles, Mumps, and Rubella (MMR) Vaccination Rate among Adolescents 13-17 Years, National Immunization Survey 2012-2017
Vaccination Rate
100
95
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75
70
91.4
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90.7
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92.1
89.5
89.5
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90.2
89.5
91.5
2012
2013
2014
2015
2016
2017
Year
AR
US

Questions or Concerns?

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