Why Measles Matters

Division of Immunization Services Webinar
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Gregory S Wallace, MD, MS, MPH
Lead, Measles/Mumps/Rubella/Polio Team
Epidemiology Branch, Division of Viral Diseases
National Center for Immunization and Respiratory Diseases
Centers for Disease Control and Prevention

What is Measles

- Febrile rash illness
- Most contagious of the vaccine preventable diseases
- Highly effective vaccine part of the routine immunization schedule

Clinical Presentation

- Rash ~14 days after exposure (range 7-21 days)
- Fever (up to 105^{o}F)
- Cough, Coryza, and/or Conjunctivitis

Measles Rash

- Follows prodrome lasting 2-4 days
- Prodrome may include Koplick Spots
- Erythematous maculopapular eruptions
  - Spreads from head to trunk to extremities
  - Initially blanching
- Fades in order of appearance

Measles Complications

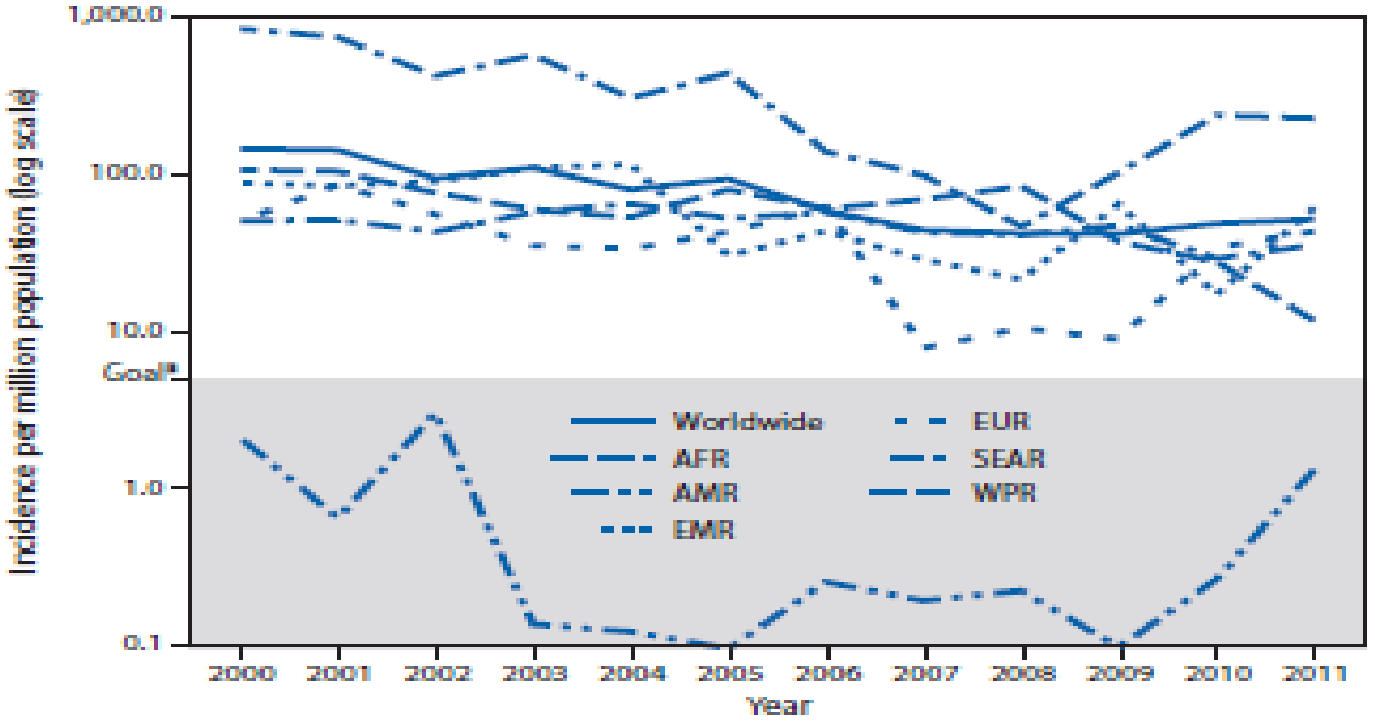
Condition	Percent reported
Diarrhea	8
Otitis media	7-9
Pneumonia	1-6
Encephalitis	0.05-0.1
Death	0.1-0.2 (2-15 in developing countries)
Subacute Sclerosing Panencephalitis (SSPE)	0.001

Global Burden of Measles

- Prior to Vaccine: 5-8 million deaths/year
- 77% decrease in incidence from 2000 to 2012
- 78% decrease in deaths from 2000 to 2012 (90% since 1985)
  - 122,000 deaths in 2012 (~14 deaths/hour)
- Remains a leading cause of Vaccine Preventable Deaths in young children
  - Most deaths in children under 5 years old

Measles Disease Incidence by WHO Region

FIGURE. Reported measles incidence per million population, by World Health Organization region and worldwide, 2000–2011

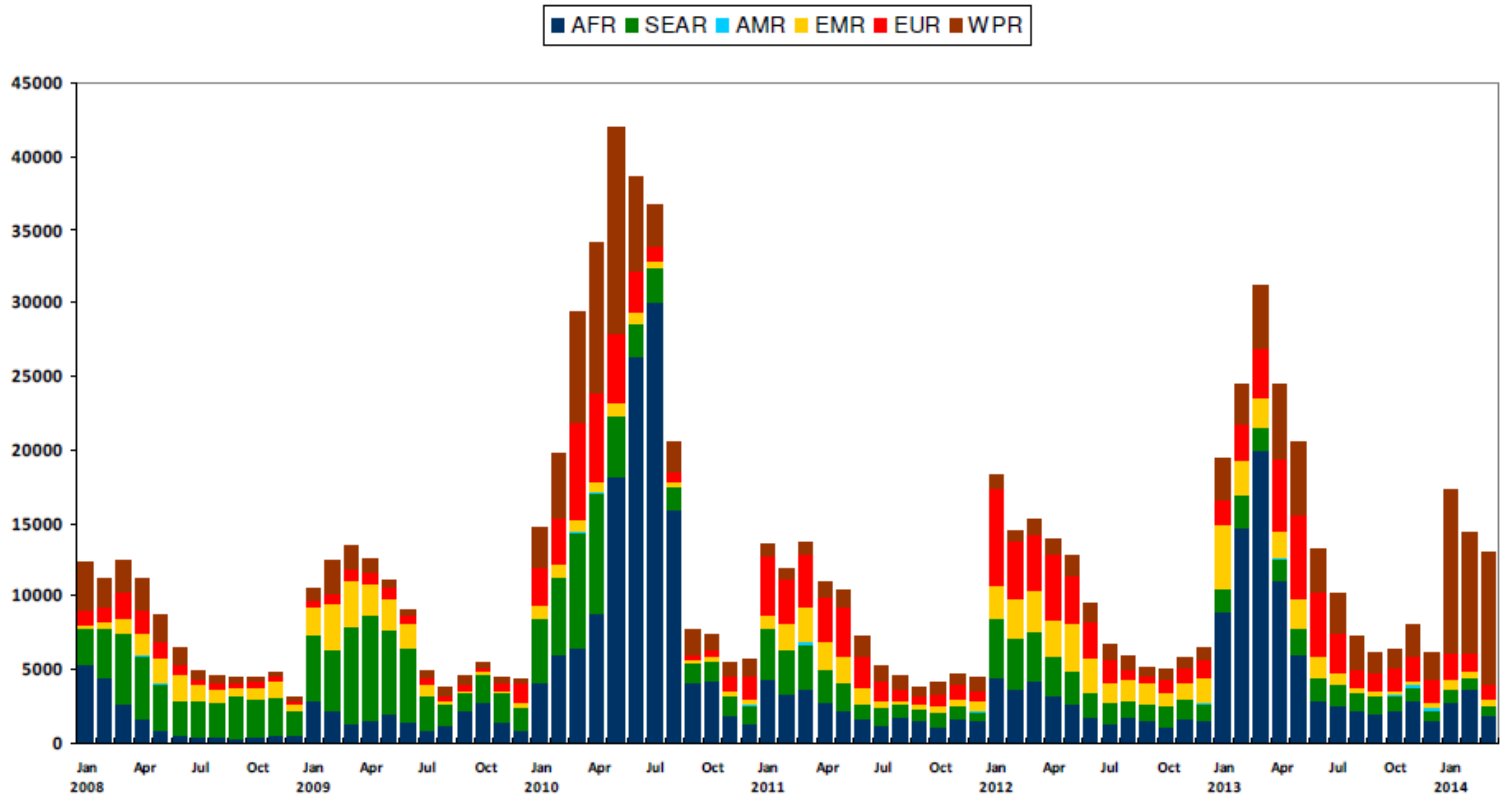


Abbreviations: AFR = African; AMR = Americas; EMR = Eastern Mediterranean; EUR = European; SEAR = South-East Asia; WPR = Western Pacific.

* As a milestone to measles eradication, the World Health Organization has set a goal of reducing the global incidence of measles to <5 cases per million population by 2015.

CDC. MMWR 2013; 62:27-31.

Measles Case Distribution by Month and WHO Regions, 2008-2014



This is surveillance data, hence for the last month, the data may be incomplete.

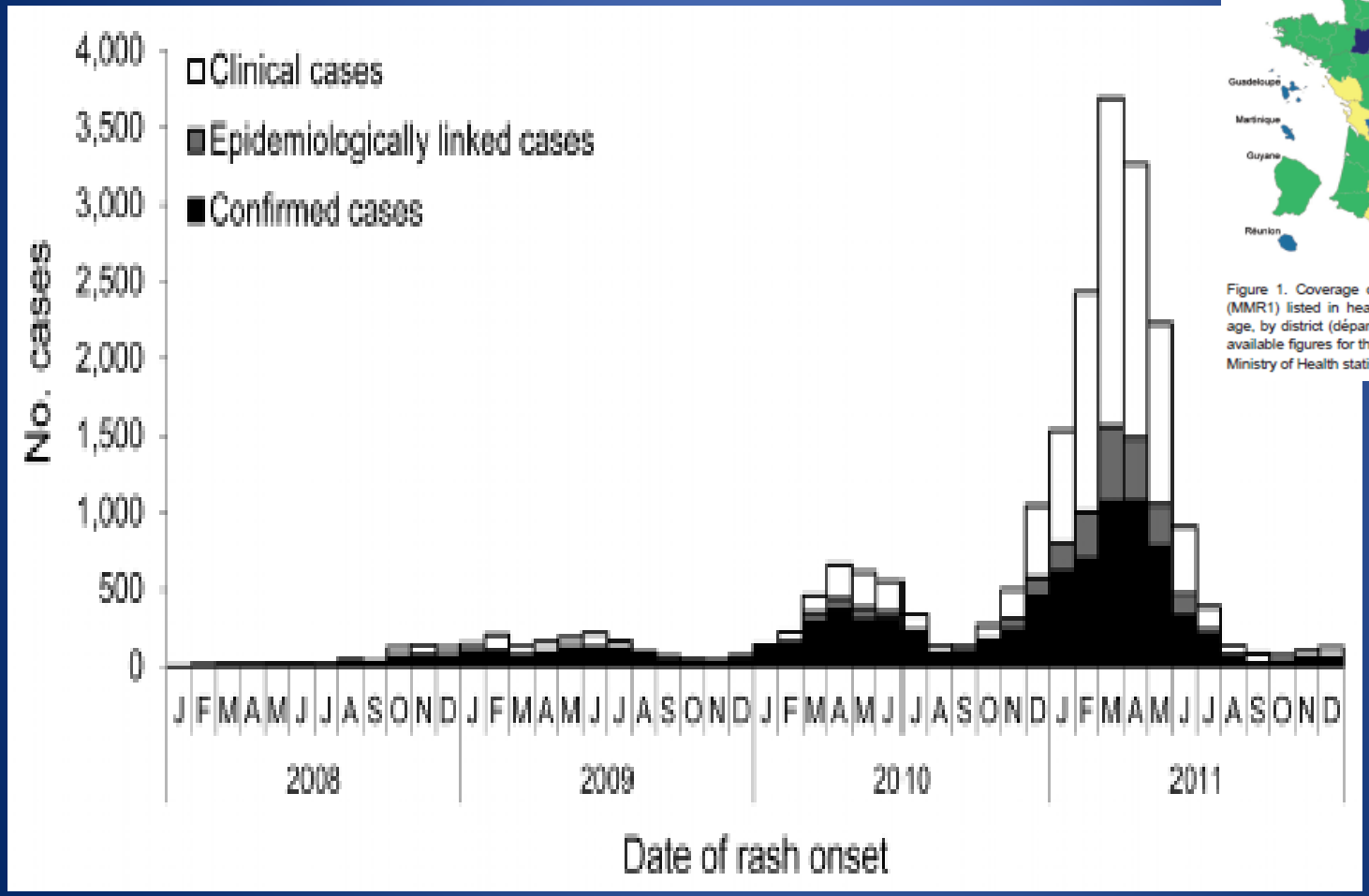
SEAR India is not included in this graph.

As of 27 May 2013, South Sudan has reassigned to the Africa region (AFR) from the Eastern Mediterranean region (EMR).

Data source: surveillance DEF file
Data in HQ as of 5 May 2014

WHO

Measles Outbreak, France, 2008-2011 (n>20,000)



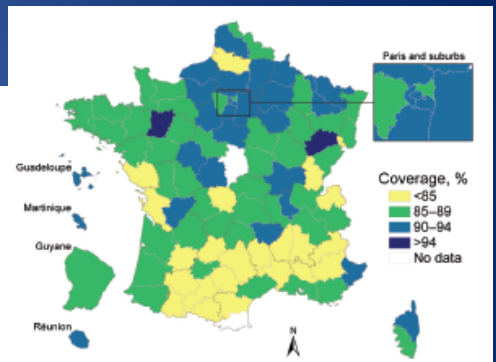
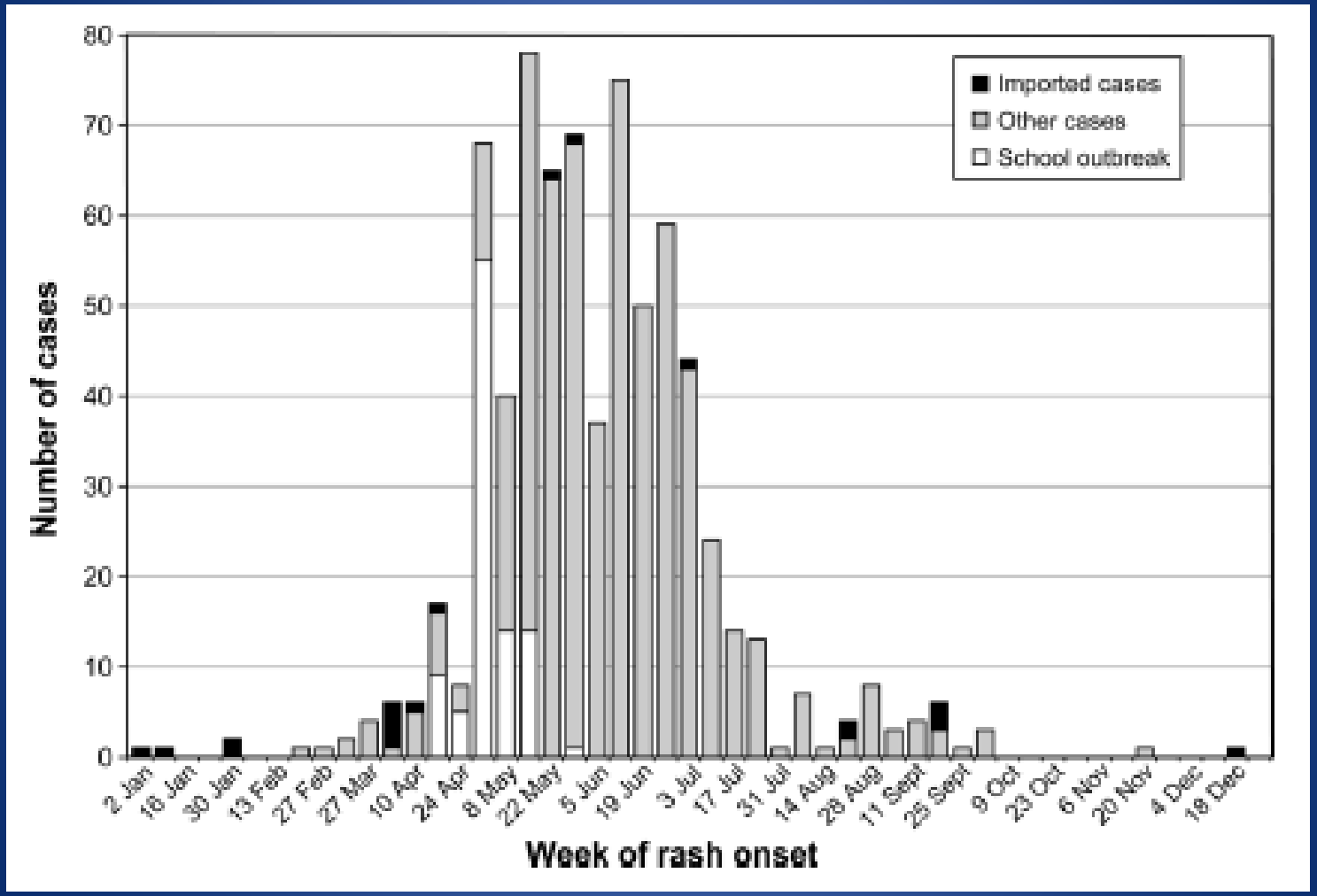


Figure 1. Coverage of initial measles-mumps-rubella vaccination (MMR1) listed in health certificates for children at 24 months of age, by district (département), France, 2003–2008. Data are latest available figures for the period. Sources: Institut de Veille Sanitaire, Ministry of Health statistical department.

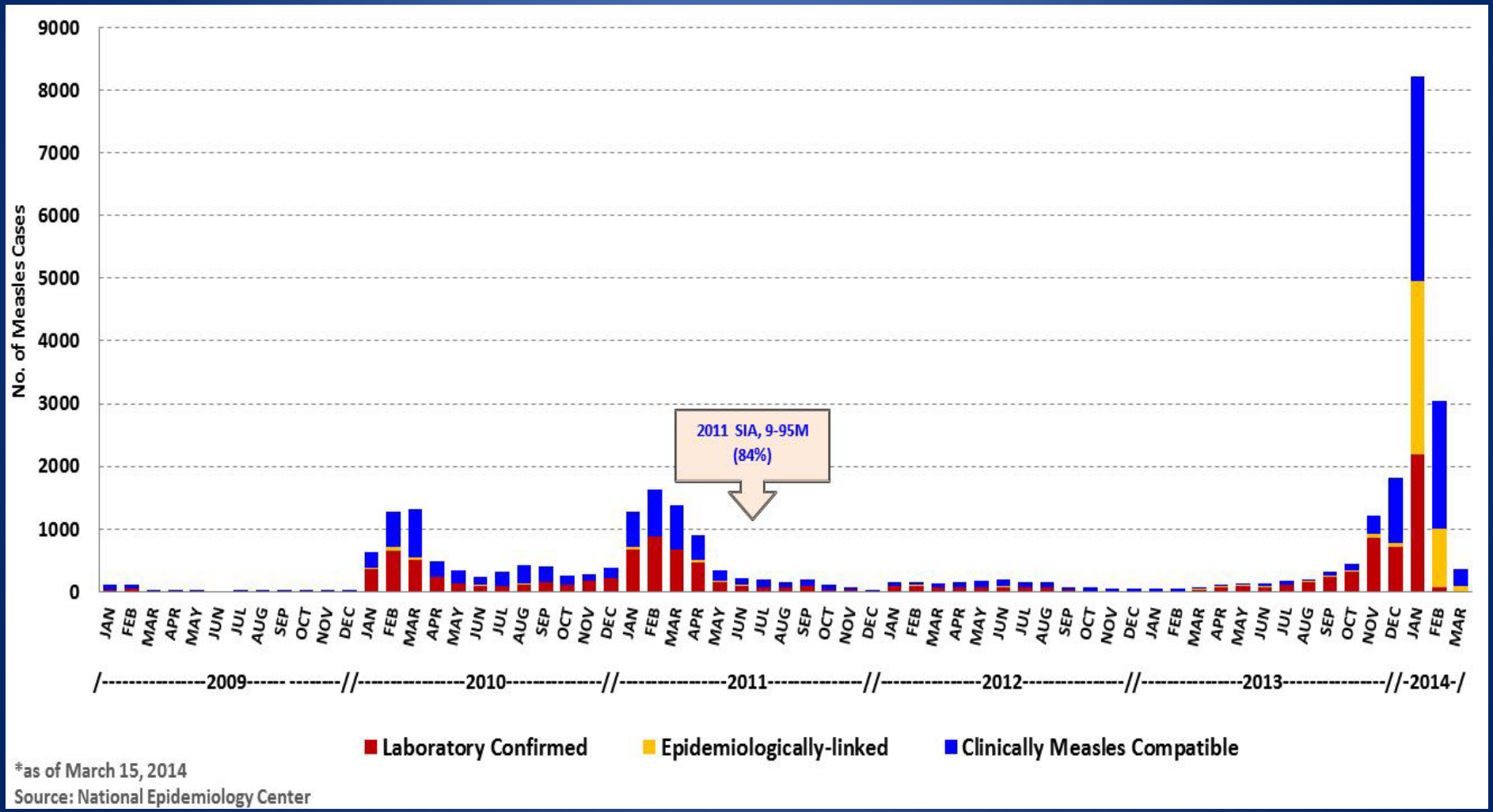
Antona, et al. EID 2013;19:357-364.

Measles Outbreak, Quebec, Canada, 2011 (n=725)



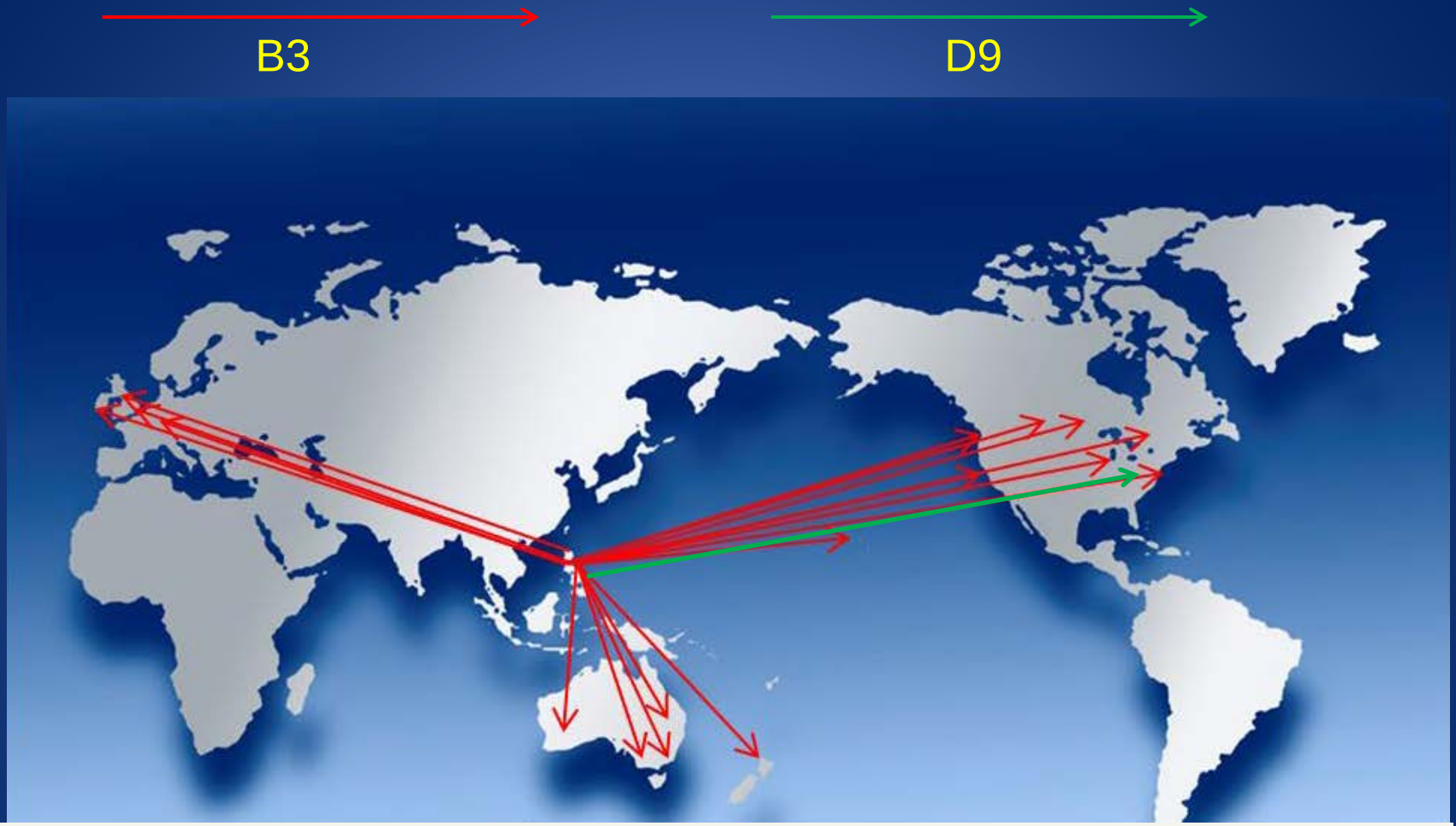
De Serres, et al. JID 2013;207:990-8.

Measles cases by month of rash onset Philippines, 2009–2014*



*as of March 15, 2014

Source: National Epidemiology Center

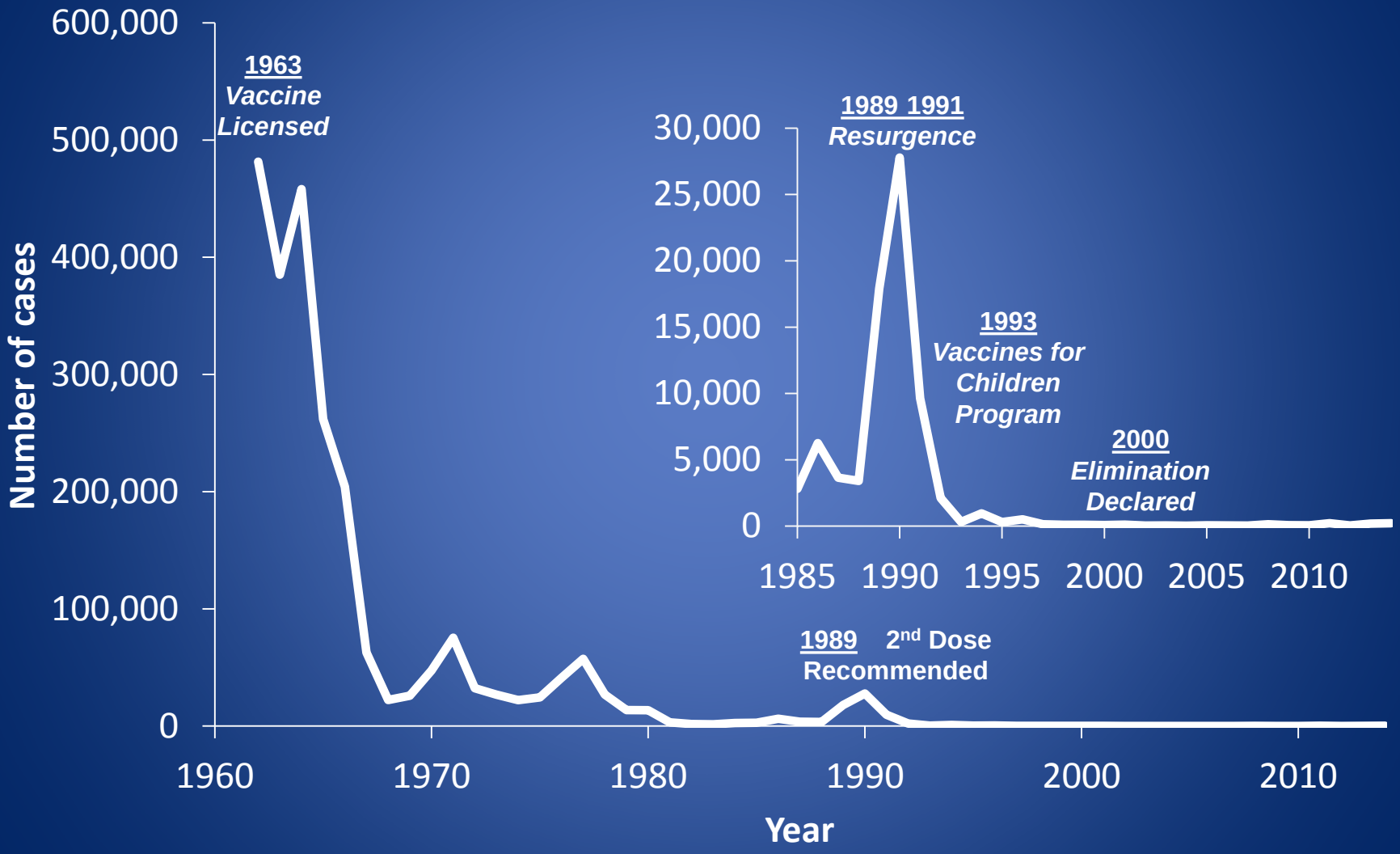


Global transmission patterns of measles viruses from the Philippines, 2014

US Annual Disease Burden Prior to Vaccine

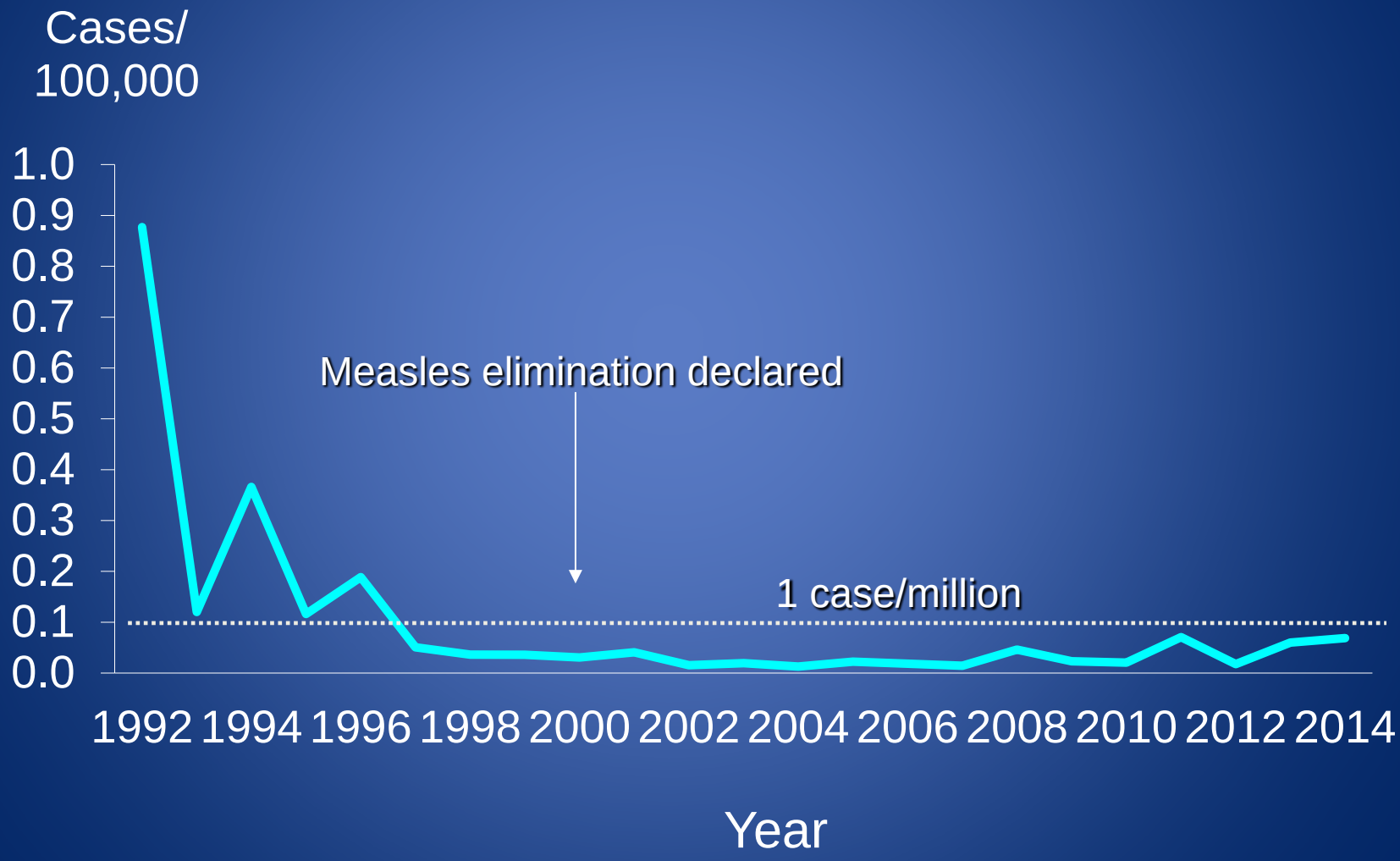
- 3-4 million estimated and ~ 500,000 reported cases
- 48,000 hospitalizations
- 4,000 encephalitis cases
- 450-500 deaths

Measles Cases, United States, 1962-2014*



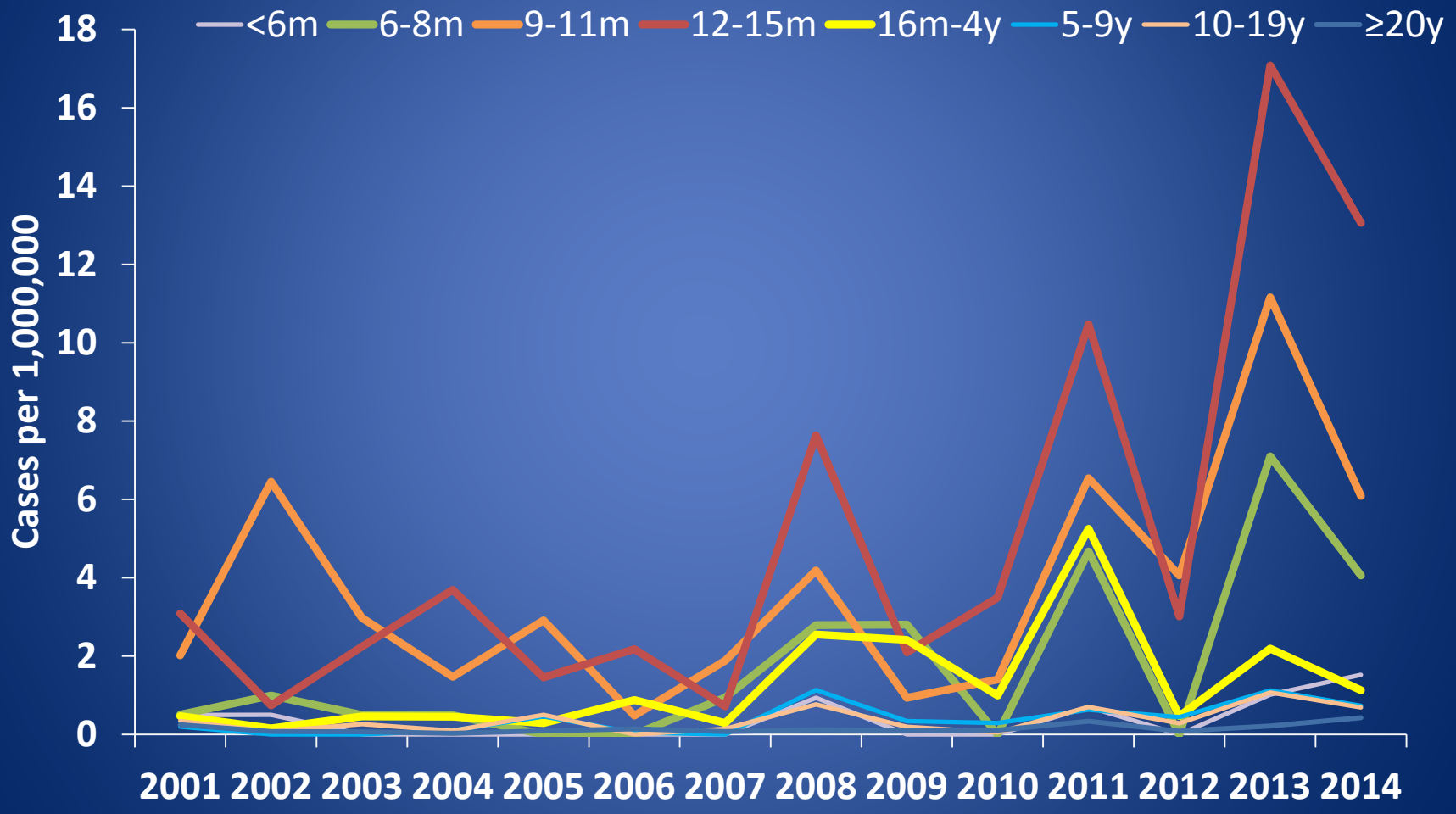
*2014 case count preliminary as of May 16

Reported Measles Incidence United States, 1992-2014*



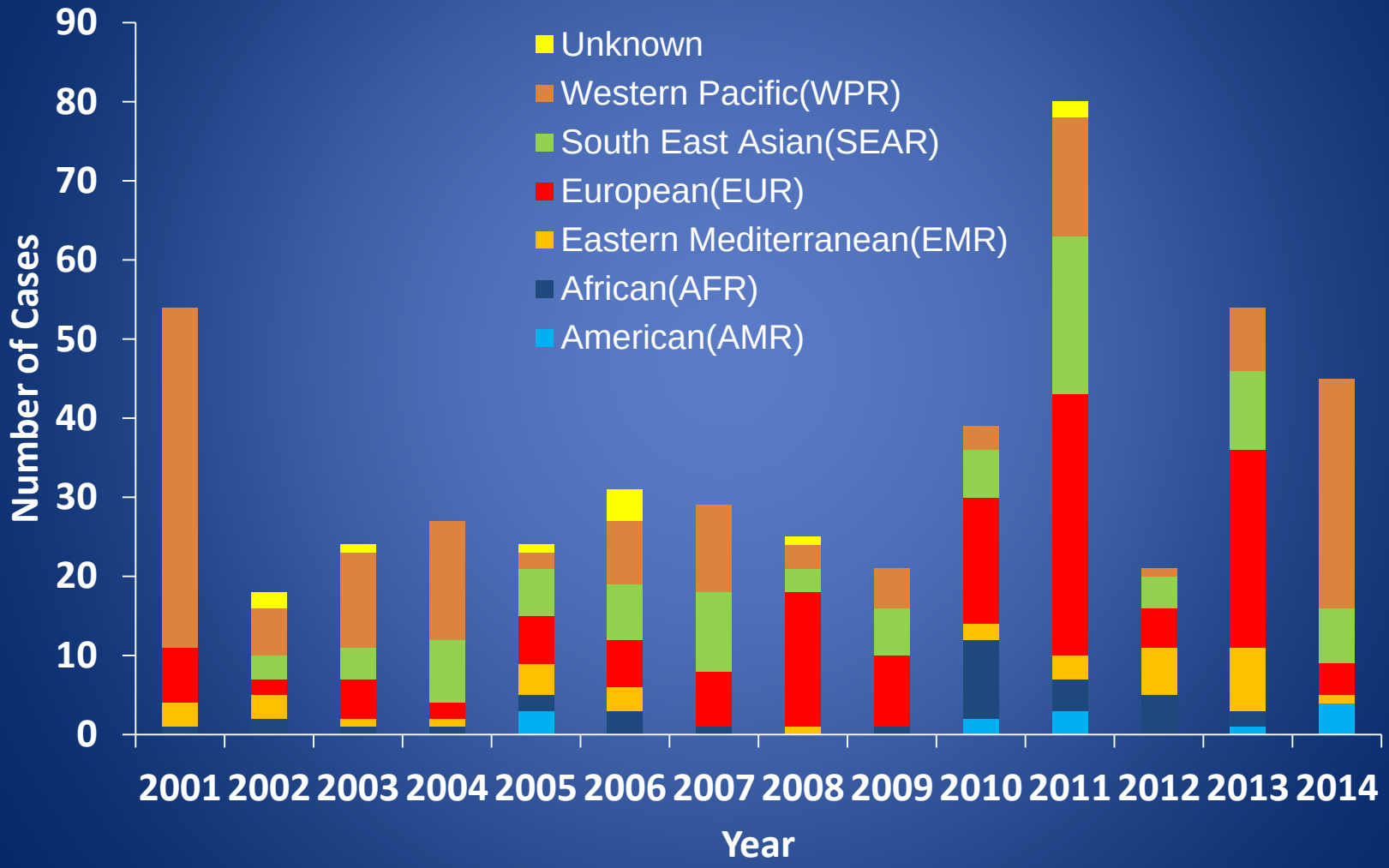
*2014 case count preliminary as of May 16

Measles, United States, 2001-2014*
Age Specific Incidence



*2014 case count preliminary as of May 16

Measles, United States, 2001-2014*
Importations by WHO Region



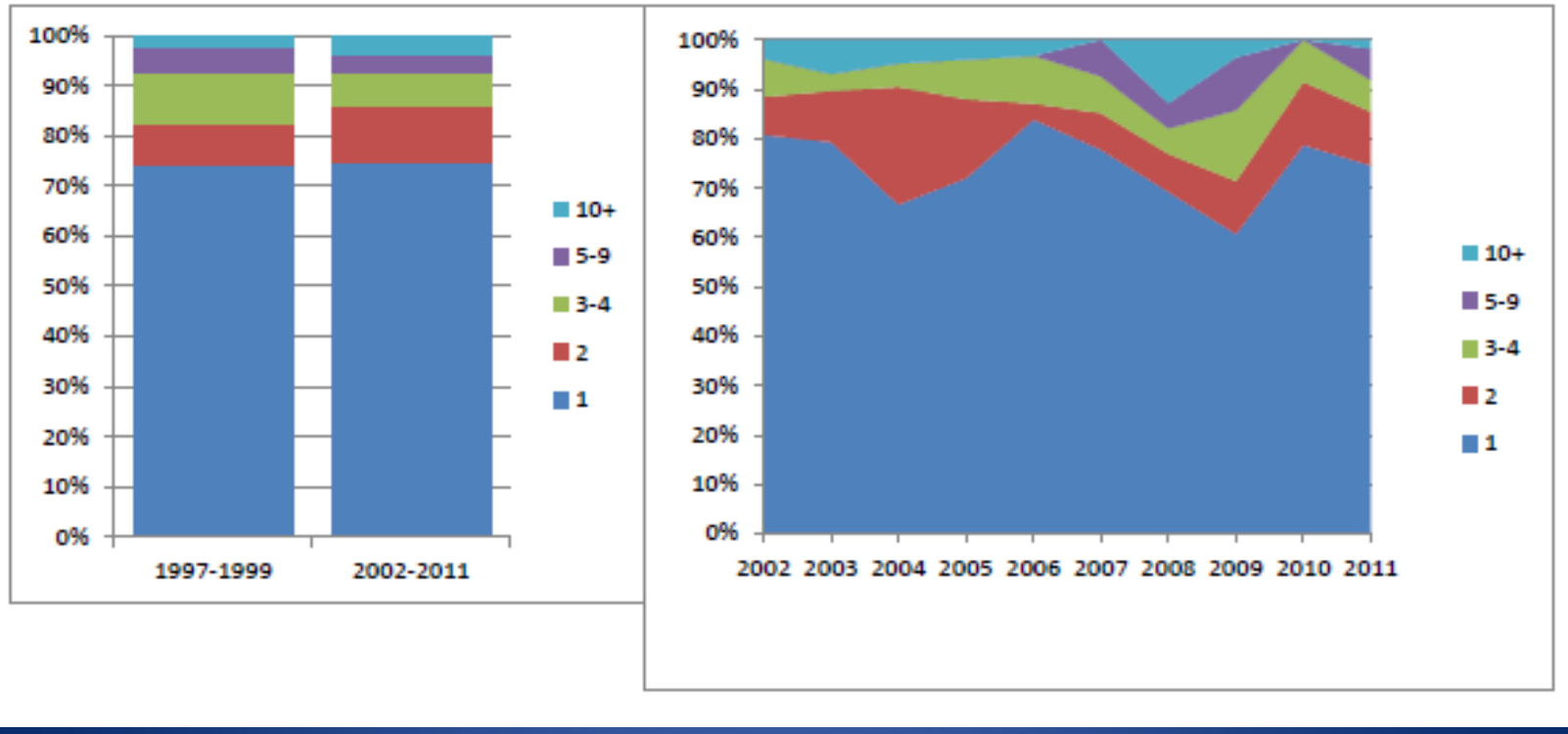
*2014 case count preliminary as of May 16

Measles, United States, Jan – May 16, 2014
Source of Importations (N=45)

WHO Region	# of cases	Countries of travel
African	0	
Eastern Mediterranean	1	Pakistan
European	4	Dubai/Germany/London (1), Republic of Georgia (1), Netherlands (1), France/Belgium
Americas	4	Brazil (1), Canada (2), Chile (1)
South-East Asia	7	India (7)
Western Pacific	29	China (2), Philippines (22), Singapore (1), Saipan (1), Vietnam (1), SE Asia/Philippines (1), Malaysia/Micronesia (1)

Most Measles Cases Result in Limited Transmission

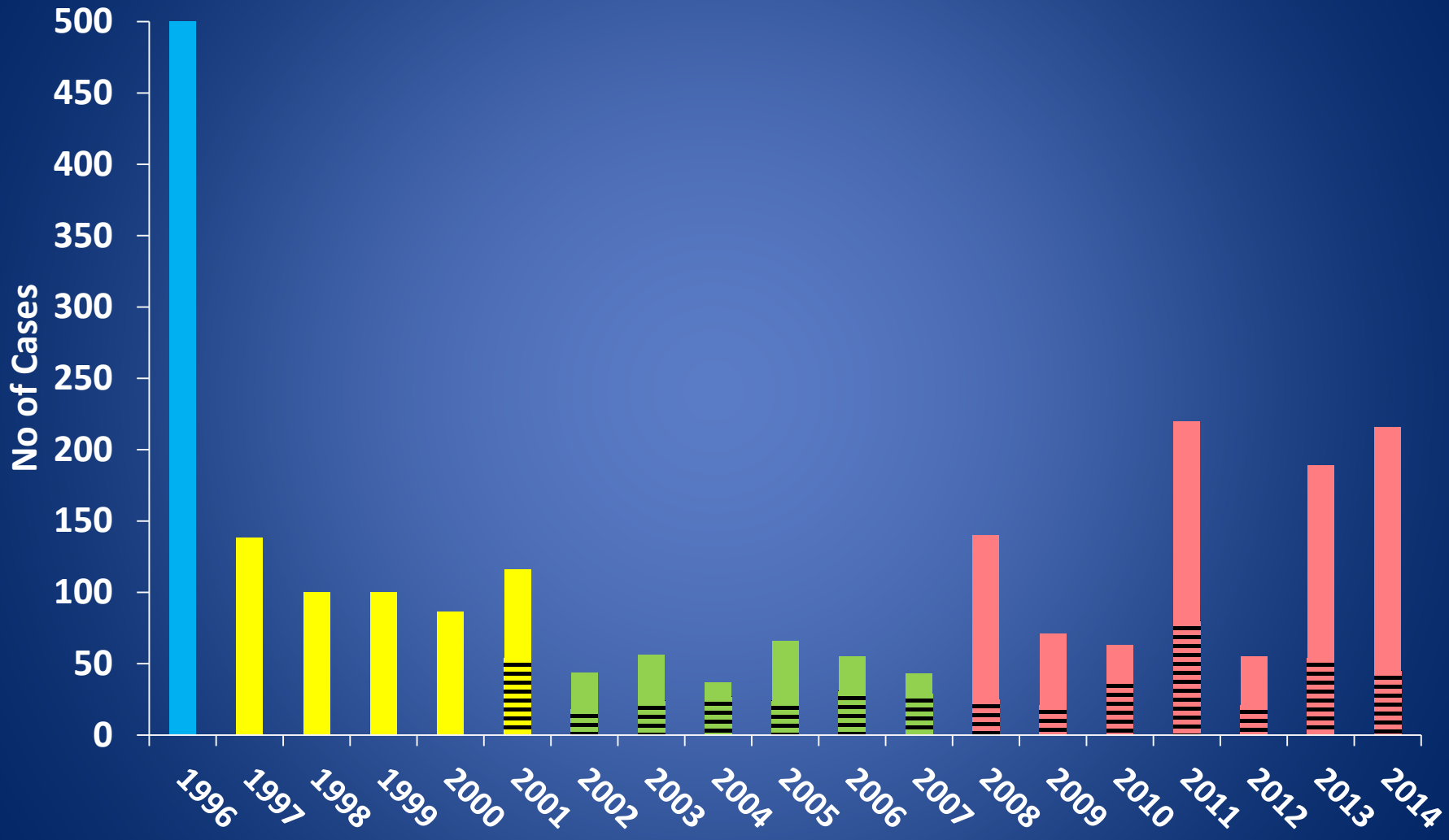
Figure 7. Measles Chains of Transmission
Proportion by Chain Length, United States 1997- 2011



2014: 80% with 1 or 2 chains of transmission, 4% with 10 or more

Measles, United States, 1996-Present*

(Importations indicated by hashed lines from 2001)



*2014 case count preliminary as of May 16

Measles Outbreaks with 20 or more Cases, United States, 2001-2014*

Year	Outbreak Name	State	Cases #	Import Status	Genotype	Setting	1st & last rash onsets	Duration	Median Age	Age Range
2014	**Knox County**	**OH**	**69***	**Imported (Philippines)**	**D9**	**Community**	**3/24/2014 – 5/7/2014**	**8 weeks and counting**	**22 y**	**12 mos – 52 y**
2013	Brooklyn	NYC	58	Imported (UK)	D8	Household/ community	3/13/2013 – 6/9/2013	13 weeks	10 y (early) 19 mos (late)	0 mos – 32 y
2005	Tippecanoe County	IN	34	Imported (Romania)	D4	Church/ household	5/16/2005 - 6/24/2005	6 weeks	12 y	9 mo - 49 y
2008	DuPage/Cook County	IL	30	Imported-virus	D4	Homeschool	5/17/2008 - 7/3/2008	7 weeks	10 y	8 mo - 43 y
2013	Stokes/Orange County	NC	23	Imported (India)	D8	Community	4/5/2013 – 5/7/2013	5 weeks	14 y	12 mo -59 y
2013	Tarrant/Denton County	TX	21	Imported (Indonesia)	D9	Church	7/21/2013 – 8/21/2013	5 weeks	11 y	4 mos – 44 y
2011	Hennepin County	MN	21	Imported (Kenya)	B3	Shelter	2/15/2011 - 4/24/2011	10 weeks	23 m	3 mo - 51 y
2008	Brooklyn/ Kings County	NYC	21	Imported (Israel, Belgium)	D4	Community	2/17/2008 - 4/25/2008	10 weeks	15 m	5 mo - 11 y
2014	Manhattan	NYC	20	Imported-virus	B3	Community	2/16/2014 – 3/24/2014	5 weeks	23 y	3 mo – 36 y

*as of May 16, 2014

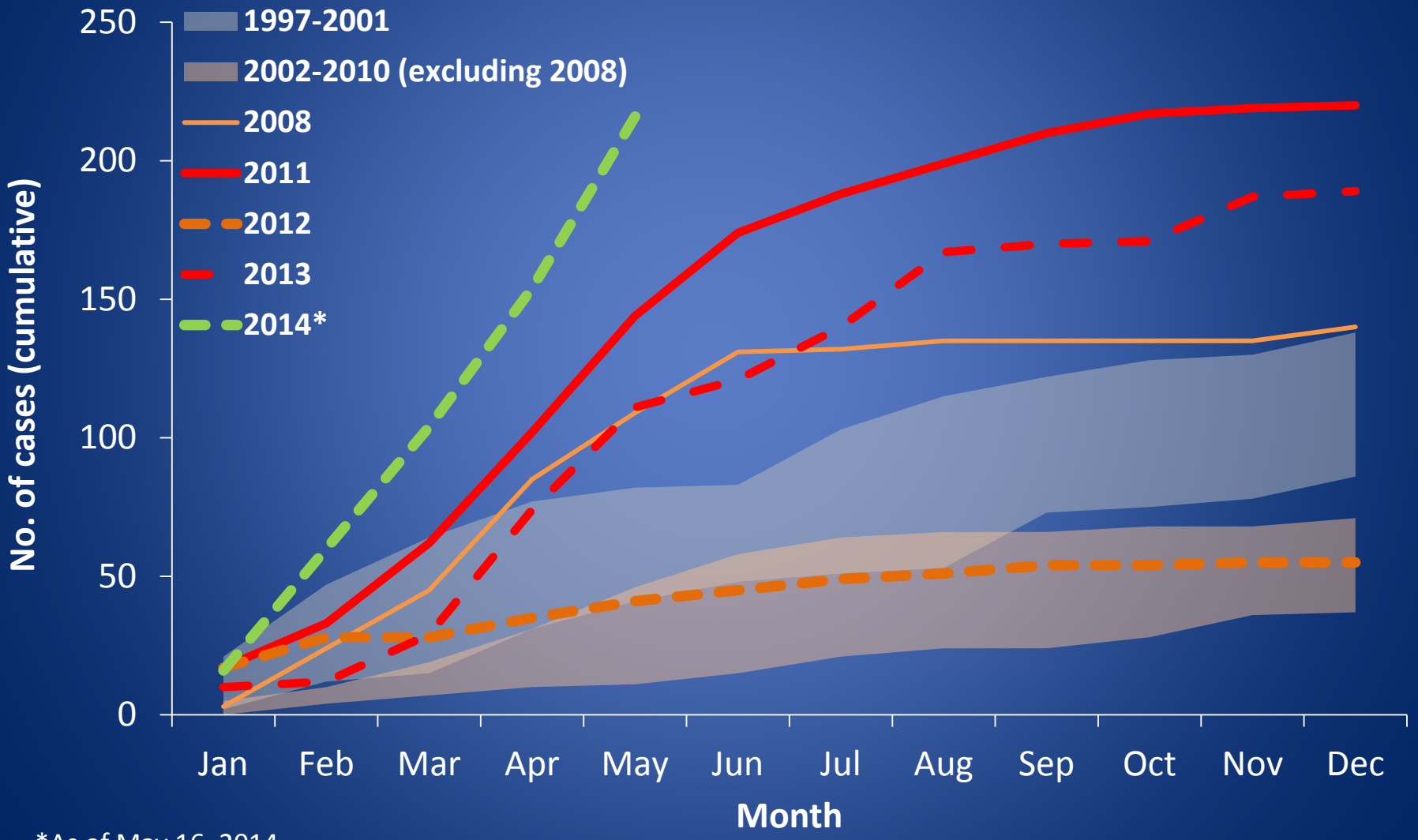
Measles outbreak response has a high economic burden in the U.S.

Year	Location	Number of cases (outbreaks)	Estimated public health cost*
2011	US	107 (16)	$2.7-5.3M
2011	Utah	13 (2)	>$330,000
2008	California	12 (1)	$125,000
2008	Arizona	14 (1)	$800,000 (limited to cost for 2 hospitals to respond to 7 cases in their facilities)
2005	Indiana	34 (1)	$168,000
2004	Iowa	1	$142,000

*Public health and health care costs expended to control the spread of measles

Measles, U.S., 1997-2014*

Cumulative Number by Month of Rash Onset



*As of May 16, 2014

Measles U.S. 2014*

- 216 cases reported from 15 states including 15 outbreaks
  - 45 importations
    - 22 from the Philippines
    - 38 (85%) US residents
  - 96% cases import-associated
  - 38 cases (17%) hospitalized

- Cases in US residents (N=207)
  - 63% unvaccinated
  - 25% unknown vaccination status (90% of those adults)
  - 12% vaccinated (including 8% with 2 or more doses)
  - Among unvaccinated
    - 83% were personal belief exemptors
    - 6% unvaccinated travelers age 6-15 mos
    - 7% too young to be vaccinated

* Provisional reports to CDC through May 16, 2014

Measles Vaccine

- Available as Measles, Mumps, Rubella (MMR) in the U.S.
- Licensed in 1963 in the U.S.
- Combination MMR vaccine licensed in 1971
- Vaccine Effectiveness
  - 1-dose: ~93%
  - 2-dose: ~97%

ACIP Measles Vaccine Recommendation History

1963: Age 9 mos

1965: Age 12 mos

1967: Age 15 mos

1989: 2 doses (as MMR) @ age 15 mos & 4-6 yrs

1994: 2 doses (12-15 mos & 4-6 yrs)

Travel Recommendations for Measles

- Persons aged ≥12 months should receive 2 doses*
  - Includes providing a 2nd dose to children prior to age 4-6 yrs
  - Includes adults** who have only received one routine dose in the past

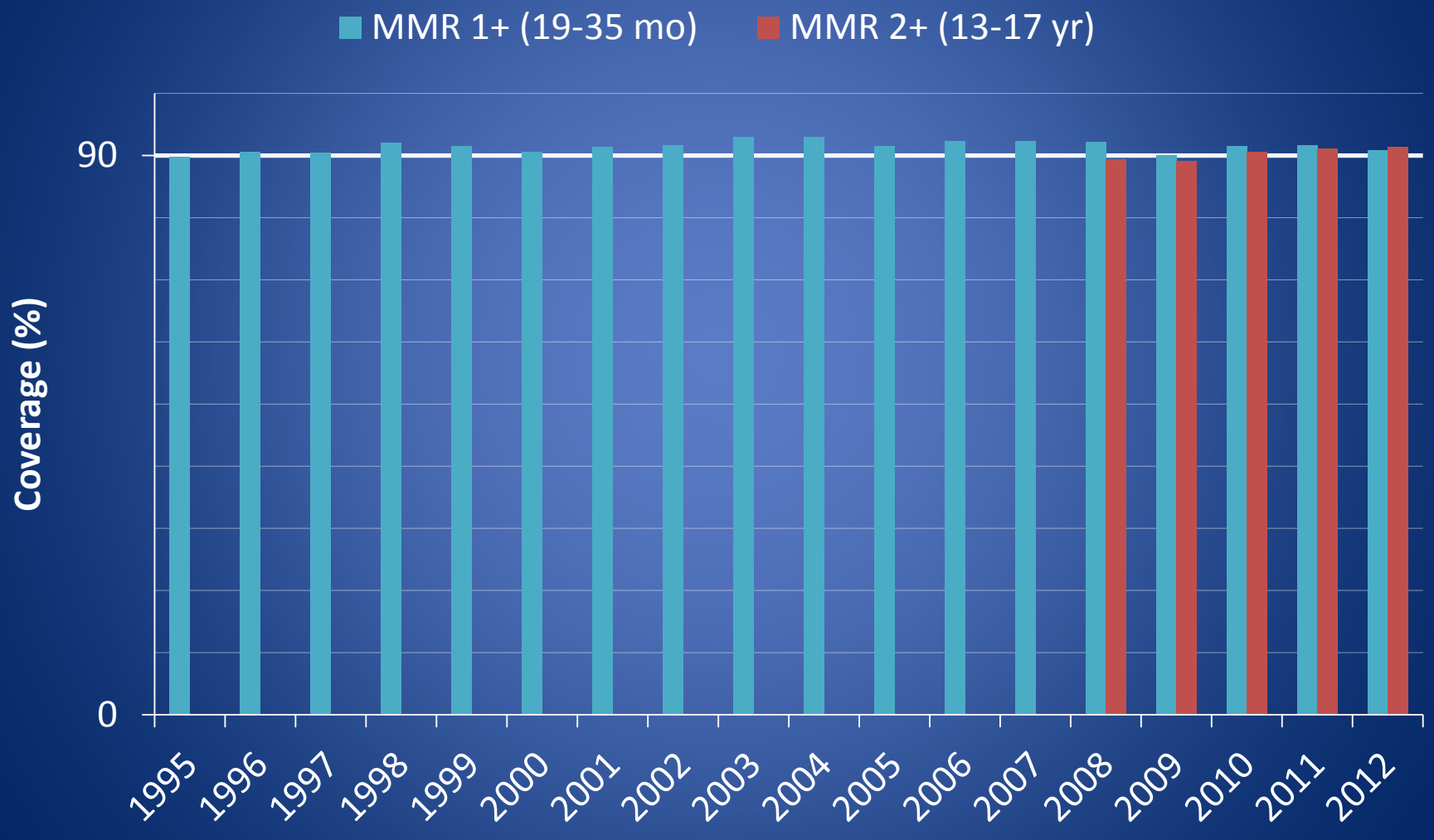
- Children aged 6-11 months should receive 1 dose
  - If vaccinated at age 6-11 months, still need 2 subsequent doses at age ≥12 months

* 2nd dose of MMR should be administered at least 28 days after the 1st dose
** Born in 1957 or later

Keys to Measles Prevention, Diagnosis, & Response

- Vaccine
  - Vaccine Rates
  - VE
- Diagnostics
  - Differential Diagnosis
  - Hx & PE
  - Lab testing
- Case Response
  - Reporting
  - Contact Investigation
  - Presumptive evidence of immunity
  - Isolation and Quarantine
  - Post Exposure Prophylaxis

MMR Vaccination Coverage
National Immunization Survey, U.S.



Diagnosing Measles

- Consider measles in differential diagnosis of febrile rash illness
  - e.g. Kawasaki's, Dengue
- Travel History or Exposure to Recent Travelers
- Documented Vaccine History
- Lab testing
  - Serology for IgM
  - Viral specimen (nasopharyngeal, oropharyngeal, or nasal swab) for PCR (and genotyping)

Public Health Response
(for confirmed and suspect cases)

- Respiratory isolation of cases
  - Infectious period 4 days prior through 4 days after date of rash onset
- Report to Health Department
  - Immediately notifiable to CDC (within 24 hours)
  - Contact CDC Quarantine Station if relevant travel
  - Enhanced Surveillance
- Contact investigation

Contact Investigation for Exposure to Measles

- Persons exposed during cases infectious period
  - Includes exposure to area 2 hours after case left
- Establish presumptive evidence of immunity for contacts
- Quarantine of contacts without presumptive evidence of immunity (through 21 days after exposure)
- Postexposure prophylaxis (PEP)
  - Vaccine or Immune globulin (IG)

Presumptive Evidence of Immunity for Measles

Routine	**Students at post-high school educational institutions**	**Health-care personnel**	**International travelers**
(1) Documentation of **age-appropriate vaccination** with a live measles virus-containing vaccine: –preschool-aged children: 1 dose –school-aged children (grades K-12): 2 doses –adults not at high risk: 1 dose, or (2) Laboratory evidence of immunity, or (3) Laboratory confirmation of disease, or (4) Born before 1957	(1) **Documentation of vaccination with 2 doses** of live measles virus-containing vaccine, or (2) Laboratory evidence of immunity, or (3) Laboratory confirmation of disease, or (4) Born before 1957	(1) **Documentation of vaccination with 2 doses** of live measles virus-containing vaccine, or (2) Laboratory evidence of immunity, or (3) Laboratory confirmation of disease, or (4) Born before 1957 - should consider 2 doses	(1) Documentation of **age-appropriate vaccination** with a live measles virus-containing vaccine: **–infants aged 6–11 months: 1 dose** **–persons aged ≥12 months: 2 doses,** or (2) Laboratory evidence of immunity, or (3) Laboratory confirmation of disease, or (4) Born before 1957

Postexposure Prophylaxis (PEP)
MMR Vaccine

- Administer within 72 hours of exposure
  - May return to normal activities (except health care settings)
  - Still monitor for symptoms
  - Can be given down to age 6 months
  - Be aware of possibility of vaccine rash

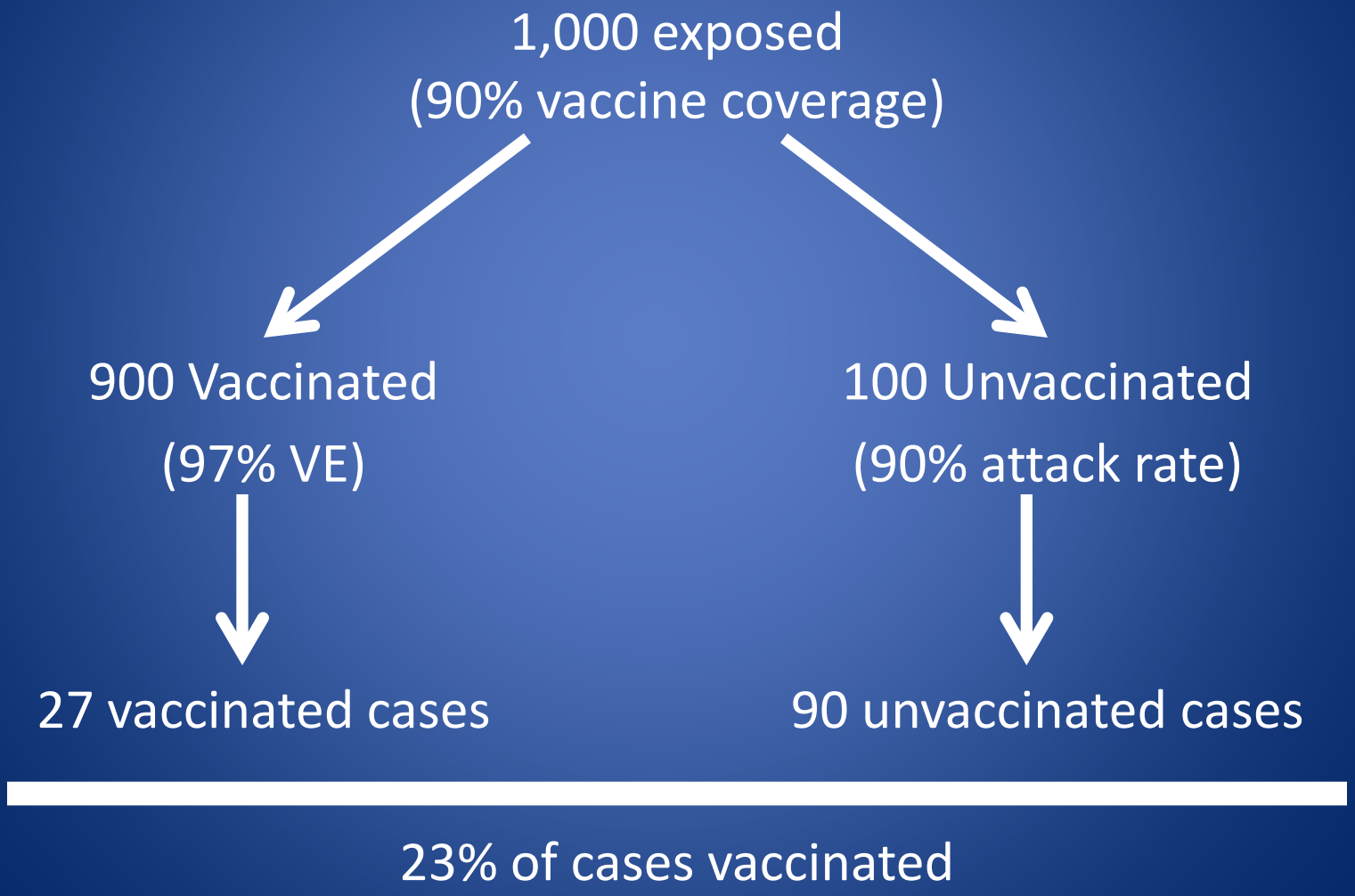
Postexposure Prophylaxis (PEP)
Immune Globulin

- Administer within 6 days of exposure

- Recommended Dose
  - Intramuscular (IGIM): 0.5 mL/kg (max = 15 mL)
  - Intravenous (IGIV): 400 mg/kg

- Recommended for the following groups (risk of severe disease and complications)
    - Infants aged <12 months (IGIM)
    - Pregnant women without evidence of immunity (IGIV)
    - Severely immunocompormised patients (IGIV)

Does the Vaccine Really Work?



Keys to Maintaining Elimination in the U.S.

- High 2-dose MMR vaccine coverage
- High quality surveillance
  - Rapid identification of and response to measles cases
  - Reportable within 24 hours per Council of State and Territorial Epidemiologists (CSTE) guidelines
- Aggressive outbreak control measures
- Information sharing tools (Epi-X, HAN)

Keeping Sight on the Successes

- Elimination Achieved & Maintained
- Vaccine Works, Disease Recognizable
  - Eradication Possible & Achievable
- Outbreaks are Limited (size & # of generations)
  - High Overall Vaccine Coverage
  - Rapid/Aggressive Public Health Response to (*suspect*) Cases

Measles Era Approaching Elimination

- Measles is due to Failure to Vaccinate
- Measles Elimination is a Global Problem
- Maintenance of Elimination is Resource Intensive
  - Maintaining vaccine coverage
  - Intensive case/contact investigations
  - Healthcare workers diagnostic skills
  - Advanced laboratory techniques

Summary of Measles Elimination in the U.S.

- Declared in the U.S. in 2000
  - Pan American Health Organization (PAHO) documenting for the Americas
- Huge Public Health Achievement
- Brings New Challenges
  - Case investigations very resource intensive
  - Continued global threat
  - Highly contagious
  - Clustering, accumulation, and aging of susceptibles

DISCUSSION