McNew Memorial Lecturers, 2006 - 2025

2006-07 – **Laura Gibson**, U Mass (Worcester) Medical School

2007-08 – **Ed Mocarski**, Stanford University (currently, Emory University)

2008-09 – **Michael McVoy**, Virginia Commonwealth University Med. School

2009-10 – **Pablo Sanchez**, University of Texas/Southwestern University School of Medicine (currently, Nationwide Children's Hospital)

2010-11 – **Ravit Arav-Boger**, Johns Hopkins Medical School (currently, Medical College of Wisconsin)

2011-12 – **Adam Geballe**, University of Washington Medical School and Fred Hutchinson Cancer Research Center

2012-13 – **Mark R. Schleiss**, University of Minnesota Medical School

2013-14 – **Felicia Goodrum**, University of Arizona College of Medicine

2014-15 – **Sallie Permar**, Duke University School of Medicine (currently, Weill-Cornell School of Medicine)

2015-16 – **Albert Park**, University of Utah Medical School

2016-17 – **Soren Gantt**, Univ. British Columbia Medical School (currently, Centre Hospitalier Universitaire Sainte-Justine/Université de Montréal)

2017-18 – **Jeremy Kamil**, Louisiana State University Medical School

2018-19 – **Sheila Dollard**, Centers for Disease Control and Prevention

2019-20 – **Emma Mohr**, University of Wisconsin (Madison)

2020-21 – **Nico Suarez**, MRC, Glasgow, Scotland

2021-22 – **Bill Britt**, University of Alabama-Birmingham

2022-23 – **Rana Chakraborty**, Mayo Clinic (currently, Univ. of Miami)

2023-24 **Elizabeth Enninga**, Mayo Clinic

2024-2025 **Stanley A. Plotkin**, University of Pennsylvania

Congenital Cytomegalovirus Public Health and Policy Workshop, 2025

Jamie McNew Endowed Memorial Lecture in CMV Research and Education

University of Minnesota Foundation

CMV Congenital Cytomegalovirus Public Health & Policy Conference

The Development of Rubella Vaccine

by
Stanley Plotkin

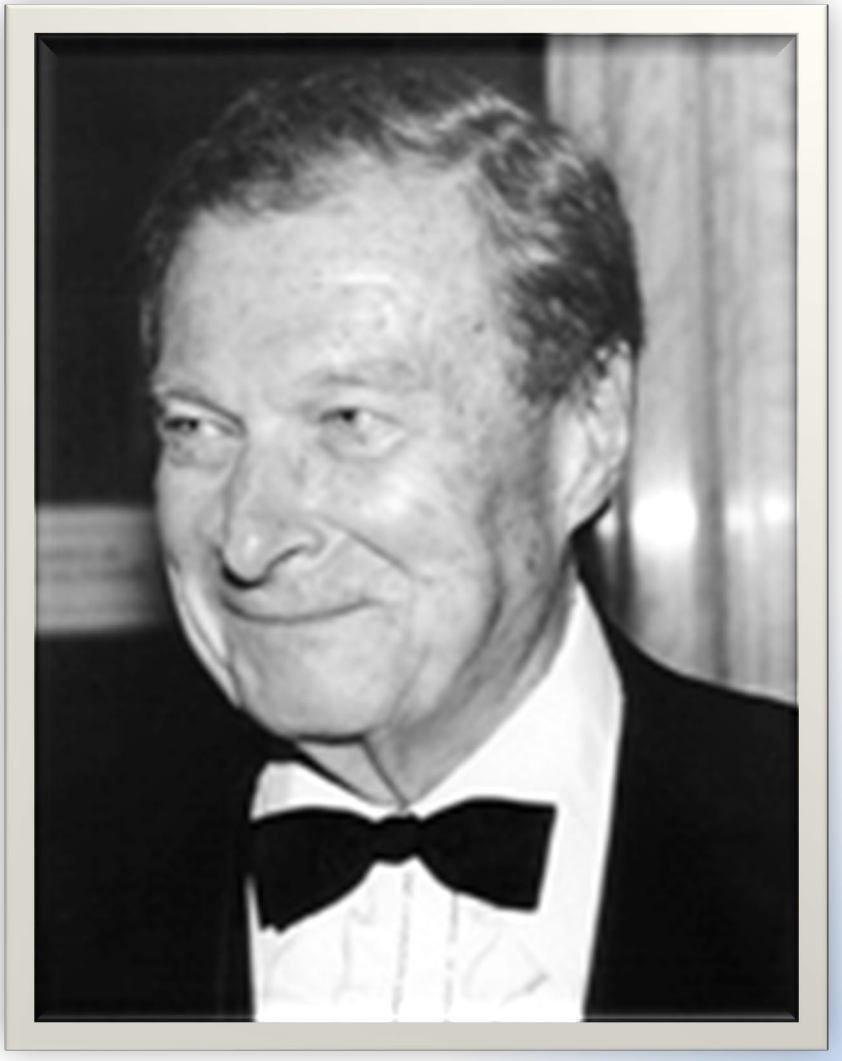
The older I grow, the more I distrust the familiar doctrine that age brings wisdom.

H. L. Mencken

Evolution of Vaccines Textbook

Edition	Date	Chapters
1	1988	32
2	1994	35
3	1999	59
4	2004	63
5	2008	76
6	2013	78
7	2018	84
8	2024	87

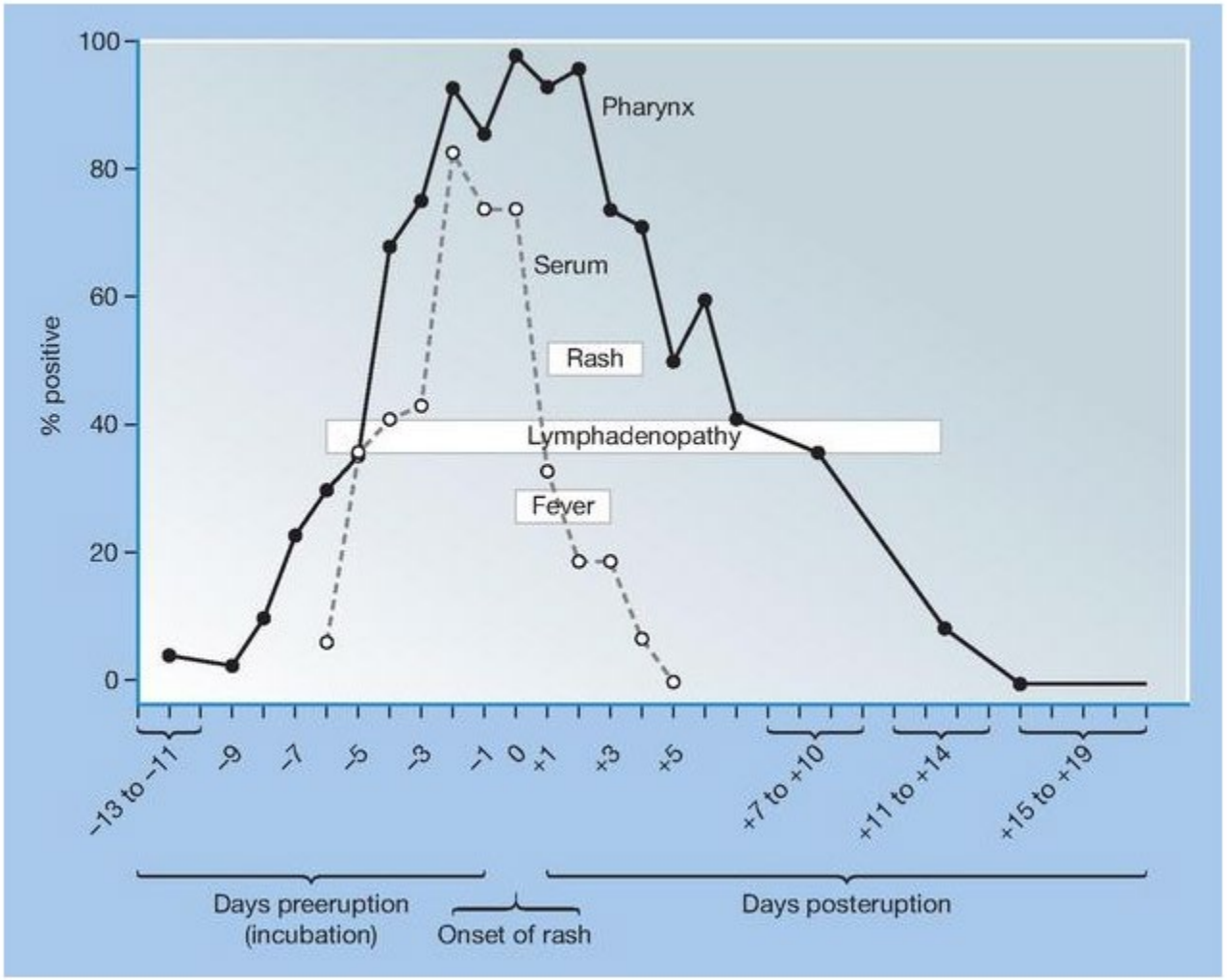
OPV



Hilary Koprowski
1916-2013
First live polio vaccine.

June 4, 1965


LIFE
GERMAN MEASLES AND PREGNANCY
Current U.S. epidemic will damage up to 20,000 babies
JUNE 4 · 1965 · 35¢

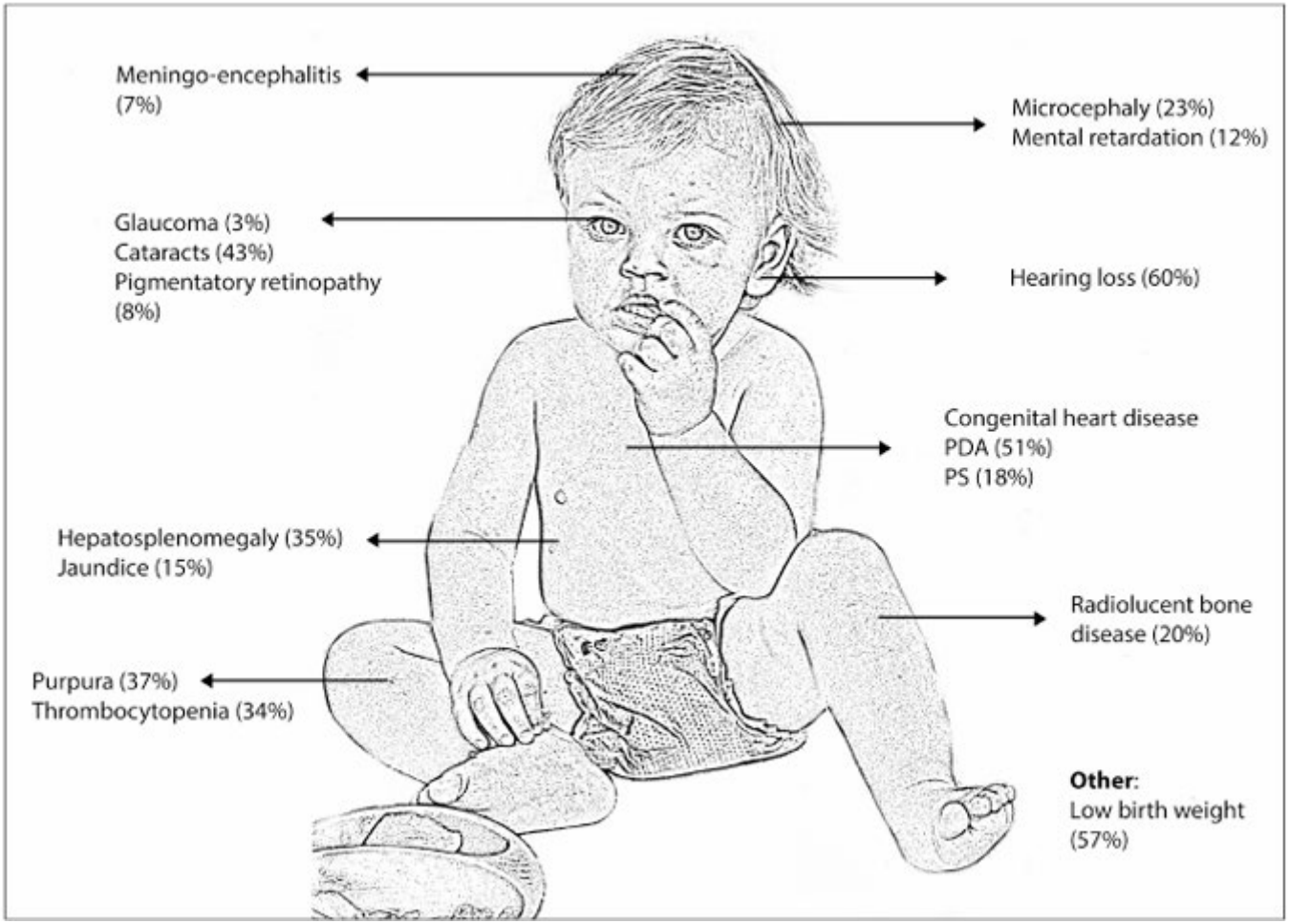


Sequence of events in acquired rubella infections, showing the relationship between onset of rash and other clinical symptoms and recovery of rubella virus from diagnostic specimens. Serum is noted by the dotted line; pharynx is noted by the solid line.

Blueberry muffin baby

A newborn baby with typical lesions of a blueberry muffin baby.

Common clinical manifestations of congenital rubella syndrome



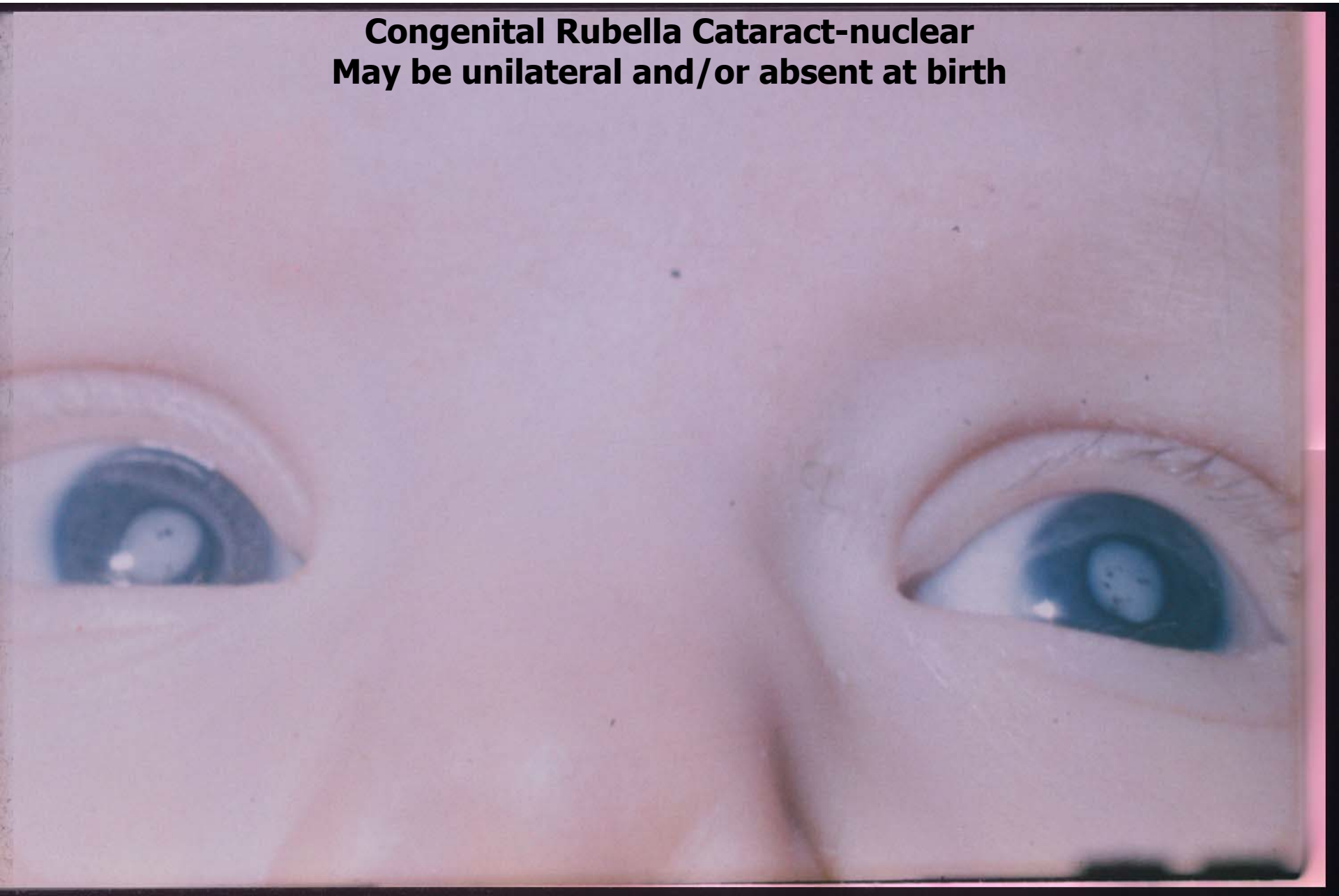
Boshoff, L., Tooke, L., So African Jour of Child Health 6(4) 2012

Prominent Clinical Findings in Congenital Rubella Syndrome

Cataracts
Retinitis
Microphthalmia
Glaucoma
Cochlear deafness
Central auditory imperception
Patent ductus arteriosus
Peripheral pulmonic artery stenosis
Encephalitis
Microcephaly
Mental disability
Autism
Intrauterine growth retardation
Metaphyseal rarefactions
Hepatosplenomegaly
Thrombocytopenic purpura
Interstitial pneumonitis
Late:
Diabetes
Hypothyroidism

Modified from Cooper LZ, Preblud SR, Alford CA. Rubella. In: Remington JS, Klein JO, eds. Infectious Diseases of the Fetus and Newborn Infant. 4th ed. Philadelphia, PA: WB Saunders; 1995:288

Congenital Rubella Cataract-nuclear
May be unilateral and/or absent at birth



Estimated Morbidity Associated with the 1964 to 1965 Rubella Epidemic in the U.S.

Clinical Events	
Rubella cases	12,500,000
Arthritis-arthralgia	159,375
Encephalitis	2,084
Deaths	
Excess neonatal deaths	2,100
Other deaths	60
Total deaths	2,160
Excess fetal wastage	6,250
Congenital rubella syndrome	
Deaf children	8,055
Deaf-blind children	3,580
Mental retarded children	1,790
Other congenital rubella syndrome	6,575
Total congenital rubella syndrome	20,000
Therapeutic abortions	5,000

TABLE 54.6 Estimated Morbidity Associated With the 1963–1964 Rubella Epidemic

Clinical Events	Cases
Rubella cases	12,500,000
Arthritis-arthralgia	159,375
Encephalitis	2,084
Deaths	
Excess neonatal deaths	2,100
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Total deaths	2,160
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Other congenital rubella syndrome	6,575
Total congenital rubella syndrome	20,000
Therapeutic abortions	5,000

From National Communicable Disease Center. Rubella Surveillance. *Bethesda, MD: U.S. Department of Health, Education, and Welfare; 1969.*

TABLE 54.4 Fetal Abnormality Induced by Confirmed Rubella at Various Stages of Pregnancy

Stage of Pregnancy (Week)	United Kingdom Study (% Defective)[a]	United States Study (% Defective)[b]
≤4		70
5–8		40
≤10	90	
11–12	33	
9–12		25
13–14	11	
15–16	24	
13–16		40
≥17	0	8[a]

[a]Data from Miller E, Cradock-Watson JE, Pollock TM. Consequences of confirmed maternal rubella at successive stages of pregnancy. *Lancet*. 1982;2:781–784.

[b]Data from South MA, Sever JL. Teratogen update: the congenital rubella syndrome. *Teratology*. 1985;31:297–307.

TABLE 54.2 Age of Gestation at Time of Rubella in Relation to Abnormalities Observed

	Month of Gestation Measured From Last Menstrual Period				
	0[a]	1	2	3	4
Birth weight <2,500 g	0/1[b]	9/21	9/21	10/18	0/2
<38 weeks gestation	0/1	5/21	2/21	4/18	0/2
Growth retardation	0/1	7/21	5/20	7/17	0/2
Ocular defects	0/1	14/21	9/21	9/18	0/2
Cardiac defects	0/1	17/21	13/21	6/18	0/2
Deafness	0/1	8/18	10/18	11/17	2/2
Mental retardation	1/1	7/20	7/20	8/16	0/2
Microcephaly	1/1	3/18	2/19	4/17	0/2

[a]Before conception.

[b]Ratio of number of patients with condition to total number for whom information is available.

From Plotkin SA, Cochran W, Lindquist J, et al. Congenital rubella syndrome in late infancy. JAMA. *1967;200:435–441. Copyright 1967, American Medical Association.*

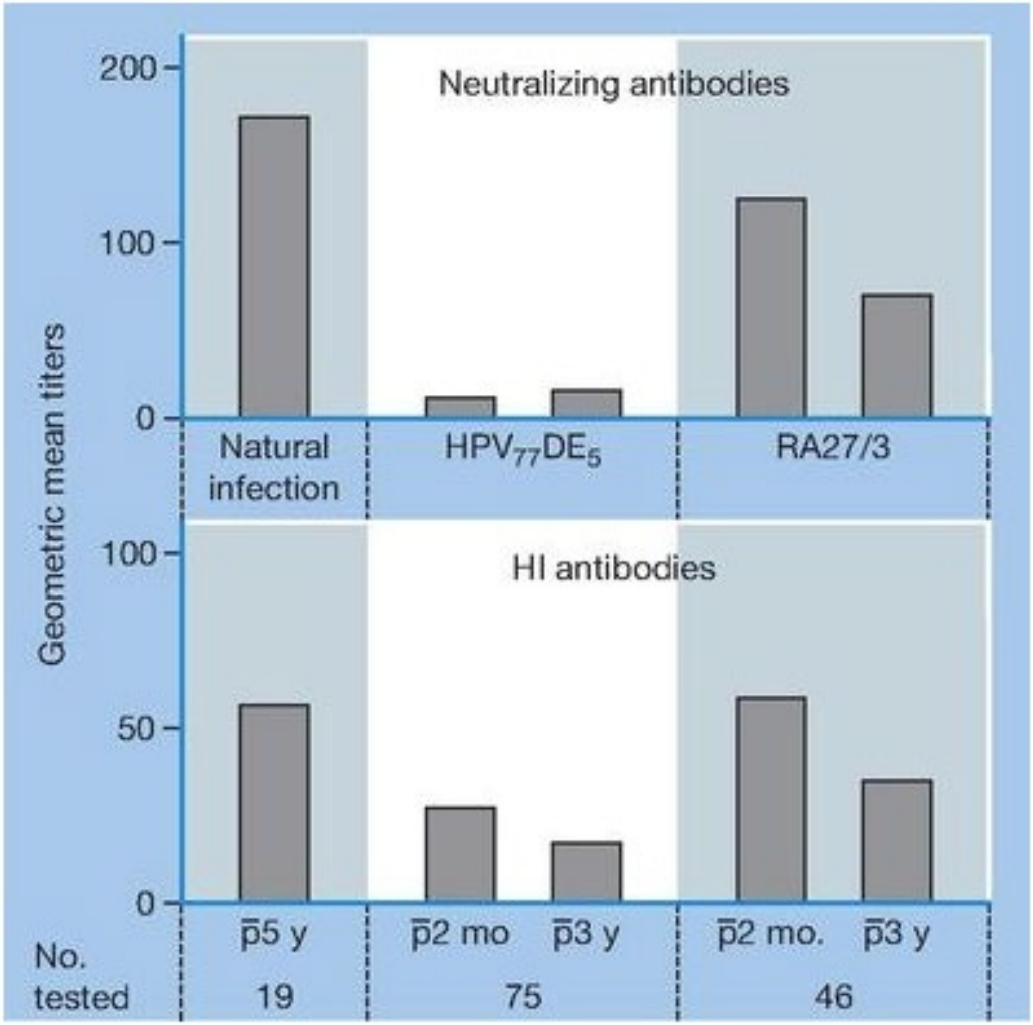
Laboratory Diagnosis of Acquired and Congenital Rubella

		When Positive	
Test	**Specimen**	**Acquired Rubella**	**Congenital Rubella**
Virus Isolation	Throat, urine, blood	First week of illness	At birth, declining thereafter
RT-PCR	Amniotic fluid, placenta	NA	Throughout pregnancy
IgM antibody	Serum	Up to 2 months post illness	At birth and first year of life
IgG antibody rise	Sera	Fourfold increase between acute and convalescent	NA
Low IgG antibody avidity	Serum	Up to 2 months post illness	At birth and years later
IgG antibody persistence	Serum	NA	Beyond 6 months of age, until exposure to infection or vaccination

IgG, immunoglobulin G; IgM, immunoglobulin M; NA, not applicable; RT-PCR, reverse transcription–polymerase chain reaction.

What We Learned About Rubella

How to grow virus in large quantity (BHK 21)
Diagnosis of maternal infection
How to isolate virus from fetus
Importance of placental infection
Distribution of virus in fetus
Clinical description of fetal infection
Mechanism of persistent fetal infection
Mitotic inhibition and apoptosis of fetal cells explain pathogenesis
Adaptions of virus to human cell culture



Comparison of neutralizing antibodies and hemagglutination-inhibiting (HI) antibodies in three groups of persons: naturally infected children, children given human papillomavirus 77 duck embryo ($HPV_{77}DE_5$) vaccine, and children given RA27/3 vaccine. *(From Horstmann DM. Viral vaccines and their ways. Rev Infect Dis.1979;1:502–516.)*

TABLE 54.12 Reinfection[a] of Vaccinees After Virus Challenge

Vaccinees	Previous Vaccine Given	Vaccinees Showing Reinfection	
		Total No.	Percentage
Cendehill	27	18	66.7
HPV-77	30	14	45.7
RA27/3	28	2	7.1

[a]As revealed by a positive booster in at least one of four serologic tests.

From Fogel A, Gerichter CB, Barena B, et al. Response to experimental challenges in persons immunized with different rubella vaccines. J Pediatr. *1978;92:26–29.*

The Confrontation at NIH in 1969

I must say that despite my great and sincere respect for Dr. Sabin, I think the statements he has made are strictly ex cathedra and without a factual basis.

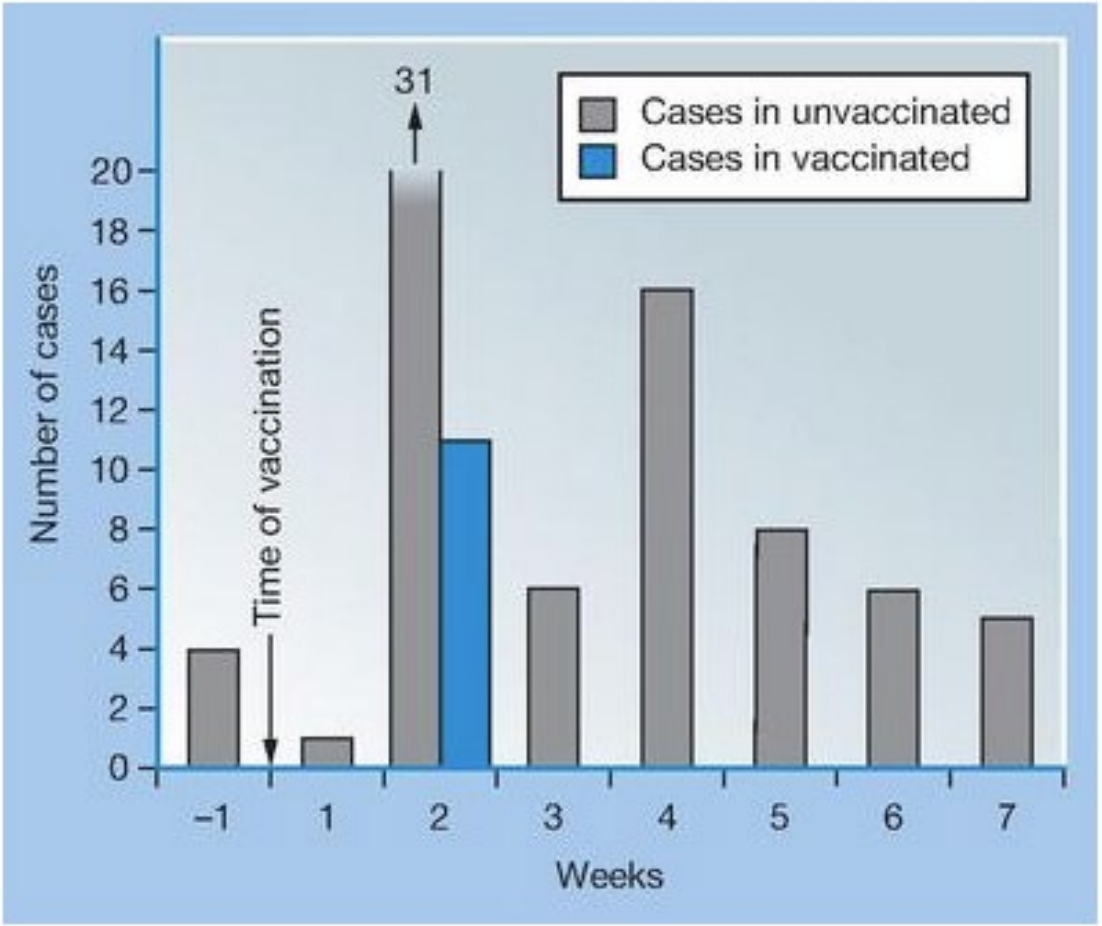
So, my conclusion is that what we are dealing with here is theology, and you see, in theology it is very difficult to disprove the existence of ghosts. But this is not, to my mind, a basis for making intellectual decisions.

Stanley Plotkin

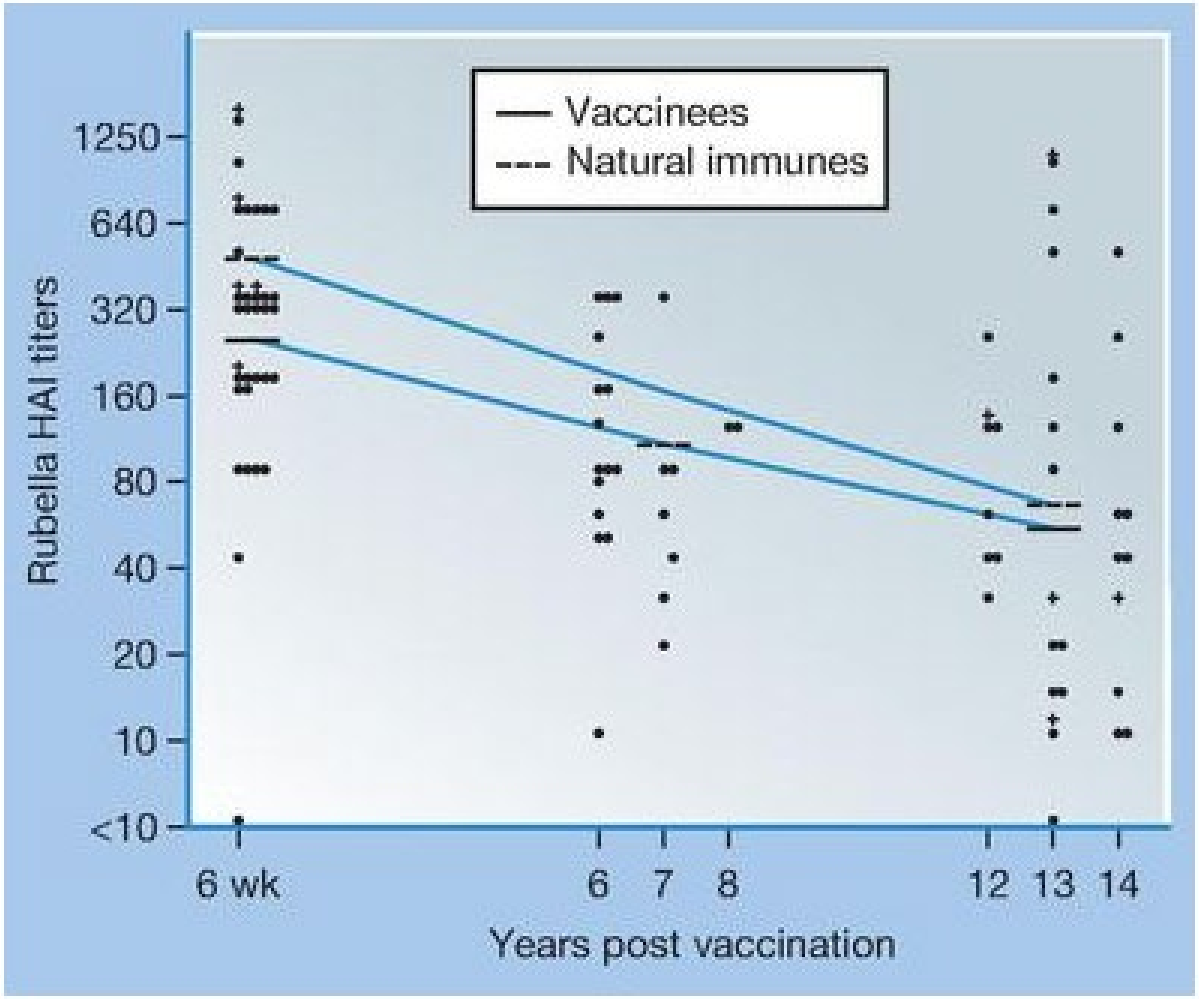
TABLE 54.14 Persistence of Rubella Antibodies After Vaccination of Seronegative Schoolgirls

Time After Vaccination	Number	% HI Titers ≥1:8	GMT (HI)
8 weeks	486	100	110
2 years	346	99	80
4 years	136	99	53
8 years	486	96	34
16 years	190	94	18

HI, hemagglutination inhibition; GMT, geometric mean (antibody) titer.
From Christenson B, Bottinger M. Long-term follow-up study of rubella antibodies in naturally immune and vaccinated young adults. Vaccine. *1994;12:41–45.*



Demonstration of protection against rubella during an epidemic in a boys' school at the Toyota car factory near Nagoya, Japan



Persistence of hemagglutination-inhibiting antibody (HAI) to rubella after natural infection or the administration of RA27/3 vaccine

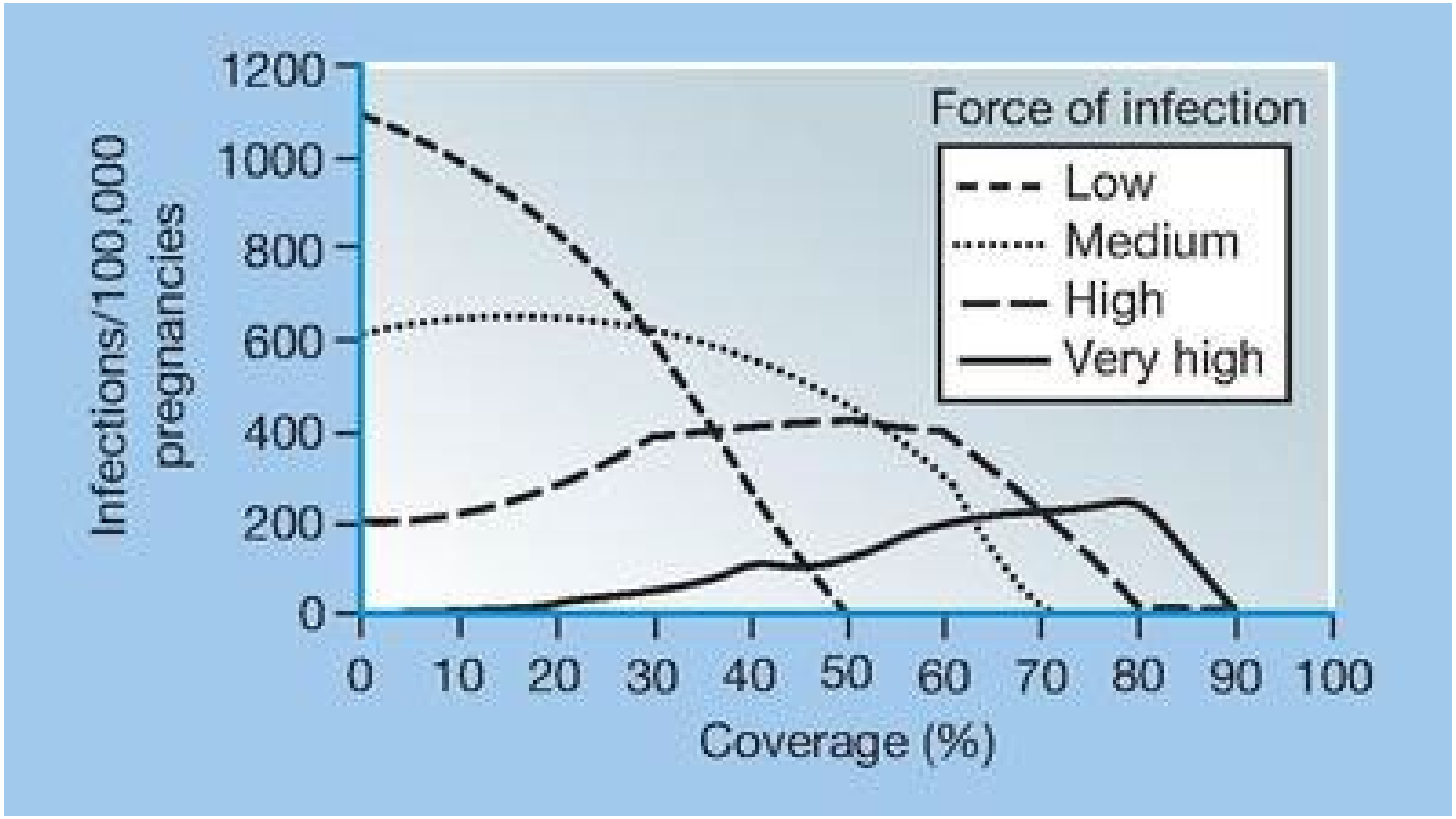
TABLE 54.20 Summary of Data on Vaccination of Unknowingly Pregnant Rubella-Susceptible Women

Country	Live Births to Women Receiving Rubella Immunization		
	Within 3 Months Before Conception or During Pregnancy	Evidence of Infection	Abnormalities Compatible With CRS
United States	324[a]	6/222 (2.7%)	0/324
Germany (West BRD)	280[a]	3/69 (4.3%)	0/279
Sweden	5[a]	NK	0/5
United Kingdom	71[a]	4/52 (7.7%)	0/71
Brazil	1647[b]	67/1,647 (4.1%)	0/1,647
Ecuador	43[b]	2/43 (5%)	0/43
El Salvador	59[b]	1/59 (1.6%)	0/59
Paraguay	119[b]	0/119	0/119
Iran	117[c]		0/117
Costa Rica	93[b]	0/93 (0%)	0/93
Mexico	175[d]	0/174	0/174
Total	2,933[e]	83/2,478 (3.3 %)	0/2,931

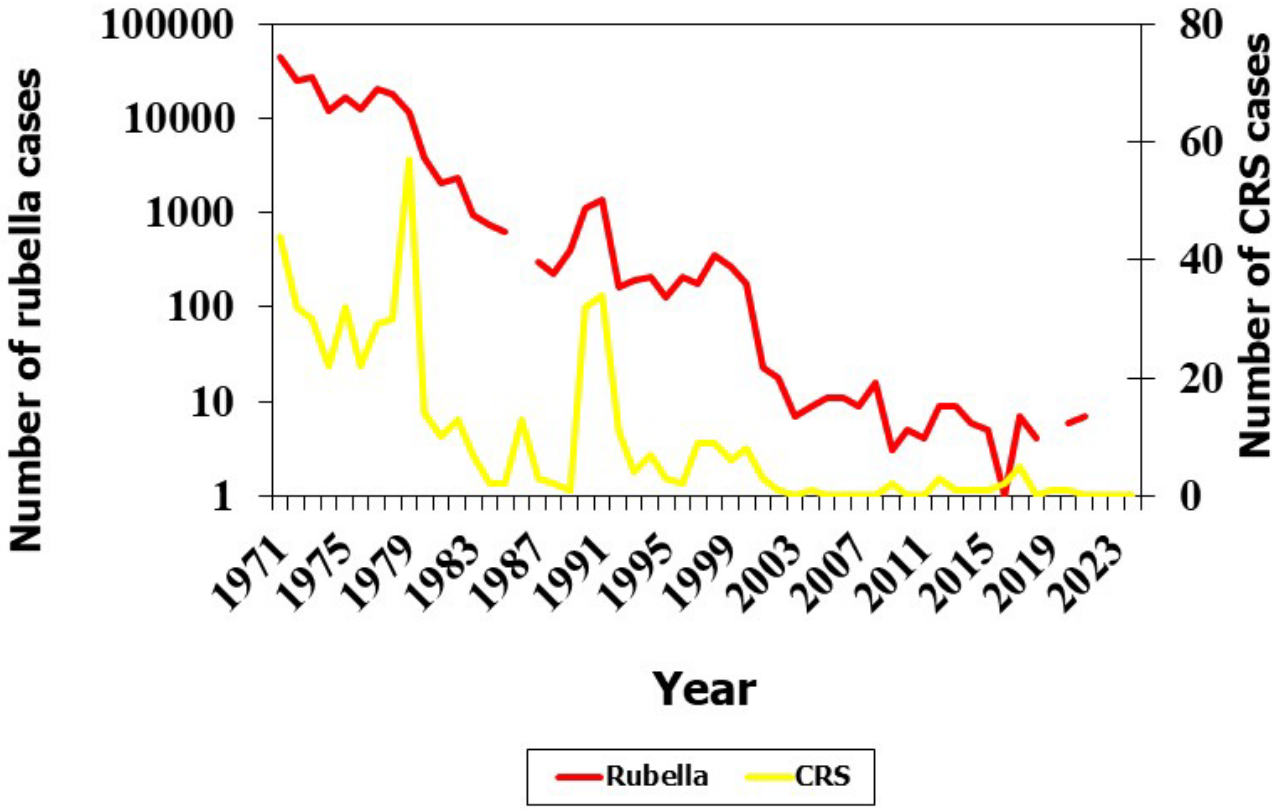
TABLE 54.9 Current Manufacturers of Rubella Vaccines

Manufacturer	Virus Strain	Cell Substrate
Merck (United States)	RA27/3	HDCS
GlaxoSmithKline–RIT (Belgium)	RA27/3	HDCS
Sanofi Pasteur (France)	RA27/3	HDCS
Serum Institute of India	RA27/3	HDCS
Kitasato Institute (Japan)	Takahashi	Rabbit kidney
Biken (Japan)	Matsuura	Quail embryo fibroblast
Takeda Chemical Industries (Japan)	TO-336	Rabbit kidney

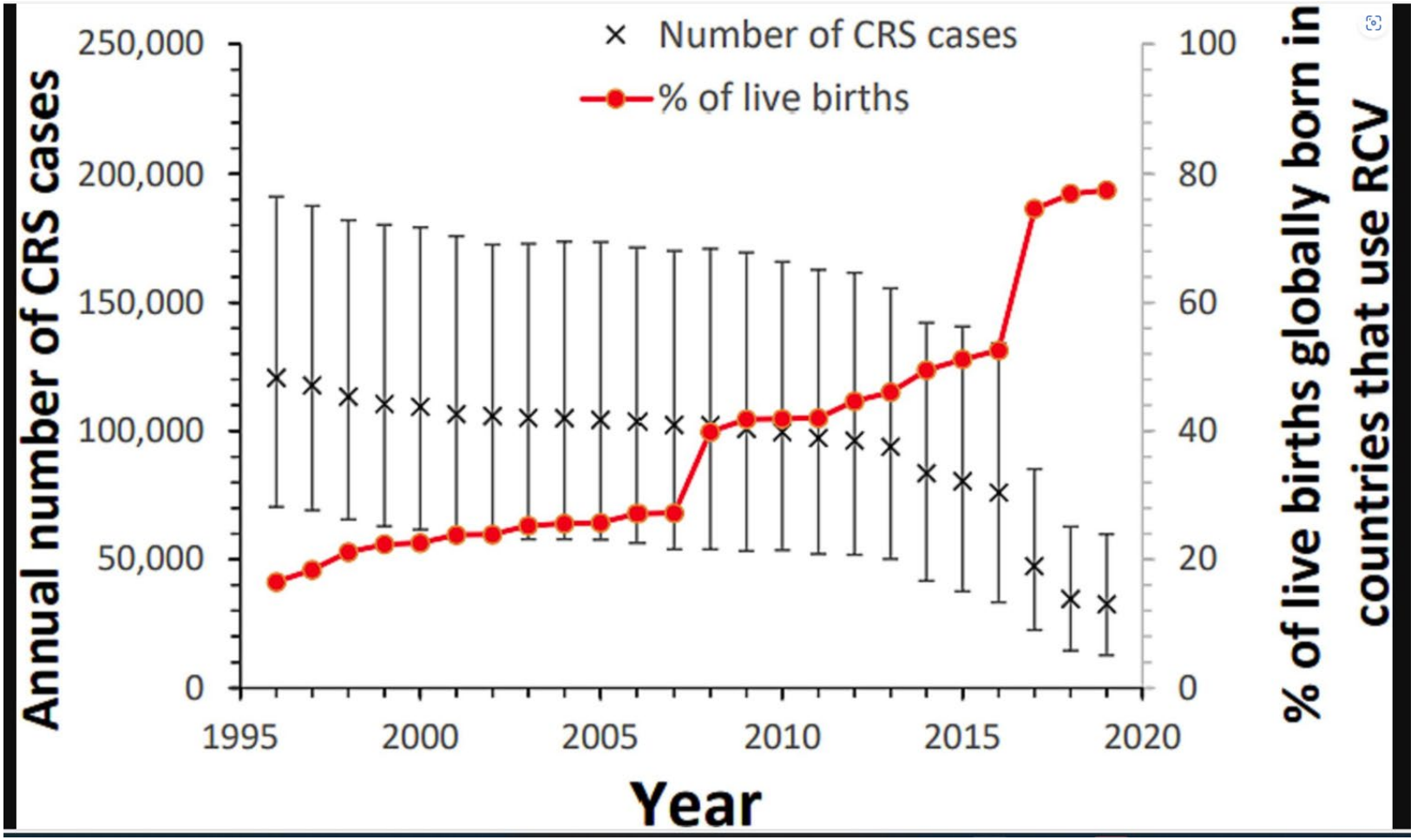
HDCS, human diploid cell strain.
Modified from Perkins FT. Licensed vaccines. Rev Infect Dis. *1985;7:S73–S76.*



Predicted long-term effect of coverage by rubella vaccination of infants on the incidence of congenital rubella syndrome (CRS) according to the force of infection in a given population. (Courtesy Nigel Gay, Consultant, Berkshire, UK)



Reported routine coverage (2004–2024), time frame of campaigns conducted, and reported rubella cases (1982–2024), region of the Americas. PAHO, Pan American Health Organization; WHO, World Health Organization.



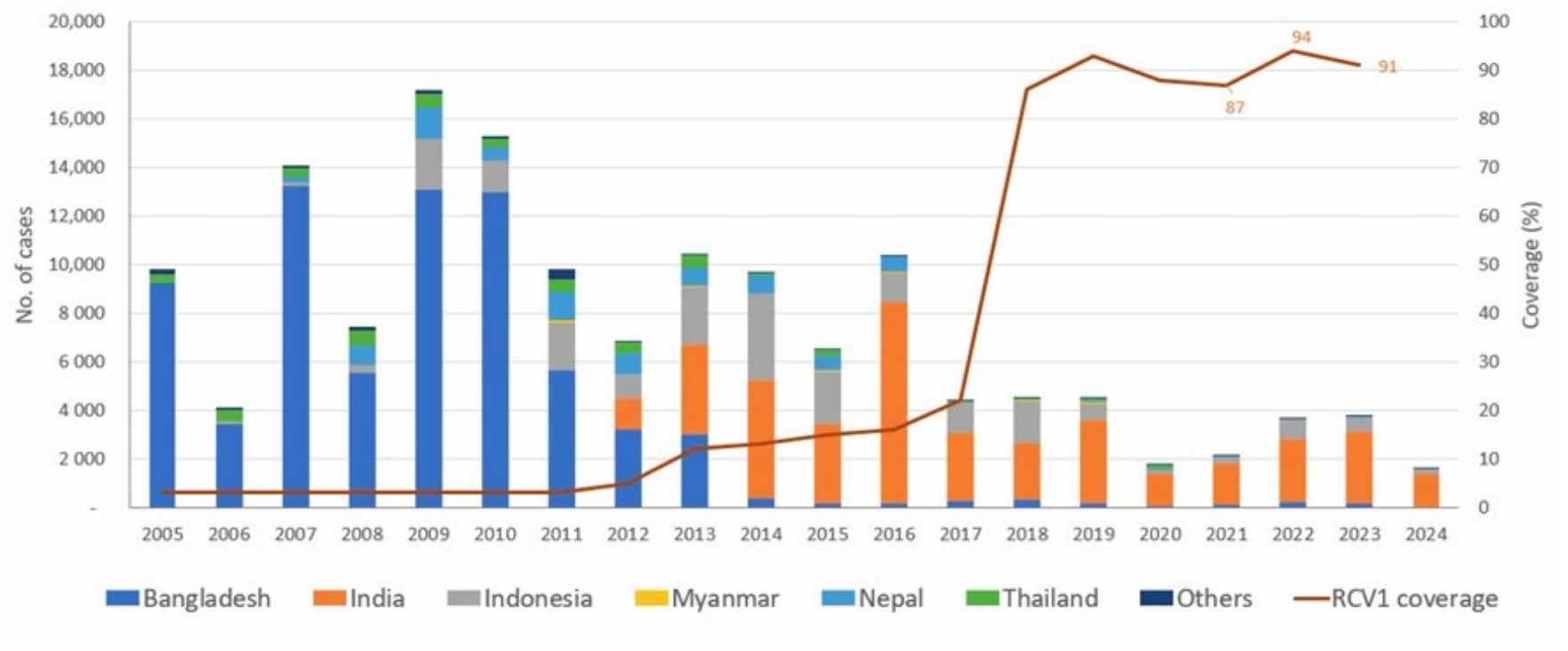
Reef SE, et al. *Vaccine*. 2023 Dec 7;41(50)

Estimated number of pregnant women aged 16-39 years Infected with rubella infection in a year in India

Age-Group (Years)	Estimated number of women aged 16-39 years	Annual Expected Births	Number of Births to Rubella susceptible women	Estimated number of pregnant women infected with Rubella per year (95% CI)
16-19	48,712,691	594,295	84,925	11,874 (11,734,11981)
20-24	59,089,941	7,262,154	1,321,712	106,491 (103,769,108,823)
25-29	54,952,542	8,045,052	1,381,335	83,487 (80,080,86542)
30-34	48,218,732	4,566,314	666,225	33,535 (31,663,35,262)
35-39	46,338,709	1,709,898	347,280	8,887 (8,260,9,479)
Total	257,312,615	22,177,713	3,801,478	244,275 (235,506,252,087)

Shanmugasundaram D, et al. *PLoS Negl Trop Dis*. 2021 Jul.

Number of reported rubella cases in Southeast Asia



Source: WHO/UNICEF coverage estimates , July 2024 and WHO /UNICEF JRF; Rubella cases from JRF 2000-2024

Khanal S, et al. *Vaccines* (Basel). 2024 Sep 25;12(10)

Percentage of member states by World Health Organization (WHO) region, with routine rubella vaccination, 2020

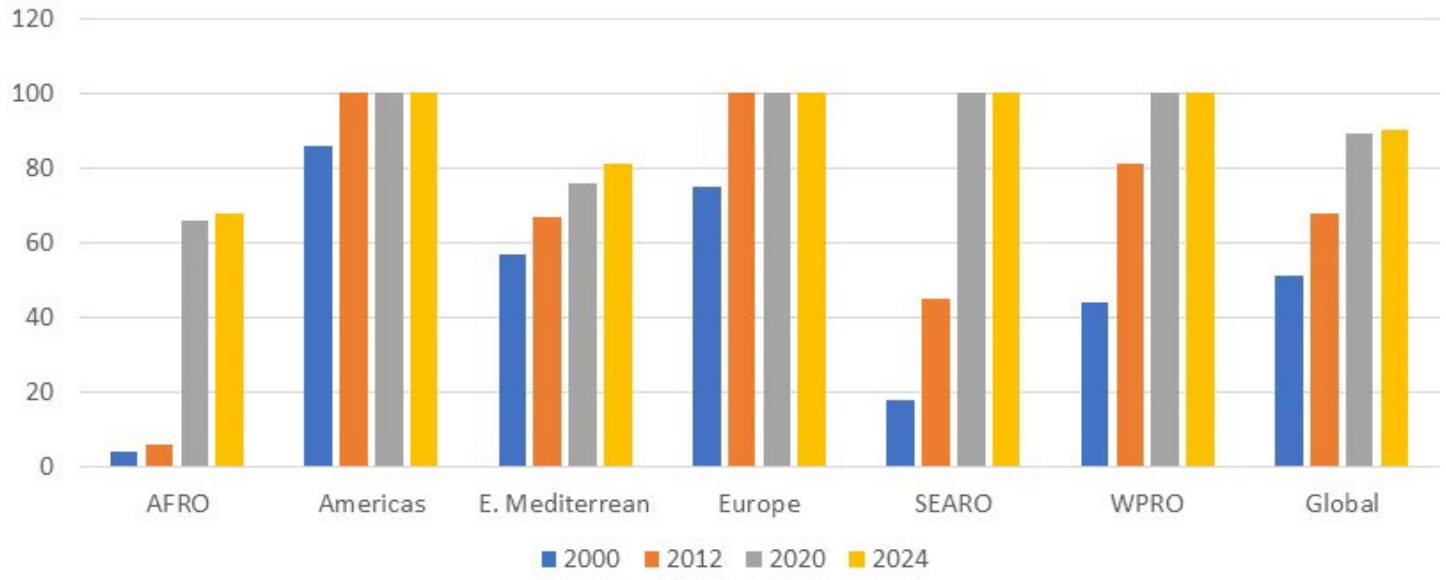
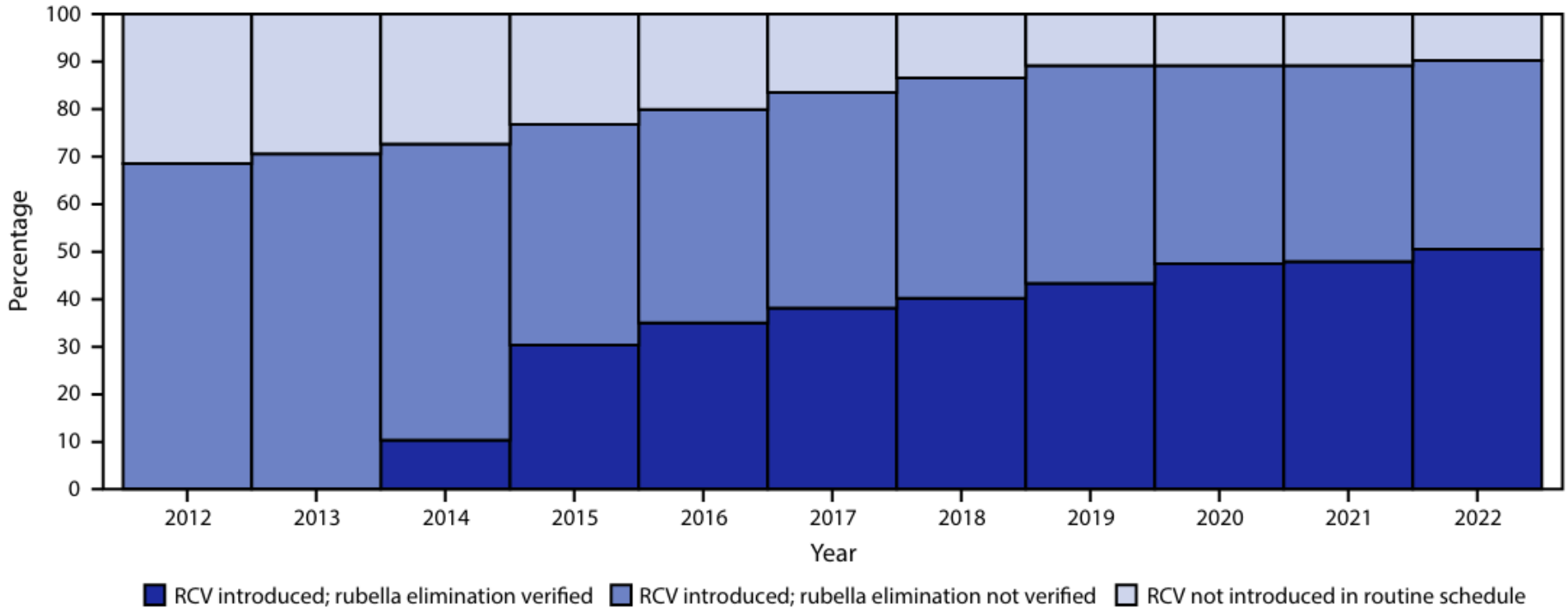


FIGURE 1. Percentage of World Health Organization countries that introduced rubella-containing vaccine into the routine immunization schedule and the percentage with verified rubella elimination, by year (N = 194) — worldwide, 2012–2022



Abbreviation: RCV = rubella-containing vaccine.

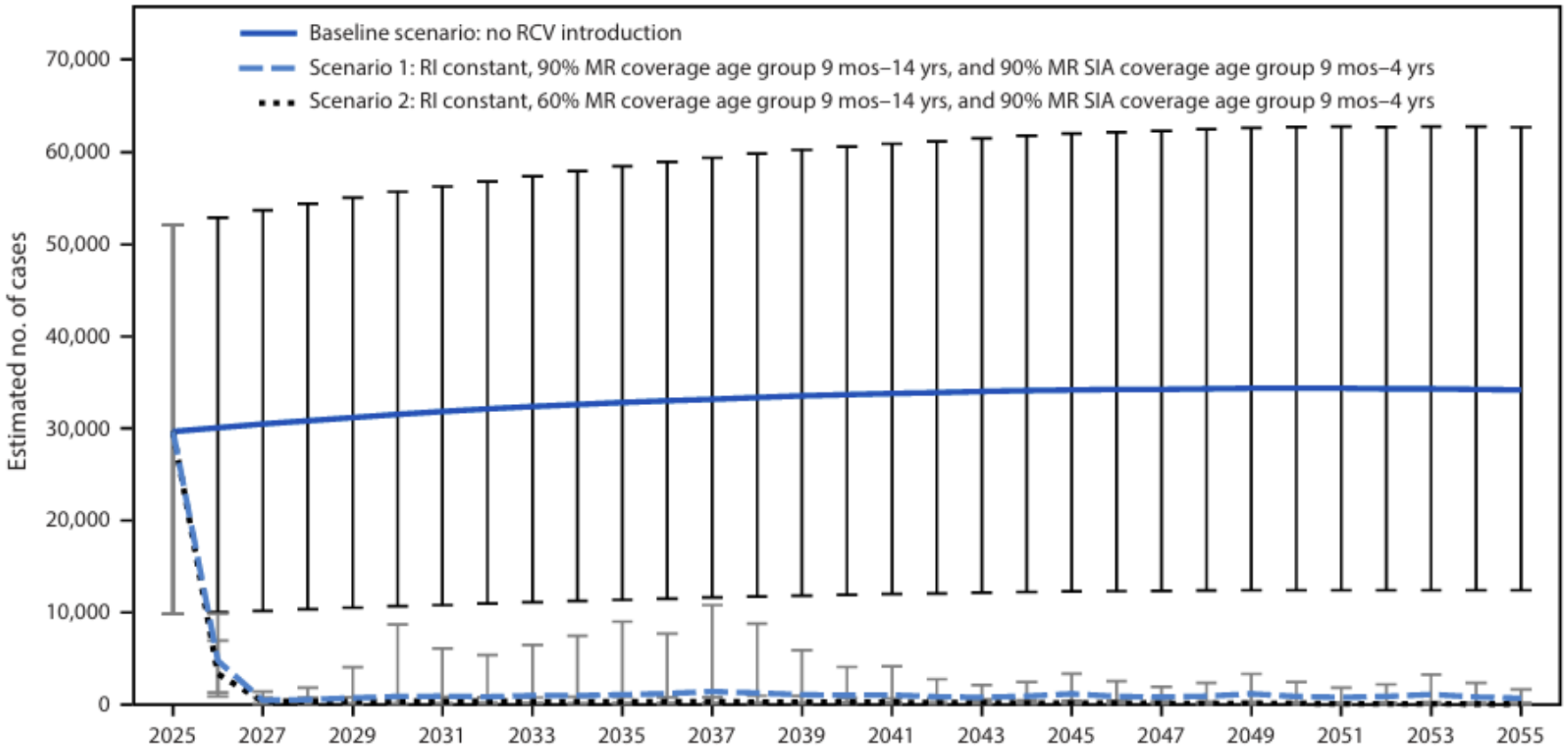
Ou AC, et al. MMWR Morb Mortal Wkly Rep. 2024 Feb

Table 1. The status of rubella elimination by region - August 31, 2023.

Region	Member States	Eliminated (Verified)	% Verified	Endemic	Not Classified
AFR	47	0	0%	47	0
AMR	35	35	100%	0	0
EMR	21	4	19%	17	0
EUR	53	50	94%	0	3
SEAR	11	5	45%	5	1
WPR	27	5	19%	22	0
GLOBAL	194	99	64%	92	4

Reef SE, et al. *Vaccine*. 2023 Dec 7;41(50)

Estimated number of annual congenital rubella syndrome cases with rubella vaccine introduction and in the absence of rubella vaccine introduction – 19 countries, 2025-2055



Lebo, E., et al. *MMWR*, May 2025, 74;18

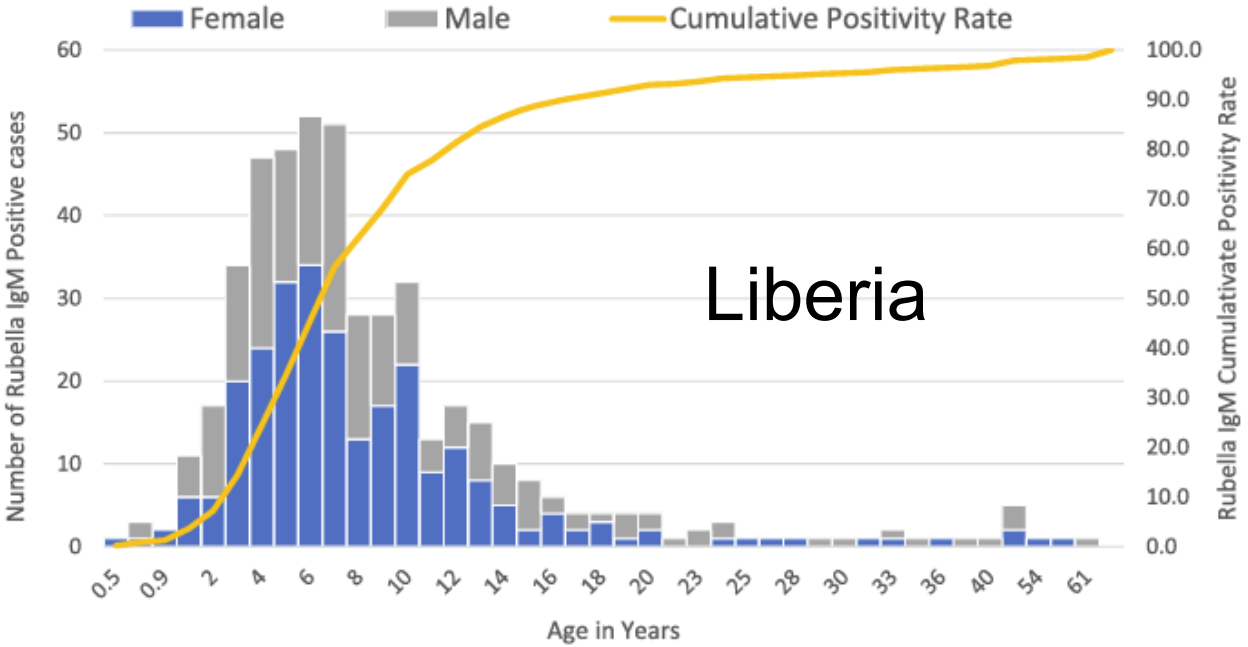
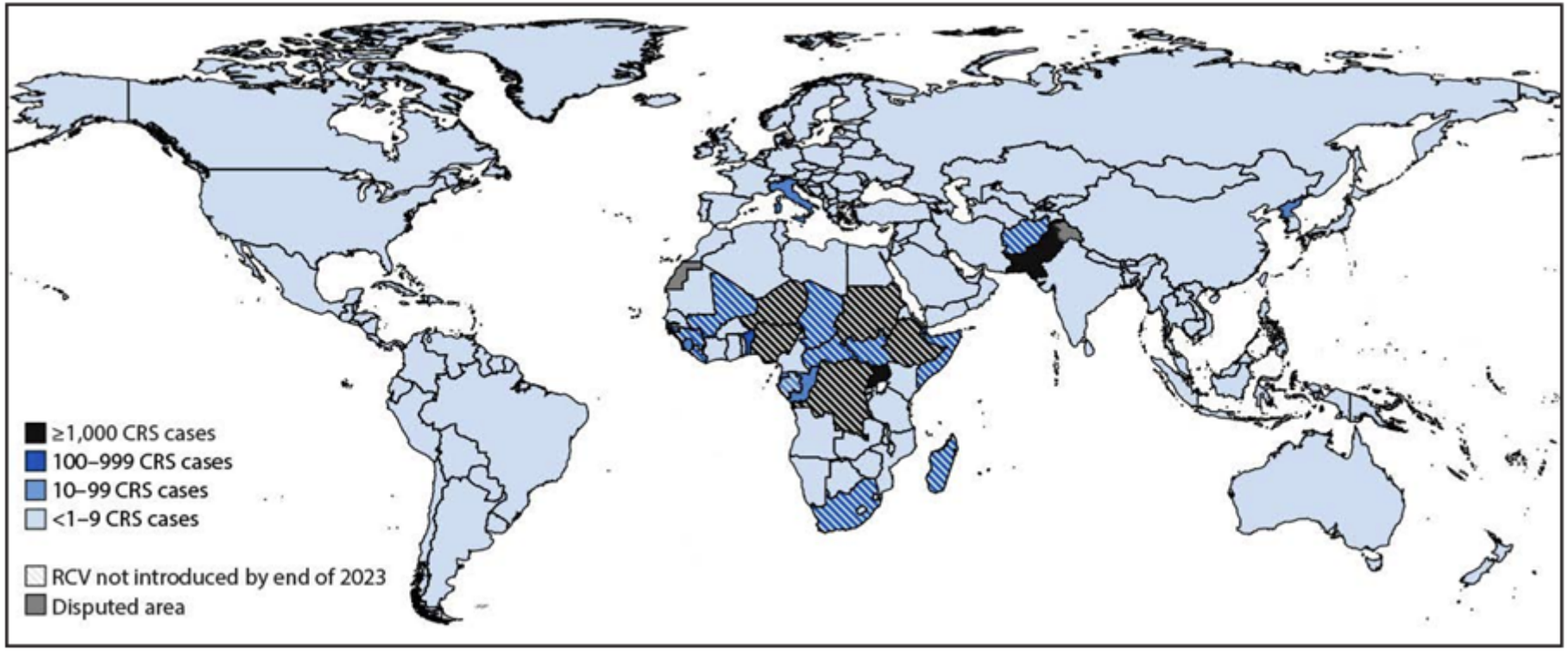


Fig. 1 Frequency of laboratory-confirmed rubella-specific immunoglobulin M antibody testing result by age and sex with a cumulative age distribution curve, 2017–2018, Liberia, $N = 472$ (6 months to 61 years old)

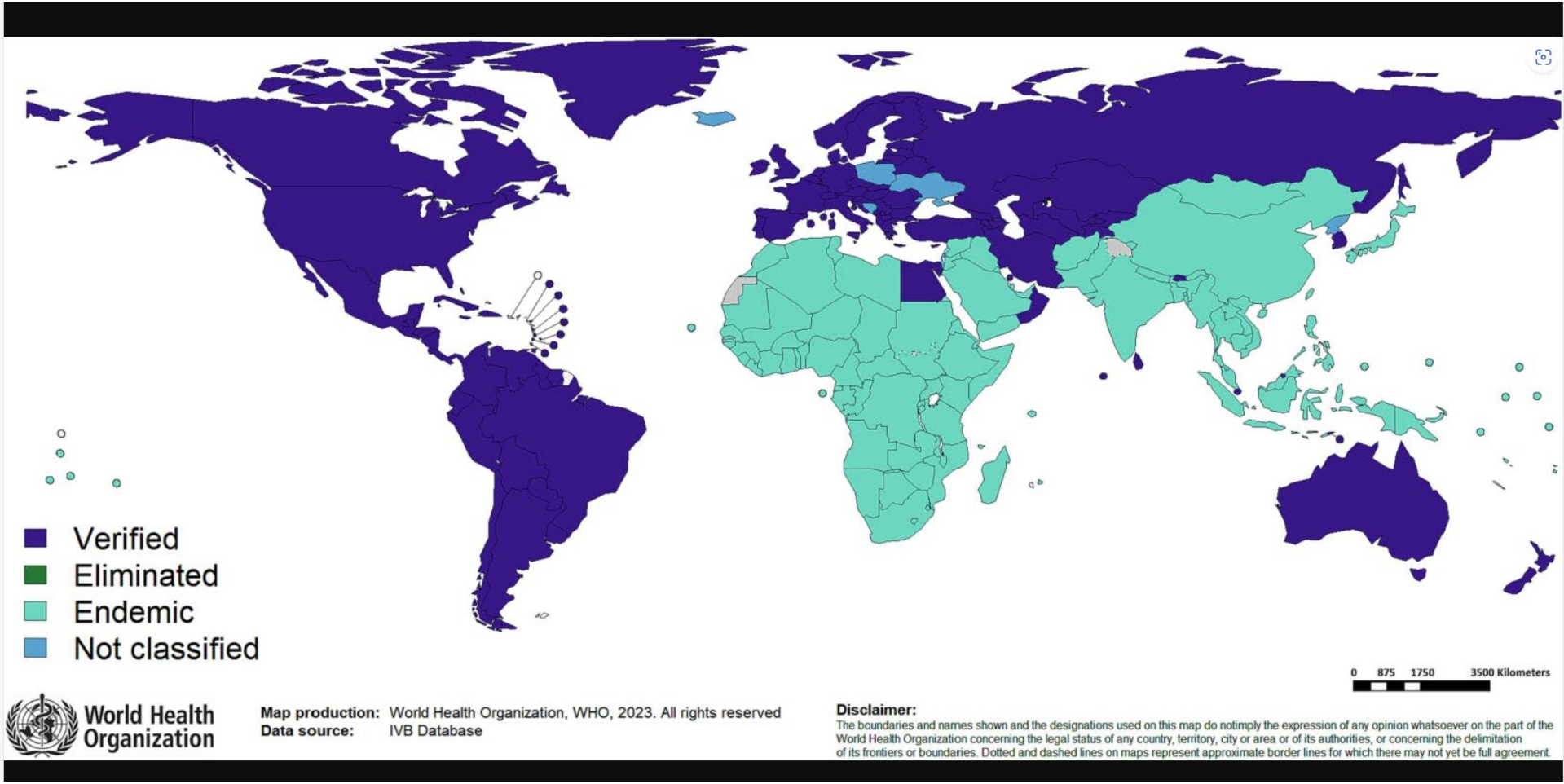
Woyessa AB, et al. *BMC Infect Dis*. 2019 Sep 18;19(1):813

Estimated number of congenital rubella syndrome cases, 2019 and introduction of rubella-containing vaccine, by country, 2023 - worldwide



Lebo, E., et al. *MMWR*, May 2025, 74;18

Status of Rubella Elimination



Reef SE, et al. *Vaccine*. 2023 Dec 7;41(50)