Session 5: Tuesday, February 9, 2021

Session 5a: Current and past Immunization Programs

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Learning Objectives

- Programs in resource-rich vs. resource-poor countries
- Examples of past & current immunization campaigns:
  - Polio, *Smallpox, Influenza, Ebola*

Table 1 Recommended Child and Adolescent Immunization Schedule for ages 18 years or younger, United States, 2020

These recommendations must be read with the notes that follow. For those who fall behind or start late, provide catch-up vaccination at the earliest opportunity as indicated by the green bars. To determine minimum intervals between doses, see the catch-up schedule (Table 2). School entry and adolescent vaccine age groups are shaded in gray.

Vaccine	Birth	1 mo	2 mos	4 mos	6 mos	9 mos	12 mos	15 mos	18 mos	19–23 mos	2–3 yrs	4–6 yrs	7–10 yrs	11–12 yrs	13–15 yrs	16 yrs	17–18 yrs
Hepatitis B (HepB)	1st dose	2nd dose			3rd dose												
Rotavirus (RV): RV1 (2-dose series), RV5 (3-dose series)			1st dose	2nd dose	See Notes												
Diphtheria, tetanus, acellular pertussis (DTaP <7 yrs)			1st dose	2nd dose	3rd dose			4th dose				5th dose					
Haemophilus influenzae type b (Hib)			1st dose	2nd dose	See Notes		3rd or 4th dose, See Notes										
Pneumococcal conjugate (PCV13)			1st dose	2nd dose	3rd dose		4th dose										
Inactivated poliovirus (IPV <18 yrs)			1st dose	2nd dose	3rd dose							4th dose					
Influenza (IIV)					Annual vaccination 1 or 2 doses								Annual vaccination 1 dose only				
or													or				
Influenza (LAIV)											Annual vaccination 1 or 2 doses		Annual vaccination 1 dose only				
Measles, mumps, rubella (MMR)					See Notes		1st dose					2nd dose					
Varicella (VAR)							1st dose					2nd dose					
Hepatitis A (HepA)					See Notes		2-dose series, See Notes										
Tetanus, diphtheria, acellular pertussis (Tdap ≥7 yrs)														Tdap			
Human papillomavirus (HPV)													*	See Notes			
Meningococcal (MenACWY-D ≥9 mos, MenACWY-CRM ≥2 mos)			See Notes											1st dose		2nd dose	
Meningococcal B													See Notes				
Pneumococcal polysaccharide (PPSV23)											See Notes						

Range of recommended ages for all children

Range of recommended ages for catch-up immunization

Range of recommended ages for certain high-risk groups

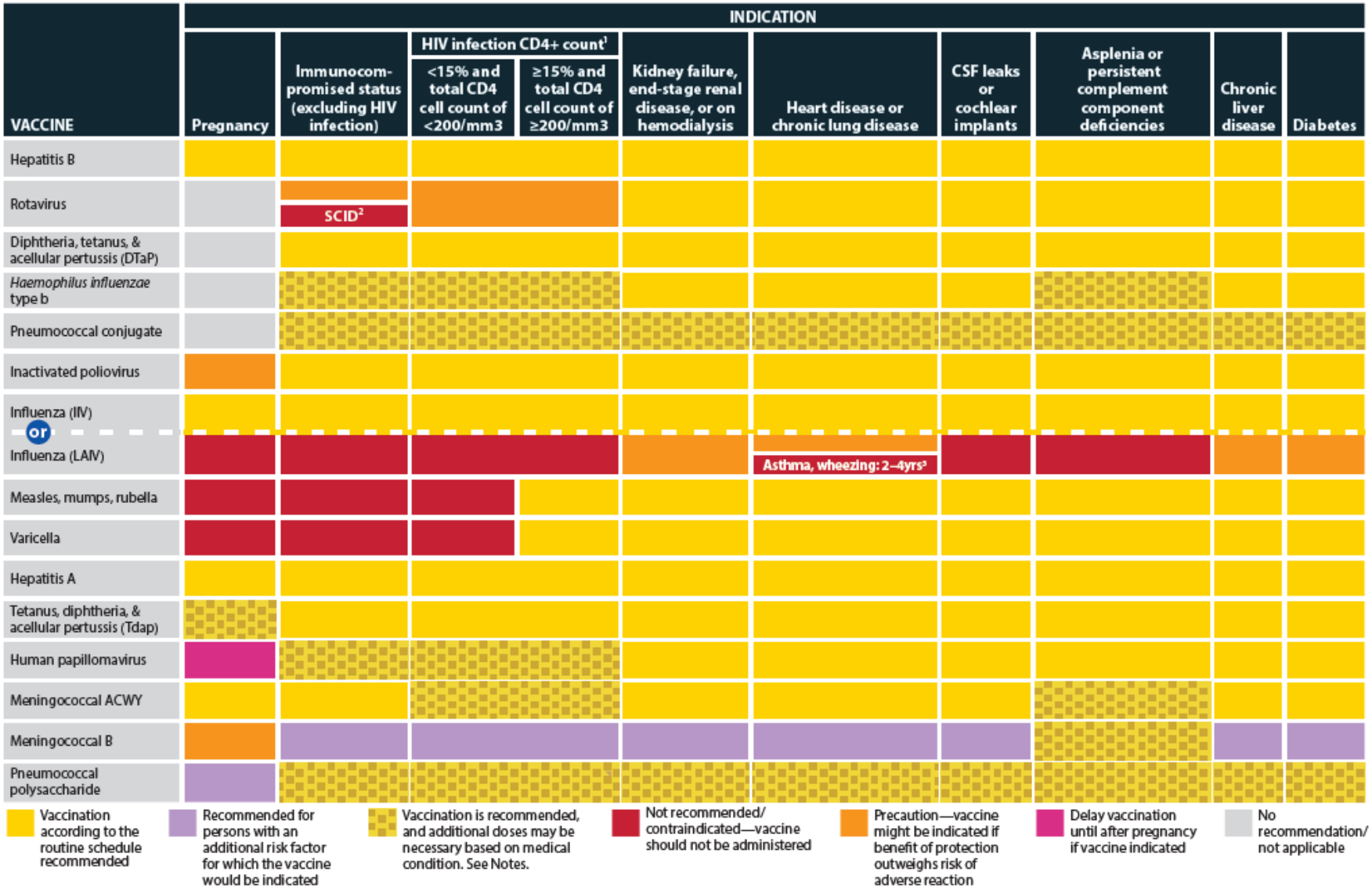
Recommended based on shared clinical decision-making or *can be used in this age group

No recommendation/ not applicable

https://www.cdc.gov/vaccines/schedules/downloads/child/0-18yrs-child-combined-schedule.pdf

Table 3 Recommended Child and Adolescent Immunization Schedule by Medical Indication, United States, 2020

Always use this table in conjunction with Table 1 and the notes that follow.



1 For additional information regarding HIV laboratory parameters and use of live vaccines, see the General Best Practice Guidelines for Immunization, "Altered Immunocompetence," at www.cdc.gov/vaccines/hcp/acip-recs/general-recs/immunocompetence.html and Table 4-1 (footnote D) at www.cdc.gov/vaccines/hcp/acip-recs/general-recs/contraindications.html.

2 Severe Combined Immunodeficiency

3 LAIV contraindicated for children 2–4 years of age with asthma or wheezing during the preceding 12 months.

https://www.cdc.gov/vaccines/schedules/downloads/child/0-18yrs-child-combined-schedule.pdf

Table 1 Recommended Adult Immunization Schedule by Age Group, United States, 2020

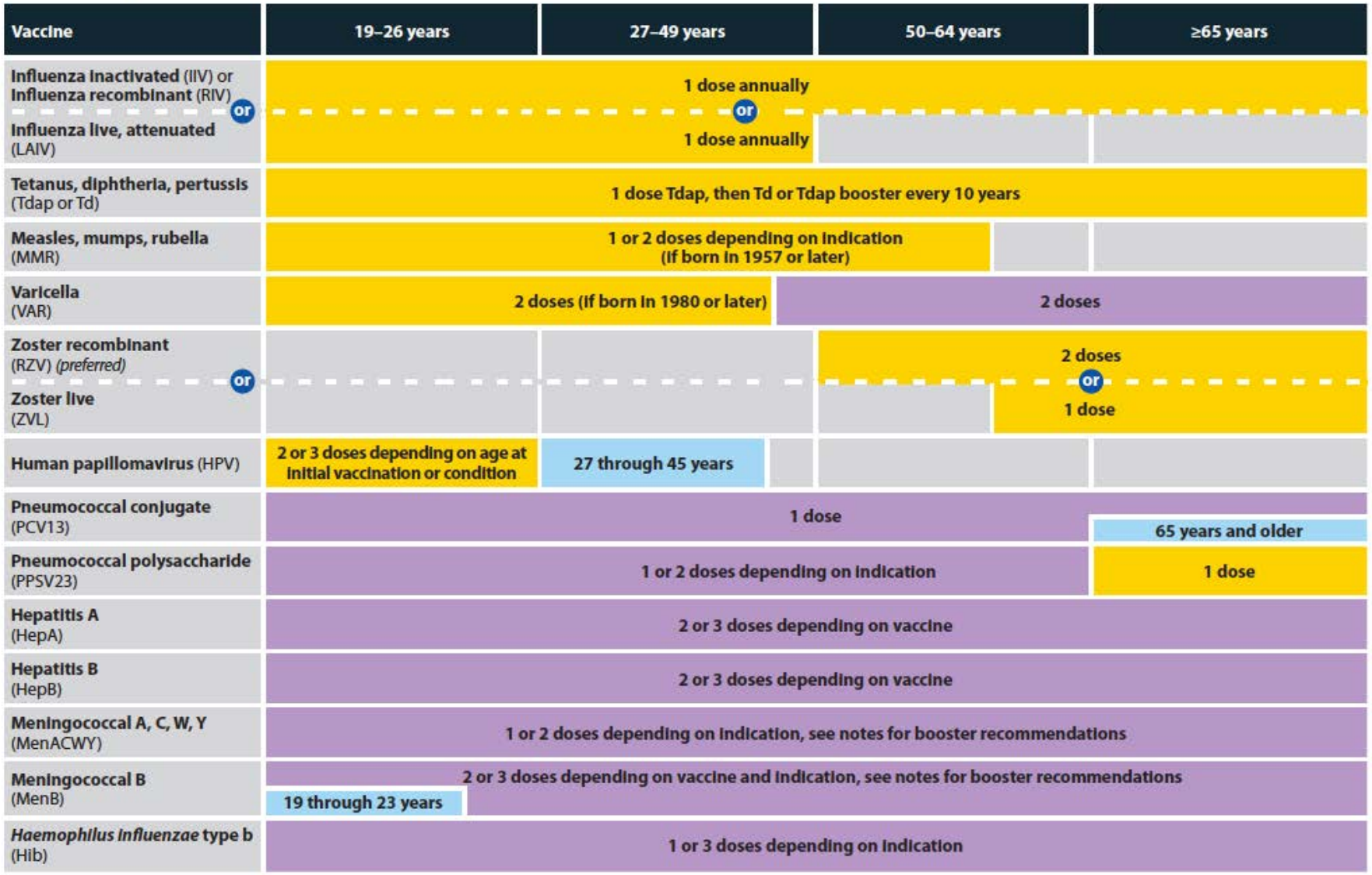


Table 2 Recommended Adult Immunization Schedule by Medical Condition and Other Indications, United States, 2020

Vaccine	Pregnancy	Immuno-compromised (excluding HIV infection)	HIV infection CD4 count <200	HIV infection CD4 count ≥200	Asplenia, complement deficiencies	End-stage renal disease; or on hemodialysis	Heart or lung disease, alcoholism[1]	Chronic liver disease	Diabetes	Health care personnel[2]	Men who have sex with men
IIV or RIV	1 dose annually										
or										or	
LAIV	NOT RECOMMENDED						PRECAUTION			1 dose annually	
Tdap or Td	1 dose Tdap each pregnancy	1 dose Tdap, then Td or Tdap booster every 10 years									
MMR	NOT RECOMMENDED	1 or 2 doses depending on indication									
VAR	NOT RECOMMENDED	2 doses									
RZV *(preferred)*	DELAY				2 doses at age ≥50 years						
or					or						
ZVL	NOT RECOMMENDED				1 dose at age ≥60 years						
HPV	DELAY	3 doses through age 26 years			2 or 3 doses through age 26 years						
PCV13		1 dose									
PPSV23		1, 2, or 3 doses depending on age and indication									
HepA	2 or 3 doses depending on vaccine										
HepB	2 or 3 doses depending on vaccine										
MenACWY	1 or 2 doses depending on indication, see notes for booster recommendations										
MenB	PRECAUTION	2 or 3 doses depending on vaccine and indication, see notes for booster recommendations									
Hib		3 doses HSCT[3] recipients only			1 dose						

- Recommended vaccination for adults who meet age requirement, lack documentation of vaccination, or lack evidence of past infection
- Recommended vaccination for adults with an additional risk factor or another indication
- Precaution—vaccination might be indicated if benefit of protection outweighs risk of adverse reaction
- Delay vaccination until after pregnancy if vaccine is indicated
- Not recommended/ contraindicated—vaccine should not be administered
- No recommendation/ Not applicable

1. Precaution for LAIV does not apply to alcoholism. **2.** See notes for influenza; hepatitis B; measles, mumps, and rubella; and varicella vaccinations. **3.** Hematopoietic stem cell transplant.

General Best Practice Guidelines for Immunization

BEST PRACTICES GUIDANCE OF THE ADVISORY COMMITTEE ON IMMUNIZATION PRACTICES (ACIP)

Ezeanolue E, Harriman K, Hunter P, Kroger A, Pellegrini C

https://www.cdc.gov/vaccines/hcp/acip-recs/general-recs/downloads/general-recs.pdf

W.H.O. Expanded Program on Immunization (EPI)

- **1974: established to provide guidance & support**
  - Improve vaccine delivery & make vaccines available for all children
- **1984: standard immunization schedule on the basis of a review of immunological data for the original EPI vaccines:**
  - BCG, DTP, oral polio, and measles
- **2002: Reaching Every District strategy (RED):**
  - Achieve 80 % coverage rate of DTP3 in 80% of districts
  - Use immunization contacts to deliver other high-priority child health interventions.

Table 1: Summary of WHO Position Papers - Recommendations for Routine Immunization

(updated: September 2020)

Antigen		Children (see Table 2 for details)		Adolescents	Adults	Considerations (see footnotes for details)
Recommendations for all immunization programmes						
BCG[1]		1 dose				Birth dose and HIV; Universal vs selective vaccination; Co-administration; Vaccination of older age groups Pregnancy
Hepatitis B[2]		3-4-doses (see footnote for schedule options)		3 doses (for high-risk groups if not previously immunized) (see footnote)		Birth dose Premature and low birth weight Co-administration and combination vaccine Definition high-risk
Polio[3]		3-4 doses (at least one dose of IPV) with DTPCV				bOPV birth dose Type of vaccine Transmission and importation risk criteria
DTP-containing vaccine (DTPCV)[4]		3 doses	2 boosters 12-23 months (DTPCV) and 4-7 years (Td/DT containing vaccine, see footnote)	1 booster 9-15 yrs (Td)		Delayed/interrupted schedule Combination vaccine Maternal immunization
***Haemophilus influenzae type b*[5]**	**Option 1**	3 doses, with DTPCV				Single dose if > 12 months of age Not recommended for children > 5 yrs old Delayed/interrupted schedule Co-administration and combination vaccine
	Option 2	2 or 3 doses, with booster at least 6 months after last dose				
Pneumococcal (Conjugate)[6]	**Option 1**	3 primary doses (3p+0) with DTPCV				Schedule options (3p+0 vs 2p+1) Vaccine options HIV+ and preterm neonate booster
	Option 2	2 primary doses plus booster dose at 9-18 mos of age (2p+1) with DTPCV				
Rotavirus[7]		2-3 doses depending on product with DTPCV				Vaccine options Not recommended if > 24 months old
Measles[8]		2 doses				Combination vaccine; HIV early vaccination; Pregnancy
Rubella[9]		1 dose (see footnote)		1 dose (adolescent girls and women of child-bearing age if not previously vaccinated; see footnote)		Achieve and sustain 80% coverage Combination vaccine and Co-administration Pregnancy
HPV[10]				2 doses (females)		Target 9-14 year old girls; Multi-age cohort vaccination; Pregnancy Older age groups ≥ 15 years 3 doses HIV and immunocompromised

Refer to http://www.who.int/immunization/documents/positionpapers/ for most recent version of this table and position papers.

This table summarizes the WHO child vaccination recommendations. It is designed to assist the development of country specific schedules and is not intended for direct use by health care workers. Country specific schedules should be based on local epidemiologic, programmatic, resource and policy considerations.

https://www.who.int/publications/m/item/table-1-who-recommendations-for-routine-immunization

(updated: September 2020)

Table 1: Summary of WHO Position Papers - Recommendations for Routine Immunization

Antigen		Children (see Table 2 for details)	Adolescents	Adults	Considerations (see footnotes for details)
Recommendations for certain regions					
Japanese Encephalitis[11]		*Inactivated Vero cell-derived vaccine:* generally 2 doses *Live attenuated vaccine:* 1 dose *Live recombinant vaccine:* 1 dose			Vaccine options and manufacturer's recommendations; Pregnancy; Immunocompromised
Yellow Fever[12]		1 dose, with measles containing vaccine			
Tick-Borne Encephalitis[13]		3 doses (> 1 yr FSME-Immun and Encepur; > 3 yrs TBE-Moscow and EnceVir) with at least 1 booster dose (every 3 years for TBE-Moscow and EnceVir)			Definition of high-risk Vaccine options; Timing of booster
Recommendations for some high-risk populations					
Typhoid[14]		*Typhoid conjugate vaccine (Typbar-TCV®):* 1 dose; *Vi polysaccharide(ViPS):* 1 dose; *Ty21a live oral vaccine:* 3-4 doses (see footnote); *Revaccination for ViPS & Ty21a; every 3-7 years*			Definition of high-risk Vaccine options
Cholera[15]		*Dukoral (WC-rBS)*: 3 doses ≥ 2-5 yrs, booster every 6 months; 2 doses adults/children ≥ 6 yrs, booster every 2nd year; *Shanchol, Euvchol & mORCVAX*: 2 doses ≥1 yrs, booster dose after 2 yrs			Minimum age Definition of high-risk
Meningococcal[16]	**MenA conjugate**	1 dose 9-18 months (5µg)			2 doses if < 9 months with 8 week interval
	MenC conjugate	2 doses (2-11 months) with booster 1 year after 1 dose (≥12 months)			Definition of high-risk; Vaccine options
	Quadrivalent conjugate	2 doses (9-23 months) 1 dose (≥2 years)			
Hepatitis A[17]		At least 1 dose ≥ 1 year of age			Level of endemicity; Vaccine options; Definition of high risk groups
Rabies[18]		2 doses			PrEP vs PEP; definition of high risk; booster
Dengue (CYD-TDV)[19]		3 doses 9-45 years of age			Minimize risk of vaccine among seronegative individuals by pre-vaccination screening;Pregnancy & lactation
Recommendations for immunization programmes with certain characteristics					
Mumps[20]		2 doses, with measles containing vaccine			Coverage criteria > 80% Combination vaccine
Seasonal influenza (inactivated tri- and qudri-valent)[21]		First vaccine use: 2 doses Revaccinate annually: 1 dose only (see footnote)	Priority for pregnant women 1 dose ≥ 9 years of age Revaccinate annually		Priority risk groups Lower dosage for children 6-35 months
Varicella[22]		1 - 2 doses	2 doses		Achieve & sustain ≥ 80% coverage Pregnancy Co-administration with other live vaccines

https://www.who.int/publications/m/item/table-1-who-recommendations-for-routine-immunization

W.H.O. Expanded Program on Immunization (EPI)

- Most developing countries:
  - Immunizations provided through a system of fixed facilities at different levels of the health system
  - Immunization campaigns are discrete, time-limited efforts at national or subnational levels:
    - Usually focus on specific antigens
  - Mobile strategies: specialized vehicles to transport health professionals/vaccines to to remote/migrating populations.

Vaccines included in the EPI

- The original six given to young children:
  - diphtheria, tetanus, pertussis, measles, polio, and tuberculosis
- The past decade, new & underused vaccines added :
  - Hepatitis B, *Haemophilus influenzae type b (Hib), mumps, pneumococcal disease,* rotavirus, rubella, and – in countries where needed – yellow fever and Japanese encephalitis.
- If all countries immunize 90% of children ≤ 5 yrs with these vaccines:
  - Immunization could prevent an additional two million deaths a year in this age group

≈ 20% of children born do not get complete 1st year of life scheduled immunizations

- Underlying weakness of health systems in many developing countries:
  - Independent silos of care & responsibility
  - Functional vaccine regulatory system in only 20% of developing countries ➜ WHO Prequalification System
- Difficulty in delivering vaccines through an overloaded infrastructure and logistical support system
- Lack of understanding about the importance of vaccines – especially among the poorest populations
  - False or unsubstantiated rumors about vaccine safety:
    - Need for efficient post-licensing safety surveillance
    - WHO Global Advisory Committee on Vaccine Safety

≈ 20% of children born do not get complete 1st year of life scheduled immunizations

- Projected shortfall in funding needed to reach global immunization-related goals
  - Annual expenditure in developing countries per live birth:
    - 1980s ➔2000 ➔ 2010 ➔ Near future

      $3.5 $6 $18 $≥30
    - GIVS* goals/ 117 low- & lower-middle-income States between 2006 and 2015: $76 billion, 40% paid by national governments
- Supplier Issues:
  - Divergence/ vaccines used in developed & resource poor countries: IPV vs. OPV & PCV vs. no PCV
  - Decreased number of manufacturers:
    - WHO/UNICEF Vaccine Security Strategy: specific procurement strategies & ensuring that accurate forecasting, timely funding, & appropriate contracts in place

***Global Immunization Vision & Strategy**

Global Immunization Vision & Strategy (GIVS) for 2006 - 2015, WHO/ UNICEF, 2005

- **Increase coverage on/before 2010**:
  - Countries will reach ≥ 90% national vaccination coverage and
  - ≥ 80% coverage in every district
- **Reduce measles mortality** by 90% compared to the 2000 level

Global Immunization Vision and Strategy (GIVS) for the decade 2006 to 2015 WHO & UNICEF, 2005

By 2015 or earlier:

- Sustain coverage reached in 2010
- Reduce global childhood morbidity and mortality due to vaccine-preventable diseases by at least two thirds compared to 2000 levels
- Ensure access to vaccines of assured quality
- Offer newly introduced vaccines to the entire eligible population within five years of the introduction into national programs

Global Immunization Vision and Strategy (GIVS) for the decade 2006 to 2015, WHO & UNICEF, 2005

By 2015 or earlier:

- Ensure capacity for surveillance and monitoring:
  - Conduct case-based surveillance of vaccine preventable diseases at all levels, with lab confirmation as needed: polio as the template
- Strengthen systems:
  - National immunization plans as an integral component of sector-wide plans for human resources, financing and logistics
- Assure sustainability:
  - National immunization plans will have been formulated, costed and implemented so as to ensure that human resources, funding and supplies are adequate

Global Alliance for Vaccine Initiatives (GAVI)

- 1999: WHO, UNICEF, World Bank, donors, Gates & Rockefeller Foundations, manufacturers, & NGOs
  - Increase access to new/ underused vaccines in poorest countries (GNI <$1,000 per capita):
    - Progressive country contribution based in GNI
  - Improve access to basic immunization services
  - Accelerate R & D for new vaccines & delivery technology
  - Raised ≥ $1.3 billion with ≥ $3 billion pledged over next 10 yrs

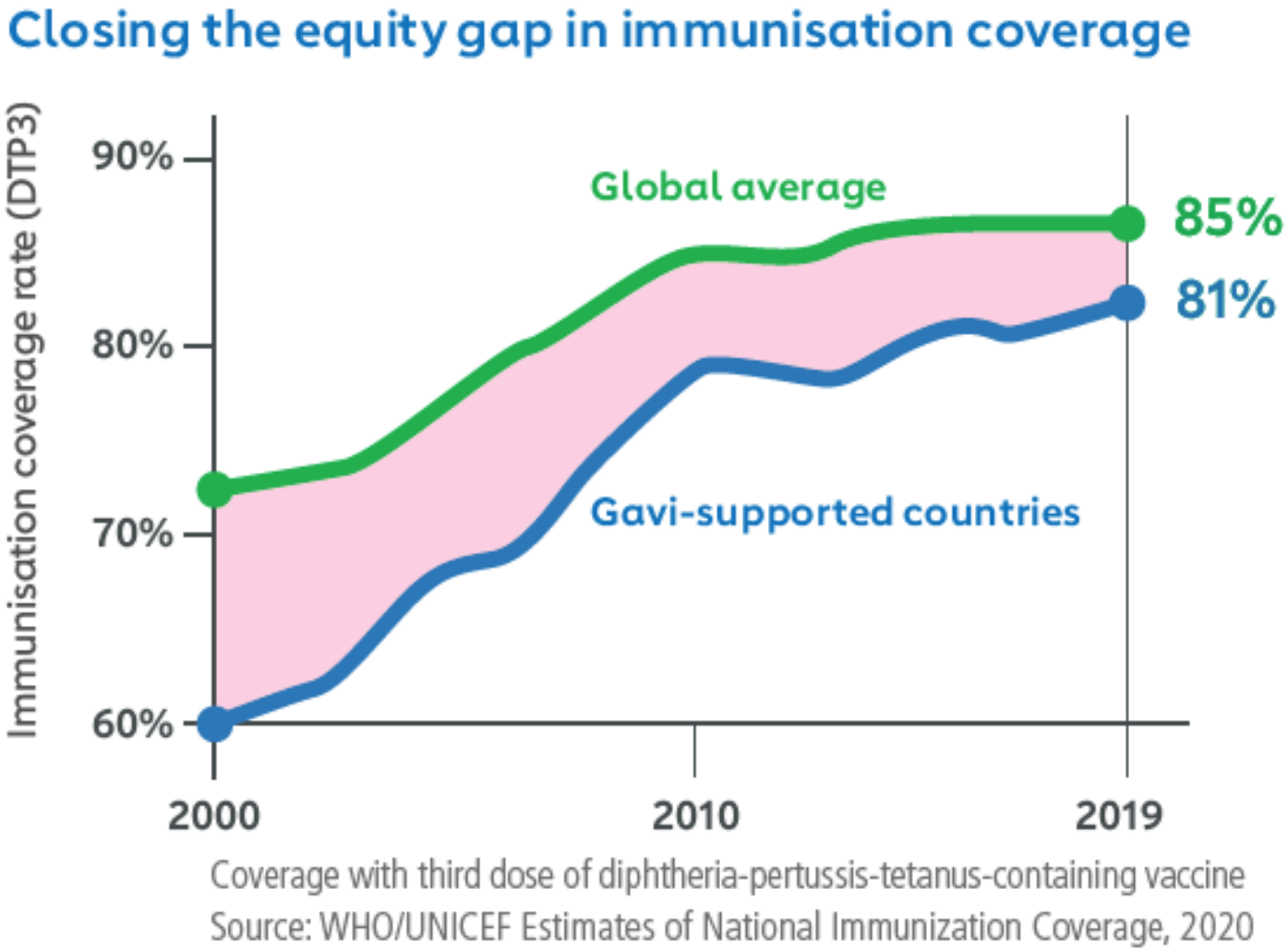
Global Alliance for Vaccine Initiatives (GAVI)

- Additional children vaccinated, 2000 to 2003:
  - 4 million with DTP3
  - 42 million with Hepatitis B
  - ≈ 5 million with Hib
  - ≥ 3 million with Yellow Fever vaccine
- 2nd Phase/ 2006-2015:
  - Rotavirus & pneumococcal vaccines
- Possible future support:
  - ***HPV***, Japanese encephalitis, rubella, typhoid

Linking Interventions for Greater Impact

- Use any & every contact with a child in a health centre to check the child's (and mother's) immunization status and to vaccinate if needed.
  - Since 2001, routine and supplementary polio and measles immunization activities have been used to deliver **insecticide-treated bed nets**
  - In 2008, Measles SIAs used to distribute ≥ 35 million doses of **vitamin A**, 30 million doses of **deworming medicine**, ≥5.6 million **insecticide-treated bed nets**
  - Use distribution of Rotavirus & Conjugate Pneumococcal vaccines as opportunity to introduce/ educate on **other measures to control diarrheal & respiratory diseases**

GAVI


Closing the equity gap in immunisation coverage
Immunisation coverage rate (DTP3)
90%
80%
70%
60%
Global average
85%
81%
Gavi-supported countries
2000
2010
2019
Coverage with third dose of diphtheria-pertussis-tetanus-containing vaccine
Source: WHO/UNICEF Estimates of National Immunization Coverage, 2020

MISSION INDICATORS 2016–2020

Vaccine Alliance partners and countries are making great strides towards achieving our five mission indicators. By the end of 2019, we were on track to reach all our 2020 targets.

2020 target: **300m**

2015: **n/a**

2019: **65m**

Children immunised

259m

The number of children immunised with the last recommended dose of a Gavi-supported vaccine delivered through routine systems.[a] People immunised through campaigns and supplementary immunisation activities are not included.

2019 performance: Countries immunised an additional 65 million children with Gavi support in 2019, often with more than one vaccine. This is an increase from the 64 million children reached in 2018, and the Vaccine Alliance is on track to help countries immunise an additional 300 million children in the 2016–2020 period. From 2016–2019, 259 million unique children were immunised.

a – To not double-count recipients of more than one vaccine, we only take into account the vaccine with the highest coverage level per country.

2020 target: **5–6m**

2015: **n/a**

2019: **1.5m**

Future deaths prevented

5.4m

The number of future deaths prevented as a result of vaccination with Gavi-funded vaccines in the countries we support.

2019 performance: Countries prevented approximately 1.5 million future deaths in 2019 with Gavi-supported vaccines. Together with the approximately 1.5 million deaths averted in 2018, this puts us on track to help countries avert 5–6 million future deaths in the 2016–2020 period.

2015: **63/1,000**

2020 target: **57/1,000**

Under-five mortality rate

2018: **57/1,000**

2019 data available: **Q4 2020**

The average probability of a child born in any of the Gavi-supported countries dying before they reach the age of five.

2019 performance: The under-five mortality rate fell from 59 to 57 deaths per 1,000 live births between 2017 and 2018, putting us on track to reach our target of 57 deaths per 1,000 live births by the end of 2020. Estimates for 2019 will be available in late 2020.

2020 target: **250m**

2015: **n/a**

2019: **74m**

Future DALYs averted

255m

The number of future disability-adjusted life years (DALYs) averted as a result of vaccination with Gavi-supported vaccines. DALYs measure the number of healthy years lost due to disability or premature death.

2019 performance: Countries averted approximately 74 million DALYs in 2019 with Gavi support, having averted approximately 66 million in 2018. We have exceeded our target of 250 million DALYs averted by 2020.

2020 target: **100%**

2015: **n/a**

2019: **100%**

Vaccines sustained after Gavi support ends

100%

The percentage of countries that continue to deliver all recommended vaccines included in their routine programmes after they transition out of Gavi financing. This indicator covers all vaccines recommended by national authorities for routine immunisation, not only those supported by Gavi.

2019 performance: All transitioned countries (100%) continued to deliver all their recommended routine vaccination programmes throughout 2019.

COVAX

GAVI initiative with support from the **Coalition for Epidemic Preparedness Innovations (CEPI), WHO, industry partners, UNICEF, the World Bank** and **others:**

- An “antidote to vaccine nationalism – with a belief that, in a pandemic, no one is safe unless everyone is safe.”
- Backing the development and at-risk manufacturing of a large, diverse portfolio of COVID-19 vaccines in order to increase the chances for all countries, regardless of income level, to get access to vaccines and have sufficient doses to end this crisis.
- The Gavi COVAX Advance Market Commitment (AMC), a building block of the COVAX Facility, supports the participation of 92 low- and middle-income economies, plus other IDA*-eligible economies.

*The International Development Association, World Bank

Polio, USA
1920s to 1950s

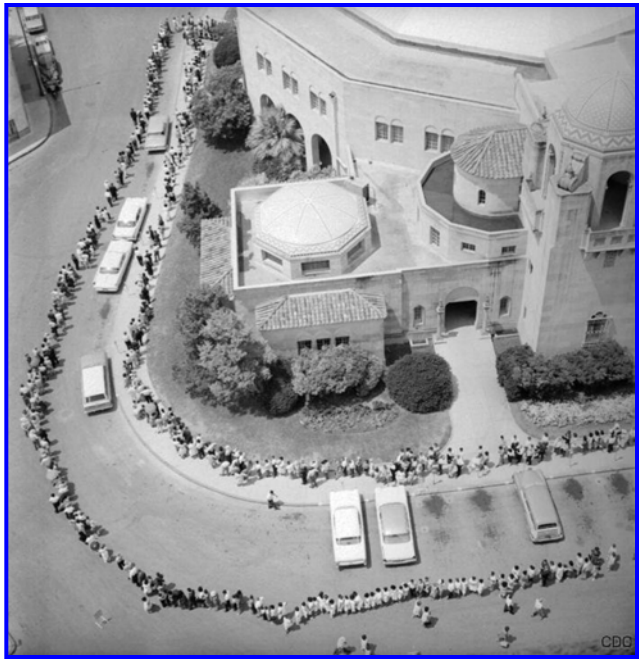
Rancho Los Amigos Hospital, California,1953

Franklin Roosevelt contracts Polio in 1921

Polio Timeline, The Americas

- **1950's**: Major Polio U.S. Epidemics (18,000 AFP/yr.)
- **1955:** Introduction of Salk IPV
- **1960:** 2,525 cases
- **1961-3:** Introduction of Sabin OPV, TOPV
- **1965:** 61 cases; 1973: 7 cases
- **Last U.S. epidemics:**
  - **1970** (Texas/Mexican border)
  - **1972 & 1979:** Outbreaks in religious groups who refused vaccination ('79 outbreak← Netherlands ← Turkey)
- **1980-94:** 4-8 VAPP's + 1 imported case per year
- **1991:** Last documented indigenous wild-type AFP (Peru)
- **1994:** Americas certified as free of wild-type polio viruses

Mass Polio Vaccination Campaigns



Columbus, Georgia, 1961

San Antonio, Texas, 1962

The Global Polio Eradication Initiative

- In 1988, the 41st World Health Assembly adopted a resolution for the worldwide eradication of polio.
  - spearheaded by national governments, WHO, Rotary International, the US Centers for Disease Control and Prevention, UNICEF, and later the Bill & Melinda Gates Foundation and GAVI, the Vaccine Alliance.

Why is the global eradication of poliovirus possible ?

- There are 2 highly effective vaccines available
- There is no significant animal reservoir
- There are only 3 wild-type virus serotypes and they are immunologically stable
- TOPV is inexpensive and easy to administer
- eIPV may be effective after fewer doses than IPV/OTPV
- Potential confounding factors:
  - OPV is less efficacious in tropical climates
  - IPV is expensive & more difficult to administer
  - Politics, war, poverty……

Polio Timeline, World-wide

- Parts of Asia, Africa, Europe:
  - Prior to 1985: estimated > 400,000 AFP cases annually
  - 1994: estimated 107,000 AFP cases
  - Original target for world-wide eradication:
    - 2000, 2010, 2020?
  - Routine immunization
    - 3 TOPV's in 1st year of life
  - National Immunization days
    - 2 TOPV's to all children ≤ 5 years of age
  - Mopping up Campaigns
  - Surveillance for cases of AFP
- 1999: Wild-type serotype 2 last detected in India

Poliomyelitis:
Emergency Action Plan

- Intensified focus on worst-performing areas of Nigeria, Pakistan and Afghanistan to increase vaccination coverage by end of 2012 to levels needed to stop transmission
- New approaches tailored to each country to tackle persistent challenges and improve polio vaccination campaign performance
- Heightened accountability, coordination and oversight to ensure success at every level of government and within every partner agency and organization
- Surge of technical assistance and social mobilization capacity

http://www.polioeradication.org/Resourcelibrary/Strategyandwork/EmergencyActionPlan.aspx

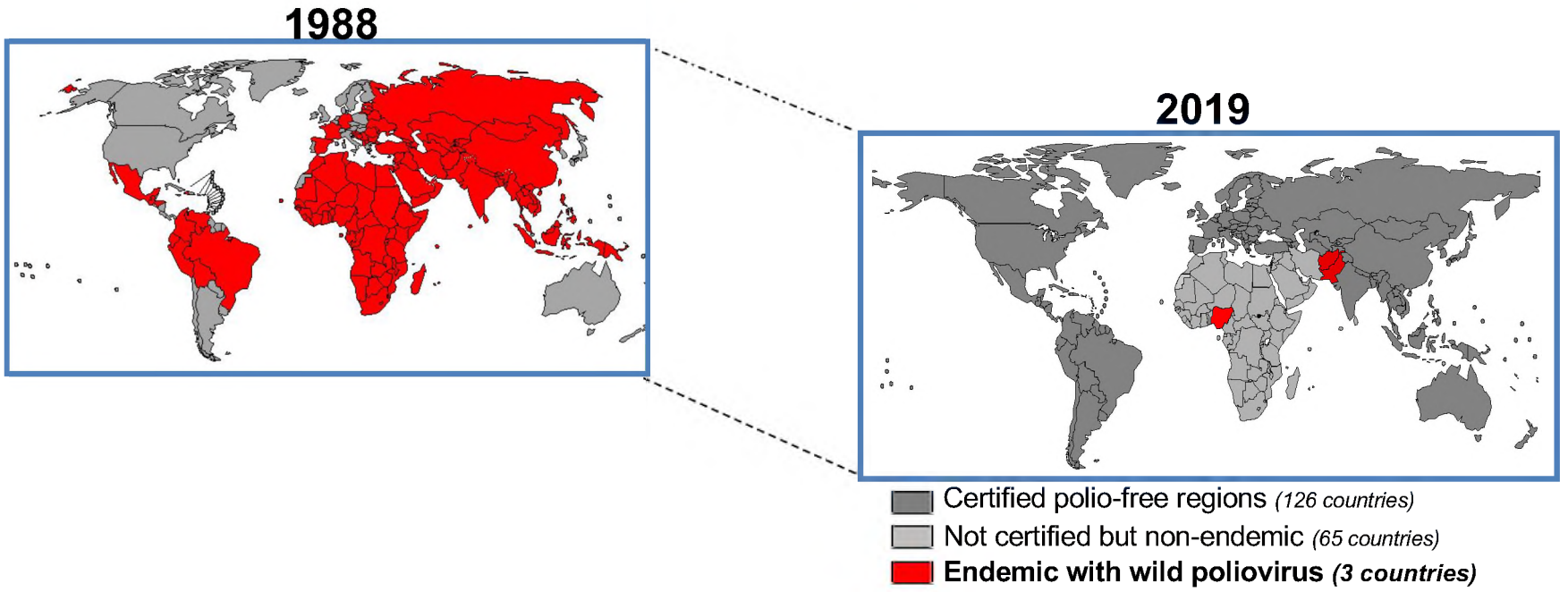
Outbreak of Vaccine-associated Poliomyelitis Dominican Republic and Haiti, 2000-2001

- July 12 - February 8, 2001
- Dominican Republic:
  - 33 persons with acute flaccid paralysis
  - 14 were unvaccinated, 5 inadequately vaccinated
  - 12 lab-confirmed poliovirus vaccine type 1 (14 as of 6/18/01)
  - 11/12 (92%) ≤ 6 years (9 months-14 years)
  - Date of onset for last case: Jan. 2, 2001
- Haiti:
  - 3 persons with acute flaccid paralysis
  - 1 lab-confirmed poliovirus type (6 as of 6/18/01)
  - 1/1 in an inadequately vaccinated 2 year old child

Proposed mechanism of OPV reversion back to wild-type neurovirulence

- **Error rates/ poliovirus replicase**: 10^{-4} - 10^{-5} per site per replication
  - Progeny of a single infected cell are heterogeneous
- **Recombination with**:
  - Variant resulting from replicase errors
  - The other two OPV strains & (wild-type polioviruses)
  - Non-polio enteroviruses
  - ex: 1991, Northern provinces /China:
    - Recombinant Sabin/ wild-type-1 strain containing a 375 nt sequence identical to that of Sabin-1 strain
    - Sequence divergence & spread to rest of China by 1993-4
- **Polioviruses evolve rapidly and at a uniform rate** during replication in the human gut

Polio Eradication Progress, 1988 – 2019

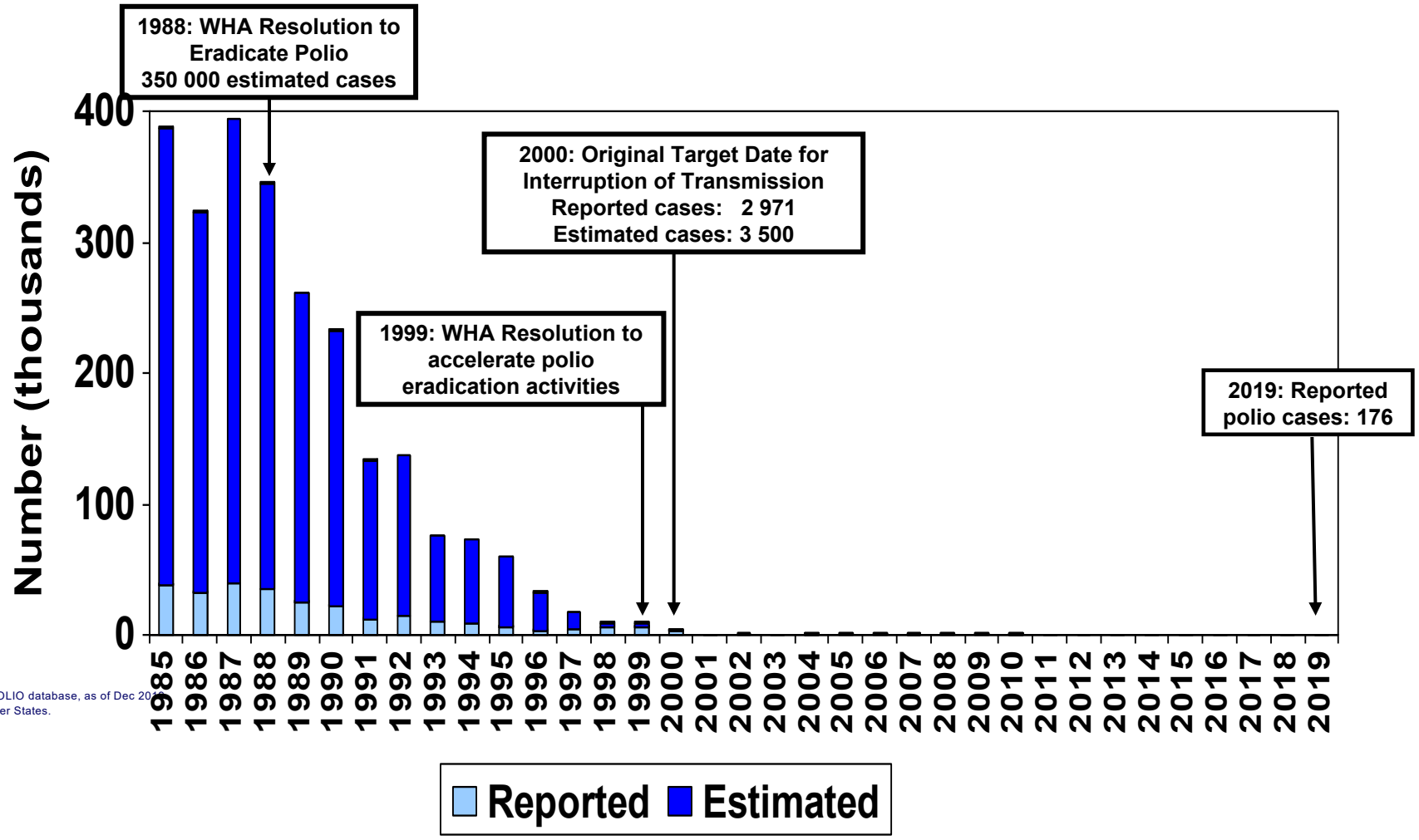


(Nigeria & African region declared WPV free August 25, 2020)

Source: WHO/POLIO database, as of Dec 2019.
194 WHO Member States.

https://www.who.int/immunization/monitoring_surveillance/data/en/

Progress in Polio Eradication, Estimated and Reported Polio Cases, 1985-2019



Source: WHO/POLIO database, as of Dec 2019
194 WHO Member States.

https://www.who.int/immunization/monitoring_surveillance/data/en/

2012

World Health Organization

Media centre

India records one year without polio cases

One year polio free in India is a major achievement; the country was once the world's epicentre of polio

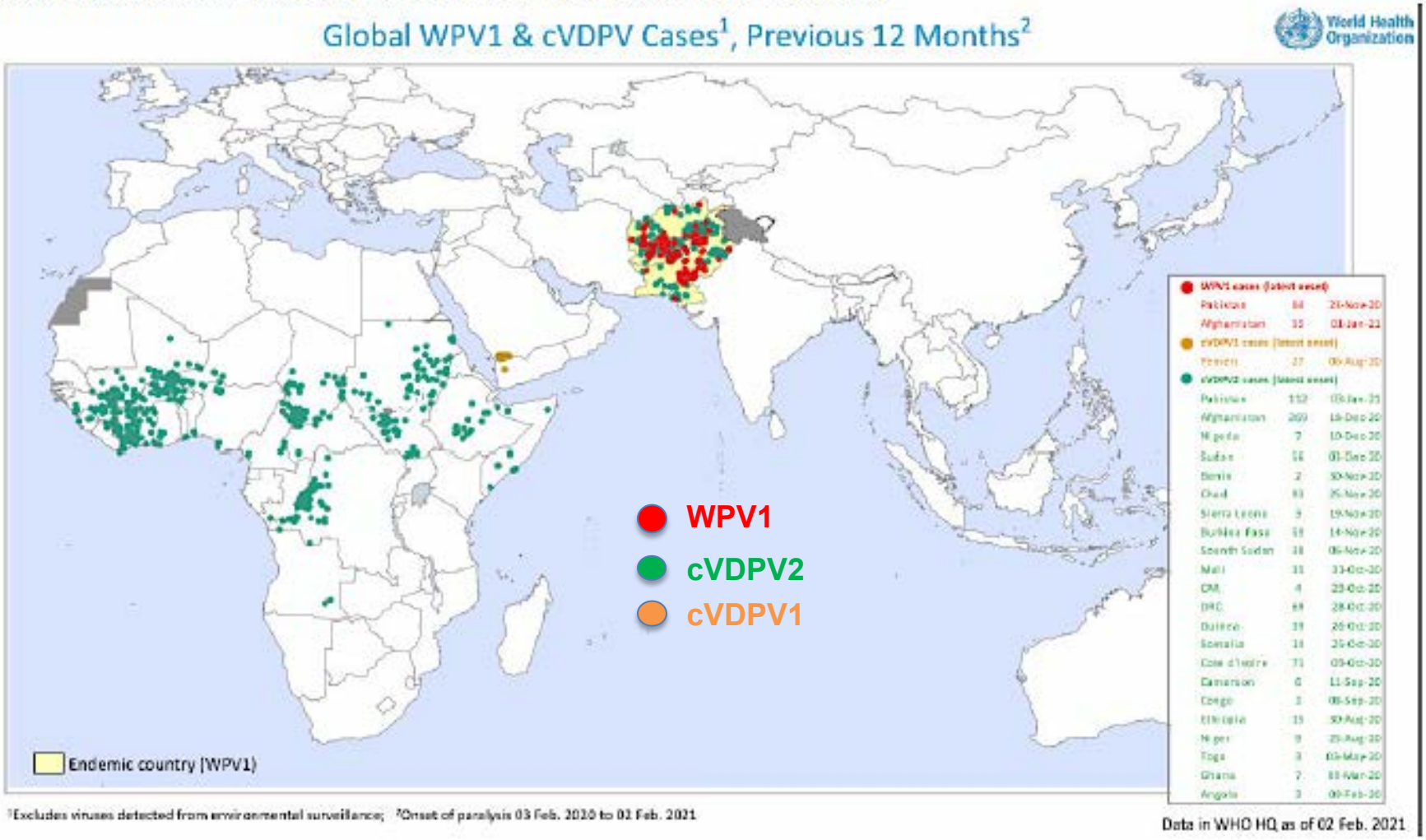
News release

12 JANUARY 2012 I ATLANTA/EVANSTON/GENEVA/NEW YORK/SEATTLE - India appears to have interrupted wild poliovirus transmission, completing one year without polio since its last case, in a 2-year-old girl in the state of West Bengal, on 13 January 2011.

India was once recognized as the world's epicentre of polio. If all pending laboratory investigations return negative, in the coming weeks India will officially be deemed to have stopped indigenous transmission of wild poliovirus. The number of polio-endemic countries, those which have never stopped indigenous wild poliovirus transmission, will then be reduced to a historical low of three: Afghanistan, Nigeria and Pakistan.

Polio Now

A map showing the latest number of WPV1 and cVDPV cases in each affected country



https://polioeradication.org/polio-today/polio-now/

Polio Situation, 2020

- **Oct. 1999:** last wild-type poliovirus type 2 detected worldwide (India)
- **Jan. 2011:** last wild-type poliovirus in India
- **Nov. 2012**: last wild-type poliovirus type 3 detected worldwide (Nigeria)
- **March 2014:** entire South East Asia region certified polio free
- **Sept. 2015: wild-type 2 declared eradicated**
- **April, 2016:** switch from trivalent to bivalent

When can we stop vaccinating against polio?

- Criteria:
  - Decline in AFP cases to background rates
  - No wild-type polio-virus isolated from AFP cases
  - Reduction in wild-type virus sequence heterogeneity
  - Eradication of all wild-type polioviruses from the human pool
- Then what do we do?

Options for the end game?

- Immediate discontinuation of all live OPV vaccines
- Region by region discontinuation ?
- A global immunization day with OPV followed by immediate discontinuation ?
- **Intermediate phase of global use of IPV or eIPV, followed by discontinuation of all polio vaccines ?**

Questions?