University of Otago
ŌTĀKOU WHAKAIHU WAKA

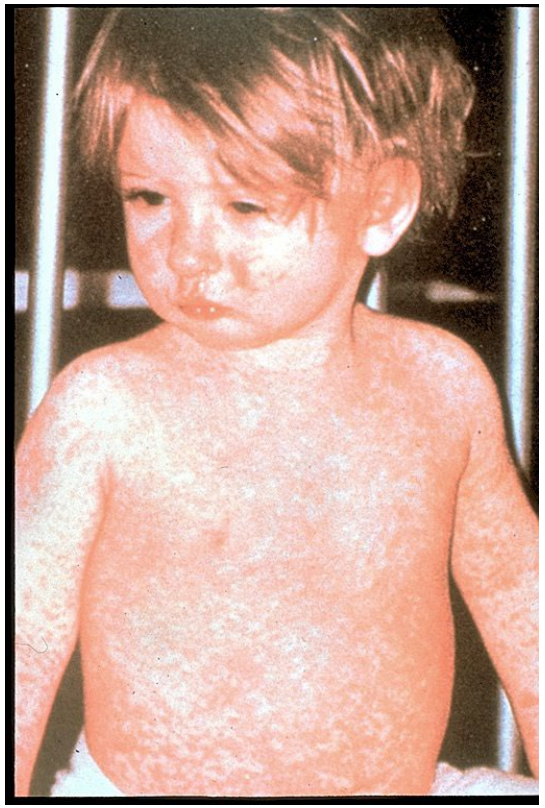
# The long road to zero



**Peter McIntyre**
**Professor**
**Department of Paediatrics and Child Health**
**Faculty of Medicine – Dunedin**

# What do the pictures on Left and Right have in common?















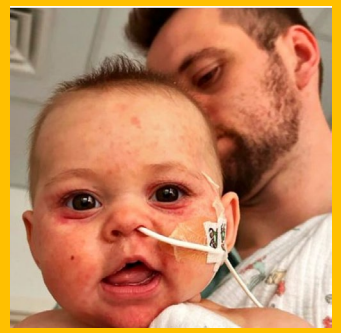
Walking backwards into the future

With my eyes fixed on the past

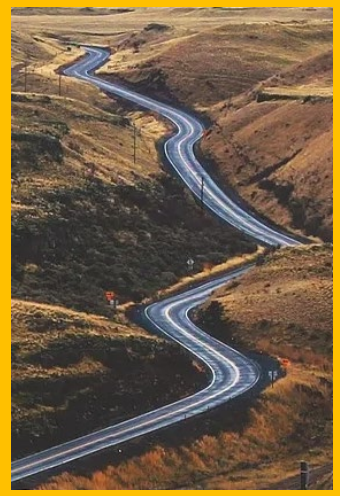
THREE DISEASES







THREE THEMES

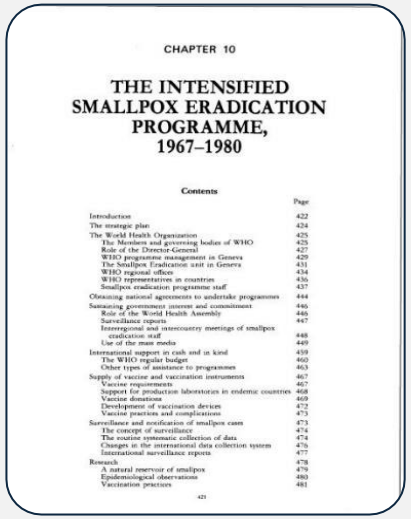






# VPD elimination strategies – 8 diseases

At founding of EPI, one disease - specific strategy: smallpox



CHAPTER 10

THE INTENSIFIED SMALLPOX ERADICATION PROGRAMME, 1967–1980

Contents



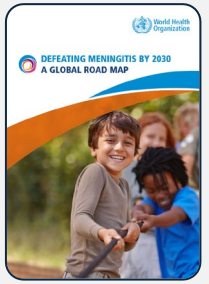


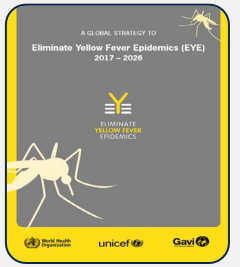


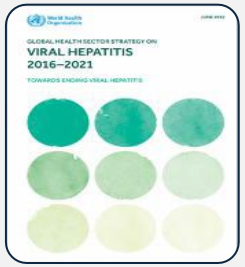






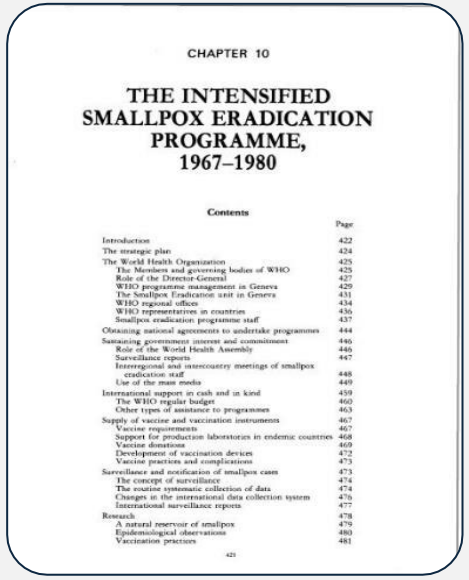



1967 1974 2024

# VPD elimination strategies
# Smallpox



CHAPTER 10

THE INTENSIFIED SMALLPOX ERADICATION PROGRAMME, 1967–1980

Contents

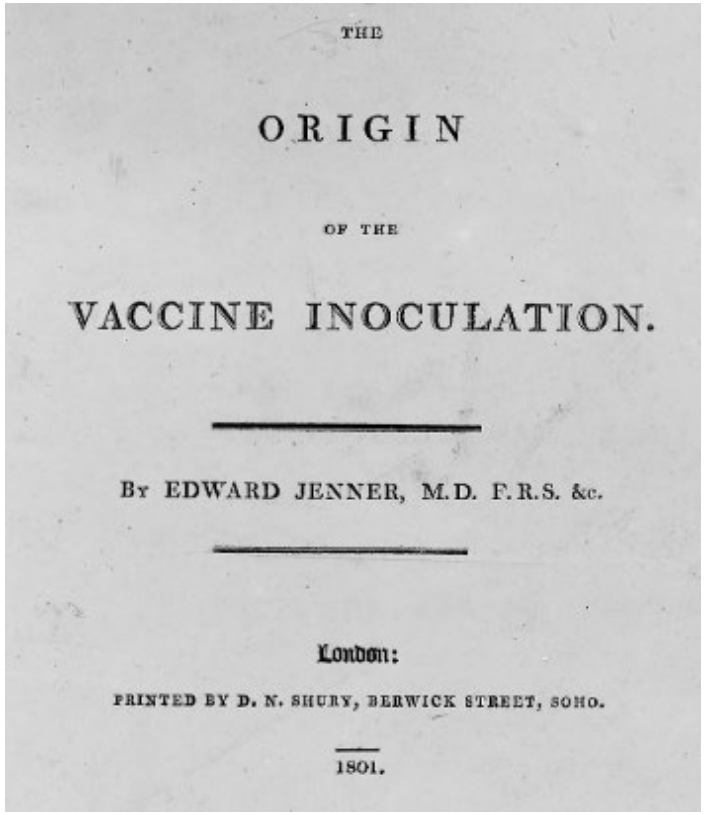

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1801



THE

ORIGIN

OF THE

VACCINE INOCULATION.

By EDWARD JENNER, M.D. F.R.S. &c.

London:

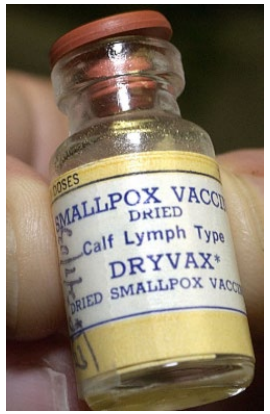
PRINTED BY D. N. SHURY, BERWICK STREET, SOHO.

1801.

**"It now becomes too manifest to admit of controversy that the annihilation of the smallpox, the most dreadful scourge of the human species, must be the result of this practice (vaccination)."**












- **1801**
- **1958** – 11th World Health Assembly – Eradication proposed
- **1967** – Programme began

10 years

- **1977** – Last case

- Stable vaccine
- Mass production
- Special needle

- Shift in strategy
  100% coverage
  to
  “search and destroy”

# GLOBAL SMALLPOX ERADICATION

The historically important dates highlighted in the map show countries in which the last naturally acquired cases of smallpox occured.

The years for each continent correspond to the year when the disease was eradicated there.



Rahima Banu

NORTH AMERICA
1952

EUROPE
1953

ASIA
1975

AFRICA
1977

SOUTH AMERICA
1971

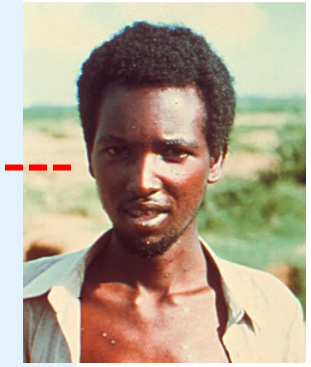
AUSTRALIA*

**Ecuador, 1962**
Last known case of variola major on the continent

**Brazil, April 19, 1971**
Last known case of variola minor on the continent

**Bangladesh, October 16, 1975**
Last known case of variola major in the world

**Somalia, October 12, 1977**
Last known case of variola minor in the world



Ali Maalin

Australia
NZ

1919

1952, North America

1953, Europe

1950

**>10 M cases**
**> 2M deaths**

1960

1967

1971, South America

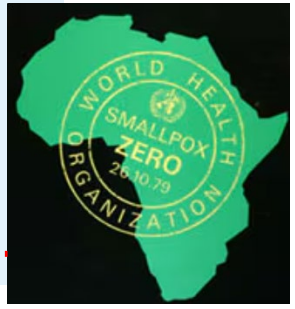
1970

1975, Asia

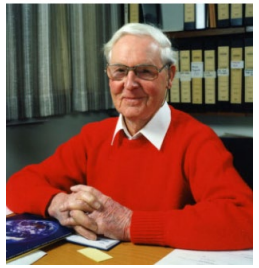
1977, Africa

**1980, WHO declares the world free of smallpox**

1980



# “Smallpox eradication was achieved, but just barely achieved”



Frank Fenner



D. A. Henderson

Had the biological and epidemiologic characteristics of the disease, or the world political situation, been even slightly more negative, the effort might have failed” [2]


1. Fenner F. Global eradication of smallpox. Reviews of infectious diseases. 1982;4:916-30
2. Arita I, Nakane M, Fenner F. Is polio eradication realistic. Science. 2006;312:852-4.

*DA Henderson 2000:* **20 years post smallpox eradication**

Smallpox eradication has spared the global community

- 350 million cases
- 40 million deaths
- Annual savings > US$ 2 billion

Cited in Ehreth J Global Value of Vaccination Vaccine 2003

# 2011

## Whither monkeypox vaccination

Anne W. Rimoin [a], Barney S. Graham [b,*]

Monkeypox probably always around
Not recognised until 1970
- post smallpox elimination in DRC

> Thirty years later, the incidence of human MPX in the same region appears to have markedly increased

# MPOX in DRC

| Year – Année | Location – Lieu | No. of suspected cases – Nbre de cas suspects | No. of confirmed cases[a] – Nbre de cas confirmés[a] |
|---|---|---|---|
| 1970–1980 | Multiple provinces – Plusieurs provinces | — | 48 |
| 1981-1986 | | 1415 | 338 |
| 1987–1995 | | — | — |
| 1996–2004 | | >200 per year – >200 par an | |
| 2005–2015 | | >1000 per year[c] – >1000 par an[c] | |
| 2016 | | 3750 | |
| 2017 | | 2500 | |
| 2018 | | 3784 | — |
| 2019 | | 5288 | — |
| 2020 | | 6216 | — |
| 2021 | | 2841 | — |
| **2022** | | **5 677** | **279** |
| **2023** | | **13 939** | **2 985** |
| **2024** | | **59 547** | **12 402** |
| **2025** | | **165 328** | **35 085** |

# The other eradication success story



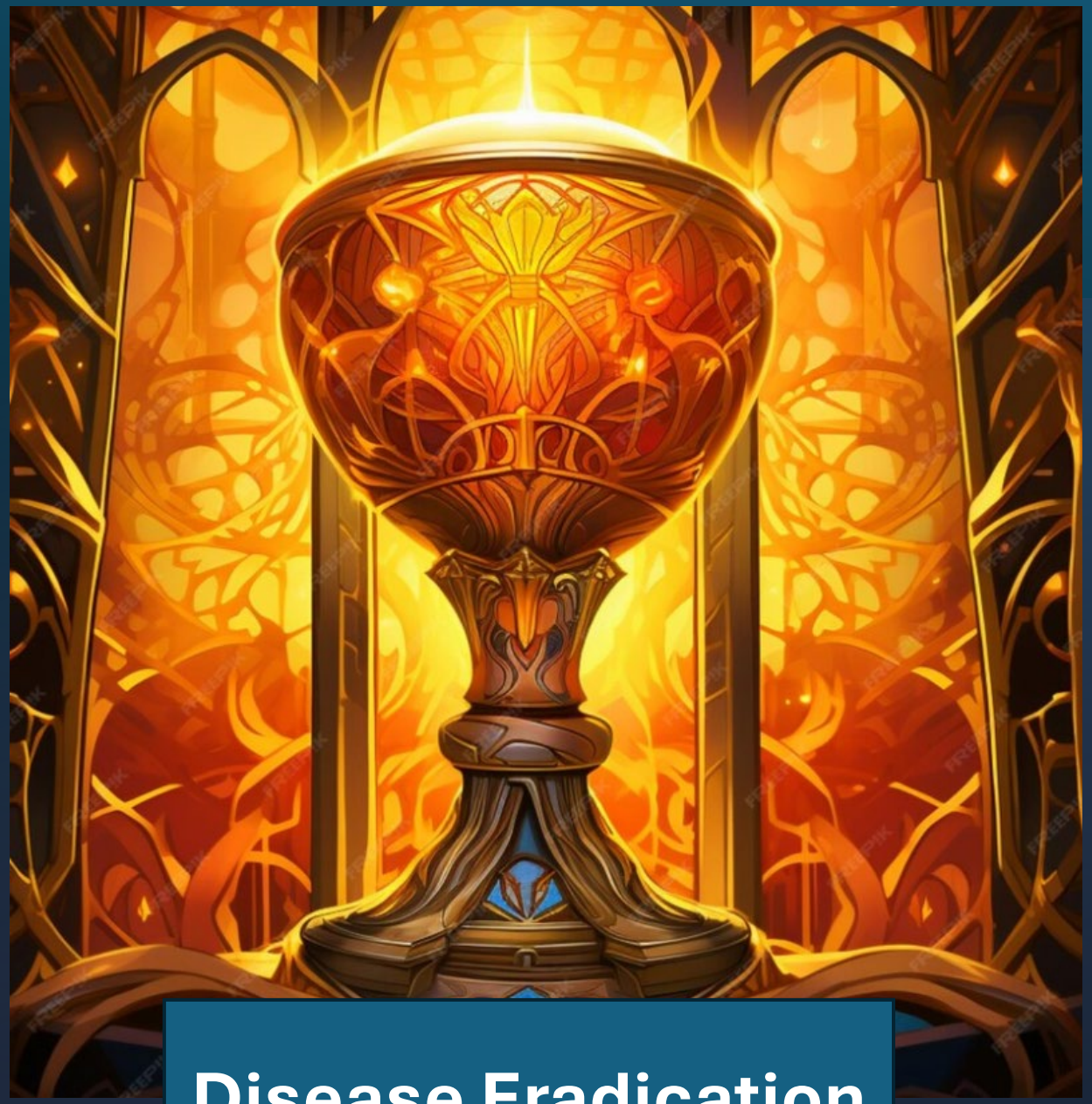

Driven to Extinction

## Rinderpest

Mortality approached 100%
Eradicated 2011
Morbillivirus related to measles
Live attenuated vaccine
Heat stable

"What made eradication possible was a really good vaccine and political support.

**You don't ask a cow if it wants to be vaccinated”**



# Disease Eradication

## Gains

- Enormous potential cost savings
- Builds health infrastructure
- Only sure route to equity


ZERO
( IS THE LONELIEST NUMBER )

Gates Foundation

About us | Our work | Ideas

Home / Ideas / A three-part plan to eliminate COVID-19

# A THREE-PART PLAN TO ELIMINATE COVID-19





By Bill Gates

*Chair, Board Member, Gates Foundation*

Sep 29, 2020

The Guardian

Int

# All countries should pursue a Covid-19 elimination strategy: here are 16 reasons why

Michael Baker and Martin McKee

Thu 28 Jan 2021 01.37 GMT

The New York Times

## Video: Eliminating Covid-19 Is ‘Incredibly Difficult,’ Jacinda Ardern Says

Prime Minister Jacinda Ardern of New Zealand acknowledged an end to the country's “Covid zero” strategy, seven weeks into a lockdown that...

4 Oct 2021



# VPD elimination strategies - Polio

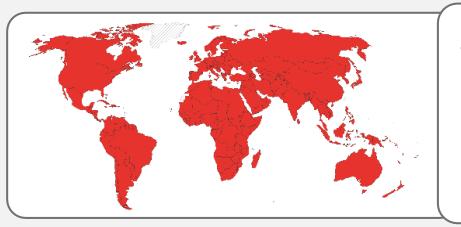


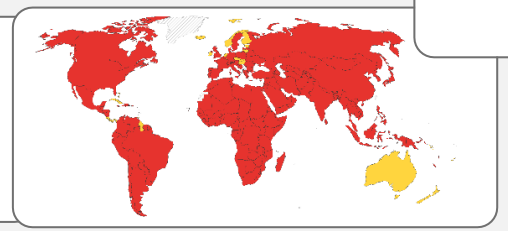
# Eradication of a second human disease?

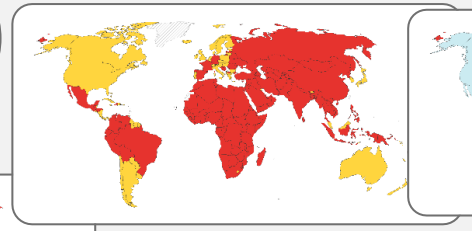
Endemic

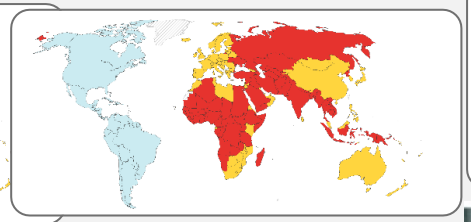
Polio-free (not certified)

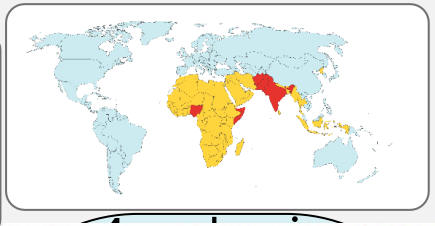
WHO Regions polio free











POLIO GLOBAL ERADICATION INITIATIVE

World Health Organization · unicef · CDC · Rotary · BILL & MELINDA GATES foundation



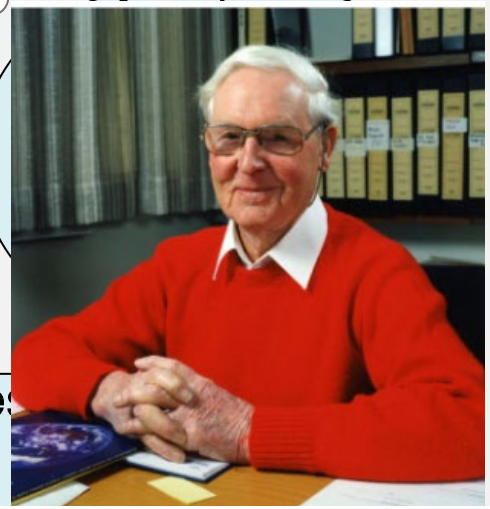




**NZ 1962**
**Australia 1973**

125 countries
> 350,000 cases

23 countries
99% case
reduction



1955 1961 1974 1988 200

PUBLIC HEALTH

## Is Polio Eradication Realistic?

Isao Arita[1]*, Miyuki Nakane[1], Frank Fenner[2]

All maps from: https://ourworldindata.org/grapher/progress-towards-polio-eradication?time

# Smallpox vs Polio

| Eradication easier if… | Smallpox | Polio |
|---|---|---|
| Only in humans | Yes | Yes |
| Cases are obvious | Old cases: scars<br>New cases – sick<br>Contacts traced ✓✓ | Undetected cases ++<br>Paralysis 1/200<br>Contacts traced ✗✗ |
| Transmission only *after* rash | Yes | No |
| Infectiousness | + | ++ |
| Serotypes | One | Three |
| Vaccine delivery | Single dose<br>No cold chain | Multiple doses<br>Cold chain required |

# ‘The Final Inch’ Towards Eradication in India

## 2010-12

- No Type 2 Poliovirus since 1999
- **New science:**
  - Bivalent OPV (Types 1 and 3)
  - Improve immune “take”
- **New delivery strategies:**
  - Including other health campaigns
  - House to house





# The Original Plan

**38 years and counting**

CERTIFICATION (GPEI DISSOLVES)

2013 — 2019 — WHA — 2023

**Polio Eradication Endgame Strategic Plan & Midterm Review**



2013–2019

**Polio Endgame Strategy 2019–2023**



**A review of:**

- what activities will remain
- what changes will be introduced
- what innovations will be needed

2019–2023

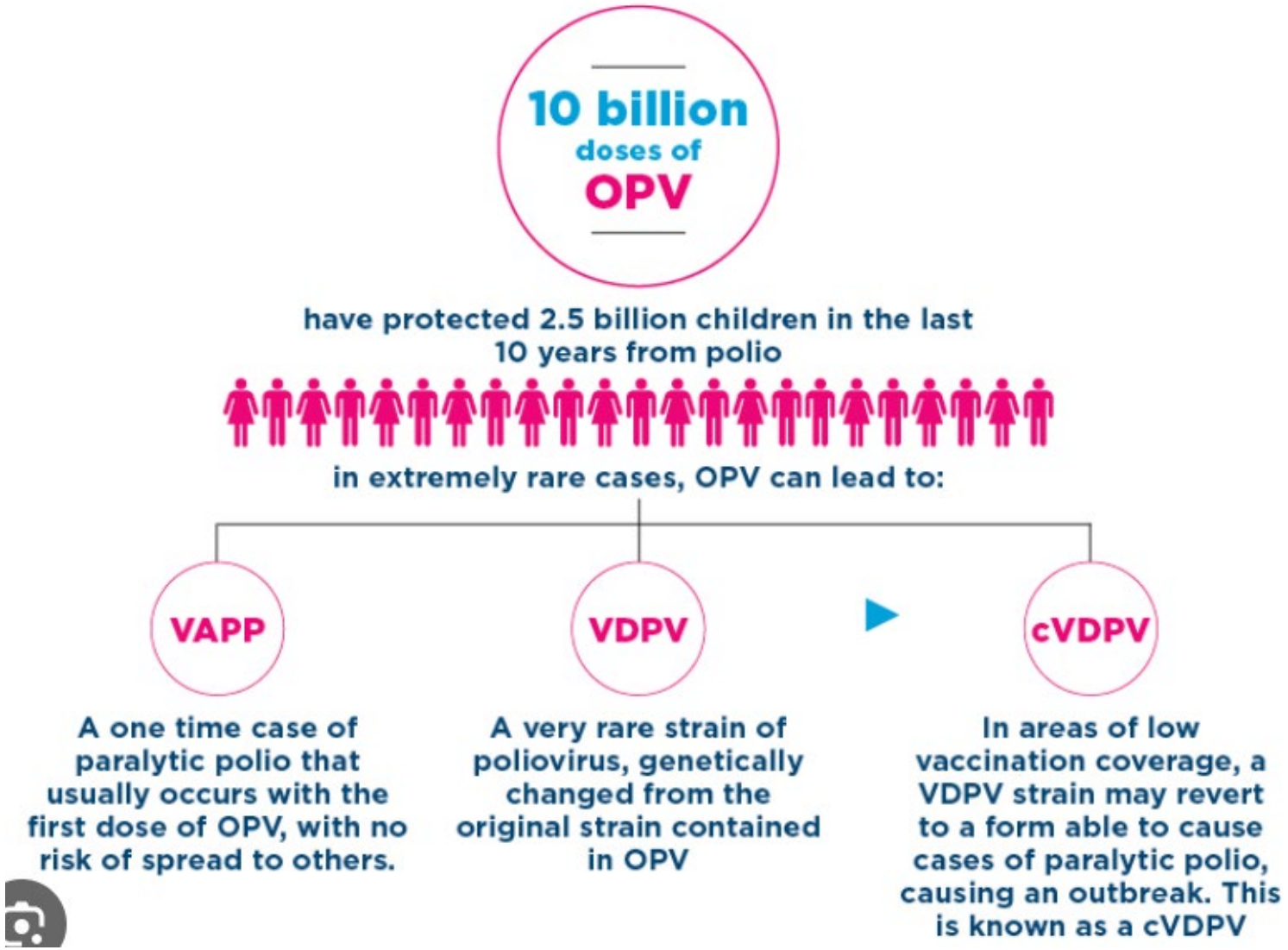
**Polio Post-Certification Strategy**




- GVAP 2.0
- Gavi 5.0
- WHO IVB Strategy
- UNICEF Immunization Strategy
- Global Health Security Agenda

2024+

# Vaccine-derived polioviruses – OPV



# Global OPV2 withdrawl “the “switch”
# April 2016: 155 countries

## ‘Unqualified failure’ in polio vaccine policy left thousands of kids paralyzed

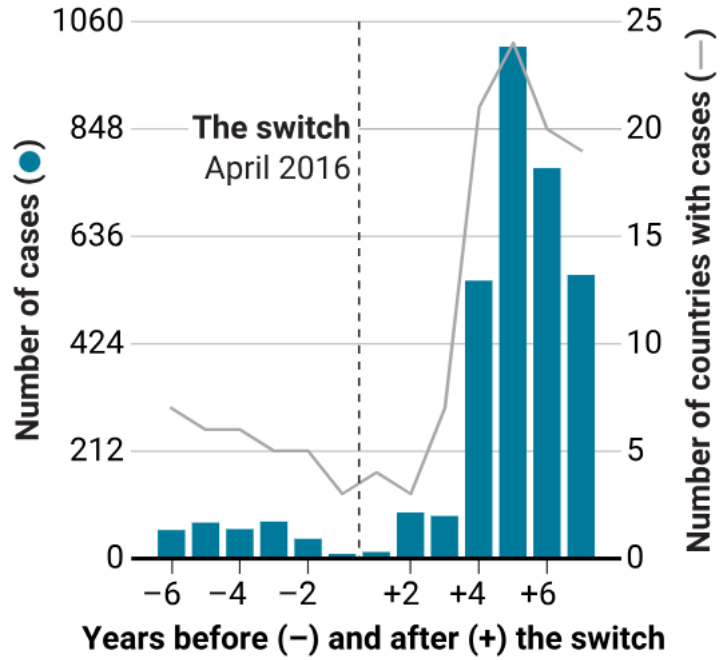
Well-intentioned decision to switch oral polio vaccines in 2016 backfired, new draft report says

7 MAY 2024 · 4:45 PM ET · BY LESLIE ROBERTS



## A fateful decision

Type 2 vaccine-derived polio cases soared, and many more countries saw outbreaks, after the 2016 decision to drop the type 2 component from oral polio vaccines.



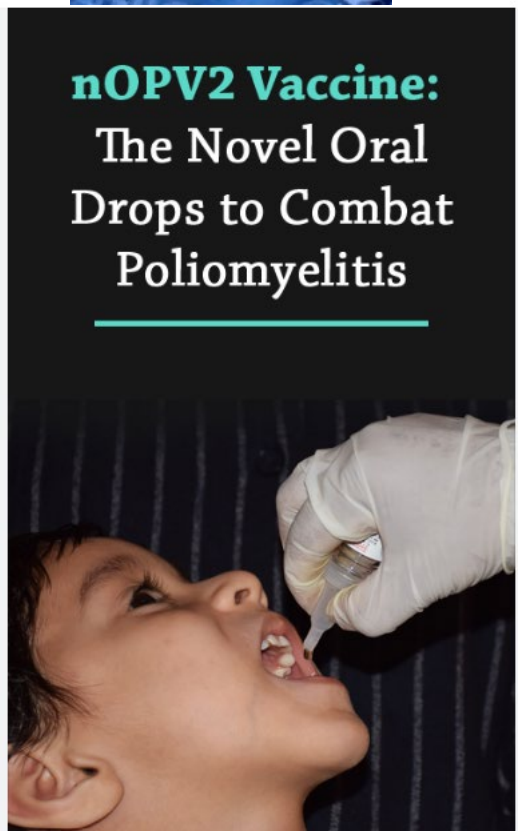

*Years range from 1 May to 30 April.

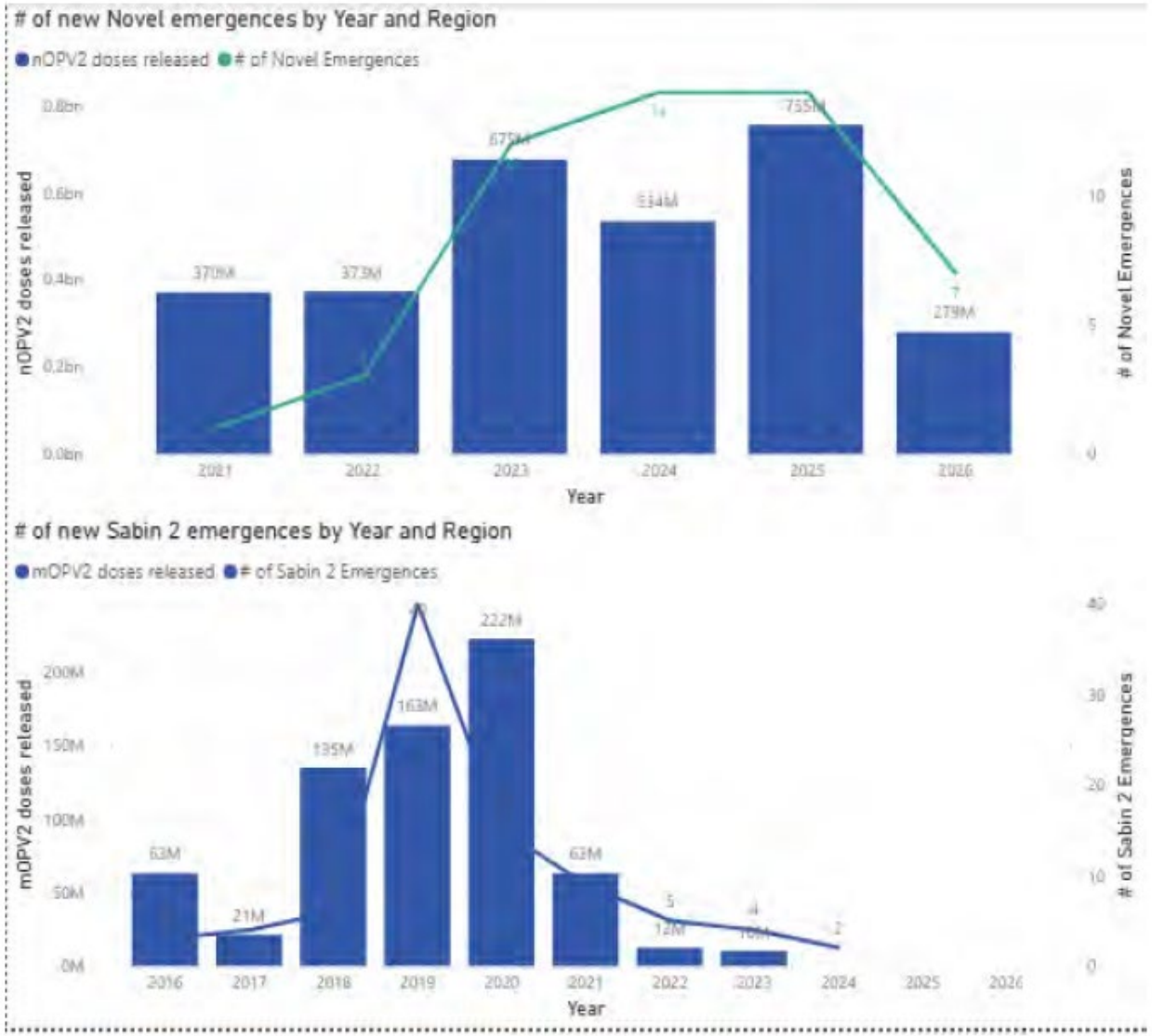
**cVDPV2 cases: 318**
**Countries: 15**

**cVDPV2 cases: 3375**
**Countries: 44**

# Novel OPV 2 vaccine – vaccine-derived polio reduced >80%






7 fold lower VDPV type 2 per dose with nOPV2

# AFP cases by poliovirus type

| Virus | 2024 | 2025 | 2026 to date | Countries |
|---|---|---|---|---|
| Wild type | 99 | 52 | 39 | Afg Pak |
| VDPV 1 | | 3 | 24 | Eth S Sudan Madag Lao |
| VDPV 2 | 448 | 228 | 126 | Nigeria DRC |
| VDPV3 | | 15 | 14 | Nigeria Chad Niger |
| TOTAL | 547 | 298 | 203 | |

WILD TYPE – AFGHANISTAN, PAKISTAN

VDPV – AFRICA (+LAO, PNG) = > 80% OF AFP

PARALYSIS IS PARALYSIS

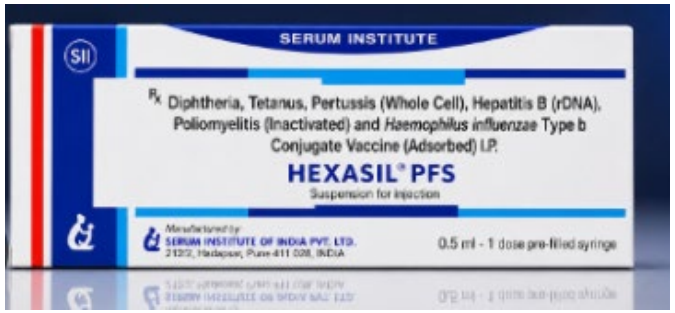


polio global eradication initiative

Gavi The Vaccine Alliance








# Inactivated polio vaccine (IPV) support

Protects against a highly contagious viral infection, mainly affecting children aged under five, which can lead to paralysis or even death.



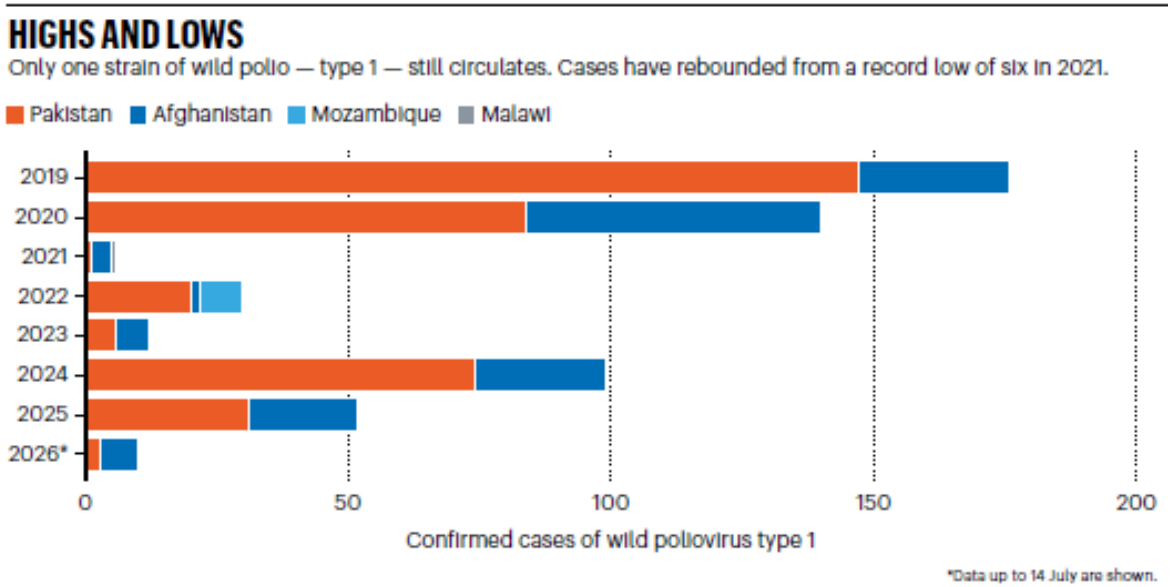
every last child



Female health workers are a crucial part of polio-vaccination campaigns, but have been banned in parts of Afghanistan.

# WILL POLIO EVER BE ERADICATED?

The polio eradication campaign has been missing deadlines for years. Is there a plan B – and, if so, when is it time to activate it?




In Pakistan and Afghanistan mistrust of vaccinators has grown
At least four police guards have been killed accompanying vaccinators just this year in Pakistan and in south Afghanistan female and house-to-house vaccinators are banned.



"In theory, eradication is possible, but in practice, it is not," says Kimberly Thompson

If the programme did everything right and resources were not an issue, it could be done
In the current funding climate
"I think it has already failed"

Irwin A https://www.nature.com/articles/d41586-026-02229-6 July 22nd 2026



## Global political commitments

- World Health Assembly
- Rotary Convention, Houston, Texas
- G20 Health/Development Ministers
- G7 Leaders
- Commonwealth Heads of Government

## Resource mobilization

- Pipeline of asks to existing, lapsed and new donors
- Discussions on new mechanism with European Investment Bank
- Momentum building opportunities in the year
- Creative approaches to private sector fundraising



# Polio - summary



A LONG WAY TO GO
2030 +



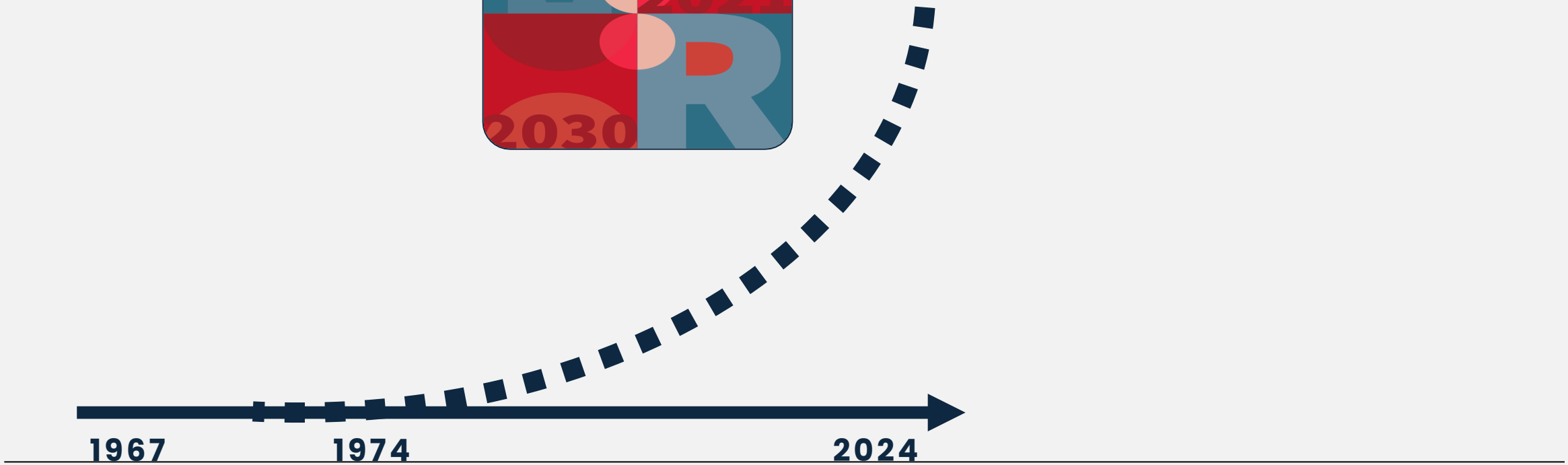
ENCOURAGING TRENDS BUT ENTRECHED PROBLEMS



NEW VACCINES

# VPD elimination strategies – measles



# Eradication criteria

| Eradication easier if… | Measles | Polio |
|---|---|---|
| Only in humans | Yes | Yes |
| Cases are obvious | Transmission before symptoms | Undetected cases ++<br>Paralysis 1/200 |
| Transmission only *after* rash | No | No |
| Infectiousness | ++++ | ++ |
| Serotypes | One | Three |
| Vaccine delivery | Two doses<br>Cold chain required | Multiple doses<br>Cold chain required |

The Fogarty
International Center,
National Institutes
Of Health
Presents

# International Symposium on Measles Immunization

March 16-19, 1982
Pan American
Health Organization
525 23rd Street, N.W.,
Washington, D.C.

The Fogarty
International Center,
National Institutes
Of Health
Presents

# International Symposium on Measles Immunization

March 16-19, 1982
Pan American
Health Organization
525 23rd Street, N.W.,
Washington, D.C.

## World Health Assembly 2010

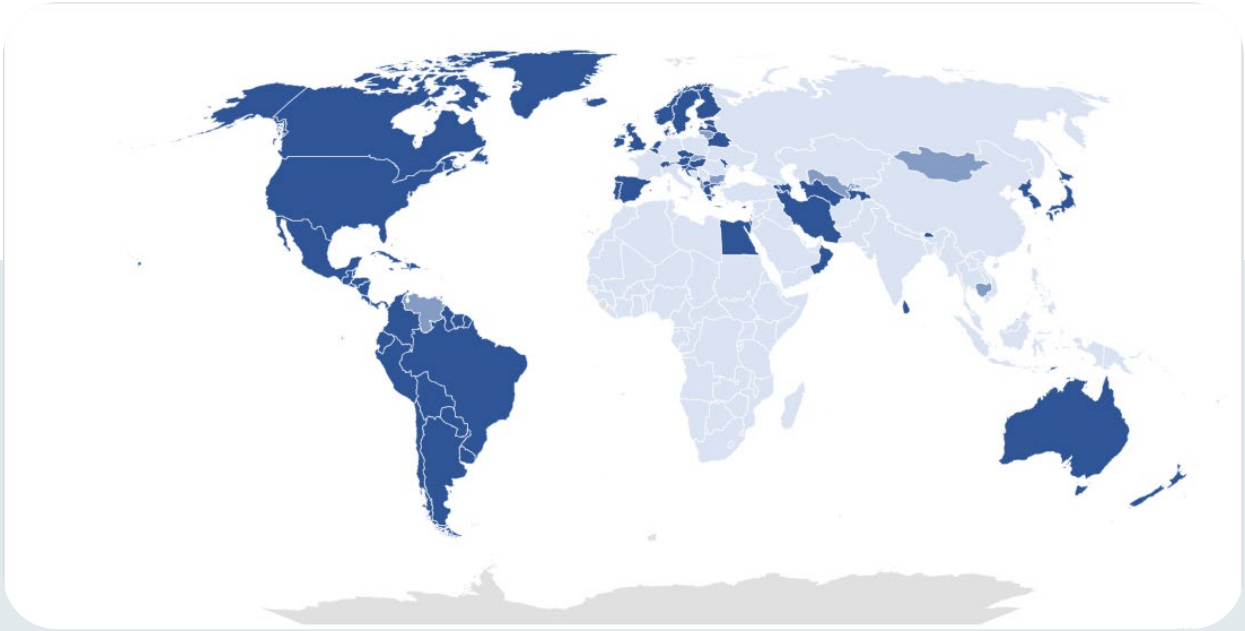
**Measles Eradication should be pursued**

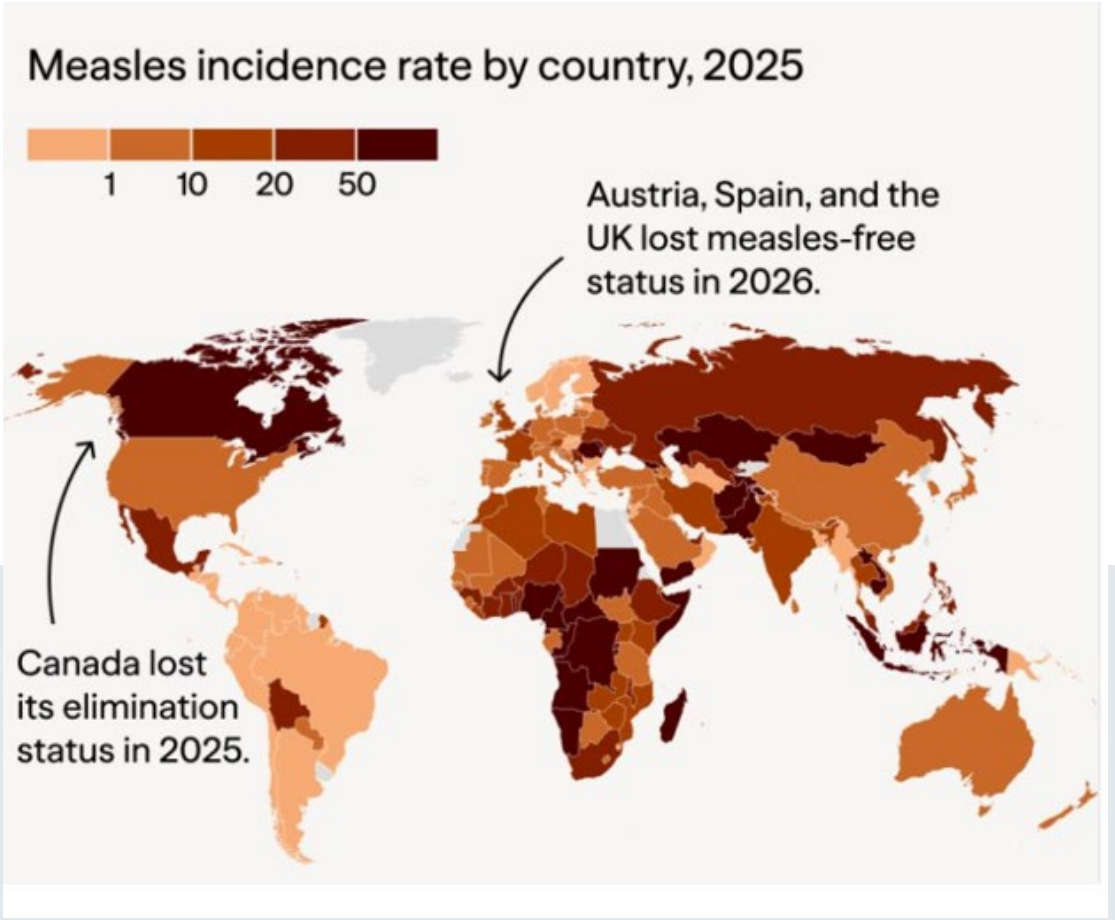
## SAGE Meeting October 2019

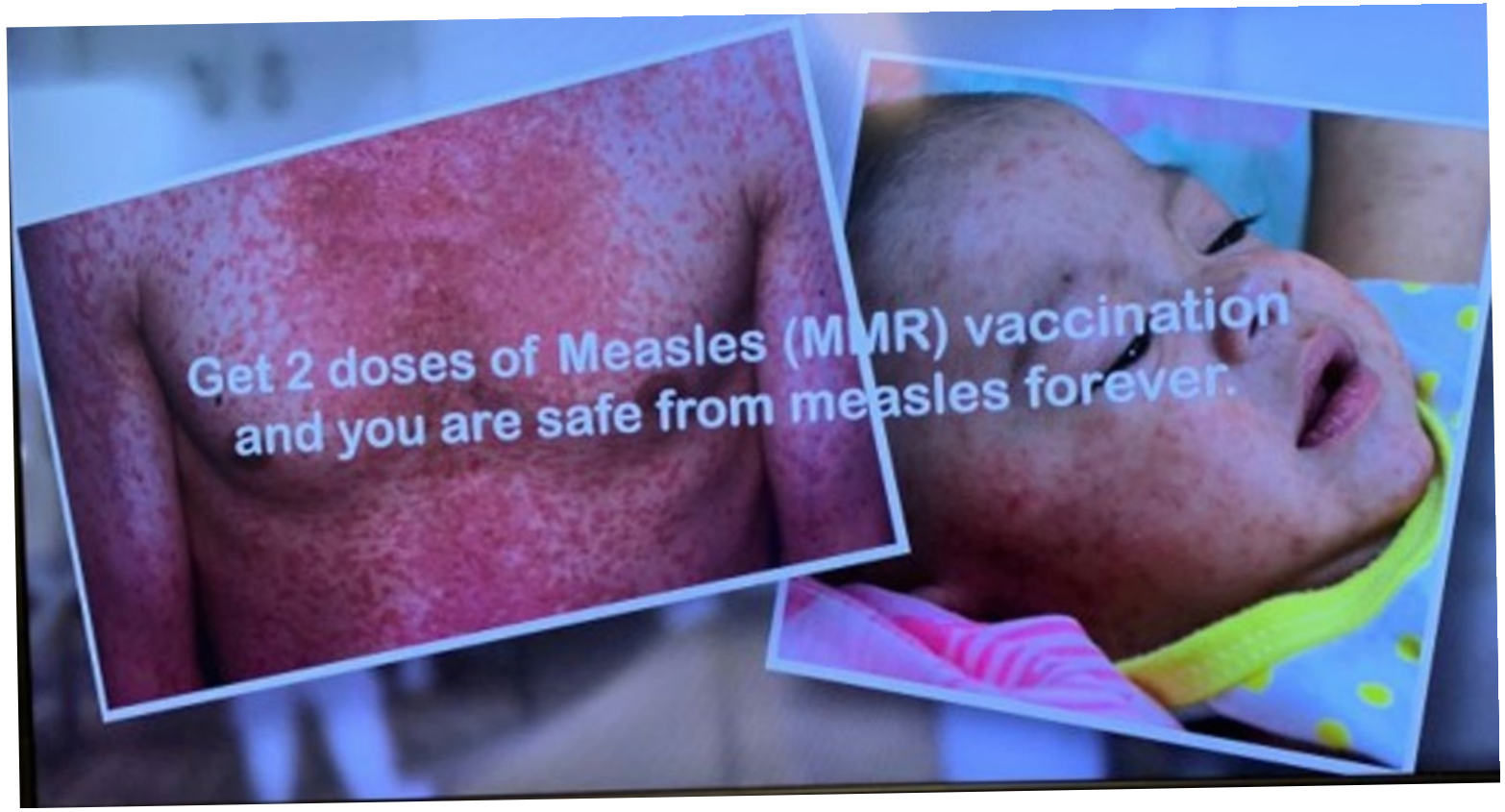
**Low probability of global eradication before 2050**



# Countries with verified measles elimination - 2023






Get 2 doses of Measles (MMR) vaccination
and you are safe from measles forever.

*Clinical Infectious Diseases*

EDITORIAL COMMENTARY

# Measles in Vaccinated Individuals and the Future of Measles Elimination

**William Moss**

Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland

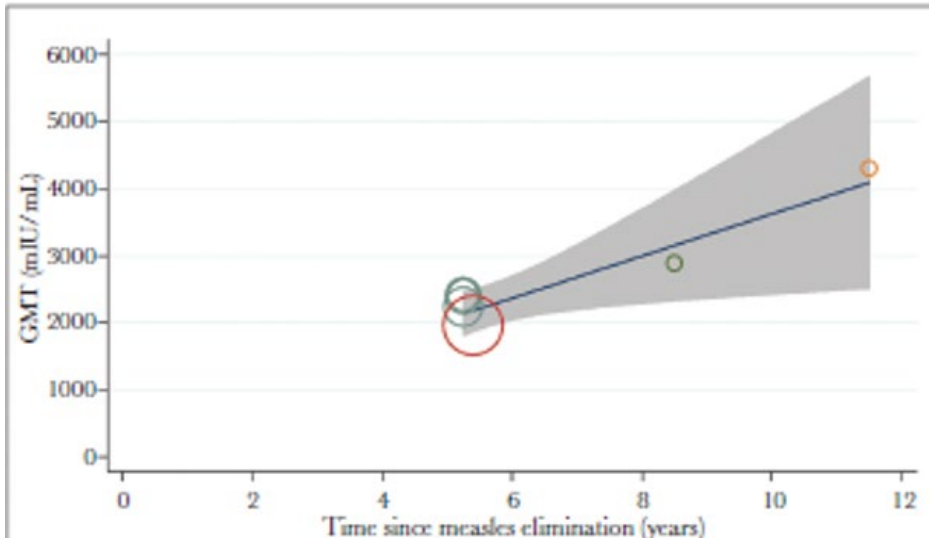
- California 2000-2015:
  - 20% of measles cases = 1 or 2 dose MMR
- Australia 2012-19:
  - 17% of cases 20-29 years = 2 doses MMR
- S Korea: University outbreak 2014:
  - Index case had 2 MMR doses
    - 2 doses only 60% effective

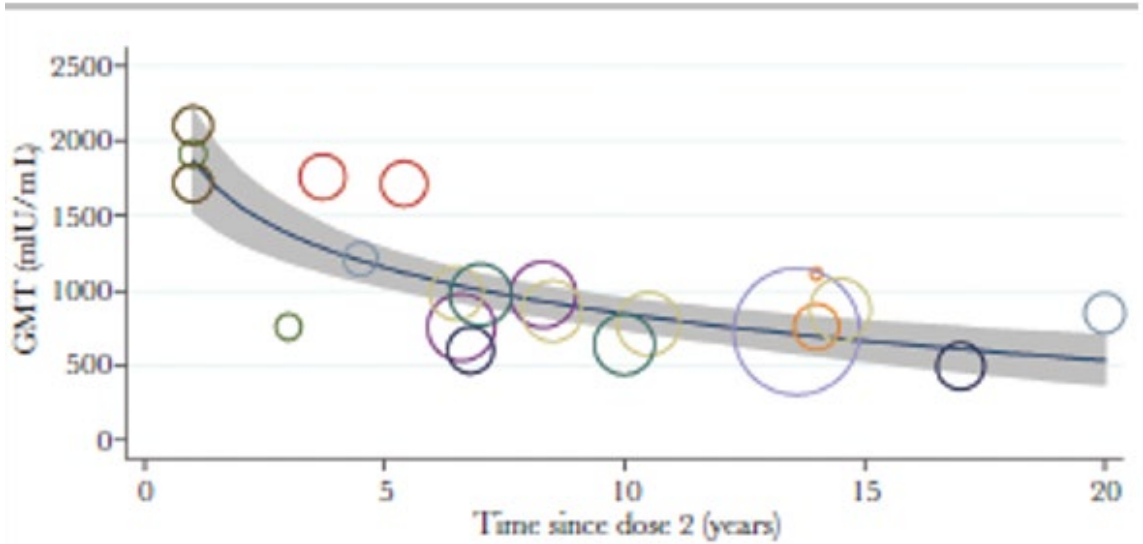
The Journal of Infectious Diseases
REVIEW

# In Elimination Settings, Measles Antibodies Wane After Vaccination but Not After Infection: A Systematic Review and Meta-Analysis

The Journal of Infectious Diseases® 2022;226:1127–39

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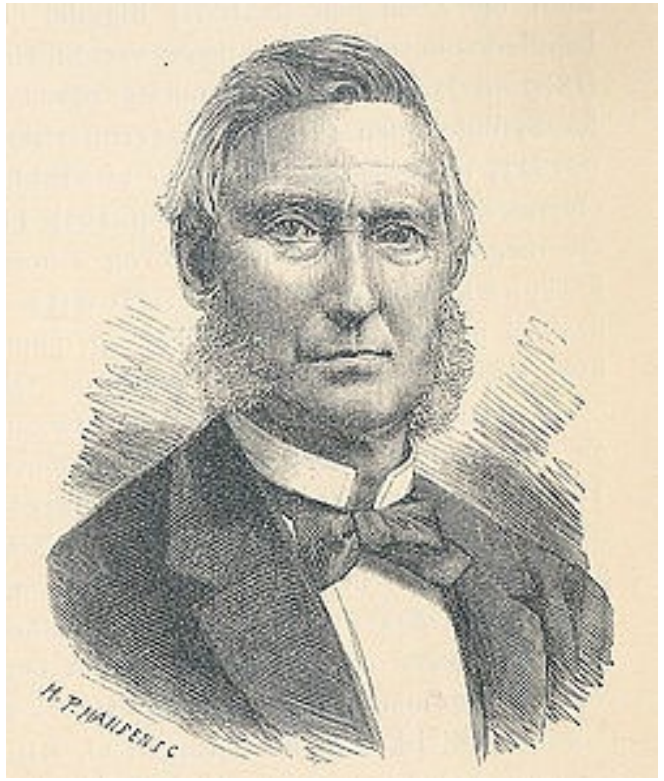

**In people with previous measles infection, antibody levels stable**

**In vaccinated people antibody levels go down**

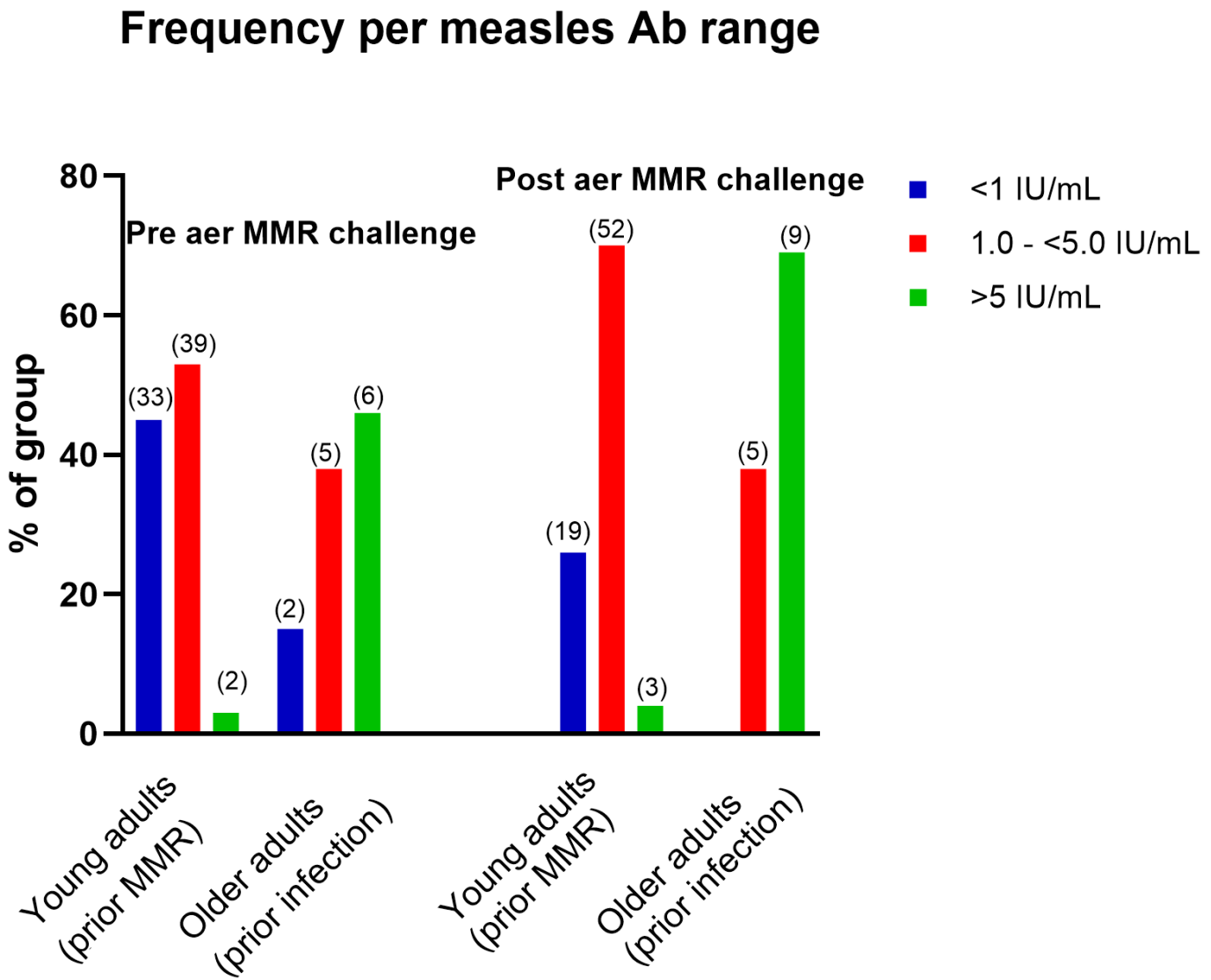





FAROE ISLANDS AND PETER PANUM



# DUNEDIN SUMMER PROJECT – 14 OLDER ADULTS WITH MEASLES INFECTION



# A few provocative questions

- What is the best strategy for “elimination countries” like Australia in a world where measles introductions continue indefinitely?
- Is it just MMR for travelling infants or do we need to think about either MMR2 at an older age or a third dose?
- How would we give a third dose and to whom?