Paradoxes of the Present and a Focus for the Future of Vaccines and Immunization

Equity-Security-Prosperity

IVB Director's Report to SAGE

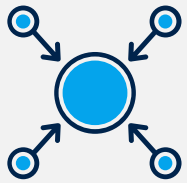
2 April 2019

World Health Organization

The paradoxes of the present and a focus for the future of vaccines and immunization

The world is improving in nearly all dimensions of development, population control, and health

We are in a ‘VUCA’ world



Vaccine and immunization agenda is reshaping to deliver on Equity-Security-Prosperity in a transformed WHO

Vaccines and Immunization are central to the SDGs and the WHO Triple Billion

Changes in Perspective

12 weeks

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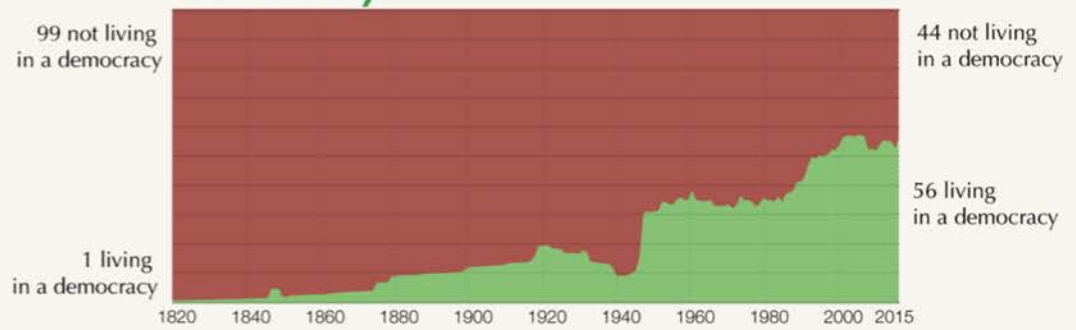
The World as 100 People
over the last two centuries

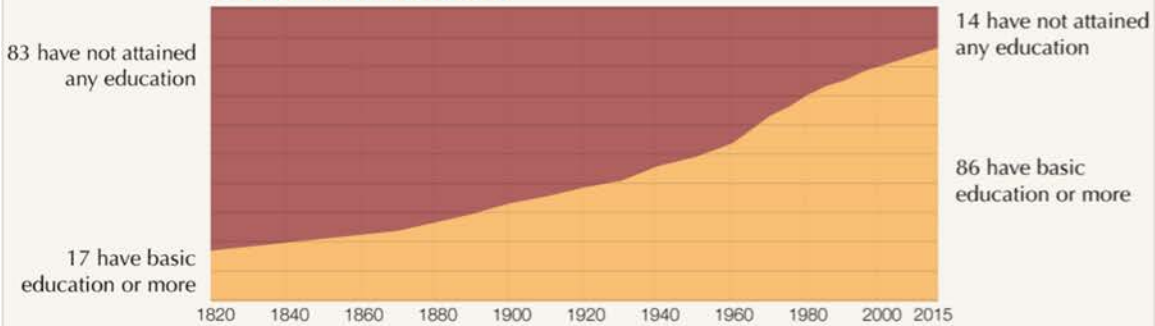
Our World in Data

Extreme Poverty

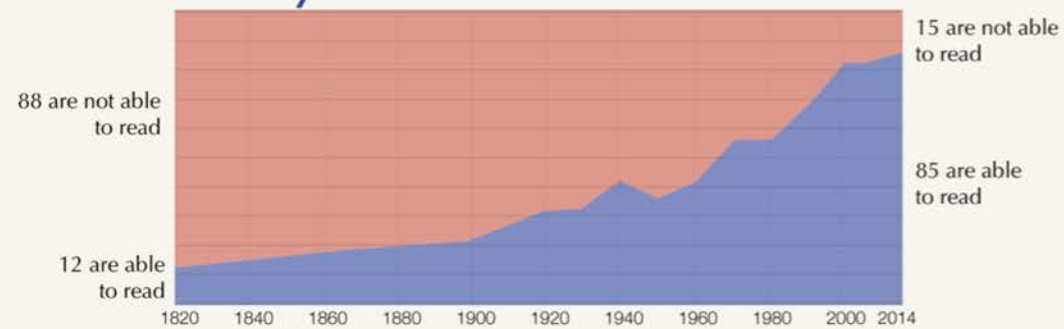
Democracy



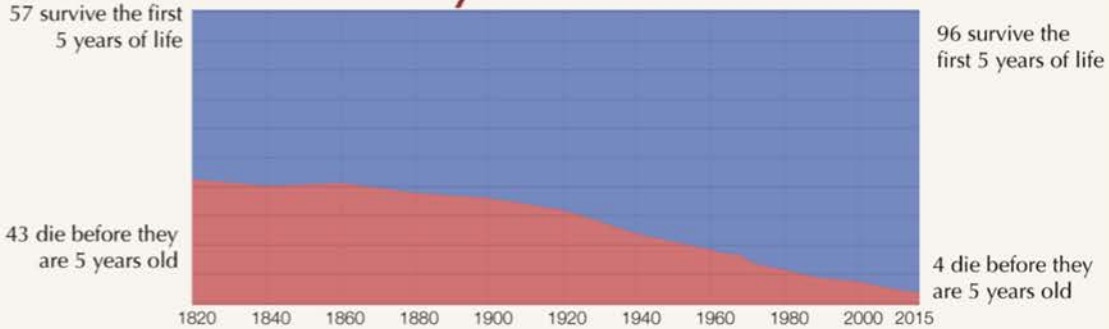
Basic Education

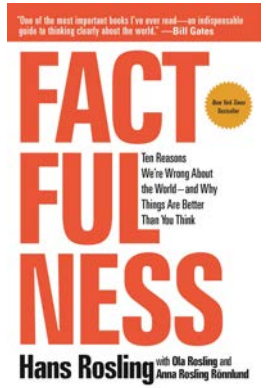


Literacy

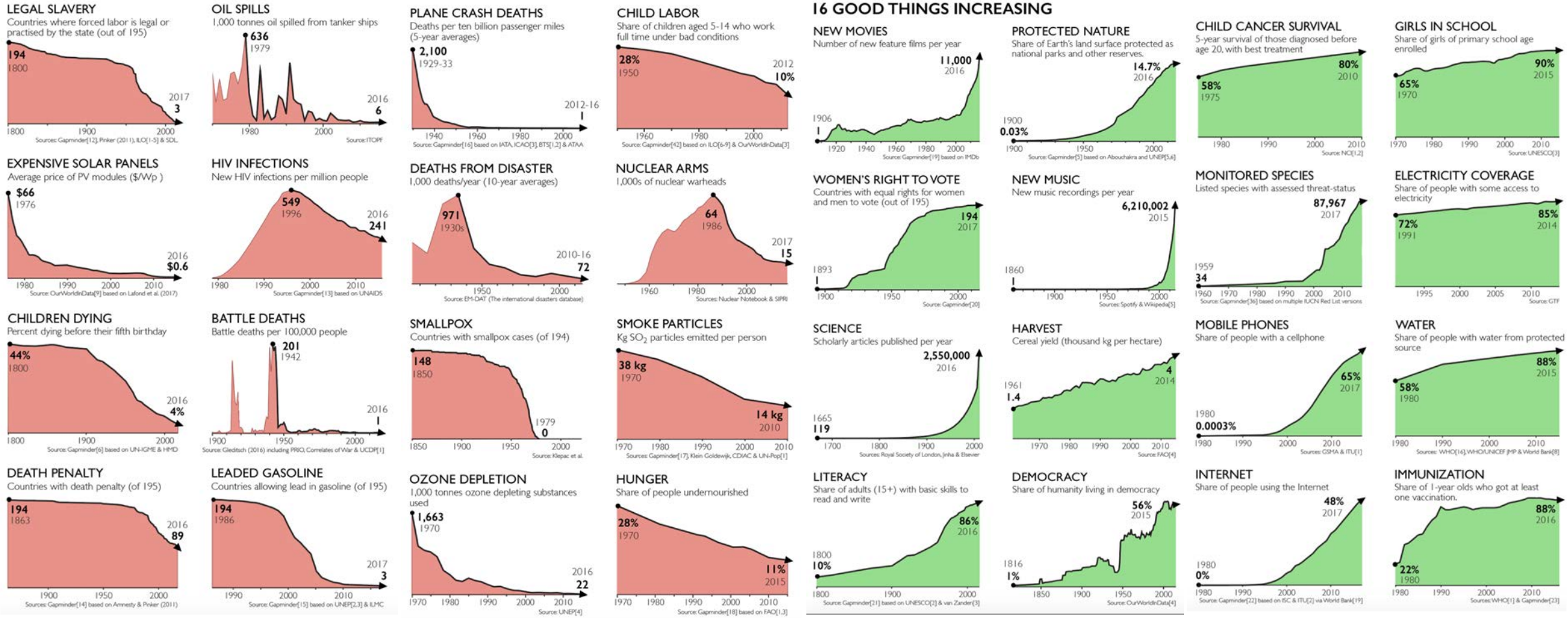


Child Mortality

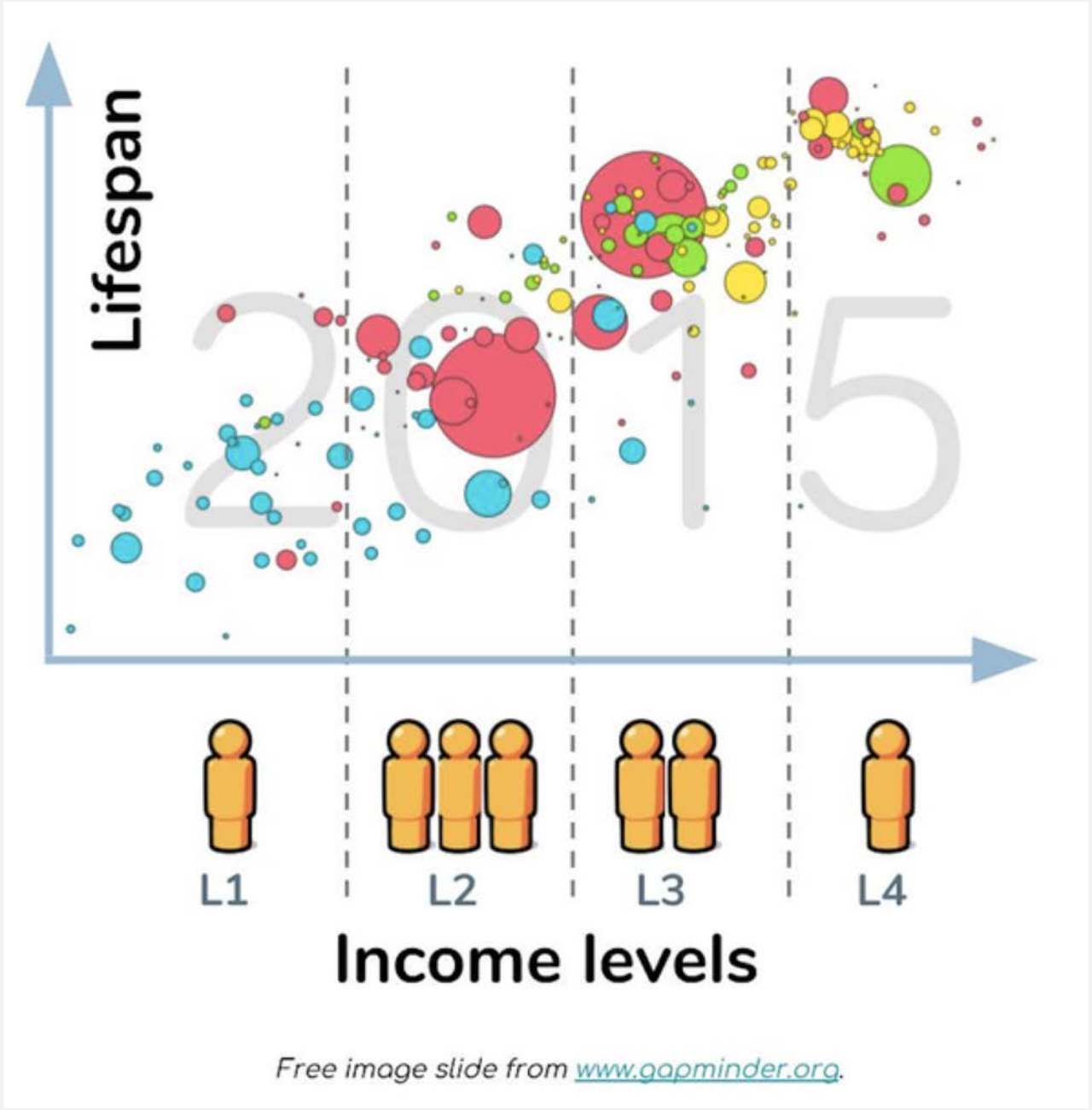




32 things improving

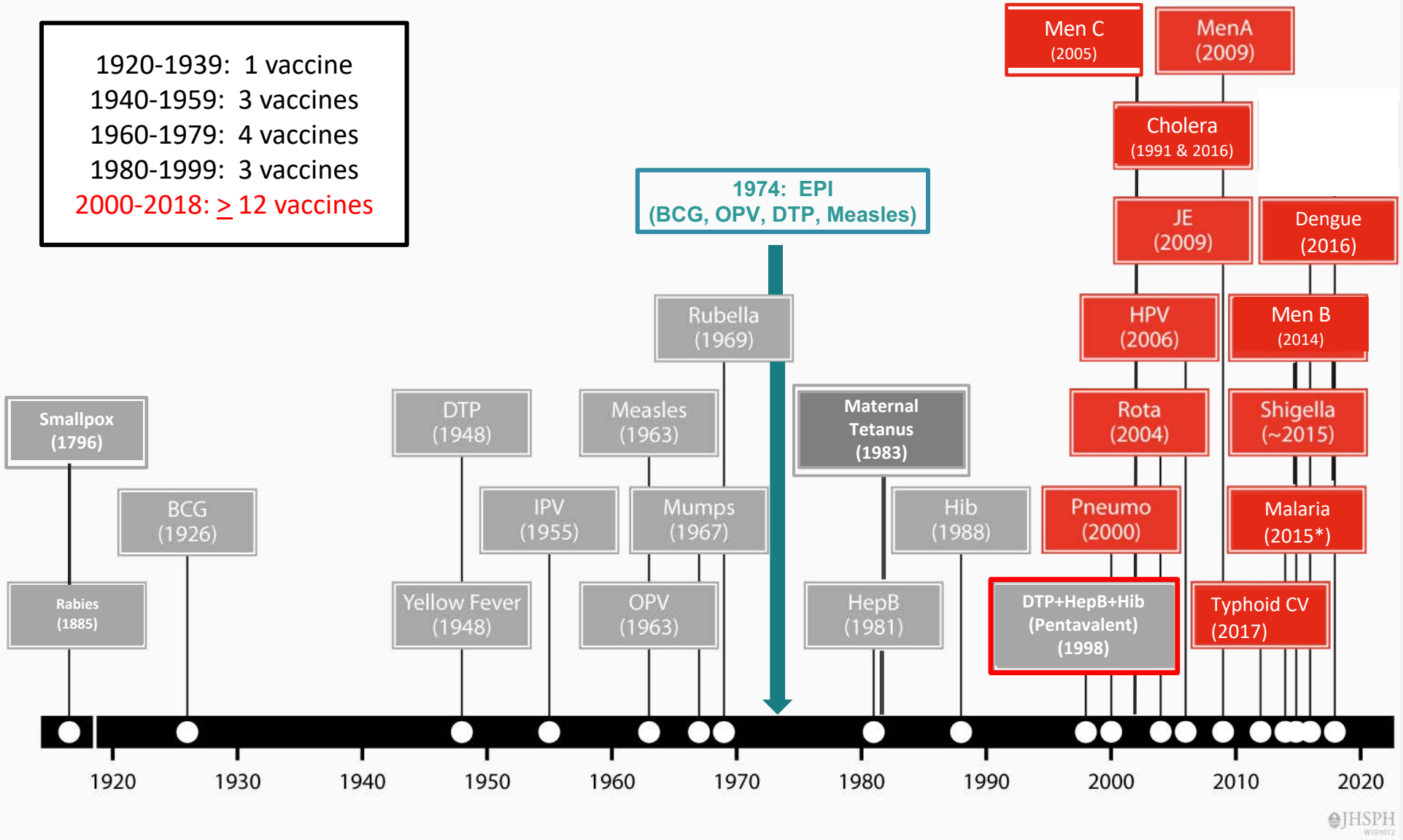


Minority of people live in countries with shortest lifespan

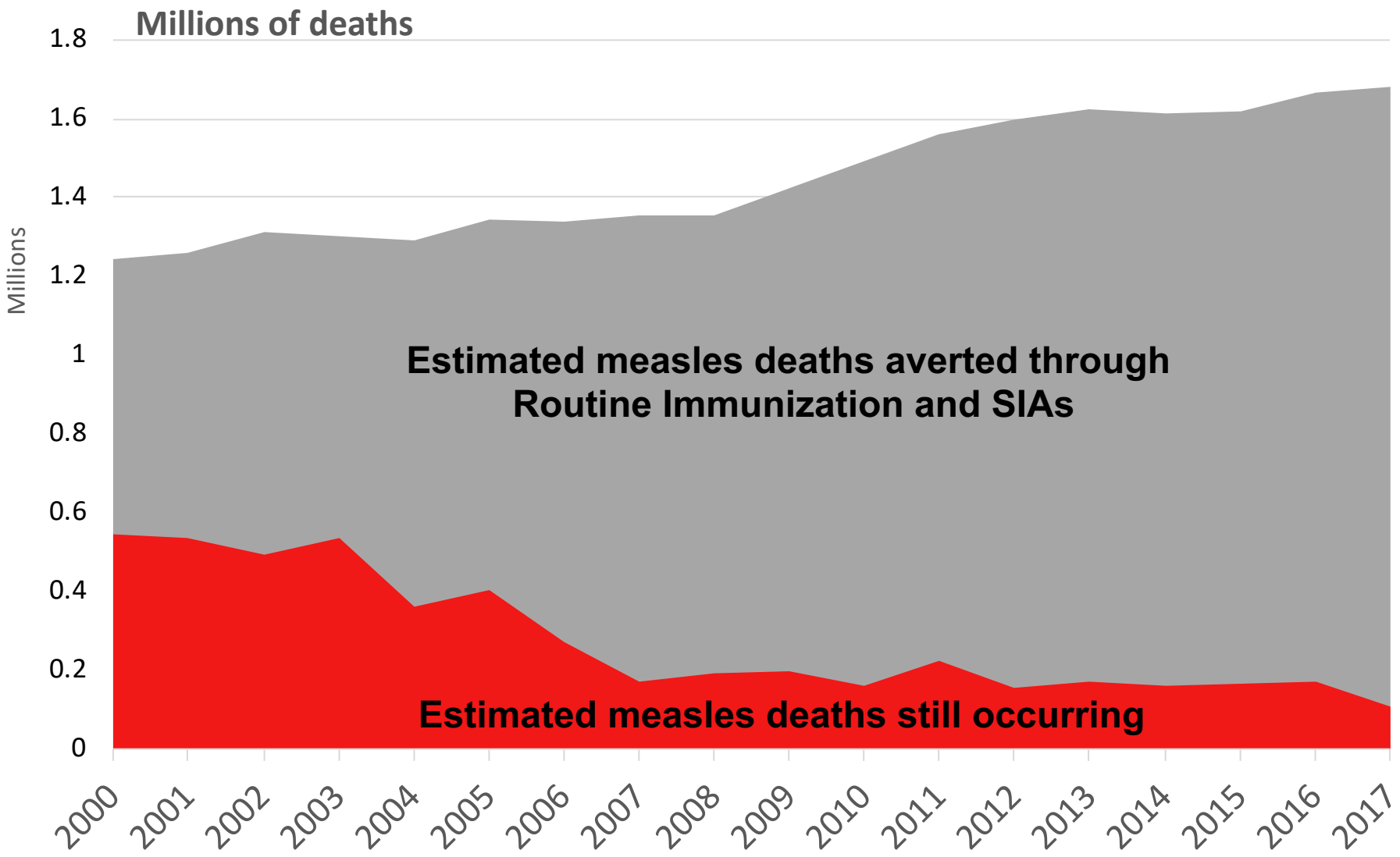


Substantial Advancement in Vaccine Innovation in last 15 years…and more to come

1920-1939: 1 vaccine
1940-1959: 3 vaccines
1960-1979: 4 vaccines
1980-1999: 3 vaccines
2000-2018: ≥ 12 vaccines



Measles program has prevented tens of millions of deaths in less than 2 decades, 2000 - 2017



Measles vaccination has averted **21.1 million** estimated deaths 2000-2017

Measles contribution to U5 mortality has dropped from 6% to 2%

110K (estimated)

Source: Weekly epidemiological record, No 48, 2018, 93, 649–660 http://www.who.int/wer

The Decade of Vaccines has achieved significant progress for immunization

116M Infants received DTP3 in 2017, the most ever

4.6M Additional infants vaccinated in 2017 (vs. 2010)

1.8M Fewer children under-vaccinated in 2017 (vs. 2010)

3 Additional countries achieved MNTE in 2017[1]

113 Countries introduced new vaccines since 2010

+140% Increase in number of NITAGs since 2010

1. Ethiopia, Haiti and the Philippines. Source: 2018 assessment report of the GVAP (WHO)

….yet, most goals set 10 years ago will not be achieved by 2020

3 Countries[1] still polio-endemic

No Region sustains measles elimination

1 Rubella-free region in 2018

14 Countries[2] yet to achieve MNTE

~85% MCV1 coverage stagnation, below 90%+ target between 2010 & 2017

< 30% Countries with DTP3 coverage at 90% national; 80% district

19M+ Children still under-vaccinated

25 LICs & MICs without new vaccines introductions between 2010 & 2016

Source: 2018 Assessment Report of the GVAP (WHO); GVAP – Secretariat Annual Report 2018

1. Afghanistan, Pakistan, Nigeria; 2. Afghanistan, Angola, Central African Republic, Chad, Democratic Republic of Congo, Guinea, Mali, Nigeria, Pakistan, Papua New Guinea, Somalia, South Sudan, Sudan, Yemen

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The 2019 VUCA World

V Volatile

U Uncertain

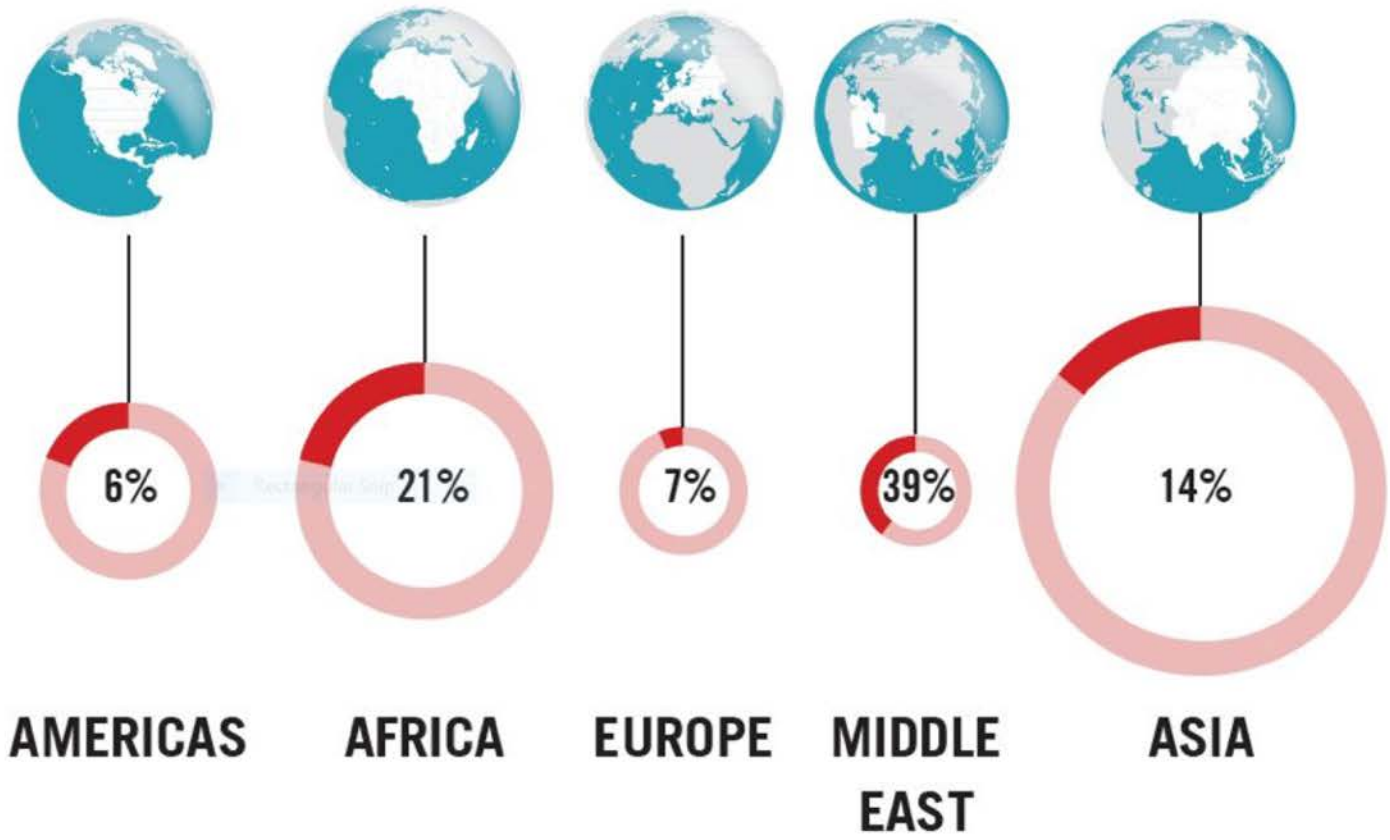
C Complex

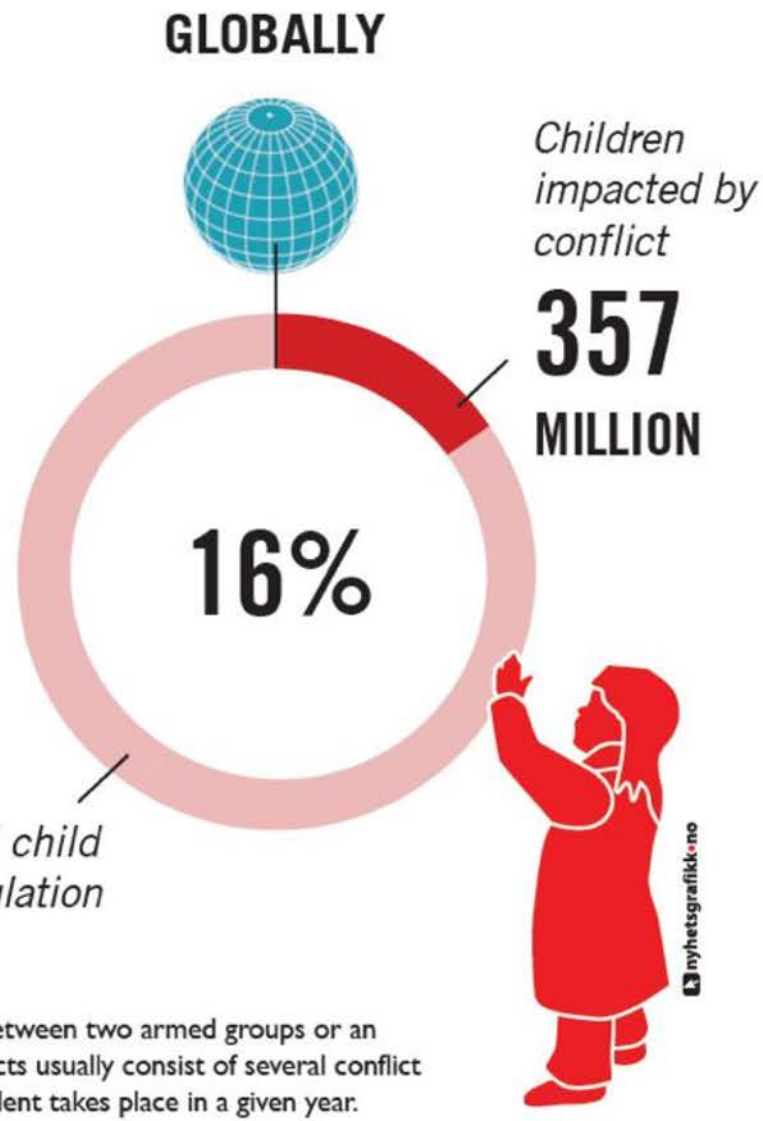
A Ambiguous

- Demographic shifts
- Fragile States
- Conflict and migration
- Climate change
- Urbanization
- Poor populations largely in Middle Income Countries
- Antimicrobial resistance
- Outbreaks, Epidemics, Pandemics
- Inequities in wealth, health, and security

Children affected by conflict

1 in 6 children were living in conflict areas in 2016





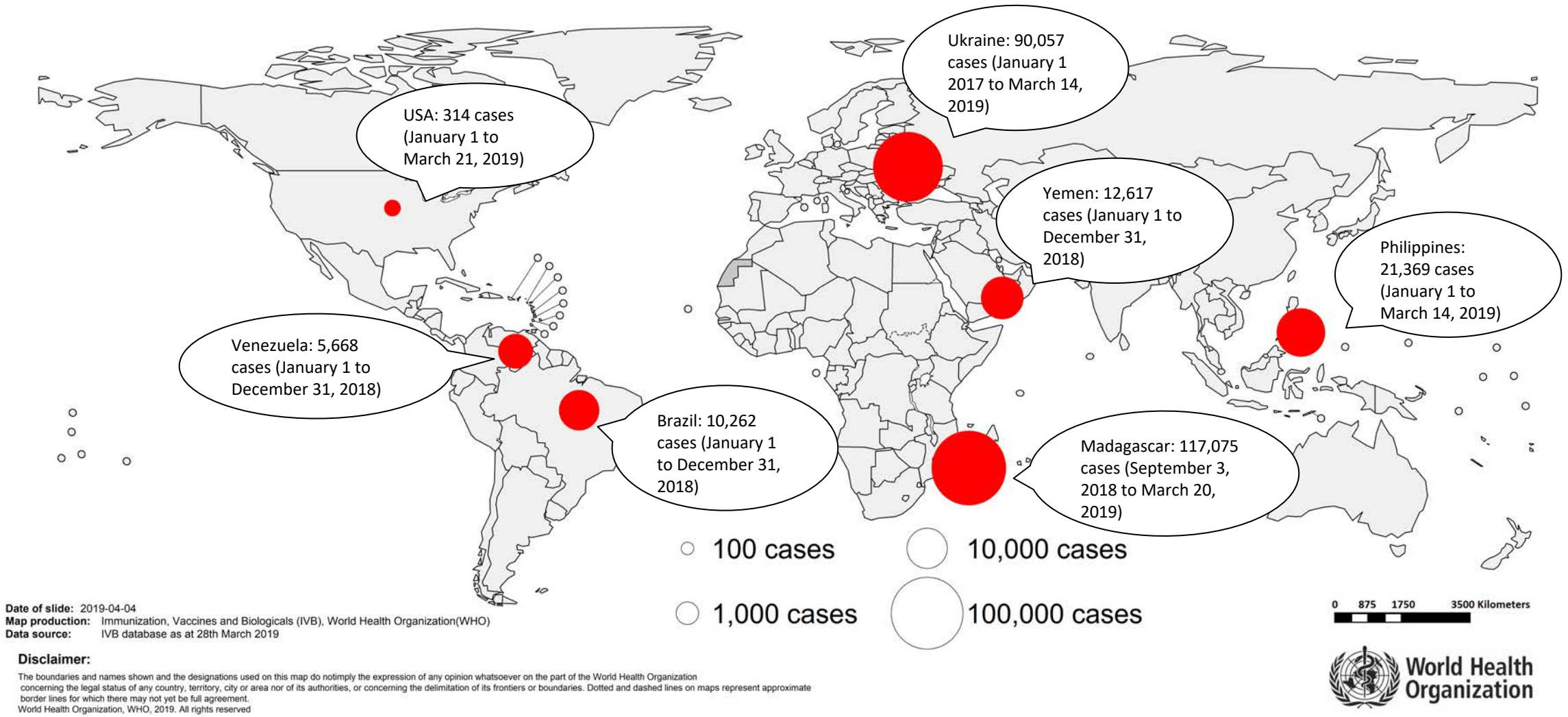
PRIO Save the Children

A conflict event is defined as a lethal incident, either a violent clash between two armed groups or an attack on civilians by a group/groups, at a given time and place. Conflicts usually consist of several conflict events. Conflict area: an area 50km or less from where a conflict incident takes place in a given year.

Data source: PRIO/UCDP. For more information: www.savethehildren.net/waronchildren


States seek to force parents to vaccinate children
Lawmakers to propose bill to allow teens to get vaccinated without parental consent
Philippines measles outbreak fed by distrust of vaccines
Hundreds of children die in Madagascar measles outbreak
Amazon removes books peddling vaccine misinformation
Anti-vaxx 'mobs'
Concerns over global resurgence of measles
New York measles outbreak prompts state of emergency
Unvaccinated children banned from public spaces
Anti-vaxxers' must not be given credence
Italy bans unvaccinated children from schools

Selected Ongoing Measles Outbreaks



Date of slide: 2019-04-04
Map production: Immunization, Vaccines and Biologicals (IVB), World Health Organization(WHO)
Data source: IVB database as at 28th March 2019

Disclaimer:

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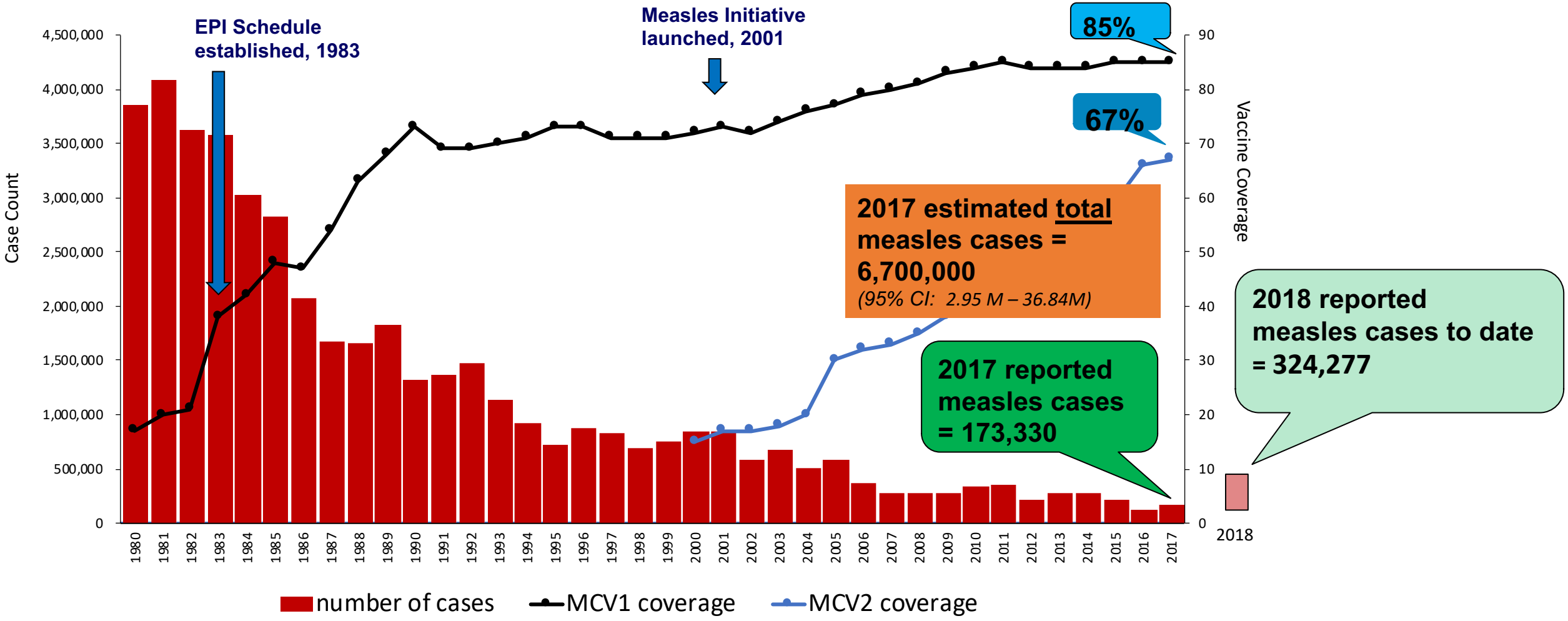
World Health Organization

Reported Global Cases are nearly 2X those of 2017

Measles Global Annual Reported Cases and
MCV1* and MCV2** Coverage, 1980-2017

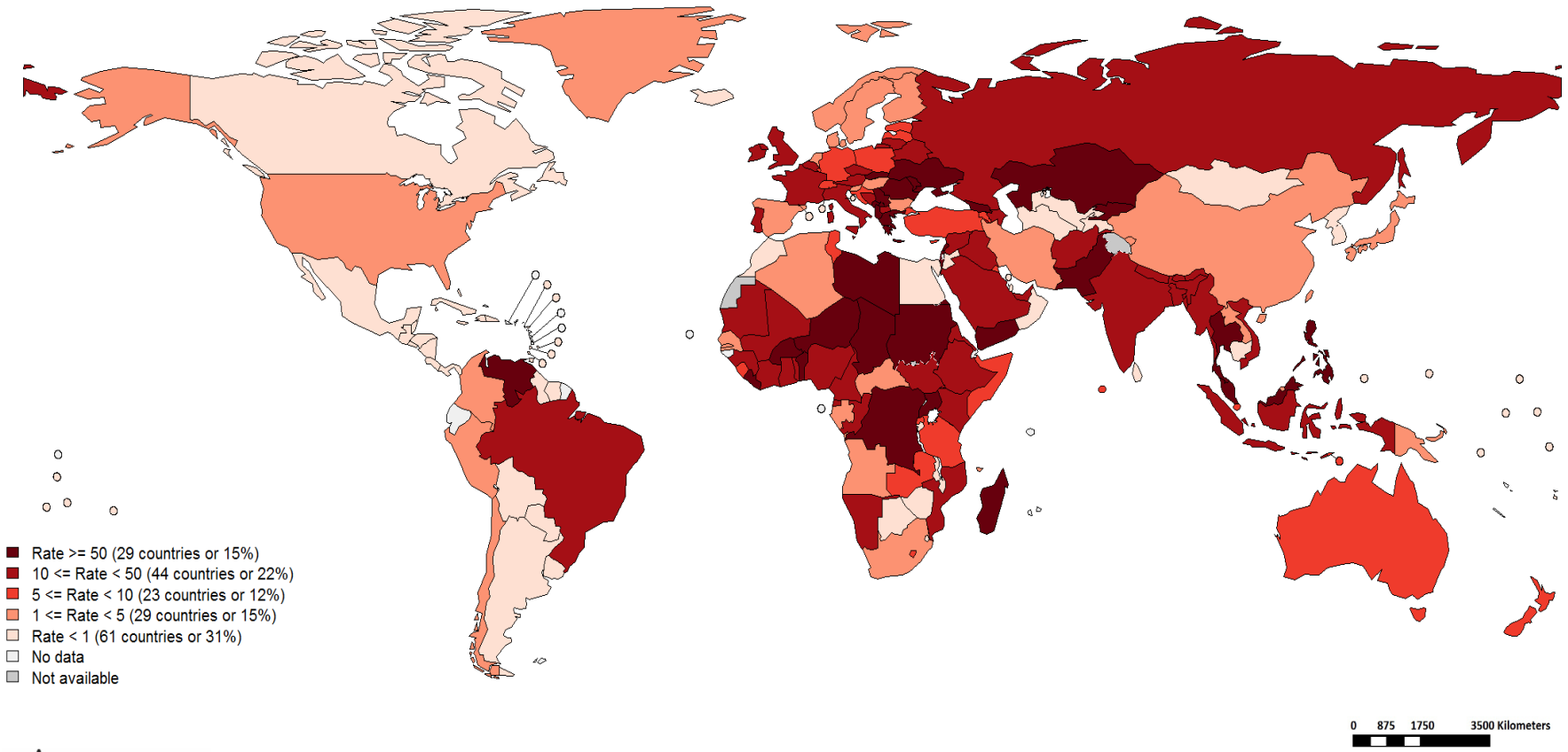


2018 Measles Incidence Rate per Million

- **Target is <5/million**
- **24 Countries with Rate ≥ 50**
- **0/6 Regions with Elimination**

Top 10**		
Country	**Cases**	**Rate**
Ukraine	63948	1439.02
India	63364	47.85
Madagascar	59407	2386.35
Pakistan	30747	159.14
Philippines	19401	187.78
Yemen	11746	425.82
Brazil	10262	49.42
Nigeria	5847	31.44
Venezuela (Bolivarian Republic of)	5668	179.55
Thailand	5579	81.02

Other countries with high incidence rates***		
Country	**Cases**	**Rate**
Georgia	3176	809.09
Liberia	3194	692.27
Albania	1476	504.38
Serbia	4176	473.46
Israel	3377	412.24
Montenegro	201	319.75
Kyrgyzstan	1509	253.37



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Map production: World Health Organization, WHO, 2019. All rights reserved
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- Notes: Based on data received 2019-02 and covering the period between 2018-01 and 2018-12
- Incidence: Number of cases / 1,000,000 population- * World population prospects, 2017 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)

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Non-exhaustive

The next decade will need to address new and emerging issues, and harness new solutions in vaccines and immunization …

Gender is a major factor in coverage and equity of vaccines

Immunization will continue to evolve from a focus on infants and children to vaccinating **along the life course**

Country-focus will be key to ownership, political commitment and sustainability of the immunization agenda

Approaches to reach un-immunized populations will target increasingly fine and precise areas, thanks to **higher-quality data**

Focus will be on driving coverage and equity for existing vaccines, leveraging **innovations in delivery products and practices**

Developing and securing healthy vaccines markets (adequate, continuous supply; affordable prices; etc.) will continue to be a key priority

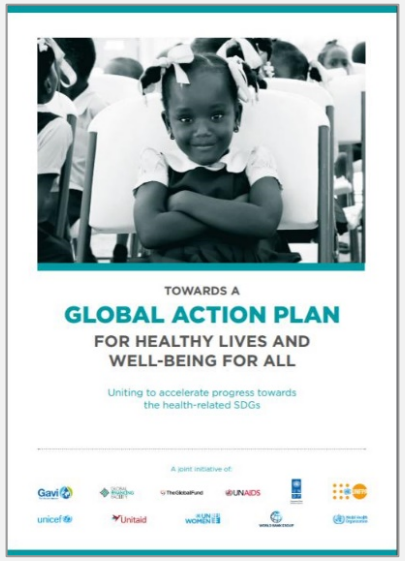
Thoughtful **integration** with Maternal, Child and Adolescent health programs and PHC, and **collaboration** across the ecosystem will be key to deliver at-scale impact

Immunization **demand and acceptance** will also be essential to drive coverage

Disease surveillance will be a driving component of high functioning vaccine and immunization systems

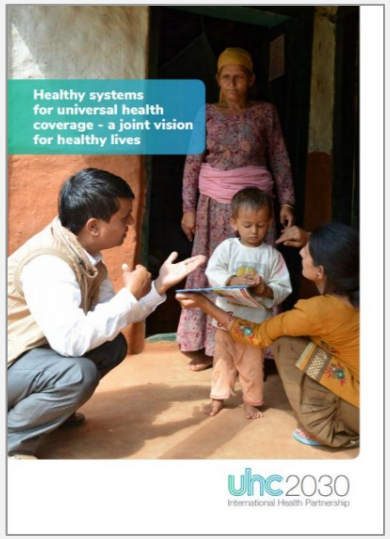
The role of vaccines in preventing or responding to **health emergencies**, even more so **in fragile contexts**, will become ever more important in the next decade

… while at the same time contributing to the broader global health and development agendas



Sustainable Development Goals

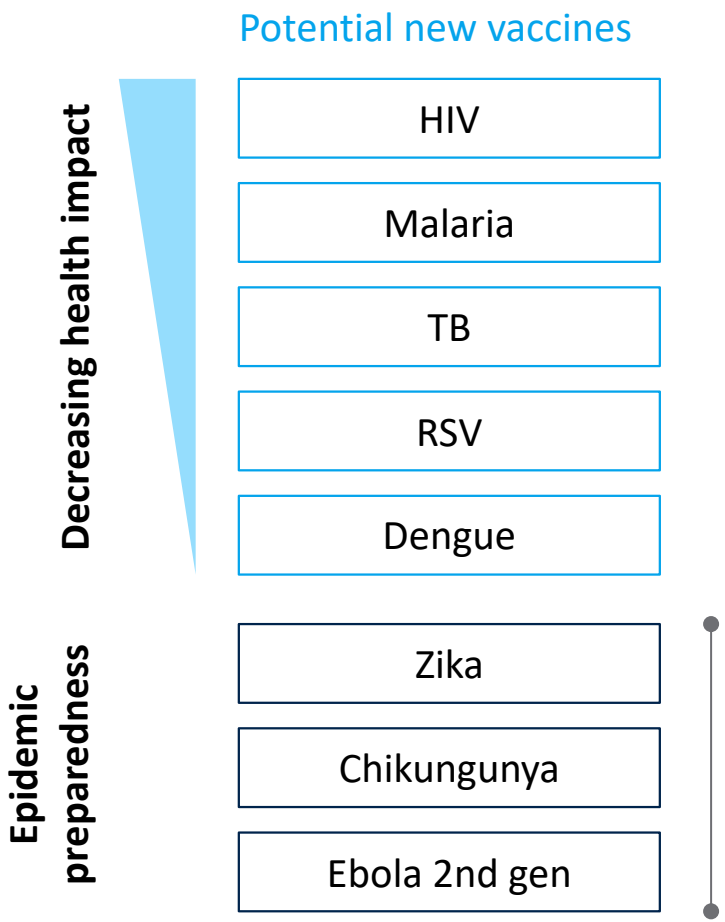
Primary Health Care



Universal Health Coverage

13th General Programme of Work

Future Equity: While no blockbusters expected in the short term, several long-awaited vaccines might enter the market towards the end of the decade



Current status

Vaccine **not expected** to enter the market **before 2025**

Phase 3 with **preliminary efficacy data** available (pilot implementation of first malaria vaccine with impact available by 2021 – 2023)

Vaccine **not expected** to enter the market **before 2025**

Vx for maternal or infant immunization **may be registered** in coming years – Uncertain future of most advanced candidates (complex phase 3 results)

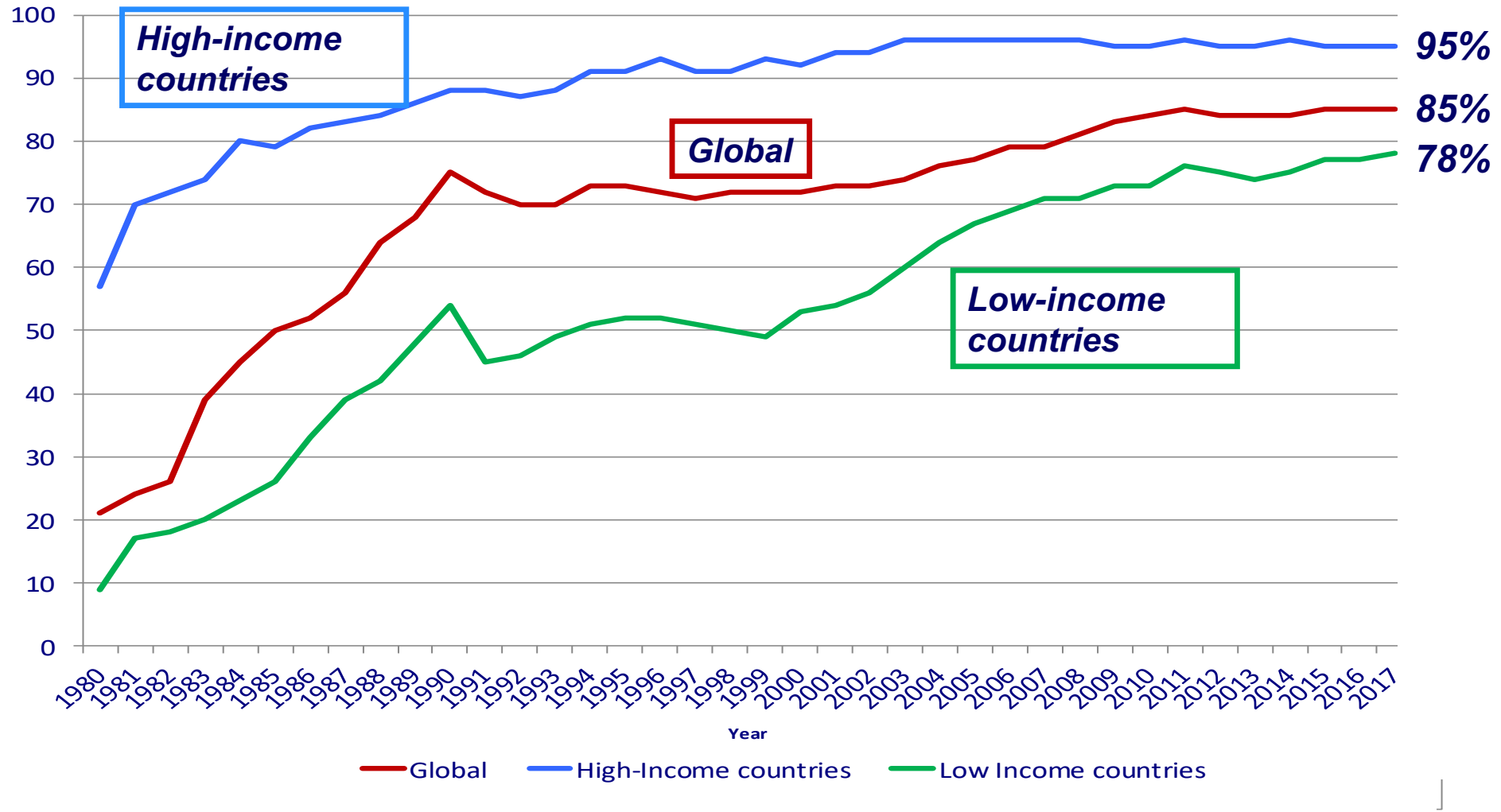
One dengue vaccine licensed in several developing countries; 5 additional vaccines expected (out of which two are now in Phase 3)

Several **candidates in phase 2**

Note: Several other vaccines considered as part of the VIS; the above only reflects selected examples
Source: Gavi analysis; WHO analysis

Equity: Vaccine coverage persistently differs by income level

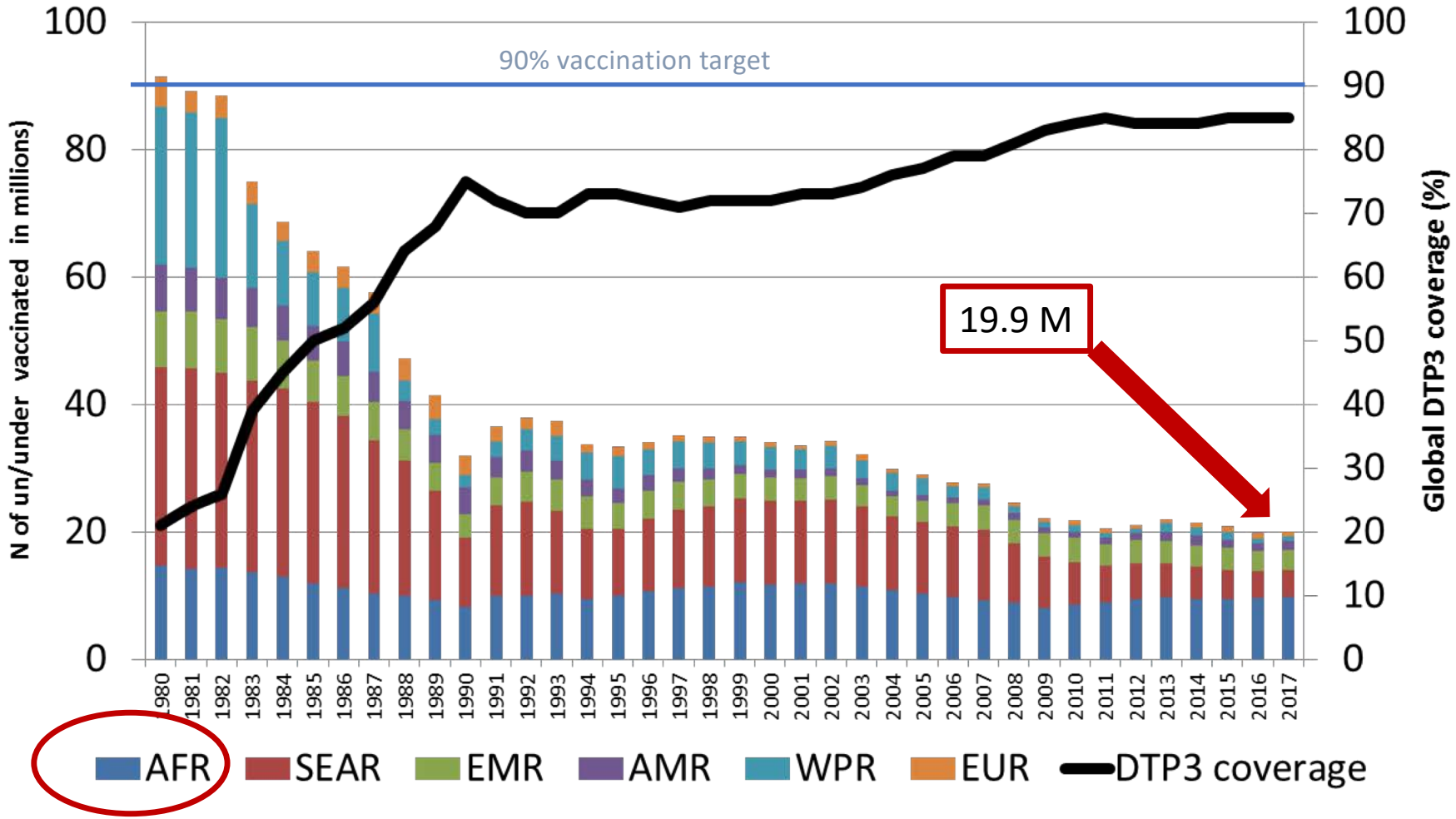
Coverage with DTPcv3, by country income levels, 1980-2017



Source: WHO/UNICEF coverage estimates 2017 revision, July 2018, and Country Income Categories (World Bank), as of June 2018.
Income classification not available for: Cook Islands and Niue
Immunization Vaccines and Biologicals, (IVB), World Health Organization.
194 WHO Member States. Date of slide: 16 July 2018.

Equity: 10% of children fully 'left out' of any immunizations

Global DTPcv3 Coverage and Number of Unvaccinated and Under-vaccinated Infants by WHO Region



DTP3 coverage remains at 85% in 2017, leaving 19.9 million children vulnerable to vaccine preventable diseases

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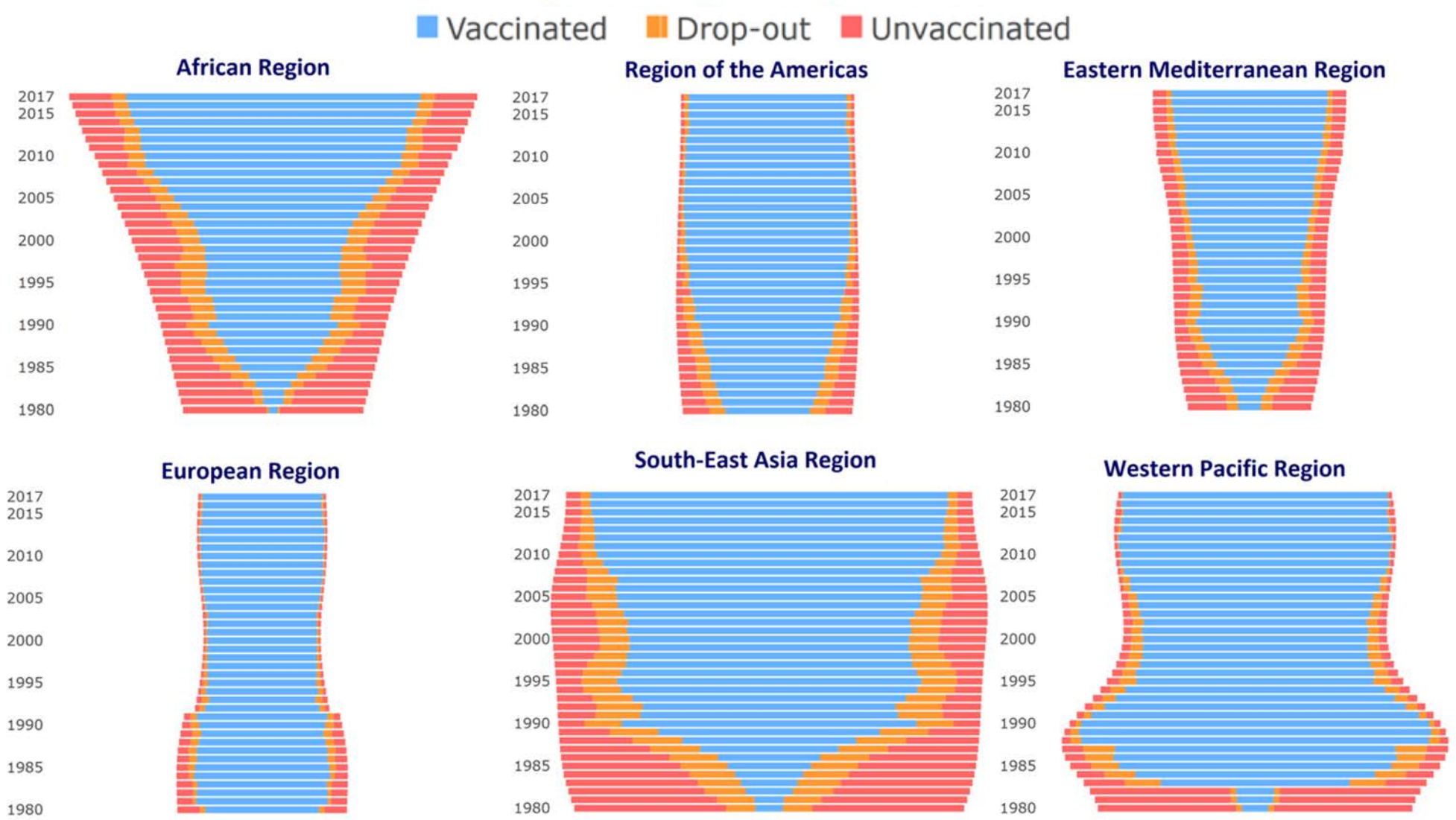
Out of 20 infants, 2 are completely left out, while 1 started but didn't complete the 3-dose course.

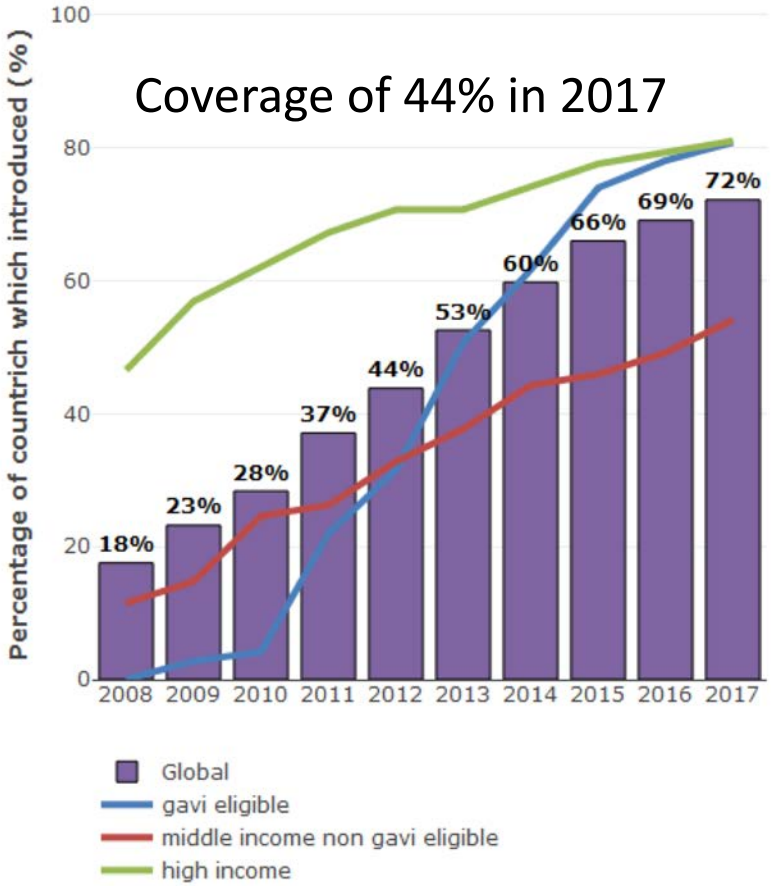
Equity: Coverage “plateau” in Africa, even as more children vaccinated

Target population and vaccinated by WHO regions over time

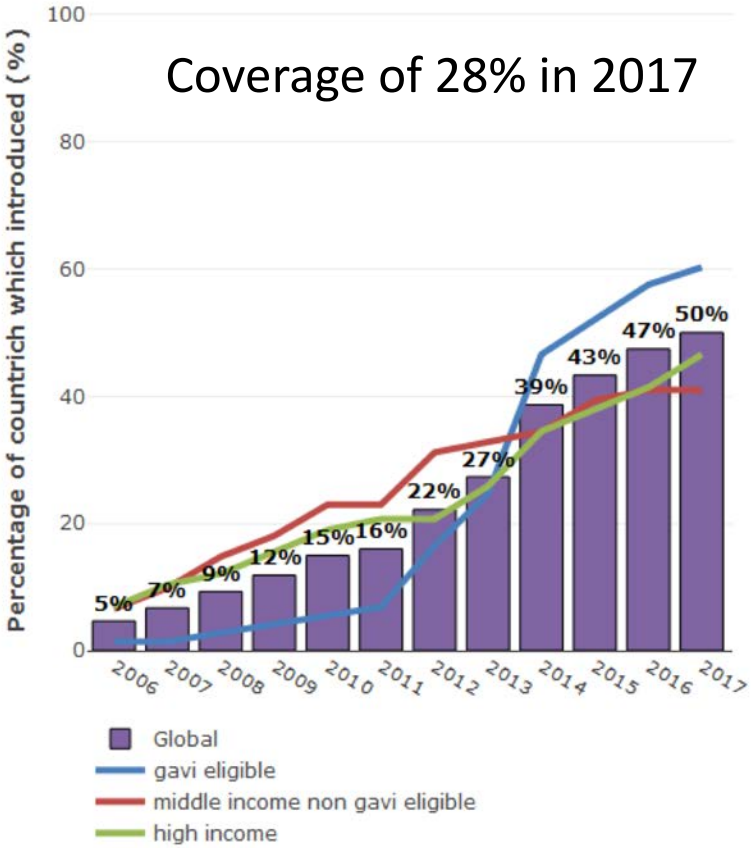


Equity: New vaccine introduction Pneumococcal and Rotavirus vaccine lagging in MIC

Pneumococcal vaccine



Rotavirus vaccine
introduced in 97** member states



New vaccine introduction

is lagging in middle income countries.

Newly available vaccines are being added as part of the life-saving vaccination package – such as those to protect against meningitis, malaria and even Ebola. On the other hand, vaccines to prevent against major killers of children such as rotavirus, a disease that causes severe childhood diarrhoea, and pneumonia, have been around for over a decade. But the use of rotavirus and pneumococcal conjugate vaccines is lagging behind.

In 2017, global coverage for rotavirus was only 28 % and 44% for PCV. Vaccination against both these diseases has the potential to substantially reduce deaths of children under 5 years of age, a target of the Sustainable Development Goals.

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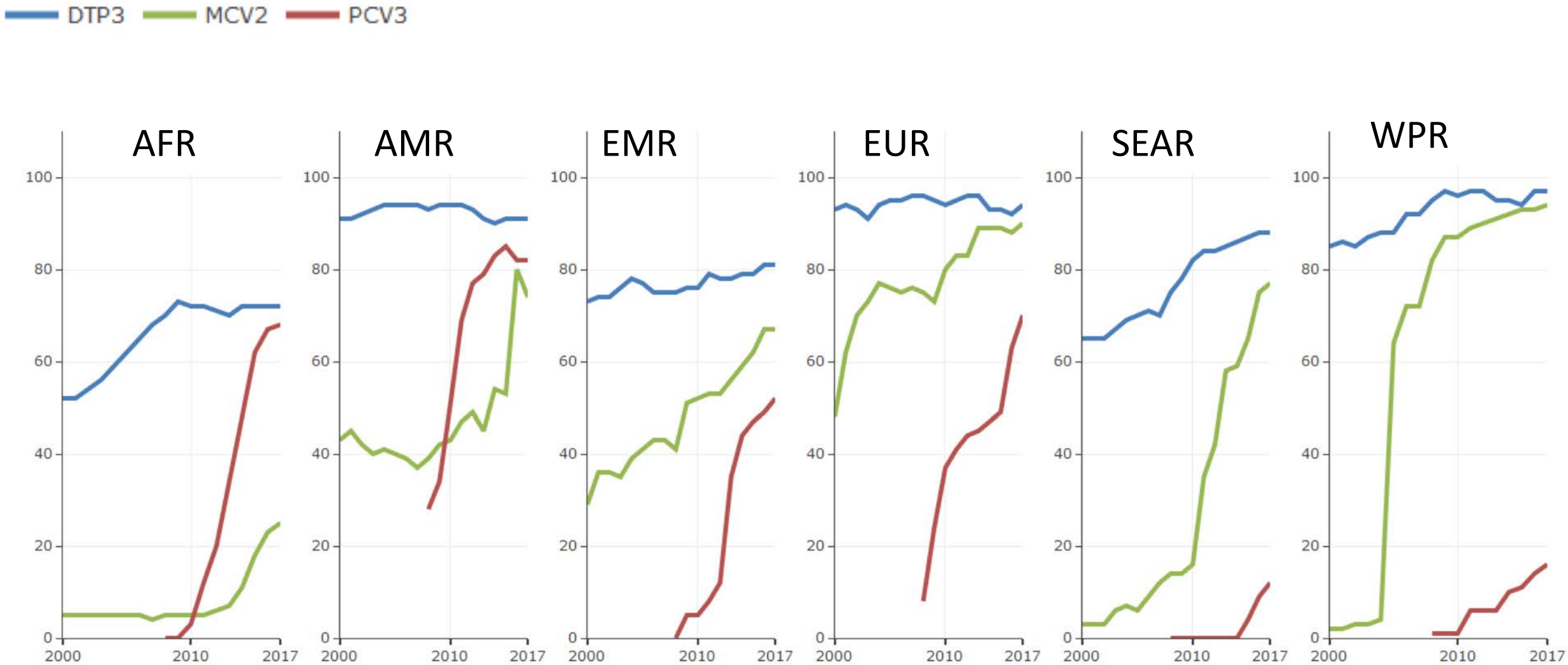
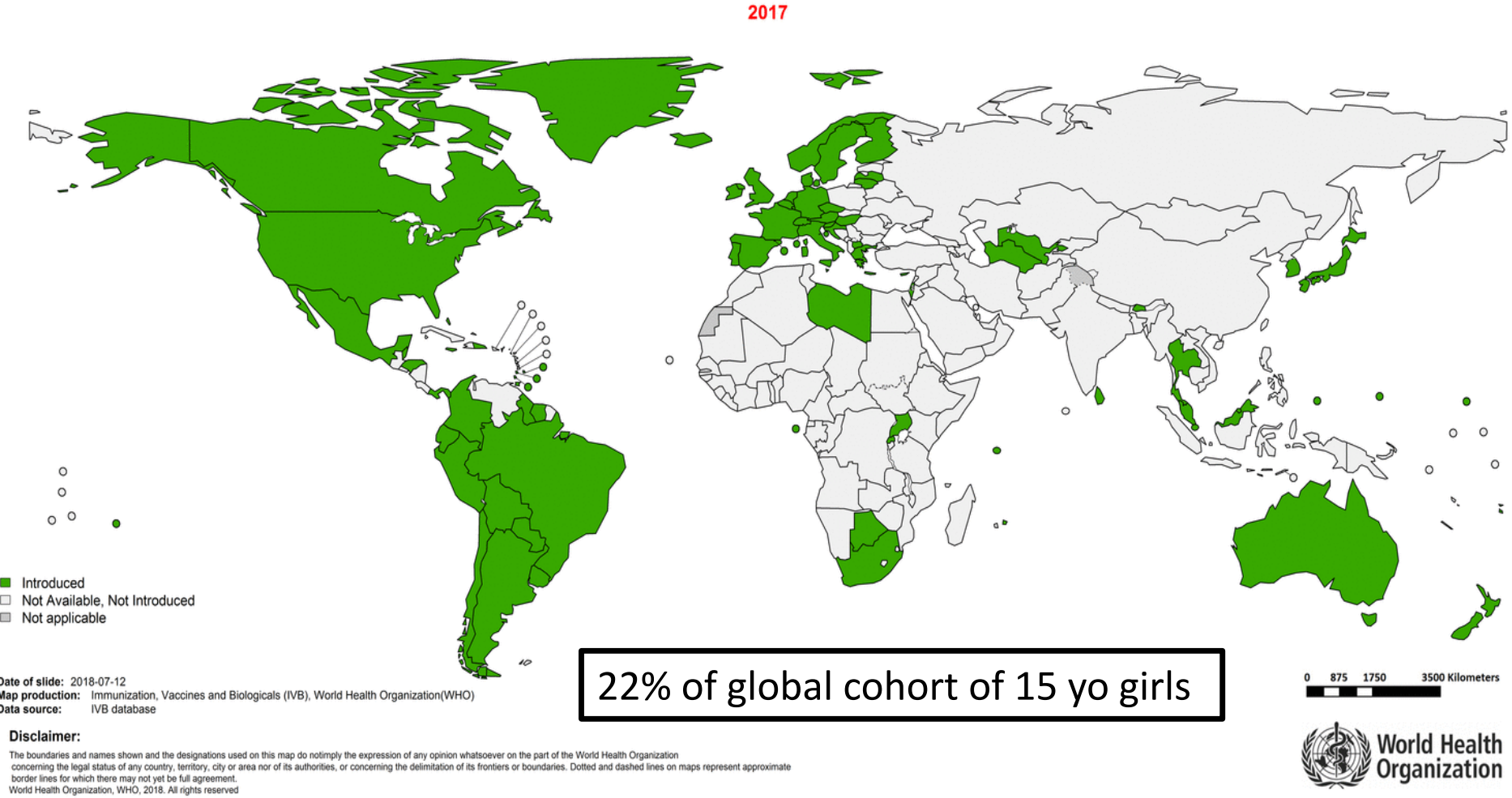
* Includes partial introduction for 5 countries
**includes partial introduction for 6 countries
Syria grouped with middle income non Gavi, but changed status to low income and Gavi eligible as of 2018.

Equity: PCV and MCV2 introduction vary substantially by region, driven by Gavi/non-Gavi and small number of large countries



Equity: Only 1 of 5 girls (15 yo) lives in a country with HPV vaccine in national immunization schedule



Human papillomavirus (HPV) is the most common viral infection of the reproductive tract, and can cause cervical cancer, other types of cancer, and genital warts in both men and women.

In 2017, the HPV vaccine was introduced in 80 countries covering 22 percent of global cohort of 15 year old girls.

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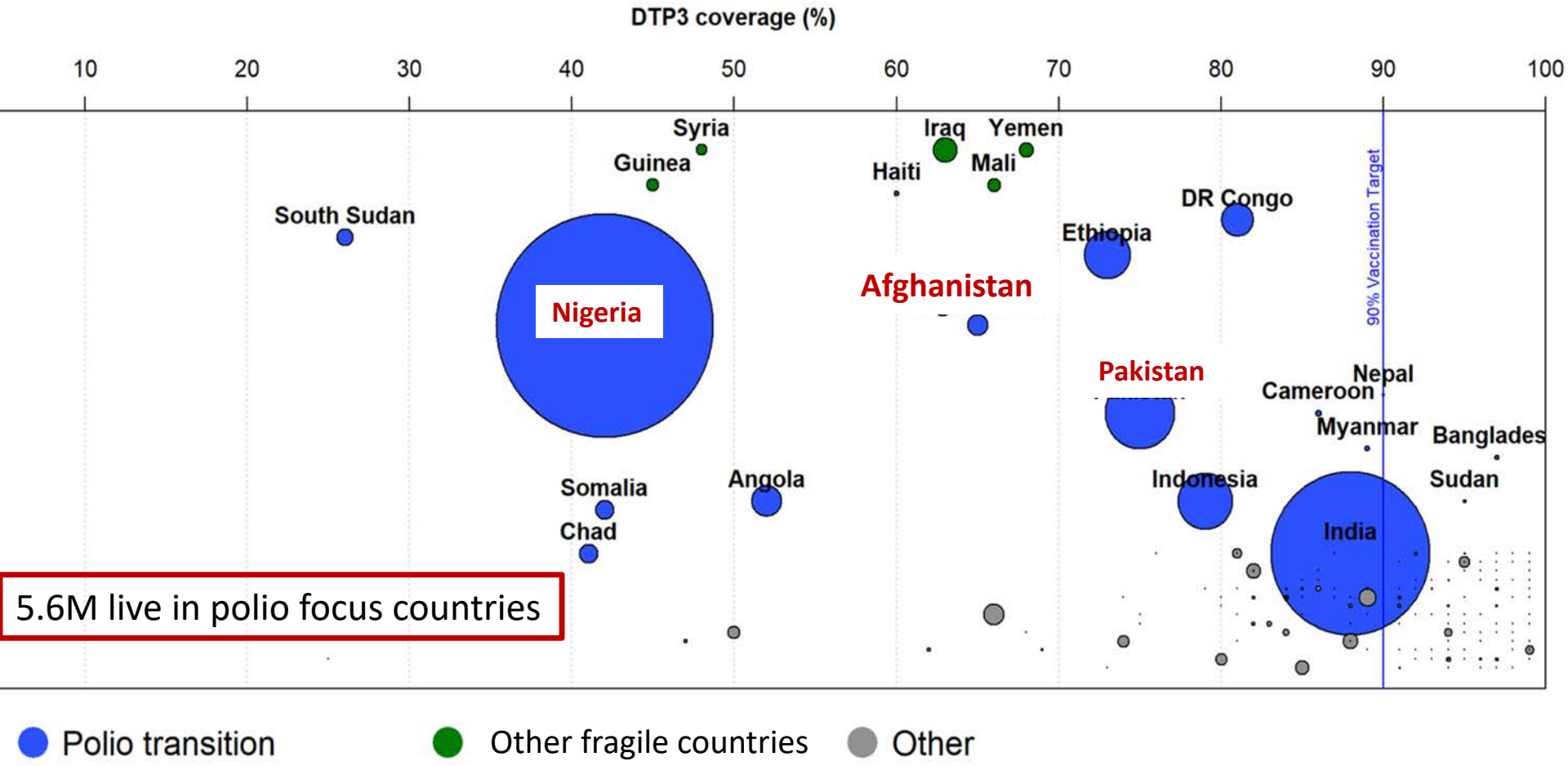
Security: 8 M (of 19.9 M) left-out or drop-out children live in fragile, conflict or humanitarian settings, including polio priority countries



Note: The size of the bubbles is proportional to the number of unvaccinated infants in each country

Of the 19.9 million infants who are not fully vaccinated with DTP3, almost 8 million (40%) live in fragile or humanitarian settings, including countries affected by conflict.

About 5.6 million of them live in just three countries – Afghanistan, Nigeria and Pakistan – where access to routine immunization services is critical to achieving and sustaining polio eradication.

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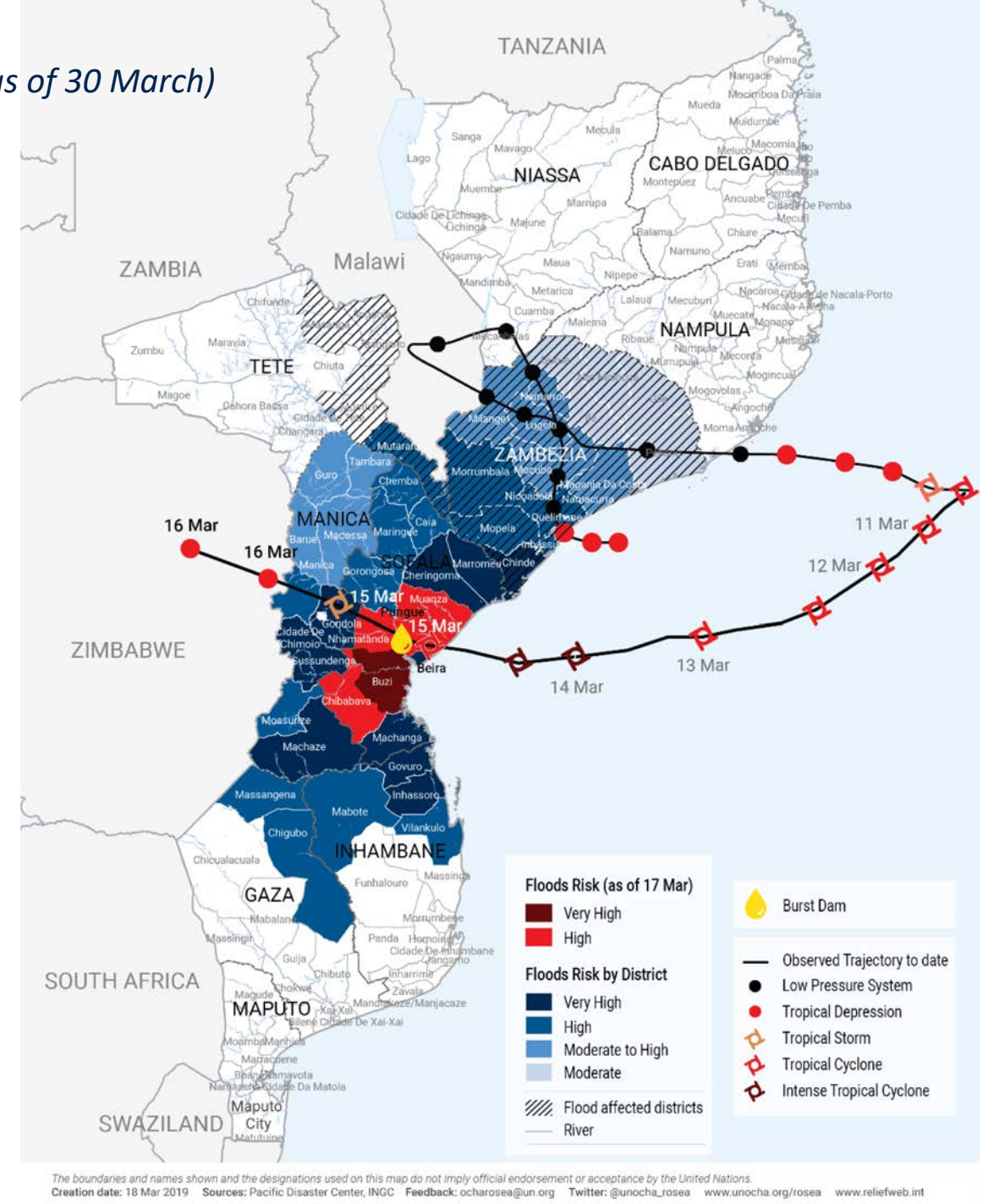
Security: Mozambique Cyclone Idai *(data as of 30 March)*

Cyclone Idai hit coastline on 14 March 2019

1.85 million people in need of humanitarian assistance ; Official death toll (30/03): 501; expected to increase, >1500 injured

Strengthening surveillance and prevention of disease

- OCV campaign: ICG approval of 900k doses of arriving in Beira on 01/04
- Preparing for emergency measles campaign and malaria bednets



The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.
Creation date: 18 Mar 2019 **Sources:** Pacific Disaster Center, INGC **Feedback:** ocharosea@un.org **Twitter:** @unocha_rosea www.unocha.org/rosea www.reliefweb.int

Security: Ebola Vaccine in DRC Outbreak ---- Public Health Heroes

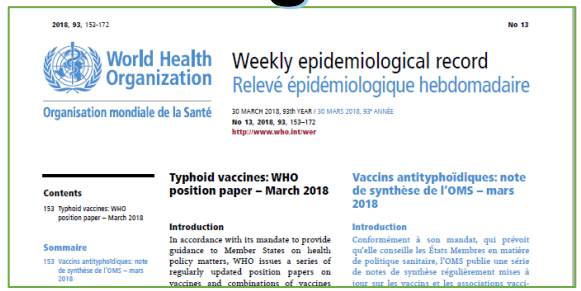
Security: The role of vaccines to prevent AMR is accelerating

'…bringing additional, and more effective, vaccines to market could have a huge impact on AMR. Vaccines already play a critical role, with an impressive track-record of reducing AMR'

Security: Rapid developments for TCV policy and funding

2017

Gavi Board approves $85M for TCV in 2019-2020



Revised WHO recommendation for typhoid vaccines

2018

October | November | December | January | February | March

WHO SAGE recommendation for TCV

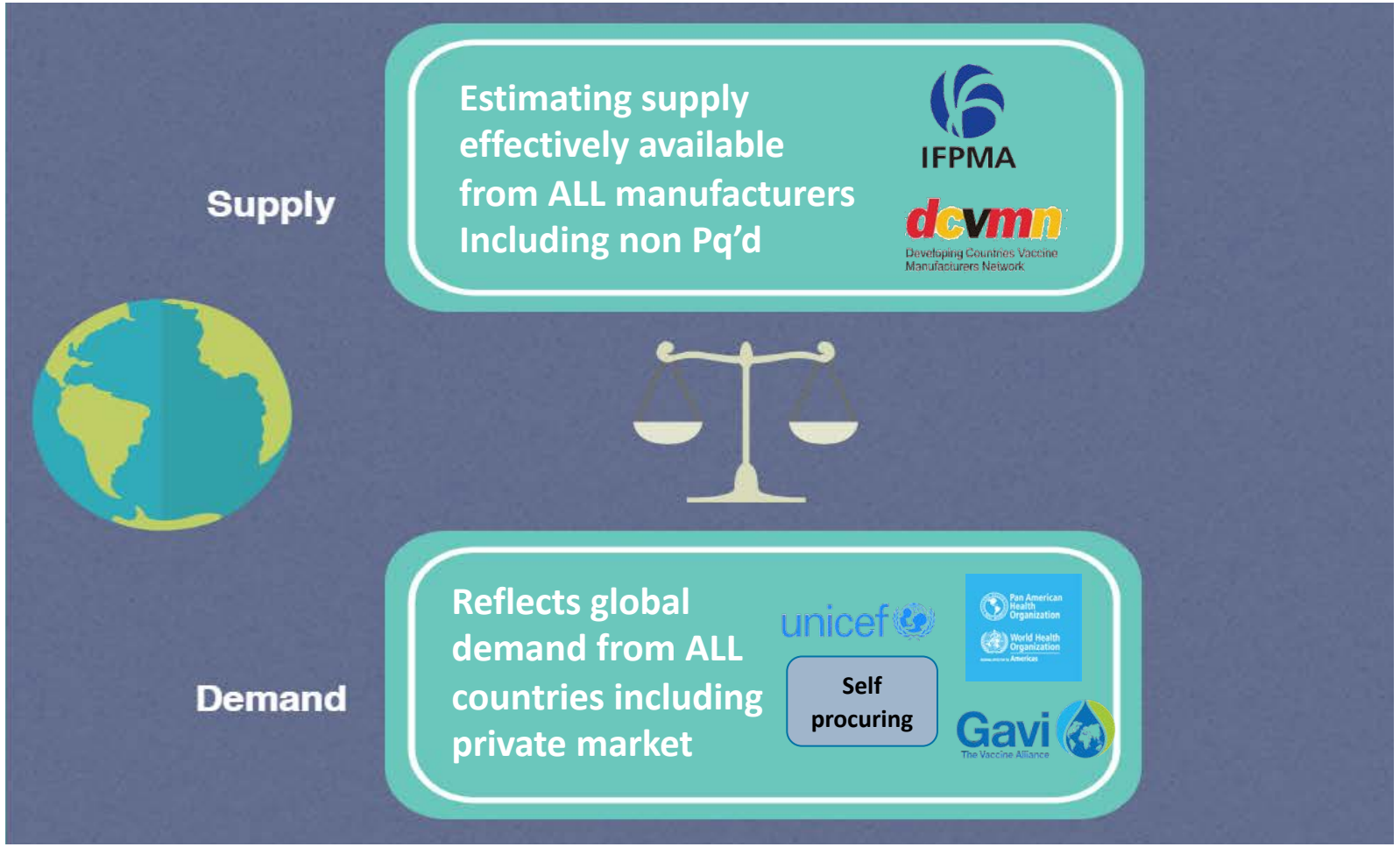
Typbar-TCV™ receives WHO PQ

IMPACT:

- **TCV used in 2 outbreaks**
- **3 countries applied and approved (2 provisionally) for introduction in 2019 & 2020**

Security: Market Information for Access – MI4A

MI4A Vaccine Market Studies provide GLOBAL analyses of supply & demand dynamics



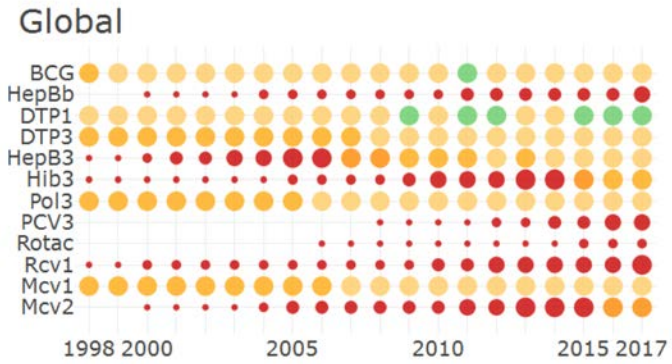
Available to SAGE as it advises WHO on different disease control priorities or implementation of policies.

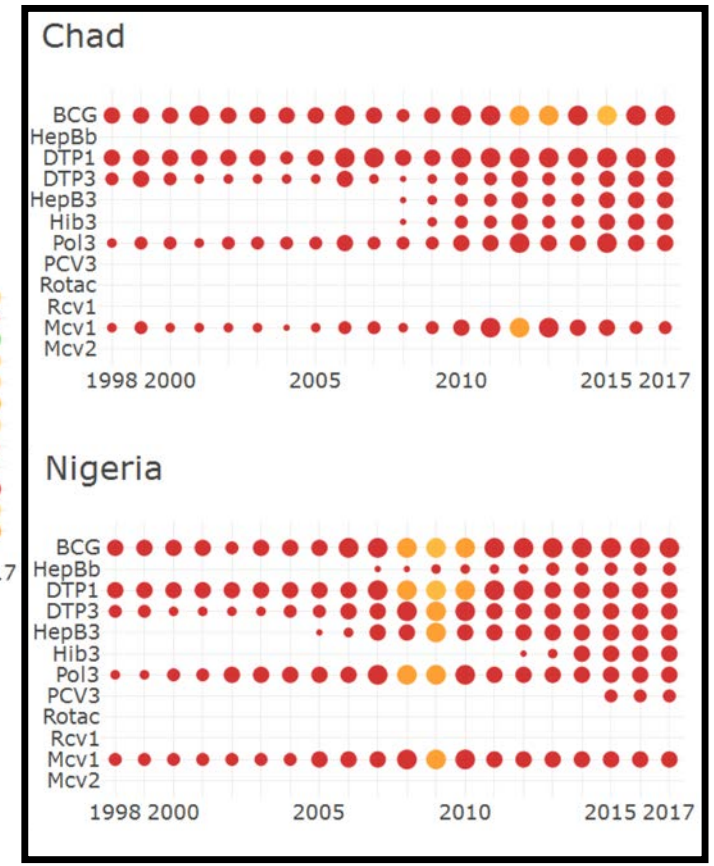
E.g. Inform SAGE recommendation on best use of scarce supply for HPV

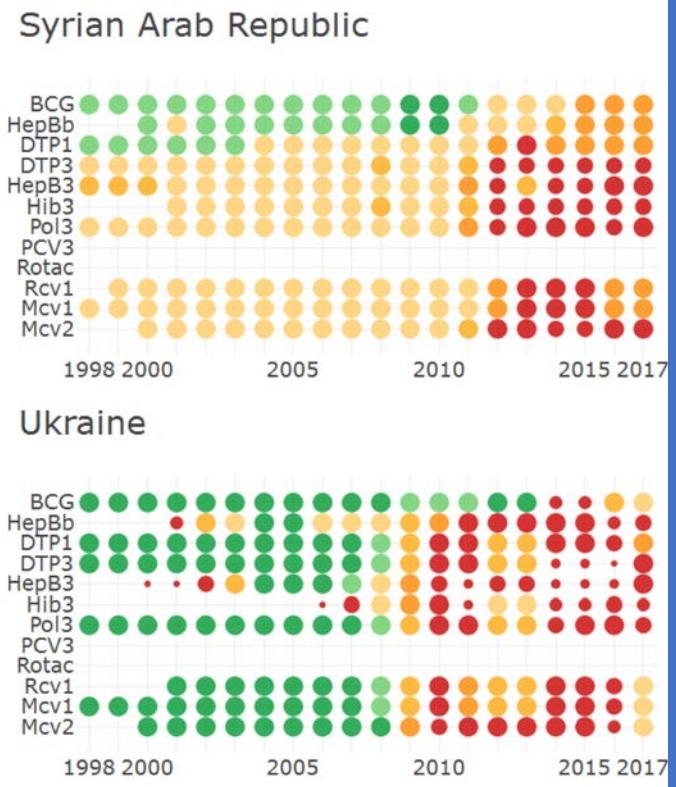
Security: Revising WHO Global Indicative Wastage Rates

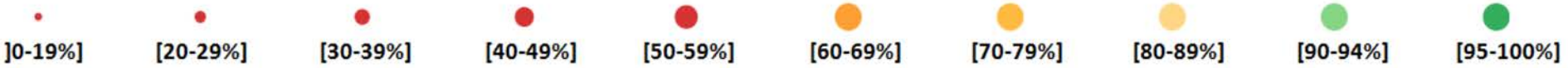
- IVB has developed a **new wastage calculator** refining our ability to forecast and monitor wastage:
  - **At country level**: provide more accurate annual vaccine needs; reduce stock out and over stocks; adapt session frequency and size; increase coverage
  - **At global level:** improve predictable global demand and reduce shortages.
- In **country testing**, refinement and development of web-based tool starting in **Q2 2019**

Security: Coverage in low performing countries reflects persistent poor coverage









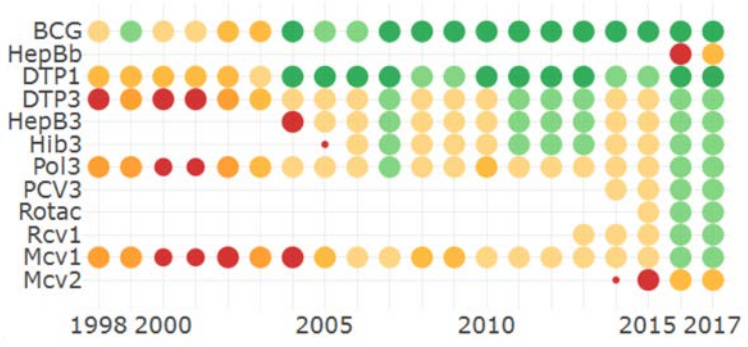
Countries with very low immunization coverage

Ten countries had DTP3 or one dose of measles vaccine (MCV1) coverage below 50%: Angola, Central African Republic, Chad, Equatorial Guinea, Guinea, Nigeria, Somalia, South Sudan, Syrian Arab Republic ,and Ukraine.

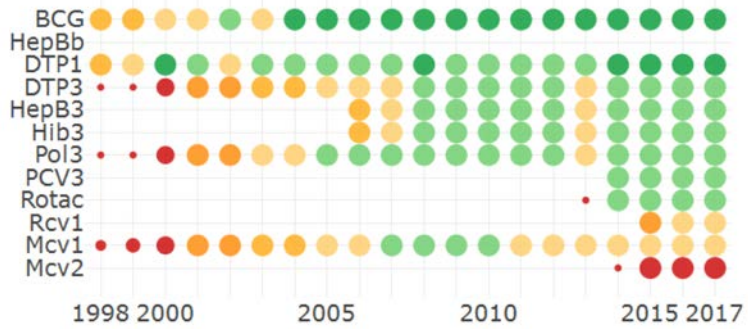
Children in these countries, already subject to multiple depravations, remain at risk of outbreaks of vaccine preventable diseases and threats to their lives.

…..while other countries are advancing

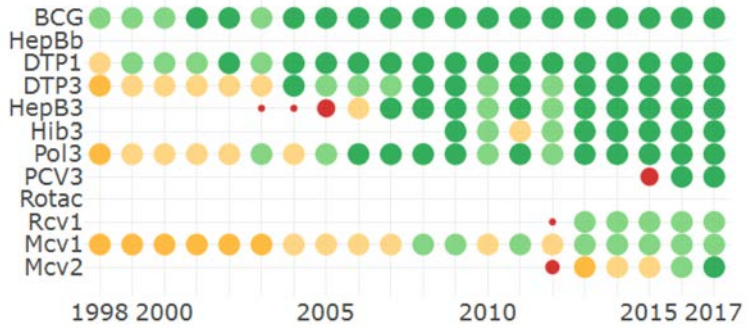
Senegal



Burkina Faso



Bangladesh



Global organizations and partners are refining their approaches to segmenting countries

From an income-based segmentation in the past decades (high-, middle-, low-income countries), strategies have now shifted to look at country capacity and vulnerability

E.g., UNICEF country context segmentation

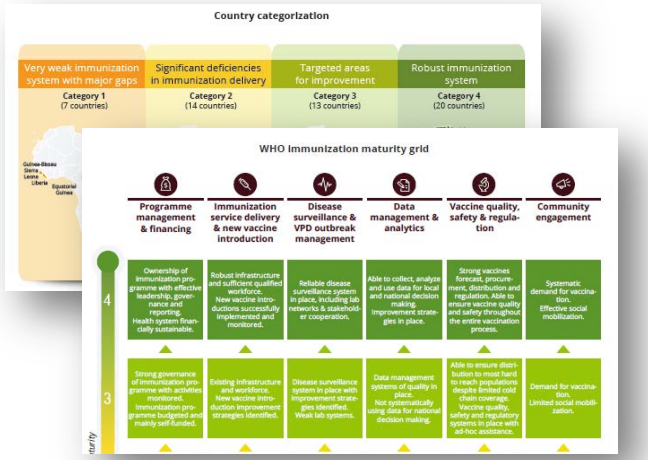
Categorizing countries by 'capacity for effective immunization programs' to into 5 levels: emergency, fragile, low-capacity, medium-capacity, high-capacity

Figure 5 UNICEF Strategy for Health: Definition of country contexts, by capacity

Emergency	Fragile	Low capacity	Medium capacity	High capacity	Global
A situation that threatens the lives and well-being of a large portion of a population and requires extraordinary action to ensure their survival, care and protection.	Areas with post-conflict or prolonged crisis. Inability to meet the population's expectations or manage changes in expectations and capacity through the political process.	Insufficient fiscal resources; low functioning government and infrastructure.	Limited fiscal resources; medium functioning government and infrastructure. May struggle with persistent equity challenges among sub-populations.	Adequate fiscal resources; high functioning government and infrastructure. May struggle with persistent equity challenges among sub-populations.	Provide guidance; influence agendas and leverage resources on a global scale.

E.g., WHO Maturity Grid

Assessing country capacity along 6 dimensions of 'immunization system' and 4 levels of maturity to produce a holistic assessment and generate tailored support/ roadmap recommendations



Country Support According to Maturity Assessment

High-Level 5-Year Regional Immunization Strategies

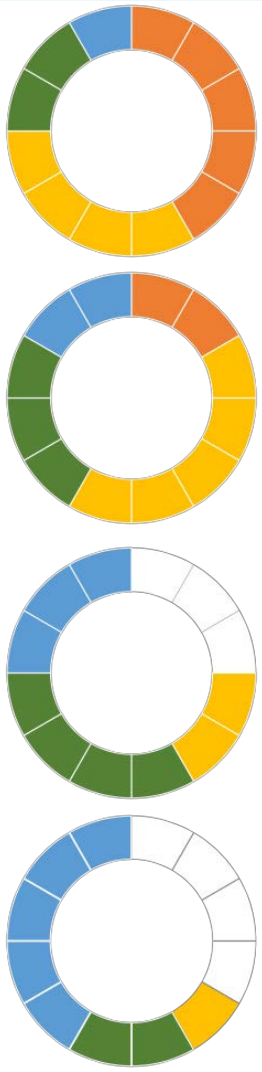
WHO support by maturity level

Level 1
Turnaround countries (TU)

Level 2
Tipping point countries (TP)

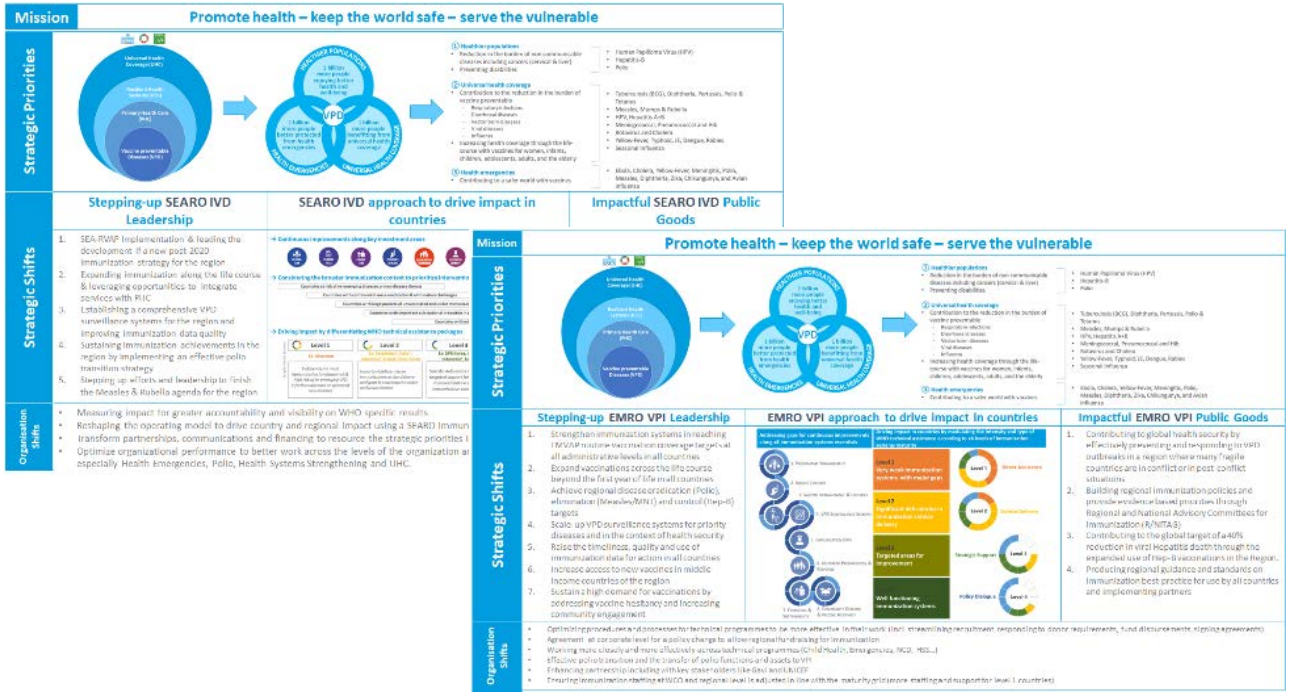
Level 3
Strategic intervention countries (SI)

Level 4
Standalone countries (SA)

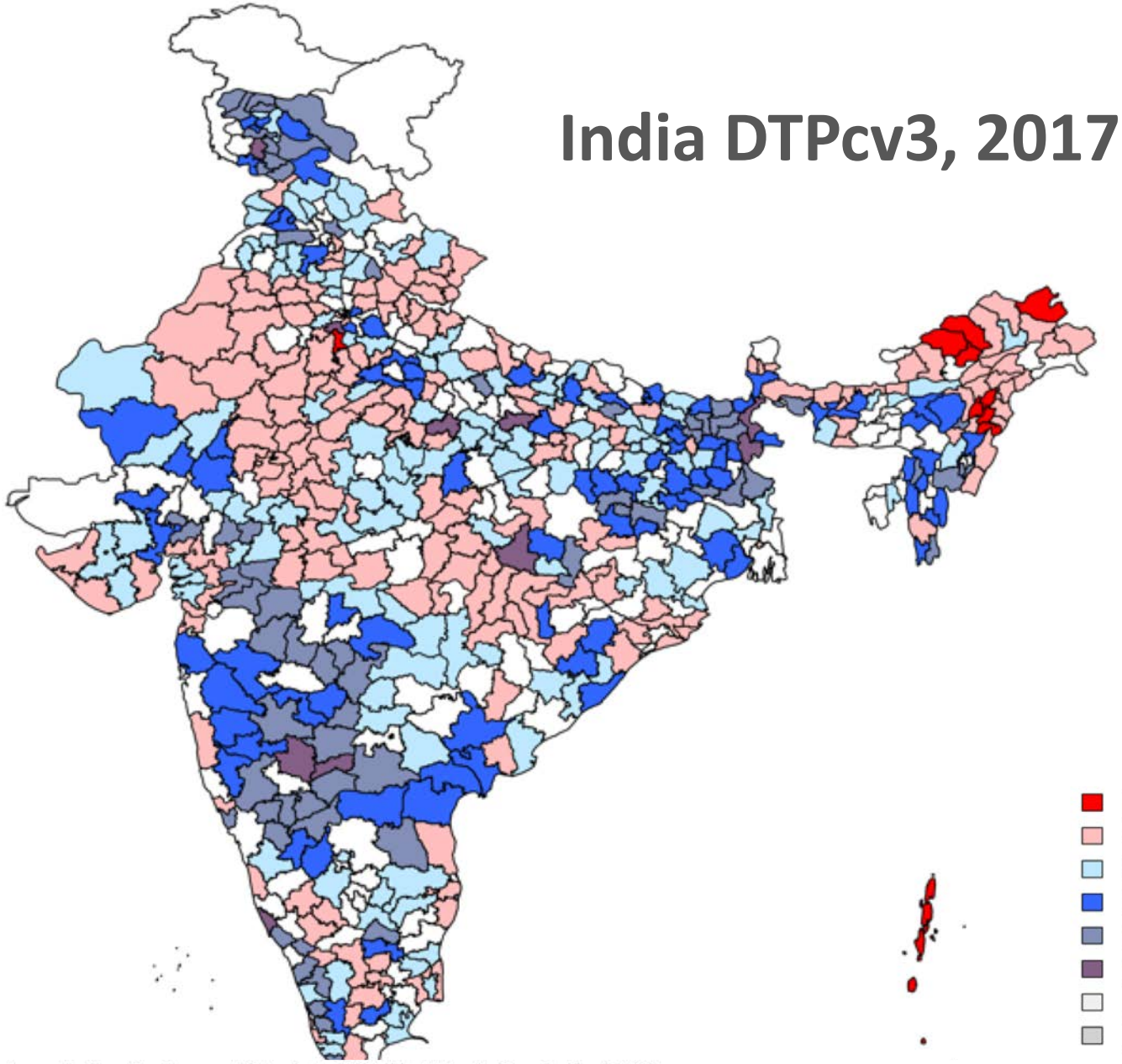


Operational support
Technical assistance
Targeted support
Policy guidance

- Regions have developed 5-year immunization strategies to support county MoH
- Aligned with GPW13
- Includes regional immunization system maturity grids to optimize WHO technical assistance



Subnational coverage reports vary substantially, allowing tailored, targeted strategies



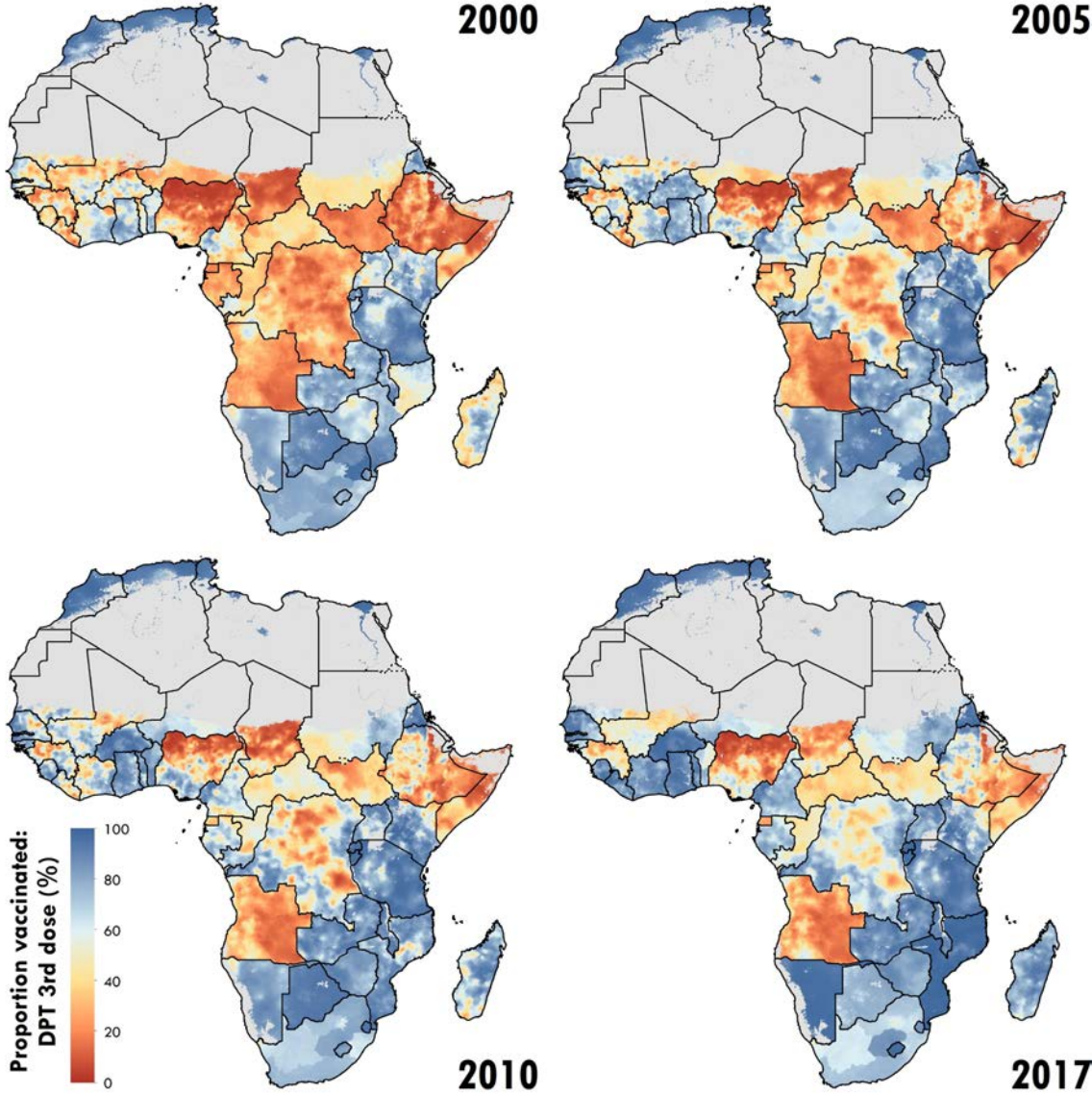
Map production: Immunization, Vaccines and Biologicals (IVB), World Health Organization(WHO)
Data source: WHO/UNICEF estimates 2016 revision, March 2018.
194 WHO Member states.

Disclaimer: The boundaries and names shown and the designations used on this map do notimply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area nor of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Modeled data allow for targeted evaluations in the field to verify

DTP3 coverage at the 5x5 km level

IHME geospatial estimates



Using Satellite Imagery for Public Health Solutions

Polio Eradication Strategies for Essential Immunization Programs

Strengthening micro-planning:

- Validating gaps and overlaps between vaccination team areas
- Analyzing equitable distance for the health facility catchment area to plan for fixed site vaccination posts

Estimating population denominators

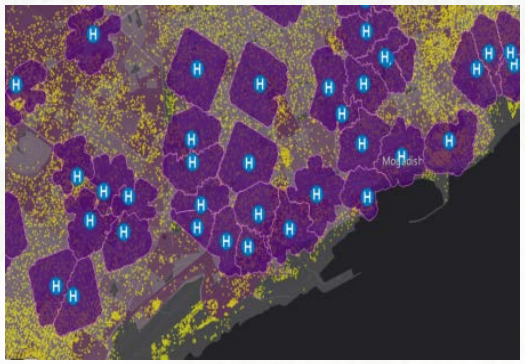
- Using algorithms to estimate the population in a defined area (for RI / VPD outbreak)

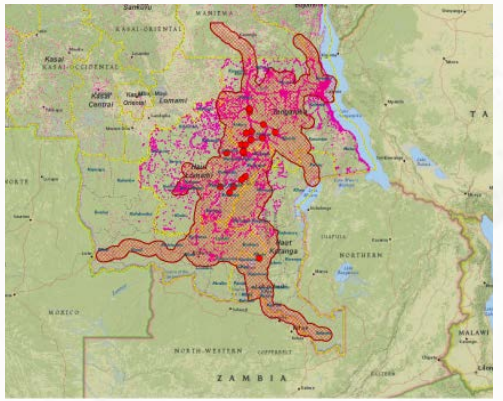
Mapping/visualizing variables:

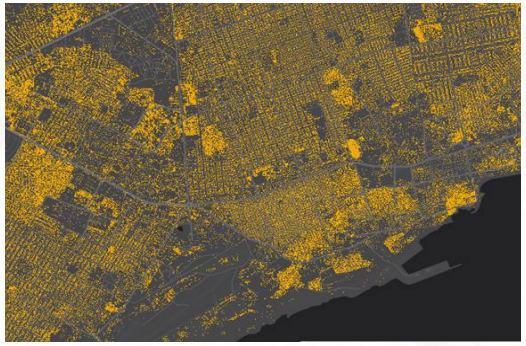
- Ares of vaccination refusals
- Areas of insecurity
- Areas of lack of mobile connectivity
- Points of interest (e.g. health facilities, sites with cold chain)

Monitoring and evaluation activities:

- Visualization of data from electronic forms
- Tracking of movement of vaccinators and SIA monitors
- Planning for logistics (e.g. roads, waterways, airports, ports, in relation to settlements)

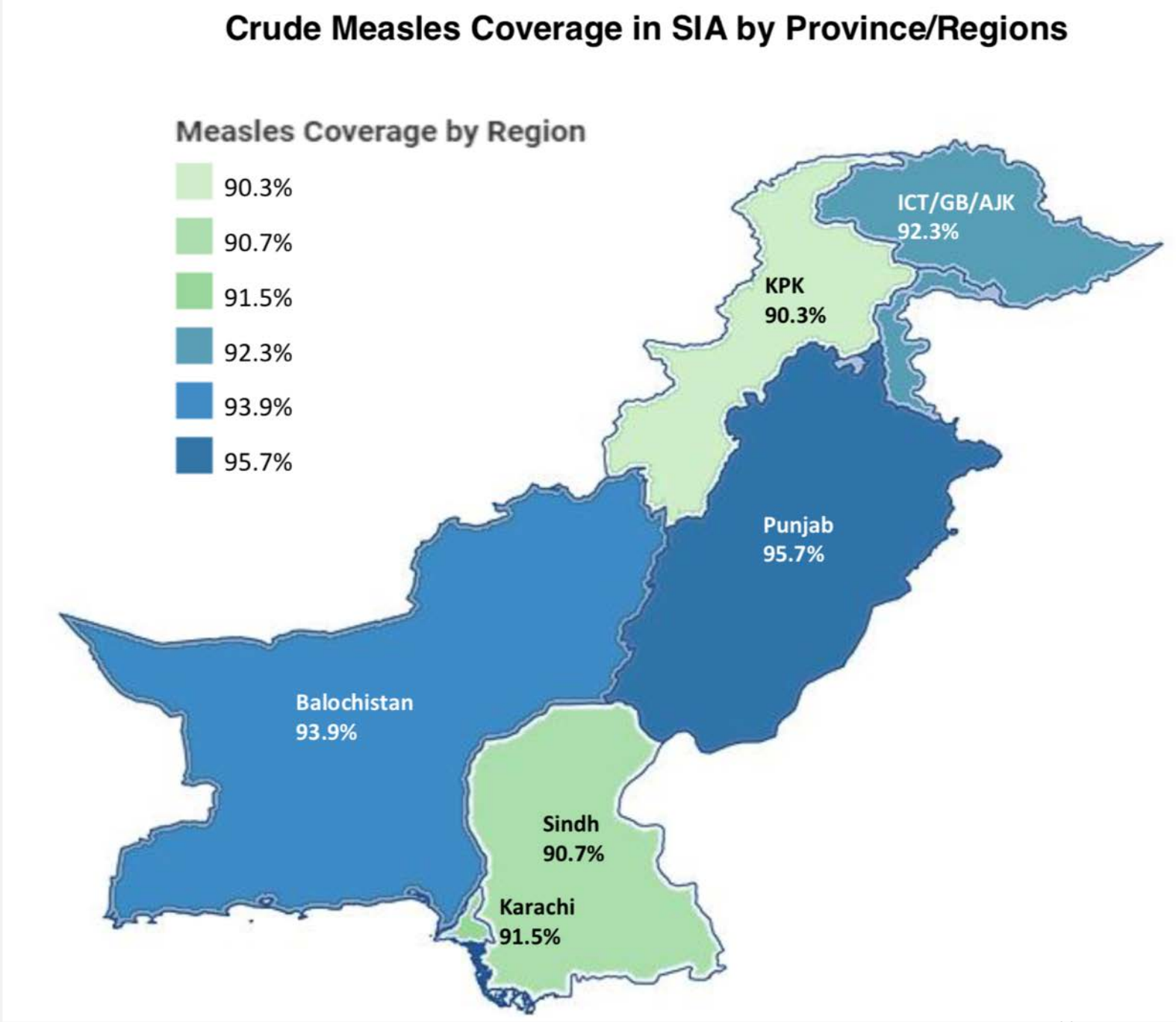






Leverage polio people and assets, including EOCs for VPD control

Pakistan measles vaccine SIA with high coverage



Integration: Combined bOPV/MCV SIAs

- **Priority** - non polio endemic, non-outbreak countries, with high performance in previous MCV SIAs (Admin ≥90%)
- **Upon country request** (e.g. PNG, DRC even if outbreak countries)
- **Implemented in 7 countries** (Nepal, Myanmar, Uganda, Sierra Leone, Sudan, PNG, DRC)

Potential to reach more children, with less cost:

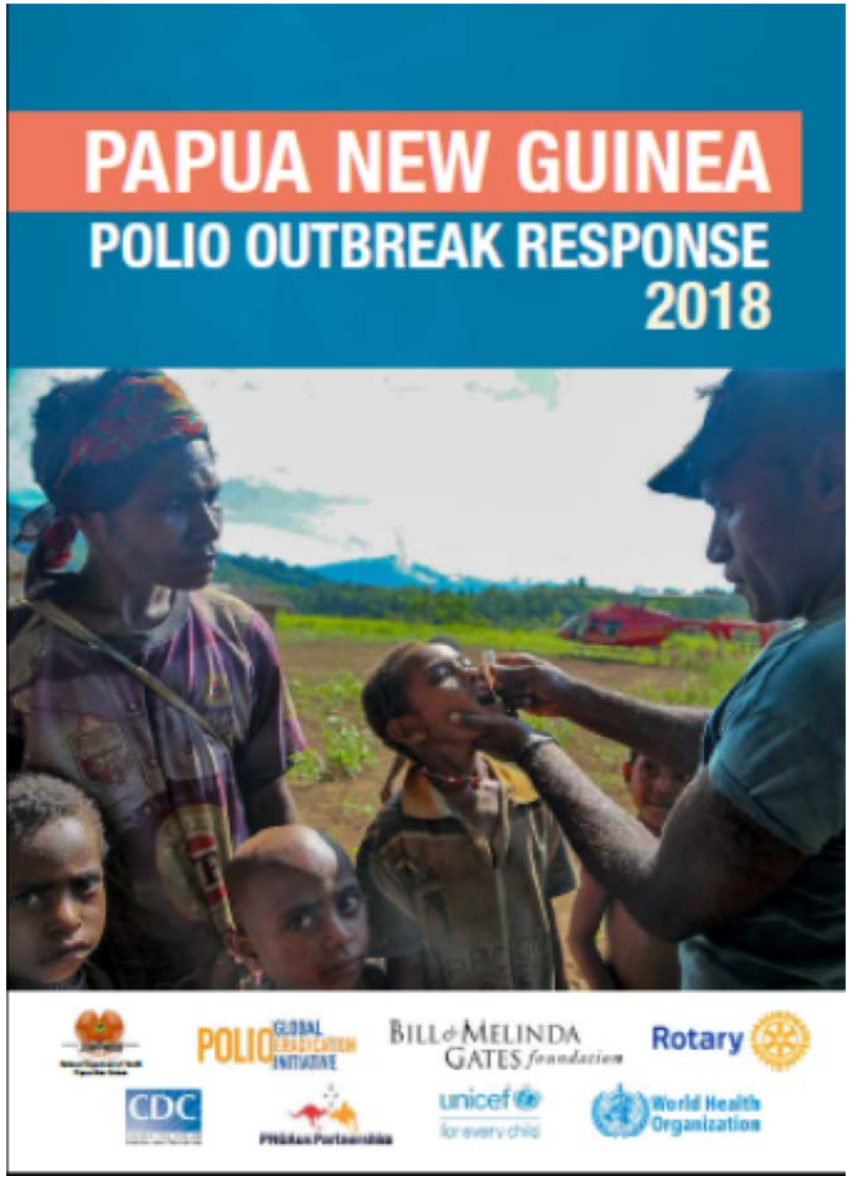
- Uganda – 8.5 million children vaccinated, $4M cost savings
- Sudan – 8.1 million children vaccinated, $1.85M cost savings
- Sierra Leone – 1.6 million children vaccinated, $350,000 cost savings

PNG: Optimizing cVDPV Outbreak Response Resources to Integrate Other Interventions

- Largest and most costly ongoing cVDPV outbreak
- 26 cVDPV cases (last case - 18 October 2018)
- 5 SIAs implemented (0-15 Y), 3 still planned

Efficient partner coordination from early stages:

- •Multi-partner advocacy (WHO, Gavi, DFAD) for a long term strategy to address weaknesses in EPI
- •Optimizing outbreak resources (e.g. surge, surveillance, capacity building, cold chain, logistics, communication, advocacy) to incorporate other interventions:
  - Combined bOPV/MR campaigns
  - Vitamin A <5Y;
  - Strengthening EPI (fixed post in 9 high risk provinces);
  - Strengthening VPD surveillance where possible (high priority for 2019)
- •Government declared 2019 as “Immunization Year”



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Prosperity: Outbreaks have high economic impact that is not (only) related to mortality

Influenza (1918-1919) – Global:
- 50-100 million deaths
- No cost estimate for 1918; at this scale today, would cost **4.8% of global GDP**

Influenza (1958) – Global:
- 1.1 million deaths
- Estimated cost of **3.1% of global GDP** in 1958

Influenza (1968) – Global:
- 1 million deaths
- Estimated cost of **0.7% of global GDP** in 1968

Ebola (2014) – Liberia, Sierra Leone and Guinea:
- 11,287 total deaths
- Lost **>10% of GDP** in 2014

SARS (2002-04) – South East Asia and US:
- Infected ~8,000 people and killed <800
- Cost **>$40 billion** between 2002 and 2004

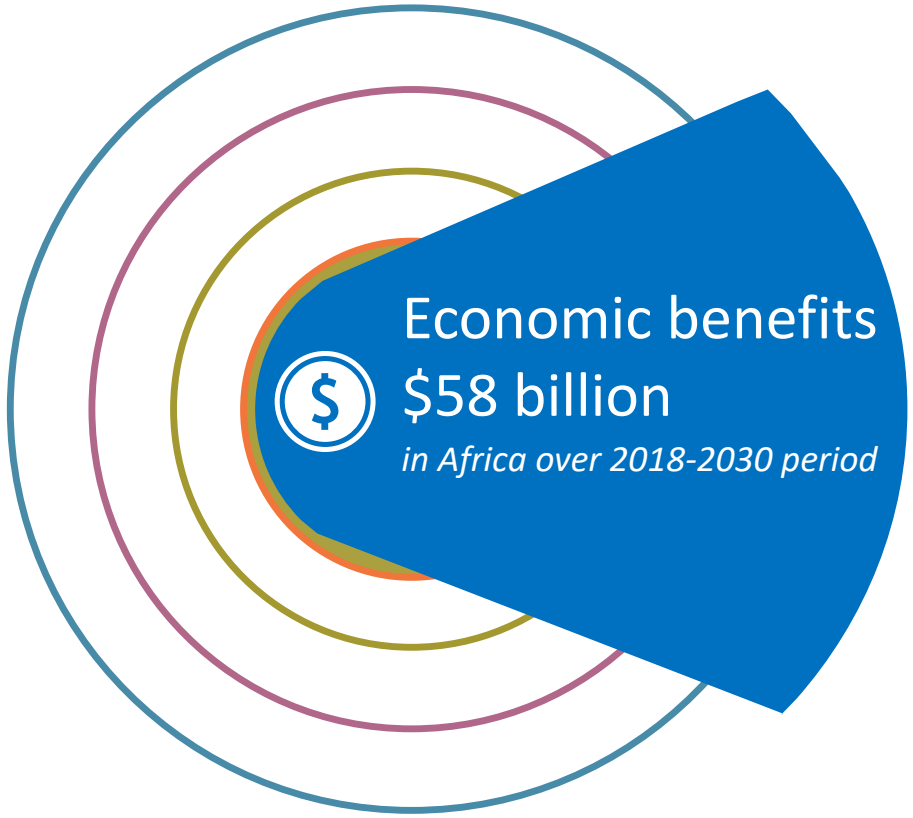
Ebola (2014) – US:
- 1 death
- Spent **$5.4 billion** in 2014

>$6T

Estimated cost of 21st century global pandemics

Prosperity: Sustaining efforts on immunization against 4 main VPD could generate ~$60B by 2030

2030 ambition: up to $58B savings in Africa



$ 16 billion
Measles

$ 14 billion
Rubella

$ 15 billion
Rotavirus

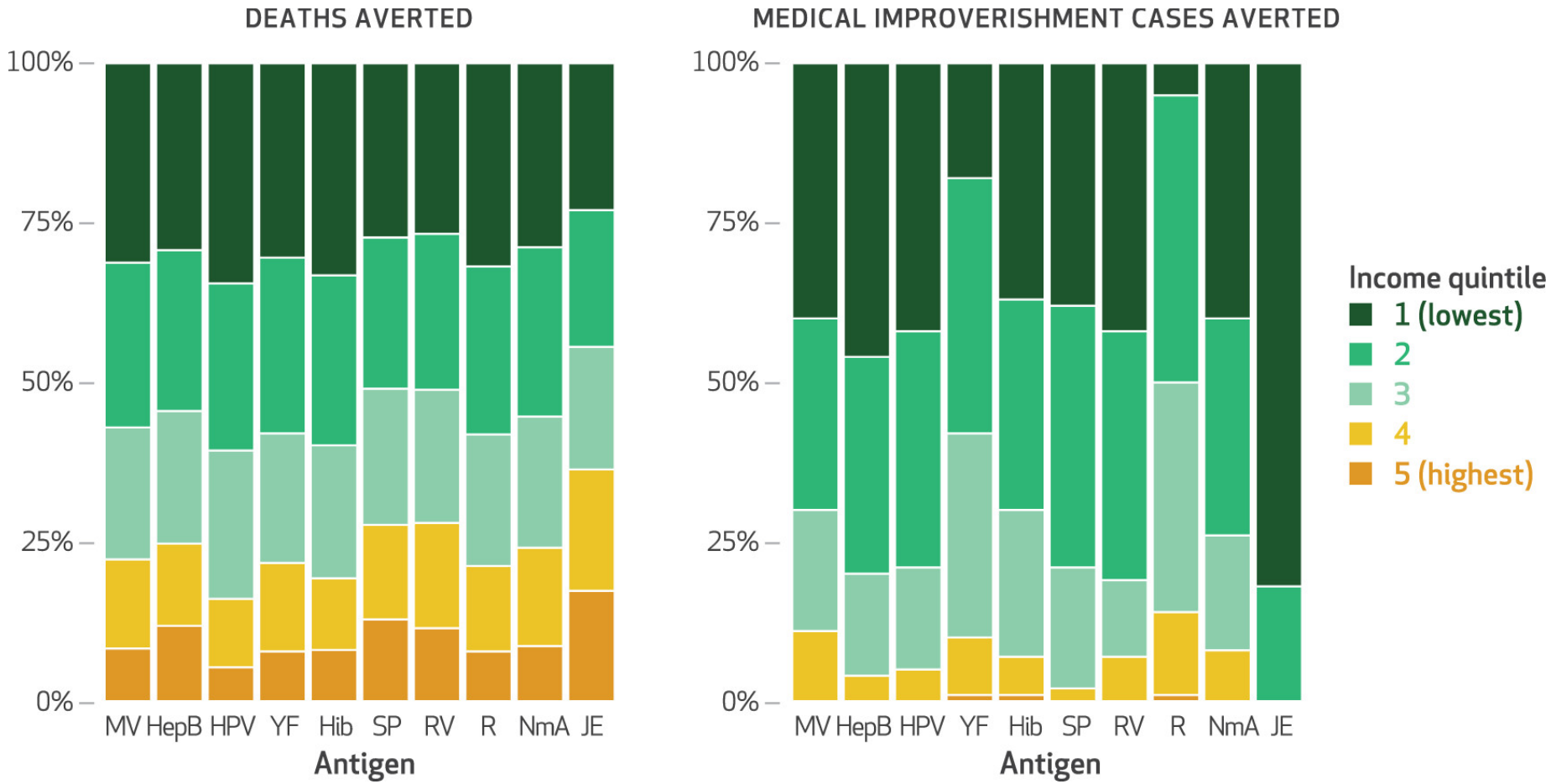
$ 13 billion
Pneumococcal Diseases

Economic benefits could reach a multiplying factor of 37x as a return on investment

Going up to 93x for measles

Note: vaccine-preventable diseases (VPDs)
Source: AFRO business case

Prosperity: Vaccines avert deaths (left) .....and cases of poverty, especially among the poorest (right)



Chang, Riumallo-Herl, et al. Health Affairs 2018

The paradoxes of the present and a focus for the future of vaccines and immunization

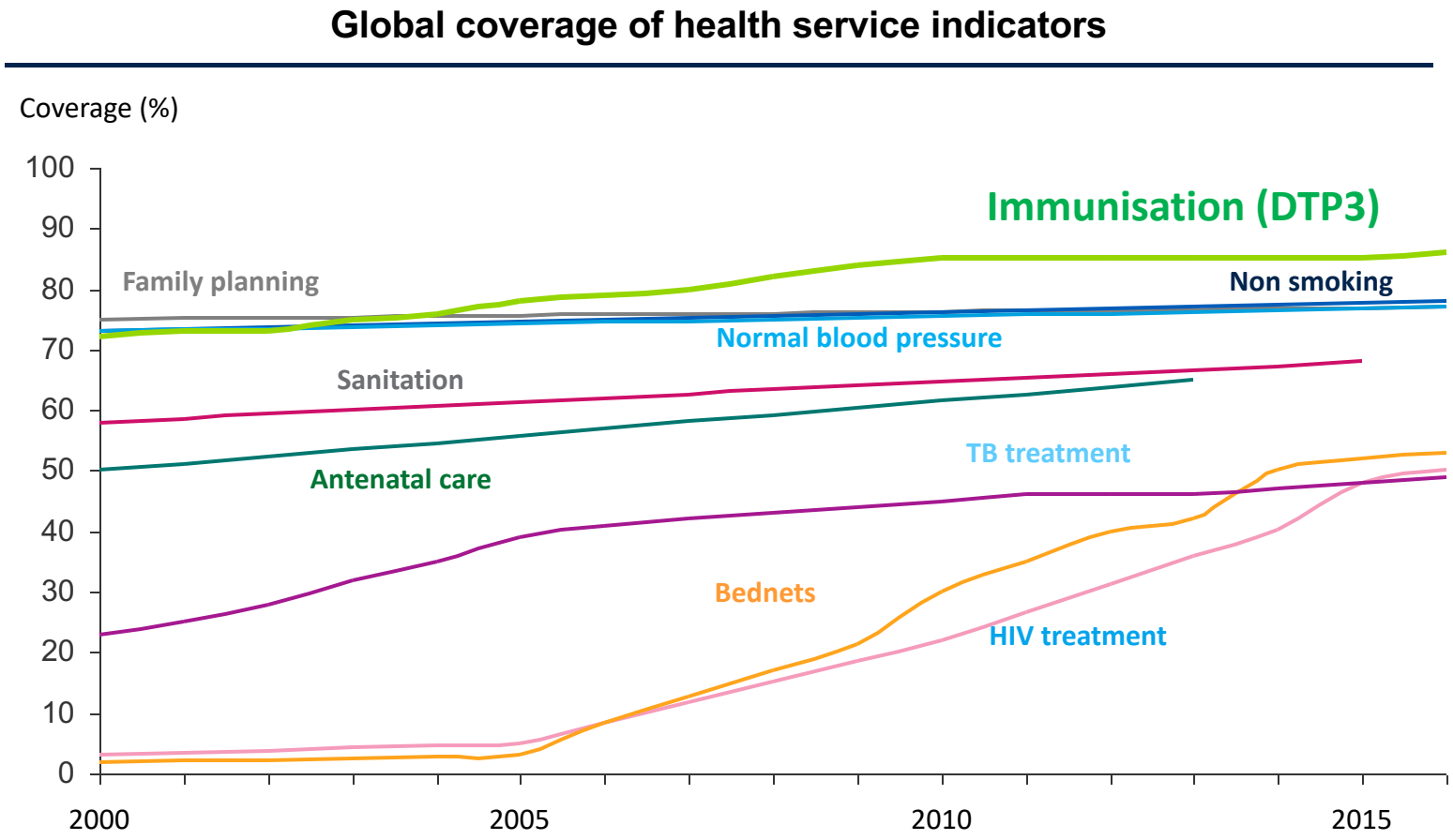
The world is improving in nearly all dimensions of development, population control, and health

We are in a ‘VUCA’ world

Vaccine and immunization agenda is reshaping to deliver on Equity-Security-Prosperity in a transformed WHO

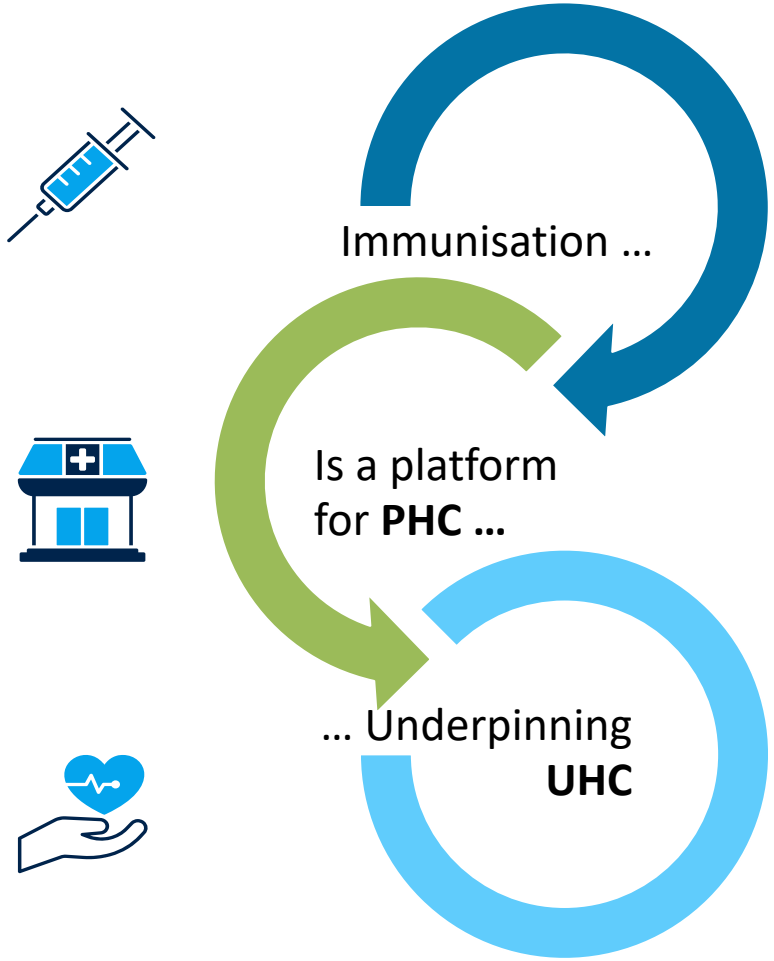
Vaccines and Immunization are central to the SDGs and the WHO Triple Billion

Immunisation has the highest coverage rates among key health interventions; back-sliding is occurring and inequities are a threat



The immunisation platform is already up and running – could be leveraged for other health services

HSS: Immunization is a platform for primary healthcare (PHC), underpinning universal health coverage (UHC)



- Immunisation reaches **more households** than any other health intervention
- Immunisation is among the **most equitable** interventions
- As a preventive intervention, immunisation is one of the **best buys** in health, preventing **medical impoverishment** especially among poorest parts of populations
- Immunisation helps remove physical and financial barriers to achieve Universal Health Coverage (UHC)

Source: Gavi analysis

The Dual Case for Universal Health Coverage with Vaccines and Immunization at the Core

When all people have access to quality, affordable healthcare without undue financial hardship…

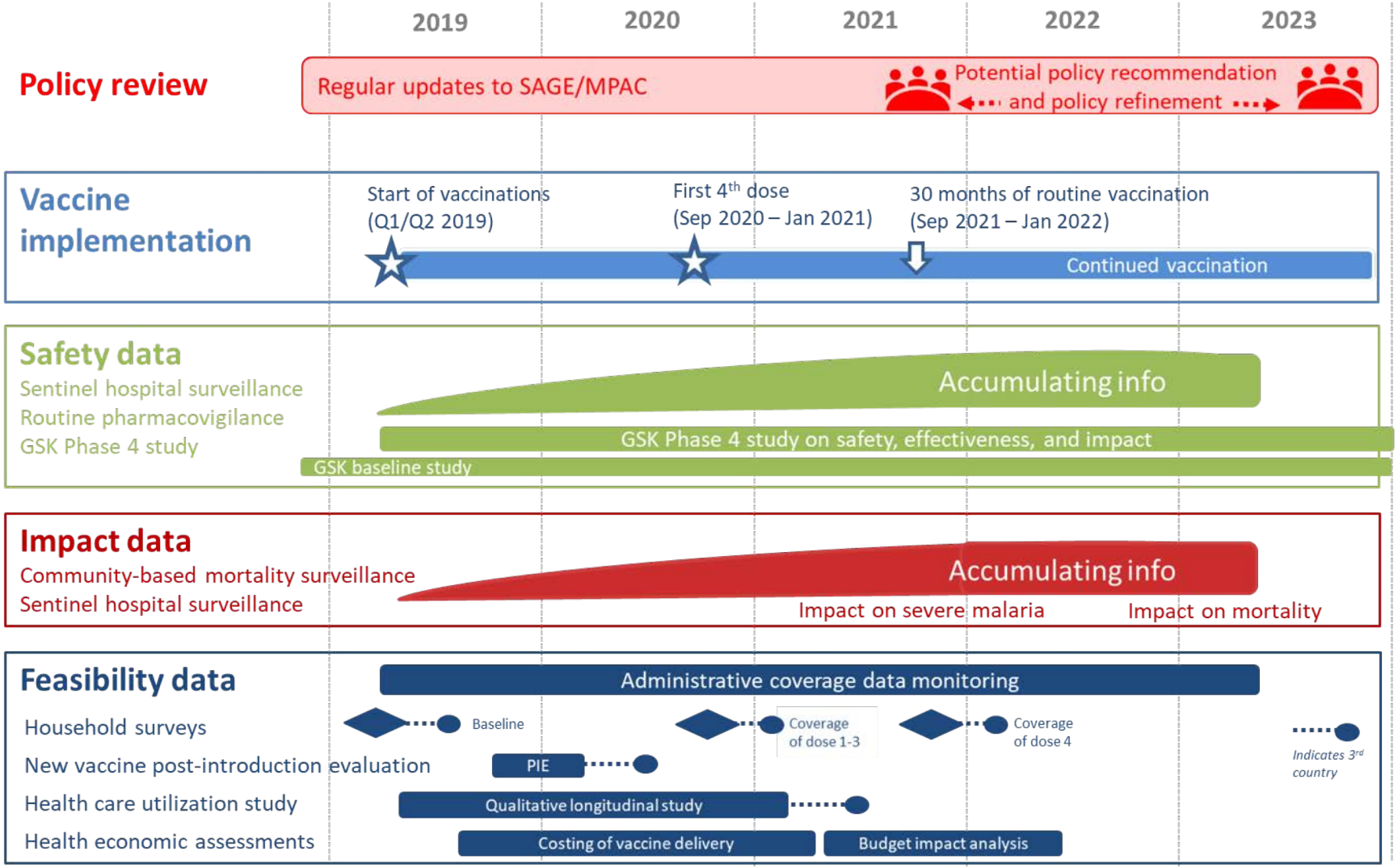
Better health outcomes

Better development outcomes

Reduced poverty and hardship

Increased productivity and equity

3-level work of WHO: MVIP implementation research for optimization



Immunization strategies in particular focus heavily on the importance of countries (ownership, accountability, impact)

Global health and development strategies

Global and regional immunization roadmaps

Disease-specific strategies

SDG 3

GVAP

Measles & Rubella

PHC

Gavi 4.0

Meningitis

UHC

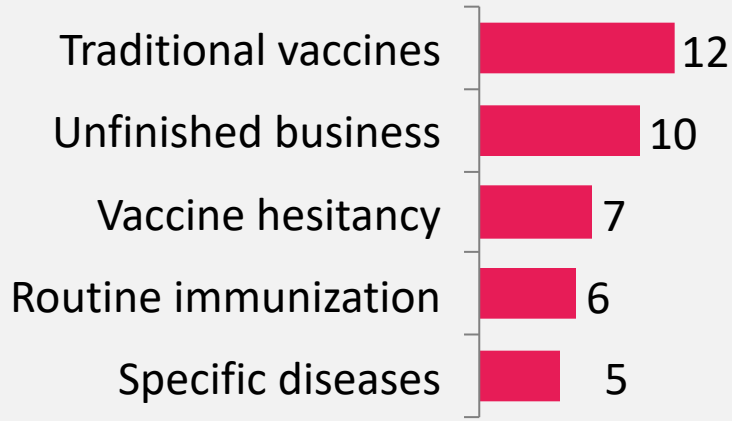
UNICEF Immunization

2030 Vision

puts vaccines as a right and part of healthy life, with people at the center, tailored approaches to country programs

5 top concepts to include

5 top concepts to avoid



Immunization linked to …

14 of 17 SDGs

… broad set of compelling arguments for value of vaccines

2021-2030 Innovation

Source: UN; Gavi analysis

With thanks to IVB, POL, WHE, and Regional Advisors on Immunization

Appreciation to Martin Friede Director IVB ai