IVB Director’s Report to SAGE
2 April 2019

Paradoxes of the Present and a Focus for the Future of Vaccines and Immunization
Equity-Security-Prosperity
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
The paradoxes of the present and a focus for the future of vaccines and immunization

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The World as 100 People over the last two centuries

**Extreme Poverty**
- 6 not living in extreme poverty (1820)
- 10 living in extreme poverty (1840)
- 90 not living in extreme poverty (2000)
- 94 living in extreme poverty (2015)

**Basic Education**
- 83 have not attained any education (1820)
- 86 have basic education or more (2000)
- 17 have basic education or more (2015)

**Democracy**
- 1 living in a democracy (1820)
- 44 living in a democracy (2000)
- 56 living in a democracy (2015)

**Literacy**
- 88 are not able to read (1820)
- 85 are able to read (2000)
- 12 are able to read (2015)

**Child Mortality**
- 43 die before they are 5 years old (1820)
- 96 survive the first 5 years of life (2000)
- 4 die before they are 5 years old (2015)
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

1920-1939: Smallpox
1930-1940: BCG
1940-1950: DTP
1950-1960: Measles, Mumps
1960-1970: Rubella, Maternal Tetanus
1980-1990: Hib
1990-2000: HepB, DTP+HepB+Hib, Typhoid CV

1974: EPI (BCG, OPV, DTP, Measles)
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)

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 2017¹
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

19M+ Children still under-vaccinated

14 Countries\(^2\) yet to achieve MNTE

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
- Demographic shifts
- Fragile States
- Conflict and migration
- Climate change
- Urbanization

U Uncertain
- Poor populations largely in Middle Income Countries
- Antimicrobial resistance

C Complex
- Outbreaks, Epidemics, Pandemics
- Inequities in wealth, health, and security

A Ambiguous
Children affected by conflict

1 in 6 children were living in conflict areas in 2016

GLOBALLY

Children impacted by conflict

357 MILLION

16%

Total child population

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.savethechildren.net/waronchildren
States seek to force parents to vaccinate children.

Anti-vaxx 'mobs' are becoming a serious concern, as lawmakers propose bills allowing teens to get vaccinated without parental consent.

Amazon removes books peddling vaccine misinformation.

New York measles outbreak prompts state of emergency.

Unvaccinated children banned from public spaces in the Philippines, with distrust of vaccines feeding the measles outbreak.

Hundreds of children have died in the Madagascar measles outbreak.

Concerns over the global resurgence of measles.

Italy bans unvaccinated children from schools.

Anti-vaxxers' must not be given credence.
Selected Ongoing Measles Outbreaks

USA: 314 cases (January 1 to March 21, 2019)

Venezuela: 5,668 cases (January 1 to December 31, 2018)

Brazil: 10,262 cases (January 1 to December 31, 2018)

Ukraine: 90,057 cases (January 1, 2017 to March 14, 2019)

Yemen: 12,617 cases (January 1 to December 31, 2018)

Madagascar: 117,075 cases (September 3, 2018 to March 20, 2019)

Philippines: 21,369 cases (January 1 to March 14, 2019)

USA: 314 cases (January 1 to March 21, 2019)
Reported Global Cases are nearly 2X those of 2017

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

2017 estimated total measles cases = 6,700,000
(95% CI: 2.95 M – 36.84M)

2018 reported measles cases to date = 324,277

2017 reported measles cases = 173,330

EPI Schedule established, 1983
Measles Initiative launched, 2001

*MCV1 coverage: first dose of measles-containing vaccine as estimated by WHO and UNICEF.
**MCV2 coverage estimates are only available from 2000 when global data collection started, however some countries introduced MCV2 earlier.


Date of slide: 20 August 2018
2018 Measles Incidence Rate per Million

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

### Top 10**

<table>
<thead>
<tr>
<th>Country</th>
<th>Cases</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ukraine</td>
<td>63,948</td>
<td>1,439.02</td>
</tr>
<tr>
<td>India</td>
<td>63,364</td>
<td>47.85</td>
</tr>
<tr>
<td>Madagascar</td>
<td>59,407</td>
<td>2386.35</td>
</tr>
<tr>
<td>Pakistan</td>
<td>30,747</td>
<td>159.14</td>
</tr>
<tr>
<td>Philippines</td>
<td>19,401</td>
<td>187.78</td>
</tr>
<tr>
<td>Yemen</td>
<td>11,746</td>
<td>425.82</td>
</tr>
<tr>
<td>Brazil</td>
<td>10,262</td>
<td>49.42</td>
</tr>
<tr>
<td>Nigeria</td>
<td>5,847</td>
<td>31.44</td>
</tr>
<tr>
<td>Venezuela (Bolivarian Republic of)</td>
<td>5,668</td>
<td>179.55</td>
</tr>
<tr>
<td>Thailand</td>
<td>5,579</td>
<td>81.02</td>
</tr>
</tbody>
</table>

### Other countries with high incidence rates***

<table>
<thead>
<tr>
<th>Country</th>
<th>Cases</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Georgia</td>
<td>3,176</td>
<td>809.09</td>
</tr>
<tr>
<td>Liberia</td>
<td>3,194</td>
<td>692.27</td>
</tr>
<tr>
<td>Albania</td>
<td>1,476</td>
<td>504.38</td>
</tr>
<tr>
<td>Serbia</td>
<td>4,176</td>
<td>473.46</td>
</tr>
<tr>
<td>Israel</td>
<td>3,377</td>
<td>412.24</td>
</tr>
<tr>
<td>Montenegro</td>
<td>201</td>
<td>319.75</td>
</tr>
<tr>
<td>Kyrgyzstan</td>
<td>1,509</td>
<td>253.37</td>
</tr>
</tbody>
</table>

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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 incidence rates (excluding those already listed in the table above)
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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
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
**Future Equity:** While no blockbusters expected in the short term, several long-awaited vaccines might enter the market towards the end of the decade

### Potential new vaccines
- HIV
- Malaria
- TB
- RSV
- Dengue
- Zika
- Chikungunya
- Ebola 2nd gen

### Current status
- **HIV**
  - Vaccine not expected to enter the market **before 2025**
- **Malaria**
  - Phase 3 with **preliminary efficacy data** available (pilot implementation of first malaria vaccine with impact available by 2021 – 2023)
- **TB**
  - Vaccine not expected to enter the market **before 2025**
- **RSV**
  - Vx for maternal or infant immunization **may be registered** in coming years – Uncertain future of most advanced candidates (complex phase 3 results)
- **Dengue**
  - One dengue vaccine licensed in several developing countries; 5 additional vaccines expected (out of which two are now in Phase 3)

### 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


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.

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*

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

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.

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

October: WHO SAGE recommendation for TCV

November:

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

2018

January: Typbar-TCV™ receives WHO PQ

February:

March: Revised WHO recommendation for typhoid vaccines

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 deprivations, 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

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

- 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.
DTP3 coverage at the 5x5 km level

IHME geospatial estimates

Modeled data allow for targeted evaluations in the field to verify
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:**
- Areas 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”
**Prosperity: Outbreaks have high economic impact that is not (only) related to mortality**

<table>
<thead>
<tr>
<th>Outbreak</th>
<th>Affected Areas</th>
<th>Deaths/Infections</th>
<th>Economic Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influenza (1918-1919) – Global</td>
<td>50-100 million deaths</td>
<td><strong>50-100 million deaths</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No cost estimate for 1918; at this scale today, would cost <strong>4.8% of global GDP</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Influenza (1958) – Global</td>
<td>1.1 million deaths</td>
<td><strong>1.1 million deaths</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Estimated cost of <strong>3.1% of global GDP</strong> in 1958</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Influenza (1968) – Global</td>
<td>1 million deaths</td>
<td><strong>1 million deaths</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Estimated cost of <strong>0.7% of global GDP</strong> in 1968</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ebola (2014) – Liberia, Sierra Leone and Guinea</td>
<td>11,287 total deaths</td>
<td><strong>11,287 total deaths</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lost <strong>&gt;10% of GDP</strong> in 2014</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SARS (2002-04) – South East Asia and US</td>
<td>Infected ~8,000 people and killed &lt;800</td>
<td>Influenza and SARS have high economic impact that is not (only) related to mortality</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cost <strong>&gt;$40 billion</strong> between 2002 and 2004</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ebola (2014) – US</td>
<td>1 death</td>
<td><strong>1 death</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spent <strong>$5.4 billion</strong> in 2014</td>
<td></td>
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</tr>
</tbody>
</table>

*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

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

Going up to 93x for measles

Economic benefits
$58 billion in Africa over 2018-2030 period

- $16 billion Measles
- $14 billion Rubella
- $15 billion Rotavirus
- $13 billion Pneumococcal Diseases

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
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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)
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:
- Everyone, Everywhere: 28
- Agile & Tailored: 20
- Global Security: 17
- Equity: 16
- Access & Availability: 12

5 top concepts to avoid:
- Traditional vaccines: 12
- Unfinished business: 10
- Vaccine hesitancy: 7
- Routine immunization: 6
- Specific diseases: 5
Immunization linked to...

14 of 17 SDGs

...broad set of compelling arguments for value of vaccines

2021-2030 Innovation

Source: UN; Gavi analysis
Appreciation to Martin Friede
Director IVB ai

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