

Immunization Highlights 2015: Select WHO's achievements in vaccines and immunization

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Foreword

There is arguably no single preventive health intervention more cost-effective than immunization. Time and again, the international community has endorsed the value of vaccines and immunization to prevent and control a large number of infectious diseases and, increasingly, several chronic diseases that are caused by infectious agents. Today, parents, communities and governments have the responsibility to strive for universal coverage with vaccines that have the potential to bring about the elimination of diseases that have limited human development for millennia.

The year 2015 was significant for global immunization, marking the mid-point in the 2011-2020 Global Vaccine Action Plan (GVAP). The current status of each of GVAP's main targets was evaluated by the WHO Strategic Advisory Group on Immunization. Results showed that several important targets remained off-track and at risk of not being met in full by the end of the decade.

In response, WHO's Vision and Mission in Immunization was developed to create a unifying vision on immunization across all departments and levels and thus to enable WHO to anticipate and respond more effectively to opportunities and challenges in future. In 2015, WHO continued to provide leadership in setting immunization policy and, working in close collaboration with Ministries of Health, partner and funding agencies, and community organizations worldwide, has overseen the successful implementation of those policies from global to household level.

This report highlights a number of specific achievements during 2015 of the WHO team based in its headquarters in Geneva. It highlights areas of notable progress that will be consolidated and built upon going forward, while renewed effort and investment are needed in order to ensure that all of GVAP's targets are met in full and on time in countries.

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1. Setting immunization policy

1.1. Publication of a journal special issue on vaccine hesitancy.

The increasing frequency of reports on vaccine hesitancy from countries regardless of their level of development highlights the gap between expert consensus and concern among the general public about vaccine safety and effectiveness. Safety was perceived as the main driver of hesitancy and the WHO Strategic Advisory Group of Experts on Immunization (SAGE) noted that increasing publicity in industrialized countries could spread globally and delay progress towards the achievement of the Global Vaccine Action Plan goals. No clear definition and scope of the problem had been established and proven strategies to address vaccine hesitancy were lacking.

In 2012, this led WHO to establish a SAGE Working Group of international experts covering a wide range of expertise in order to conduct a systematic review of the drivers and impact of vaccine hesitancy and strategies that could be used to mitigate its impact. This work was presented to SAGE in 2014.

A series of ten publications, compiled in the Special Issue on Vaccine Hesitancy published in Vaccine journal, further expands on the SAGE report and presents SAGE's huge body of work to define and address vaccine hesitancy¹. Drawing on examples from around the world, the papers included in the Special Issue demonstrate that vaccine hesitancy is complex, and the reasons for delaying or refusing vaccination are highly variable and context-specific. Vaccine safety is only one of the many potential drivers of hesitancy!

The Special Issue proposes standard survey questions for measuring vaccine hesitancy and its determinants globally and at national/subnational level. It includes a systematic review of the literature on strategies to address the problem. The series of publications concludes with a set of recommendations on the way forward targeted at WHO, partner agencies, regional and national technical advisory groups on immunization, national governments and civil society organizations. This guidance been very positively received by immunization managers. A network of support centres to assist countries in dealing with hesitancy has been developed.

The release of the Special Issue triggered international media interest highlighting the positive perception by the general public as well as the scientific community of the role that WHO took on this topic as a public health problem to highlight and address.

¹ <http://www.sciencedirect.com/science/journal/0264410X/33/34>

1.2. Publication of a WHO position paper on pain mitigation.

Fear of injection, due to pain, during immunization is one of many factors that lead some individuals to delay or refuse vaccinations. Studies show that pain at the time of vaccination is a primary source of anxiety for caregivers of children. Concerns over vaccine safety and mistrust in the health care system are also factors leading to vaccine hesitancy and lower vaccination coverage.

The WHO Strategic Advisory Group of Experts (SAGE) on Immunization studied the feasibility of adapting Canada's current clinical practice guidelines for reducing pain and fear from vaccine injections for global implementation. Based on SAGE's thorough review of the evidence and subsequent generation of recommendations, WHO published its first position paper on reducing pain at the time of vaccination². WHO recommends practical and inexpensive measures that can be applied by national immunization programmes in all countries regardless of their level of development and across all age groups. The guidance makes the following points:

- Health-care personnel administering vaccinations should remain calm, collaborative and well informed, and use neutral words when administering the vaccine such as "here we go" instead of "here comes the sting."
- Recipients of the vaccines should be positioned properly, according to age. Infants and young children should be held firmly by their caregiver. Older individuals should sit upright.
- If the cultural context permits, infants should be breastfed shortly before or at the time on immunization.
- Aspiration or pulling back of the plunger of a syringe prior to intramuscular injections should be avoided as this may increase pain.
- When multiple injections are scheduled to be administered in the same vaccination session, they should be given in reverse order of painfulness – ending with the most painful.

When caregivers are made aware of what they can do to comfort their child before and during vaccinations, hesitancy can be effectively reduced. Reducing pain is considered good practice for immunization programmes worldwide. Implementing WHO recommendations can contribute to achieving and sustaining high vaccine coverage and increasing child survival rates.

² http://www.who.int/immunization/policy/position_papers/reducing_pain_vaccination/en/

1.3. Recommendations on the use of the first malaria vaccines.

After a development process lasting over 25 years, the world's first malaria vaccine received a positive regulatory assessment by the European Medicines Agency in 2015. WHO developed a novel process to enable joint decision-making by committees from two programmes: the Malaria Policy Advisory Committee (MPAC) of the Global Malaria Programme and the Strategic Advisory Group of Experts (SAGE) on Immunization. SAGE and MPAC met in a Joint decision session and recommended that subnational pilot studies of RTS,S/AS01 malaria vaccine under field conditions should be implemented in 3-5 sub-Saharan African countries to answer remaining questions mainly concerning the programmatic feasibility of vaccine roll-out, plus further issues on vaccine safety and impact. It will be important to evaluate the field implementation of the vaccine in routine health systems particularly in view of the need for a four-dose schedule that requires new immunization contacts. The schedule is a three-dose initial series given between 5 and 9 months of age, followed by a fourth dose at 15–18 months after the third dose.

By December 2015 WHO had launched a call for expressions of interest from Ministries of Health in sub-Saharan African countries. There was a strong response to the call, indicating great interest from countries in taking part in the pilots. The earliest start date for the pilots is late 2017.

This is a critical step for the first malaria vaccine, and the outcomes will play a large role in future product development using the public-private partnership approach for indications restricted to low income settings. WHO and PATH are now working to establish a partnership in order to implement the next steps of the pilot implementation programme, with some analogies to the WHO-PATH partnership for the development of meningococcal type A vaccine. Additional information on programmatic feasibility, safety and impact will be generated that will allow SAGE and MPAC potentially to broaden their joint recommendations on vaccine on a larger scale.

1.4. Synchronization of the global switch from trivalent to bivalent oral polio vaccine.

Withdrawing the type 2 component of oral polio vaccine (OPV) is a crucial part of the Poliomyelitis Eradication and Endgame Strategic Plan, in order to eliminate very rare cases of vaccine-associated paralytic polio (VAPP) or circulating vaccine-derived polioviruses (cVDPVs). The type 2 vaccine virus accounts for 40% of VAPP cases and upwards of 90% of cVDPV cases. However, the wild type 2 virus has not been detected since 1999 and in September 2015 was declared to have been eradicated.

In October 2015, the Strategic Advisory Group of Experts on immunization (SAGE) confirmed that the synchronized global withdrawal of the type 2 component of the oral poliovirus vaccine (OPV) should occur in April 2016, in a two-week window from 17 April to 1 May 2016. The coordinated switch from trivalent to bivalent OPV constitutes a major milestone towards polio eradication.

As part of a review of type 2 vaccine-derived poliovirus epidemiology and all readiness criteria for the switch, SAGE concluded that significant progress had been made since its last meeting in April 2015.

SAGE's landmark decision follows the endorsement by the World Health Assembly in May 2015, when Ministers of Health from 194 member states adopted a resolution on the final steps required to eradicate polio, paving the way for a world free of polio. As a result of these steps, all countries and partner agencies were advised to make all necessary preparations for April 2016 for the coordinated global withdrawal of OPV type 2.

WHO has developed and disseminated a full set of guidance materials to support planning and implementation of the switch, including templates and tools for planning, logistics, communications, training and monitoring³.

1.5. Publication of an updated WHO position paper on pertussis vaccines.

Pertussis, commonly known as whooping cough, is a highly contagious respiratory disease known for characteristic, uncontrollable, violent coughing. Pertussis affects individuals of all ages, but can be deadly for infants. The disease continues to be a public health concern despite high vaccination coverage.

The main aim of pertussis vaccination is to reduce the risk of severe pertussis in infants. Therefore, the ongoing priority of immunization programmes worldwide is to vaccinate at least 90% of infants with three doses of high-quality pertussis vaccine starting at six weeks of age. Reasons for the recent resurgence of pertussis observed in a limited number of countries were found to be complex and varied by country; the shorter duration of protection and probable reduced impact of acellular vaccines on pertussis infection and transmission likely played a role.

Following a thorough review of evidence leading to new recommendations by the Strategic Advisory Group of Experts on immunization, WHO published an updated position paper with revised guidance on the choice of pertussis vaccine⁴. The guidance includes recent evidence on the use of additional strategies, particularly on vaccination during pregnancy, to prevent early infant mortality.

Two types of pertussis vaccines are available: whole cell (wP) and acellular (aP). Protection can be achieved through primary vaccination with either vaccine, and both vaccines have excellent safety records. A switch from wP to aP vaccines for the primary schedule should, however, only be considered if additional periodic boosters or maternal immunization can be assured and sustained. National programmes currently administering wP vaccination should continue to use wP vaccines for primary vaccination.

Although vaccination can prevent pertussis in adolescents and adults, there is insufficient evidence that vaccine boosters in these groups can reduce the burden of severe pertussis in

³ http://www.who.int/immunization/diseases/poliomyelitis/endgame_objective2/en/

⁴ <http://www.who.int/wer/2015/wer9035/en/>

infants. However, vaccination of pregnant women appears to be the most cost-effective additional strategy for preventing disease in infants too young to be vaccinated.

2. Strengthening immunization service delivery

2.1. The WHO Vision and Mission in Vaccines and Immunization, 2015-2030.

While the Global Vaccine Action Plan (GVAP) covering 2011-2020 was created to end the inequity in vaccination worldwide, and hence to save millions of lives, a mid-term review conducted by SAGE⁵ identified several factors that appear to be causing patchy and slow implementation, including an increasingly crowded operating environment and a lack of defined responsibilities and accountability among partner agencies.

*WHO's Vision and Mission in Vaccines and Immunization 2015-2030*⁶ describes WHO's mandate and strategic directions in achieving the goals of the of GVAP, across all areas of work and all levels of the organization, through the current decade and the next. Recognizing the importance of immunization among the most powerful and cost-effective interventions in public health, and the expanding scope and increasing complexity of immunization programmes, the *WHO Vision and Mission* was developed to create a unifying vision across all WHO departments and levels on immunization and thus to enable WHO to anticipate and respond more effectively to opportunities and challenges in future.

To develop the *Vision and Mission*, a number of work streams were conducted throughout 2015, including regional consultations, implementation of an expectations survey targeting partner agencies and donors, review of previous and current strategies and their impact, analysis of existing strategies and background documents, and a historical review of past trends and success factors in immunization. Internal consultations also took place with WHO staff at all levels, with a specific focus on identifying areas where the agency has a unique role and comparative advantage, and non-priority areas that could be phased out.

The *Vision and Mission* reasserts WHO's global leadership role in immunization through redefined normative responsibilities, policy development, expert advice and inter-agency priority-setting. It also brings forward WHO's renewed focus on technical guidance, knowledge management and data for decision-making. The document will be referenced to guide internal decisions about where and how to maximize resources and which strategic directions should be deployed over this exciting period of transition and expansion in the field of vaccines and immunization.

⁵http://www.who.int/immunization/global_vaccine_action_plan/SAGE_DoV_GVAP_Assessment_report_2014_English.pdf

⁶ [weblink](#)

2.2. Global Routine Immunization Strategies and Practices to achieve universal and sustainable coverage.

In 2015, the Global Routine Immunization Strategies and Practices (GRISP) document was developed by WHO and finalized with the support of global partner agencies. Key routine immunization staff from WHO and partner agencies participated in a steering committee which also defined the key directions that would take routine immunization forward during the next five years. Furthermore, the GRISP provides a comprehensive overview of routine immunization strategies and a structured approach to improving routine immunization. Finally, it distinguishes between strategies and activities that are designed to raise vaccination coverage from strategies and activities designed to strengthen the immunization delivery system. While these components are closely linked and influence each other, it is operationally useful to separate them.

The GRISP framework outlines the specific strategies and activities required to ensure that routine immunization services are accessible to all—regardless of who they are or where they live. To equip routine immunization programmes for success in every country, GRISP recommends that national governments, partner agencies and donors focus on and invest in the following nine areas:

- **National team:** The most important factor for all other eight investments to succeed: A qualified national team—supplied with sufficient resources and authority—to manage effectively their national immunization program.
- **Strategies to reach:** Tailored strategies that identify under-vaccinated and unvaccinated individuals and provide them regularly with the vaccines they need.
- **Strategic and multiyear plans:** Strategic multiyear plans and operational annual plans outlining and coordinating strategies and activities, with progress monitored on a quarterly basis.
- **Operational level funding:** Assurance that sufficient funds are available for expenditure at operational level when required.
- **Vaccinator capacity:** Regular and systematic capacity building, skills development and supportive supervision for vaccinators and their district managers.
- **Modern vaccine supply chain:** Modernized vaccine supply chains and management to ensure the correct amounts of the right potent vaccines are available at each vaccination session.
- **Accurate information system:** An information system that identifies and tracks each individual's vaccination status.
- **Life course vaccination:** Expanded routine immunization schedules that cover individuals' entire life course.
- **Community support:** Shared responsibility for immunization delivery between communities and the immunization programme to reach uniformly high coverage through high demand and convenient, user-friendly services.

2.3. Strengthened “hub” collaboration between WHO and UNICEF to optimize immunization supply chains.

Effective Vaccine Management (EVM) assessments are designed to evaluate the performance of national immunization supply chains from end-to-end and benchmark performance against international best-practice standards. In 2015, over 80 member states received support from WHO and UNICEF to conduct EVM assessments as part of an initiative which was originally launched in 2010. The result of these assessments revealed that most countries face chronic vaccine shortages due to weak stock management and forecasting practices; are damaging expensive vaccines by storing them in non-compliant or poorly maintained cold chain systems; are unable to introduce new vaccines due to cold chain storage constraints; and vaccines are wasted from poor handling and vaccine management practices by health workers. Current performance of in-country supply chain and logistics systems cannot ensure the uninterrupted availability of vaccines up to service delivery points. Furthermore, vaccines that have been exposed to deficient cold chain systems may lack potency due to heat or freeze damage prior to vaccination and, thus, compromise effective coverage.

In response to these mounting concerns and convinced by the need to build on the successes the EVM initiative, WHO and UNICEF have intensified their collaboration in 2015 and created a joint multi-year workplan resourced by the Bill & Melinda Gates Foundation and the GAVI Alliance. The centrepiece of this collaboration is the implementation of a four-step strategy for continuous immunization supply chain improvements, optimization and innovation in countries.

This new comprehensive approach to EVM (or cEVM) and renewed technical assistance framework will ultimately lead to immunization supply chains that are designed to maximize efficiency, effectiveness, agility and responsiveness to the needs of today's and tomorrow's immunization programmes. They will be sufficiently robust to continually adapt to and comply with WHO and UNICEF recommended vaccine management standards and policies. Future supply chains will adopt proven cost-effective technological and systems solutions that support coverage and equity improvement objectives. They will be operated by skilled health care workers managing the supply chain with key performance indicators, and adequately funded using health system strengthening resources.

2.4. Immunization sustainability.

In 2015, important investments designed to enhance the sustainability of national immunization programmes came to fruition. Sustainability in this context refers to the durability of immunization systems and processes in countries that are not eligible for external financial or other support or whose current support is due to be reduced or eliminated in the near future.

WHO led the development of a strategy to enhance immunization sustainability with particular focus on middle-income countries (MICs). Since MICs currently generate about two-thirds of all global vaccine-preventable mortality, and many are either ineligible for

external financial support from agencies such as the GAVI Alliance or will soon lose eligibility, immunization sustainability represents an issue of growing urgency.

The principal immunization partner agencies, including the Agence de Médecine Preventive, the Bill & Melinda Gates Foundation, the GAVI Alliance, the Sabin Vaccine Institute, UNICEF and the World Bank, contributed to the development of the strategy, as well as national governments, civil society organizations, and vaccine manufacturers. The strategy guides WHO's approach to sustainability in four priority areas: i) strengthened decision-making on immunization, ii) enhanced national political commitment and immunization financing, iii) increased demand for vaccination services and iv) enhanced access to affordable and timely vaccine supplies.

While some additional and reliable funding will be required by many countries in order to operationalize this vision, WHO is already providing technical support on cost-benefit and cost-effectiveness analysis to rationalize vaccine choices and the strengthening of institutions for evidence-based decision-making in immunization. Furthermore, countries are receiving technical assistance to develop their multi-year immunization plans, including the quantification of resource requirements. WHO routinely analyses and disseminates vaccine price information to inform country and global policy-making and is working to strengthen regional vaccine procurement mechanisms. WHO also provides technical support to countries whose immunization programmes enter the process of transition from GAVI Alliance support to self-sufficiency.

2.5. Ensuring that vaccines and immunization devices are of assured quality.

Vaccine prequalification is a WHO-led activity with the primary purpose of ensuring that vaccines purchased by UN agencies are consistently safe and effective for use by national immunization programs. Driven by the stringent quality requirements of donors and procurers, WHO prequalification offers manufacturers a well-established mechanism for accessing markets for products that meet internationally agreed quality norms and standards. Furthermore, the previously independent prequalification streams for diagnostics, medicines, vaccines and immunization devices have been merged to provide assurance on the quality, safety and efficacy of these products for international procurement.

WHO has introduced efficiencies designed to shorten the vaccine prequalification process, achieving the reduction of the timeframe for prequalification in 2015 from 360 to 270 days. For example, WHO prequalified a second affordable oral cholera vaccine (OCV), which is expected to double current global OCV supply, within the reduced timeframe. Through its highly participatory and collaborative activities, the WHO Prequalification Team (PQT) leveraged these well-established processes to increase the capacity of manufacturers and regulators to implement stringent quality standards. To facilitate this effort, WHO published procedures for the collaborative national registration of prequalified pharmaceutical medicines and vaccines. The new procedures were implemented on a pilot basis for the registration of inactivated poliovirus vaccines whose deployment represents an essential step in the polio end game strategy.

The PQT also provided guidance on regulatory and WHO prequalification requirements for specification of an on-label extended controlled temperature conditions for priority vaccines. Furthermore, the PQT published guidelines for vaccines (and separately for diagnostics and pharmaceutical medicines) to be used in response to Public Health Emergencies of International Concern.

The WHO Immunization Practices Advisory Committee developed guidelines to extend the vaccine prequalification process to ensure that existing and future products comply with operational requirements for programmatic suitability, primarily, that products come appropriately packaged and presented for field use. During 2014-15, WHO reviewed 16 previously prequalified vaccines that failed to comply with the new programmatic suitability guidelines, withdrawing prequalification from several products or requesting manufacturers to modify product presentation or provide additional data, for example, on thermostability characteristics.

2.6. Licensing vaccines for use in a Controlled Temperature Chain, facilitating the logistics of immunization campaigns.

The need to maintain modern vaccines in refrigerated transport and storage has complicated vaccine supply and delivery, especially in countries with tropical climates and unreliable energy supply. Consequently, WHO has been actively exploring the feasibility of distributing certain heat-stable vaccines in a Controlled Temperature Chain (CTC) to remote and difficult-to-access regions. For a vaccine to be labelled for and used in a CTC, it must be able to tolerate ambient temperatures of at least +40°C for a minimum of three days immediately prior to administration. The meningococcal type A vaccine, MenAfriVac, was the first such vaccine to be successfully licensed, WHO prequalified, and implemented with CTC. Since that initial success in 2012, four more vaccines have been licensed for CTC: two oral cholera vaccines in 2014 and 2015, a pneumococcal conjugate vaccine in 2015, and as of February 2016, a human papillomavirus (HPV) vaccine. Additional efforts are under way in support of CTC compatibility for further vaccine products, including hepatitis B and rotavirus vaccines.

Progress was achieved through dialogue with vaccine manufacturers, as well as with key partner agencies such as PATH and Médecins Sans Frontières. In collaboration with the Essential Medicines and Health Products Department, manufacturers also received guidance on regulatory and WHO prequalification requirements. An assessment of manufacturers' views on CTC was conducted to identify barriers to the process of getting licensure for more CTC-compatible vaccines.

In 2015, WHO launched a series of advocacy tools for use at regional and country level including an infographic and a film, to explain the benefits of CTC and to create demand for vaccines licensed for CTC. WHO has successfully implemented an effective CTC strategy during several meningococcal type A vaccination campaigns, and is committed to

developing detailed implementation guidelines for upcoming new products to be delivered in a CTC.

Significant operational benefits of using CTC have been observed, including freedom from the need to carry and replace ice packs continually during vaccination sessions, facilitating travel to more remote populations, allowing more vaccine vials to be transported in the vaccine carriers, and removing the risk of freezing vaccine due to contact with frozen ice packs.

2.7. Developing capacity for vaccine safety monitoring in African countries.

As the number and variety of available vaccine products keeps increasing, and as many vaccine-preventable diseases are coming under effective control, there is also greater global attention on adverse reactions following vaccination. In 2012, WHO published the Global Vaccine Safety Blueprint, a strategy designed to ensure that all everyone everywhere is protected by safe and effective biologicals. The Blueprint's first strategic goal is to ensure that all countries establish a minimum capacity for vaccine safety monitoring. This includes creating an effective mechanism to report vaccine safety concerns and unusual events, ensuring access to adequate resources for investigating serious events, committing to share information with other countries, and developing a communication strategy.

The Global Vaccine Action Plan (GVAP) established a vaccine safety indicator to monitor countries' ability to detect and report adverse events following vaccination. In recent years, several countries in Asia, Latin America and the Middle East have made considerable progress in establishing vaccine safety systems and have shared their experience through the Global Vaccine Safety Initiative (GVSI). However, analysis of data communicated to WHO in 2014 showed that less than 20% of countries in the WHO African Region were in compliance with the GVAP indicator, the smallest proportion among the six WHO Regions.

To address the challenge in the WHO African Region, four multi-country workshops were held with representatives from 29 countries during 2014 and 2015. Based on the established indicators for vaccine safety systems, countries identified gaps, prepared work plans and prioritized activities. With support from the GAVI Alliance, technical assistance was provided by the WHO African Regional Office and HQ, deploying experts from a GVSI roster.

The main challenge to expanding this initiative further is the low rate of adverse event reporting in many countries. Success in establishing monitoring systems more widely will require that all national and international stakeholders in immunization embrace the imperative to systematically report, investigate and respond to vaccine safety concerns and unusual events.

3. Vaccine assessment and monitoring

3.1. Broad dissemination and utilization of Joint Report Form databases for decision-making by WHO and partner agencies.

In an annual submission called the Joint Report Form, WHO and UNICEF collect standardized, official national data from all Member States including the reported cases of selected vaccine-preventable diseases, vaccination coverage, vaccine supply, recommended immunization schedules and other information on the structure, policies and performance of national immunization systems. The data are consolidated and disseminated through both WHO and UNICEF web sites. These data are also made available as an application (app) for use with computer tablets in the six official UN languages. The free app generates country profiles, summary tables, graphs and maps using data that are updated annually.

The data are of particular value in tracking the implementation status of the Global Vaccine Action Plan (GVAP) and the Regional Vaccine Action Plans (RVAPs). GVAP was endorsed by all WHO Member States in 2012 at the World Health Assembly (WHA), and both the GVAP and RVAPs are key frameworks to guide immunization strategies and measure performance towards quantifiable targets at global and regional levels. Monitoring reports on GVAP progress, developed using data reported by countries, are presented to the WHA each year.

Data made available on the WHO and UNICEF websites and through the free app have been accepted globally as the most comprehensive source data to which reference is made throughout the public health community. For example, data are utilized for:

- monitoring global health status and assessing health trends, one of the WHO and UNICEF core functions;
- monitoring progress towards the UN Sustainable Development Goals;
- one of the main data sources for calculating the WHO and UNICEF estimate of national vaccination coverage;
- guiding global and regional immunization policies and strategies;
- informing vaccine-preventable disease burden estimates and trends; and
- maintaining global databases and publications, such as WHO country summaries⁷ and UNICEF's annual publication State of the World's Children.

3.2. Updated guidance on vaccination coverage and serological surveys.

Reliable and timely data are essential for accountability and evidence-based decision-making at all levels of the health system. Member States, WHO and immunization partner agencies therefore all continue to call for better quality data. During 2015, WHO worked across all levels of the Organization and with partner agencies to develop and disseminate several important tools designed to improve the quality and utilization of immunization data use and quality. Several practical guidance documents were produced: **A practical Guide**

⁷ Available at http://www.who.int/immunization/monitoring_surveillance/en/

for the design use and promotion of **Home-Based Records in Immunization Programmes** (available in English and French); an **e-learning module** on coverage monitoring (available on iLearn and on the WHO extranet); guidance on **Assessing and Improving the Accuracy of Target Population Estimates for Immunization Coverage**; a **data quality assessment module** to be integrated into the overall methodology for National Immunization Programme reviews, and a working draft of a revised **WHO Vaccination Coverage Cluster Survey Reference Manual** that provides guidance on the design of vaccination coverage surveys, from protocol design, to sample size calculation, cluster selection, field data collection and interpretation of survey results. This latter draft is undergoing pilot testing in the field prior to its finalization in 2017.

Similarly, draft guidance on another document entitled **Collecting, Assessing, and Using Immunization Data** is being circulated for feedback. This document builds on existing work (1) to provide a critical and systematic way to assess monitoring systems and national immunization data, (2) to explore ways how data can be better analysed, visualized, and used, and (3) to describe ways in which information and communication technology can be harnessed for these purposes. In December 2015, a global workshop was convened to disseminate and discuss the proposed new vaccination survey methodology, as well as methods for data and systems assessments covering the entire process from situation diagnosis to action plan. The work on the area of immunization data use and quality will contribute to WHO's continued leadership in the area of immunization monitoring and evaluation, to a more purposeful approach to data quality, and eventually to more effective national systems, able to measure and demonstrate better health outcomes.

3.3. Identifying new vaccine-preventable causes of child diarrhoea using novel laboratory technology.

Diarrhoea is one of the leading global causes of mortality and morbidity in children under 5 years of age, caused by many different pathogens. Vaccines are available to prevent diarrhoea caused by rotavirus, while vaccines are under development against pathogens such as *Escherichia coli*, Norovirus and Shigella.

Since 2008, WHO has coordinated the Global Rotavirus Sentinel Site Surveillance Network to monitor the burden and epidemiology of rotavirus disease and to serve as a platform to evaluate the impact of rotavirus vaccine. In 2014, 45,320 cases of diarrhoea in children under 5 years of age were reported from 105 surveillance sites in 51 countries. Nearly a third (31%) of these cases tested positive for Rotavirus. However, the samples were not tested for other pathogens for which vaccines are currently not available.

In order to add to the current limited data on the global epidemiology of diarrhoeal pathogens and to guide the development and use of future vaccines, a novel diagnostic test, the TaqMan Array Card (TAC), was tested through the rotavirus surveillance network. Specimens were gathered and tested using the TAC for more than 25 enteric pathogens other than Rotavirus. With support from the Bill and Melinda Gates Foundation, the University of Virginia, and the U.S. Centers for Disease Control and Prevention, TAC

laboratory testing capacity was established at five regional references laboratories. More than 1,200 specimens were tested from 11 countries in Africa, Asia, and the Americas. The first phase of the project was completed in 2015 and showed that this novel diagnostic testing platform could be used successfully in diagnostic laboratories globally to identify the causes of diarrhoea in children. Rotavirus, Escherichia coli, Norovirus and Shigella were found to be the most common diarrhoeal pathogens in children, indicating that vaccines should prove effective in lowering the global burden of diarrhoeal mortality and morbidity.

4. Accelerating vaccine-preventable disease control.

4.1. Coordinating the introduction of injectable polio vaccine in 81 countries and preparing for the globally synchronized withdrawal of type 2 oral polio vaccine in 155 countries.

In preparation for the phased withdrawal of trivalent oral polio vaccine (OPV) starting in April 2016, all countries were required to include one dose of inactivated polio vaccine (IPV) in the national immunization schedule before the end of 2015.

At the start of 2015, only eight of the 126 countries exclusively using OPV had already introduced IPV into their routine immunization programmes. Introducing IPV in the 118 remaining countries represented an unprecedented and challenging task, from understanding the rationale, to generating public and professional commitment to introduce IPV within the agreed timeframe. This required intense advocacy, coordination, and frequent dialogue and information-sharing with regions and countries.

The number of IPV introductions surged during the second half of 2015, so that a total of 75 countries completed the task during 2015. Due to global supply constraints, almost 30 low-risk countries have seen their introductions postponed to 2016. The impact of the delays is continually assessed by the Immunization Management Group (IMG) through a supply task force (WHO, UNICEF, GAVI Alliance, and the Bill & Melinda Gates Foundation), using prioritization criteria endorsed by SAGE. In October 2015, SAGE reaffirmed that the globally synchronized switch from trivalent to bivalent OPV, eliminating the type 2 vaccine virus, should occur in April 2016, in all 155 countries and territories, despite delayed introduction and supply constraints affecting some countries.

By the end of 2015, all countries had initiated the development of their national switch plans, and the few remaining countries were being closely supported by WHO Regional Offices.

WHO partner agencies including the Clinton Health Access Initiative, UNICEF, the US Centers for Disease Control and Prevention, and the Task Force for Global Health and have been continually engaged in orientation and planning activities with regions and countries.

This intensive collaboration between global and regional agencies has ensured that countries would comply with the timelines of the Polio Eradication and Endgame Strategic Plan.

4.2. Strengthened case-based surveillance and new tools to improve vaccination campaign quality to accelerate progress towards measles and rubella elimination.

Using a model developed earlier, WHO updated and published global and regional measles mortality estimates in 2015⁸. These data reconfirmed that measles vaccination is one of the best buys in public health and has saved an estimated 17.1 million lives since 2000.

In accordance with SAGE recommendations and putting into practice current technical guidance, WHO assisted six countries to introduce a routine second dose of measles vaccine into their childhood immunization schedules in 2015. New guidelines on introducing rubella vaccine into national immunization programmes were published in 2015⁹. WHO provided technical assistance to eight countries to introduce rubella vaccine into their national immunization schedules in 2015.

In 2015, the Measles and Rubella Initiative provided over \$15 million in funding to 8 countries for urgent measles outbreak response vaccination. The countries supported were Djibouti, Democratic Republic of the Congo, Ethiopia (targeting 21 high-risk and drought-affected districts), Liberia (where measles outbreaks followed disruption to immunization services caused by the Ebola virus outbreak), Kyrgyzstan, Nepal (targeting 14 districts heavily affected by earthquakes), Somalia, and Sudan.

Performance during supplementary immunization activities (SIAs) with measles-containing vaccines has declined in recent years. In response, in 2015 WHO developed several new tools for improving performance, including a programme risk assessment tool¹⁰, a readiness assessment tool, and new tools for monitoring coverage. WHO provided technical assistance to more than 25 countries conducting measles or measles-rubella SIAs in 2015. In addition, special advocacy visits were made to the Democratic Republic of Congo, Ethiopia and Nigeria to stress the need for strong country commitment to achieving high equitable vaccination coverage during SIAs.

In 2015, 98% of countries globally had access to standardized quality-controlled testing through the WHO Global Measles and Rubella Laboratory Network which processed over 250,000 clinical specimens for measles diagnosis. Of the 11 measles virus genotypes detected globally during 2005-2010, five have not been detected since 2011, suggesting that they may have been eliminated. Furthermore, despite the increasing quality of measles genotype surveillance, the number of virus variants has decreased, indicating progress in the interruption of endemic virus transmission.

⁸ <http://www.who.int/wer/2015/wer9046/en/>

⁹ http://apps.who.int/iris/bitstream/10665/184174/1/9789241549370_eng.pdf?ua=1

¹⁰ <http://www.ncbi.nlm.nih.gov/pubmed/25976980>

4.3. Significant progress towards maternal and neonatal tetanus elimination.

Fifty years after a cheap and efficacious vaccine became available, by the late 1980s an estimated 787,000 neonatal deaths annually were still caused by tetanus. Global efforts following a 1989 World Health Assembly resolution calling for the elimination of neonatal tetanus (NT) led to a reduction in mortality to an estimated 200,000 deaths by 2000 and a further reduction to 49,000 deaths by 2013. In a remarkable achievement, of the 59 countries classified as high priority for Maternal and Neonatal Tetanus Elimination (MNTE) as of 2000, 38 of these countries, including China and India, achieved elimination by the end of 2015. Globally, 130 million women of reproductive age (WRA) have been reached with at least two doses of tetanus toxoid (TT) vaccine through vaccination campaigns between 1999 and 2015.

The WHO-recommended strategies implemented by countries leading to the attainment of MNTE by 2015, and confirmed through validation assessments, include the high-risk approach that is initiated by the implementation of three properly-spaced rounds of TT campaigns in high-risk districts; strengthening routine delivery of TT vaccine and extending service delivery to the school setting; supporting initiatives to improve the proportion of births occurring in health facilities and/or assisted by skilled birth attendants; encouraging clean umbilical cord care practices; and active surveillance for NT. In addition, government commitment through comprehensive micro-planning, early and active community engagement and the timely availability of resources from partner agencies has greatly contributed to the success of the programme.

In 2015, MNTE pre-validation assessments were conducted in three countries (Democratic Republic of Congo, Indonesia and Niger). Three more countries (Cambodia, India and Mauritania) were validated for the attainment of MNTE. Partial MNTE validation was confirmed in 16 of the 17 Provinces of the Philippines and TT vaccination campaigns were implemented in nine countries targeting around 9.5 million WRA.

4.4. Launch of the post-Meningitis Vaccine Project transition of key interventions into national immunization programmes.

The Meningitis Vaccine Project (MVP), a partnership between WHO and PATH which ran from 2001 to 2014, was developed with the goal of eliminating epidemic meningitis as a public health problem in sub-Saharan Africa. The MVP partnership achieved its objective of developing, testing, licensing, and introducing a safe, efficacious and affordable meningococcal conjugate vaccine to the field with over 215 million individuals vaccinated in just five years. However, to protect everyone living in the African meningitis belt against invasive meningococcal disease in a sustainable manner, the effective transition of key interventions into national routine immunization and surveillance programmes is imperative.

In 2015, the post-MVP transition of key interventions into national immunization programmes was implemented. Two components of the critical first year of the transition

deserve special mention. Firstly, the continuation of the MenAfriVac® vaccine roll-out across countries of the sub-Saharan African meningitis belt was extended to an additional 20 million persons aged 1-29 years in two more countries (Ethiopia [final phase] and Guinea). Secondly, the first eight meningitis-belt countries applied to the GAVI Alliance for funding to introduce the vaccine into the routine immunization programme following licensure and WHO prequalification (Burkina Faso, Central African Republic, Chad, Ghana, Mali, Niger, Nigeria and Sudan)¹¹.

The success of transition activities in 2015 has set the scene for the future. Among the 10 countries that have yet to conduct full campaigns, six are ready to conduct their campaigns in 2016: either nationwide (Central African Republic, Guinea Bissau and South Sudan), or selectively in high-risk areas (Democratic Republic of Congo and Uganda). The remaining five countries are expected to conduct campaigns in high-risk areas in 2017 (Burundi, Eritrea, Kenya, Rwanda and Tanzania). The remaining 18 meningitis belt countries are expected to apply for funding to introduce the vaccine into the routine immunization programme in the next couple of years.

4.5. Updated guidance and new tools to accelerate the implementation of maternal influenza vaccination.

The strategy of maternal immunization has the potential to reduce vaccine-preventable diseases in pregnant women as well as in their newborn infants. In 2012, WHO modified its influenza vaccine policy position by recommending that pregnant women be prioritized for influenza vaccination in countries expanding or initiating influenza vaccine programmes. Despite this policy recommendation, many low- and middle-income countries have still not adopted maternal influenza immunization policies, with many countries citing data gaps in disease burden, vaccine impact, and cost-effectiveness.

In 2015, WHO strengthened the evidence base for decision makers by conducting extensive reviews of influenza morbidity in pregnant women and newborn infants, as well as reviews of influenza vaccine performance in these groups. WHO convened a working group of international experts in influenza epidemiology, statistics, and modelling for the purpose. WHO is also providing technical support for the development and pilot testing of several health economics tools designed to assist countries to determine the costs of influenza illness and vaccine programs, as well as the cost-effectiveness of influenza vaccines.

In addition, WHO has launched a number of activities designed to accelerate introduction of maternal influenza immunization. A global group of experts is assisting WHO to develop implementation guidance for maternal influenza immunization in low- and middle-income country settings. WHO is also working with industry and regulatory agencies to ensure sufficient influenza vaccine supplies globally and to provide guidance on interpretation of product label statements regarding risk to pregnant women. Through these activities, the evidence base for recommending maternal influenza immunization will be greatly

¹¹ <http://www.afro.who.int/en/media-centre/pressreleases/item/8360-meningitis-a-nearly-eliminated-in-africa-through-vaccination.html>

expanded. Countries will have much more data to make informed decisions regarding the costs and benefits of introducing maternal influenza immunization into routine public health programs. WHO implementation guidance on maternal influenza immunization will accelerate national programme development and provide a platform for future vaccine introduction into routine antenatal service delivery.

5. Immunization research and innovation.

5.1. Coordination and implementation of Ebola vaccine research and product development.

During 2014 and 2015, a large-scale outbreak of Ebola disease which was declared a Public Health Emergency of International Concern affected a number of West African countries. The slow progress in controlling the outbreak underscored the urgent need for a vaccine against Ebola virus. An unprecedented and largely collaborative effort built on the availability of a number of candidate vaccines that could enter into clinical phase evaluation. In the midst of the outbreak, and facing several challenges and criticisms, a series of international consultations and activities were led by WHO as a contribution to the unprecedented global efforts to develop and evaluate an Ebola vaccine.

WHO's contribution included coordination of consortia that enabled accelerated testing of the two lead Ebola vaccine candidates in North America, Europe and Africa. WHO assumed a leading role in the design, conduct and analysis of an important Phase III trial in Guinea, the only vaccine trial that successfully estimated the efficacy of an Ebola vaccine. Another critical role was to enable comparative immunogenicity testing from different clinical trials and different vaccines.

WHO consulted urgently and widely, fostered interactions with international scientific institutions, ethical, and regulatory bodies, vaccine development and public health partner agencies, industry and funders' groups, and participated in consortia to facilitate Ebola vaccine assessments. WHO also fostered key activities to ensure the optimal policy and deployment plans for Ebola vaccines, if and when licensed. The end result of this work was to highlight several safe and immunogenic vaccine candidates, laying the groundwork for regulatory submissions for consideration of licensure. This work will enable access to safe and effective Ebola vaccines when the next outbreak occurs.

Furthermore, the work in Ebola proved critical in the follow-on development of WHO's Research and Development (R&D) Blueprint which provides a platform for accelerated research and product development for outbreaks of international concern. This R&D Blueprint initiative has already proven valuable in preparing the response to the ongoing public health emergency due to Zika virus.

5.2. Development of a partners' framework and a collaborative plan for the deployment of first generation Ebola vaccines.

The largest and most complex Ebola virus outbreak since the virus was first discovered in the Democratic Republic of Congo in 1976 occurred in west Africa during 2014-15. More cases and deaths were reported in this outbreak than in all previous outbreaks combined. In 2014, WHO declared the outbreak a Public Health Emergency of International Concern that required the implementation of extraordinary measures and collaboration to interrupt transmission and control the epidemic, including comprehensive vaccine research and development.

The inter-agency Global Ebola Vaccine Implementation Team (GEVIT) was convened and led by WHO to develop a coordinated plan to support affected countries in their efforts to prepare for the potential use of Ebola vaccines. GEVIT brought together the most affected countries (Guinea, Liberia and Sierra Leone) with partner agencies involved in vaccine policy development and procurement (Bill & Melinda Gates Foundation, GAVI Alliance, UNICEF, USAID, US Centers for Disease Control and Prevention, and WHO). In 2015, through a structure consisting of a Steering Group and three Working Groups (Vaccine supply, allocation and procurement; Country implementation; and Monitoring, surveillance and impact evaluation), GEVIT developed a "Country Guide for Use of Ebola Vaccine in Outbreak Response" which includes comprehensive technical details of Ebola candidate vaccines in clinical development. This represents a valuable resource for governments and partner agencies as they plan for the potential use of Ebola vaccines during future outbreaks. A mechanism for the management and deployment of Ebola vaccine has also been proposed through the establishment of an International Coordinating Group on Ebola Vaccine (ICG-EBOV)¹².

In 2015, countries and partner agencies agreed that GEVIT should continue functioning through 2016 and beyond, in order to ensure the integration of vaccine development efforts with Ebola preparedness and response activities as well as routine immunization service delivery at all levels. GEVIT will continue to facilitate work with partner agencies to secure adequate Ebola vaccine supply and to consolidate the establishment of the ICG-EBOV.

5.3. Publication of a WHO position paper on public disclosure of all interventional clinical trial results.

Several studies and audits in recent years showed that the results of many clinical trials remain unreported or reporting is delayed for years. This leads to major bias in information available for decisions regarding public health interventions or the allocation of resources.

To address this problem, in 2015 WHO published a new position paper on the public disclosure of clinical trial results¹³. The position paper was developed taking into account

¹² <http://www.who.int/healthsystems/publications/vaccines-deployment-workshop/en/>

¹³ www.who.int/ictpr/results/reporting

more than 700 responses to a public consultation process. The WHO statement defines reporting timeframes, calls for reporting of the results of previous unpublished trials, and outlines steps to improve linkages between clinical trial registry entries and their published results. WHO's position is that the protocol pre-specified key findings from clinical trials should be made publicly available within 12 months of study completion by posting to the results section of the primary clinical trial registry. The International Committee of Medical Journal Editors confirmed that posting results in clinical trial registries will not impact subsequent journal publication. In addition, the WHO statement recommends timelines for reporting of findings in the peer reviewed literature, noting that several journals are equally willing to publish negative or inconclusive results as to publish positive results (for example, the journals *PLoS* and *Trials*).

Since WHO and the International Committee of Medical Journal Editors recommended that all clinical trials be prospectively entered into clinical trial registry databases that are compliant with WHO's norms, registration of clinical trials has become the norm, although compliance remains incomplete. However, several recent audits have confirmed that reporting bias remains high across several classes of medical products. Consequently, WHO reconfirmed its support for universal compliance with prospective clinical trial registration and added its voice to calls for timely public disclosure of results from all interventional clinical trials, and continues to provide technical support to the global network of interventional clinical trial registries.

5.4. Information sharing to accelerate the response to public health emergencies.

The WHO Research and Development (R&D) Blueprint was established in 2015 and constitutes a global strategy and preparedness plan to ensure that targeted R&D is ready to strengthen the response to public health emergencies by generating critical research information and bringing medical technologies to patients during epidemics. The Blueprint aims to reduce the time between the declaration of an international public health emergency and the availability of effective tests, treatments and vaccines that can be used to save lives and resolve crises.

WHO convened a R&D Blueprint consultation in 2015 in recognition of the wider need to streamline global mechanisms of timely and transparent data dissemination in the context of public health emergencies. The consultation addressed the urgent need for accelerated data sharing, and a consensus statement was published which described the core principles to improve information sharing in future emergencies.

The current public health emergency caused by the Zika virus has demonstrated that implementation of these principles remains of paramount importance. WHO launched the Zika Open initiative in an attempt to make all manuscripts related to research on Zika virus publically available within 24 hours of receipt, while peer review continues in parallel. A joint statement from over 30 leading global health bodies including academic journals, non-governmental organizations, research funding agencies and institutes was released early in 2016. Signatories committed to sharing data and results relevant to the Zika crisis and

future public health emergencies as rapidly and transparently as possible. The joint statement represents a consensus set of principles for data and results sharing, and confirms that pre-publication information sharing has been accepted by leading medical journals and funders as the established global norm in the context of public health emergencies.

5.5. Establishing a maternal immunization clinical development pathway for Respiratory Syncytial Virus vaccine candidates for infants.

There is an urgent unmet public health need for interventions to prevent Respiratory Syncytial Virus (RSV) infection, particularly in neonates and infants in low- and middle-income countries. Maternal immunization could be one of the most effective ways to reduce the risk of neonatal infection and death by passive transfer of maternal RSV antibodies. Although influenza and pertussis vaccines and tetanus toxoid are currently recommended by WHO for immunization of pregnant women, the initial licensure of an RSV vaccine targeting this specific population group will create regulatory precedent. Understanding the most expeditious pathway to regulatory approval of this new class of vaccines for RSV is particularly urgent as some candidates are in advanced clinical stage development, with one entering phase III in 2015.

In 2015, WHO convened a first consultation on RSV vaccine development with vaccine developers, academics, regulators and donors, and achieved consensus on case definitions for RSV disease, considerations for clinical efficacy endpoints as well as the clinical development pathway for active and passive immunization trials in maternal and pediatric populations. The goal is to develop recommendations on high quality, safe and efficacious RSV preventive interventions for global use through (1) maternal/passive immunization to prevent RSV disease in infants less than 6 months, and (2) pediatric immunization to prevent RSV disease in infants and young children once protection afforded by maternal immunization wanes.

The recommendations from this consultation have been published¹⁴ and have guided subsequent discussions with vaccine developers, regulators and other key stakeholders. This consultation also formed the basis for developing draft Preferred Product Characteristics and a draft technology roadmap to help guide development of RSV vaccine candidates to be presented at the second WHO consultation in 2016.

5.6. Convening the global community to plan the next steps towards licensure of microarray patches for vaccine delivery.

In line with the Global Vaccine Action Plan (GVAP), WHO's mission is to increase equitable vaccination coverage against vaccine-preventable diseases, as well as to accelerate the development, approval and implementation of new vaccines and delivery technologies. Microarray patches (MAPs) are a novel vaccine delivery methodology that have the

¹⁴ http://ac.els-cdn.com/S0264410X15007677/1-s2.0-S0264410X15007677-main.pdf?_tid=2a9bc980-d5a1-11e5-b704-00000aab0f6c&acdnat=1455732575_d6642c1a095efbbca927d2b090da2ce8

potential to significantly improve vaccination coverage by making vaccination faster, safer and more acceptable by replacing needles and syringes, as well as removing the need for vaccine transport and storage in a cold chain, enabling vaccine administration by minimally-trained volunteers and virtually eliminating vaccine wastage.

MAPs are currently in preclinical development for a number of existing vaccines, including influenza, tetanus toxoid, measles-rubella (MR), inactivated poliovirus vaccine, as well as for vaccines currently in development such as inactivated rotavirus, and dengue vaccines. However, several technical aspects still need to be resolved with respect to the appropriate product development strategy and the pathway to licensure, since MAPs are considered a novel combination vaccine product.

In 2015, following up on an earlier meeting on a range of novel vaccine delivery technologies, WHO convened a workshop with MAP developers, vaccine manufacturers, regulators, funders and other key stakeholders. The workshop objectives were to better define and address the technical, financial and programmatic challenges facing product development, to identify scientifically-based evidence where available, and to propose research priorities where gaps still exist. Early clinical data with MAPs and influenza vaccine are now emerging and are encouraging with respect to end user acceptability, safety and immunogenicity. The field eagerly awaits clinical data for other vaccines such as polio and MR, whilst continuing to develop an improved regulatory route to licensure, and studies of the potential cost-effectiveness of these novel delivery devices.

The workshop raised awareness of the MAP platform's potential to transform the delivery of vaccines to hard-to-reach populations and thus increase vaccination coverage. However, the challenges associated with product development were identified in order to inform strategies for future investment. The Bill & Melinda Gates Foundation, PATH and WHO are planning additional activities in 2016 to incentivize the engagement of vaccine manufacturers and MAP developers.

5.7. Publication of a journal supplement describing the experience and results of the Meningitis Vaccine Project.

The Meningitis Vaccine Project, a partnership between WHO and PATH, had a single goal: the development, licensure, and introduction of a meningococcal group A conjugate vaccine in sub-Saharan Africa. The project ran from 2001 to 2014 and resulted in WHO prequalification of two polysaccharide-tetanus toxoid conjugate products, a 10 mcg vaccine for 1-29 year-olds and a 5 mcg vaccine for children under 2 years of age. The vaccine was registered as MenAfriVac®. Since 2010, the 10 mcg vaccine has been used to immunize 1-29-year-olds in large vaccination campaigns.

In 2015, WHO, with the collaboration of PATH and Public Health England, coordinated the documentation and publication of the many lessons learned through the multiple steps required to develop, test and introduce MenAfriVac® vaccine as a collection of 30 open-

access papers in a supplement of the peer-reviewed journal *Clinical Infectious Diseases*¹⁵. This collection of papers reports on the conduct of a dedicated project designed to solve an important public health problem in some of the poorest developing countries in the World. The success of the project highlights the potential of public-private partnerships to solve important public health problems, and will inform similar public health initiatives in future.

At least two further steps are required to ensure full control of group A meningitis in Africa. The incorporation of MenAfriVac® into national immunization schedules in Africa is essential to ensure that future cohorts of newborns are protected so that the public health benefits are enjoyed by future generations. Secondly, meningitis surveillance in sub-Saharan Africa must be strengthened in order to monitor the epidemiology of non-group-A meningococcal strains in Africa which could theoretically fill the ecological niche that group A used to occupy and assume epidemic proportions. This new vaccine's success has generated confidence that, over time, and with the development and use of affordable polyvalent meningococcal conjugate vaccines, meningococcal disease may well be eliminated from sub-Saharan Africa.

¹⁵ http://cid.oxfordjournals.org/content/61/suppl_5.toc