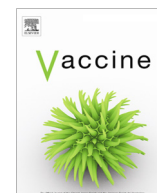


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WHO Report

Investing in life saving vaccines to guarantee life of future generations in Africa

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ABSTRACT

The World Health Organization's Regional Offices for Africa and for the Eastern Mediterranean in conjunction with the African Union and the Government of Ethiopia hosted a ministerial conference on immunization in Africa from 24 to 25 February 2016 in Addis Ababa, Ethiopia under the theme "towards universal immunization coverage as a cornerstone for health and development in Africa". The conference brought together African leaders – including health and finance ministers, and parliamentarians thus creating a powerful platform for governments to demonstrate their commitment to advancing universal access to immunization on the continent in line with the Global Vaccine Action Plan. The event also brought together advocates, technical experts, policymakers, partner agencies, donors and journalists to examine how best to drive forward immunization across Africa, ensuring every child has access to the vaccines they need. Key points highlighted throughout conference were: universal access to immunization is at the forefront of enabling Africa to reach its full potential – by improving health, driving economic growth and empowering future generations; it is one of the most cost-effective solutions in global health, with clear benefits for health and development; and immunization brings economic benefits too, reducing health care costs and increasing productivity. At the close of the conference, 46 African countries signed a historic ministerial declaration on "Universal Access to Immunization as a Cornerstone for Health and Development in Africa" signaling fierce determination among African leaders to secure the health and prosperity of their societies through immunization.

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1. Introduction

Immunization against vaccine preventable diseases (VPDs) has contributed to saving millions of lives. It was the fundamental strategy for the eradication of smallpox. Polio is now on the brink of eradication due to the efficacy of vaccines. More children than ever before now live healthy lives free of VPDs, because of immunization.

Beyond the public health benefits, immunization against VPDs has other social and development benefits. It has been demonstrated that every dollar invested in vaccines during the decade of 2011–2020 would result in an estimated return of 16 times the costs, taking into account treatment costs and productivity losses [1]. When considering broader economic and social benefits the return on investment for immunization was 44 times the vaccination costs [2].

To optimize these benefits of immunization the World Health Assembly (WHA) endorsed the Global Vaccine Action Plan (GVAP), a framework to achieve the vision of expanding access to vaccines and immunization to all by 2020. GVAP targets include 90% national coverage for 3rd doses of Diphtheria–Tetanus–Pertussis (DTP3) containing vaccines [3]. Meeting the targets requires achieving universal coverage with immunization services. Member States committed to strengthening national immunization systems to ensure equitable access to vaccines for all people by 2020.

Progress has been made toward realizing the targets. Coverage with the 3rd dose of diphtheria–Tetanus–Pertussis (DTP3), commonly used to measure the strength and reach of routine immunization programmes, increased from 57% in 2000 to 80% in 2014 in Africa. Improvements in immunization coverage have resulted in fewer VPDs among children in Africa [4–10]. As a result of immunization efforts, between 2000 and 2014, estimated measles deaths globally have declined by 69%, while the number of reported measles cases have declined by 69%. The largest decline in estimated measles deaths is in the African Region where measles deaths declined by 86% to 48,000 between the years 2000 and 2014

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[11]. The introduction of new vaccines in Africa has been a major success. The GVAP target of at least 90 low- and middle-income countries introducing one or more new or underutilized vaccines is on track [3]. Introducing new vaccines can help improve health systems. Vaccines provide benefits to families, communities and countries in the form of improved health outcomes and economic growth [12].

Despite these achievements, some critical diseases, including measles and neonatal tetanus, which have been eliminated or nearly eliminated in most regions of the world, remain endemic in Africa [5]. Worse still, the pace of improvements in routine immunization coverage, between 2000 and 2014, has in recent years decelerated. Fewer than half of African countries have met the GVAP target on DTP3 coverage. Government funding for immunization in African countries has increased in recent years, complemented by donor funds. However, in many countries across Africa, additional funding is required to ensure equitable and universal access to vaccine and immunization services in all the countries. There is an urgent need for more reliable national ownership of immunization programmes with commitment for guaranteed funding of all aspects of immunization in the Region.

Responding to this need, the WHO Africa and the Eastern Mediterranean Regional Offices in conjunction with the African Union Commission convoked a ministerial conference on immunization in Africa from 24 to 25 February 2016 in Addis Ababa, Ethiopia. The conference pulled together over 800 participants, including Ministers for Health, Local Government and Finance of the African countries. Others included national immunization program managers, past and present heads of governments in Africa, parliamentarians, religious/traditional leaders, civil society organizations, the private sector, technical experts and immunization partners across Africa and beyond. It provided a platform for African policymakers and to advocates to discuss strategies for tackling the challenges facing vaccine efforts, foster country ownership for sustainable financing for immunization, and advocate for greater engagement with all stakeholders to ensure sustainable demand for immunization. This paper summarizes the proceedings of the conference and proposed steps to tackle the challenges to achieving universal and equitable access to effective vaccines, thus keeping with the ethical and moral obligation to guarantee the life of the future generation through access to life-saving vaccine in Africa [13]. The programme included panel sessions and side events, covering the different aspects of immunization in the continent.

2. Toward high and equitable immunization coverage

Improving coverage and equity in immunization programmes is a critical element of ensuring immunization for all, in line with the commitments made in the GVAP. Coverage with DTP3 containing vaccines in Africa stood at 80.9% in 2014 [14]. About forty-three percent (42.6%) of the African countries had coverage rates of $\geq 90\%$ in 2014. However, approximately 23% or 7.4 million infants, within the WHO African Region, were not reached with the 3rd dose of DTP vaccines in 2014. A third of these children were in Ethiopia, Kenya, DR Congo, South Sudan, Nigeria and Guinea [12]. Djibouti and Somalia in the WHO Eastern Mediterranean Region had coverage rates of 78% and 42% respectively. Discussions were held around this issue, examining ways partners can identify underserved populations, develop effective plans for improving coverage, and strengthen collaboration among sectors. Participants offered various perspectives on the challenge of reaching hard to reach populations and improving equity and access to immunization, shared lessons and experiences, as well as what is most needed from various sector and partners to reach every child with

immunization services. Speakers in this session also discussed particular challenges of ensuring increased coverage with new and under-utilized vaccines, or ensuring resources are focused on specific low coverage geographic areas or target groups.

Some of the major themes that emerged from the panel discussion include strengthening immunization systems as an entry point for strengthening primary health care, and health systems; increasing number of vaccines, as well as the scope and costs for vaccination and the high economic returns of immunization. Others included the fragility of service delivery systems in conflict and disaster situations and need for better vaccine pricing for non GAVI eligible countries and countries transitioning into middle class. Participants highlighted the fact that countries now have new and powerful vaccines to prevent various types of diseases, and avert many deaths. Countries in Africa have collectively reached the highest immunization rate with DTP3 at 80.9% coverage in 2014. However, this still leaves behind one out of five children. They gave the examples of interruption of polio virus circulation and the successes in preventing meningitis A epidemics in Africa, and stressed on the remaining inequalities at subnational level in some of the big countries. Given the plateauing measles vaccination coverage in Africa in the last 5 years, and the outbreaks in some countries, it is important to work toward getting better data to better target populations and achieve high immunity coverage at sub-national level. A call was made for the development of tailored strategies to reach low coverage areas and underserved populations will be critical, and will require using data driven approaches. In addition, the critical lessons from the polio eradication initiative should be applied, when it comes to engaging the community, running functional supply chains and cold chain systems, among others. Also emphasized was the role of the private sector, alongside the public sector, in making vaccines available.

3. The role of communities in coverage and demand

Here, the point was made that civil society and community-level work is critical to advancing health. This is particularly important for increasing demand for and uptake of available services through social and behavioral change interventions, ensuring government transparency and accountability, and supporting resource mobilization. Other areas include influencing national health policies and supporting the monitoring and evaluation of effective programs. Effective engagement of communities is essential to ensuring continued progress toward universal access to immunization [15].

Participants thus examined how partners can identify underserved populations, develop effective plans for improving coverage, and strengthen collaboration among sectors. Discussions focused on the roles that religious and traditional leaders/authorities, youth and community based civil society organizations (CSO) and other groups and stakeholders could play in promoting immunization in the communities. It was noted, for instance, that traditional and religious leaders were fundamental to engaging communities for change in Africa, as demonstrated in Nigeria where their involvement strongly and positively influenced the uptake of polio vaccines in Northern Nigeria. Another example of community engagement for health in Africa was the experience of Ethiopia with extension health workers for the delivery of essential health services at the community level, which has become a remarkable success for health in Ethiopia. The cost of launching the extension health worker scheme was heavy initially because of the added workforce into the health expenditure. However, the Honourable Minister stated that “the good thing now is that cost of health care has gone down in Ethiopia.

It was stressed that engaging communities is becoming a success factor for all health interventions. Participants emphasized the need to build community trust and ownership. They called for increased awareness to address community barriers that could hinder the access to services to be able to reach the 5th child and increase demand.

Some of the key challenges mentioned included the communities' lack of information on immunization, poor geographical access because of the lack of infrastructure and difficult terrains, supply chain problems, and programming around health facilities. Participants remarked that CSOs have the capacity and proximity to give accurate information to the communities and to empower the communities to understand their rights, which will see the communities initiating their own effort. A call was made for partners to begin to see CSOs as equal partners. The youth was identified as an important part of the community, and with the potential to mobilize the community towards better health, including a stronger demand and better uptake of immunization services.

4. Harnessing polio's legacy to support other public health interventions

Africa achieved a major global health milestone in February 2016 when it reached 18 months with no indigenous case of wild poliovirus (WPV) detected on the continent. Even as the polio eradication initiative redoubles its efforts to achieve regional certification in 2017, Africa needs to plan early for the eventual ramp down of Global Polio Eradication Initiative (GPEI) support. GPEI support for polio-funded resources will gradually reduce over the next three years, as regional and global certification of polio eradication draws closer. In preparation for this ramp down, national governments, donors, implementing partners and civil society must work together to plan for a successful transition.

Participants noted that the polio eradication initiative has built an extensive infrastructure with broad benefits for health and development in Africa. This infrastructure includes: a large trained workforce, including a network of thousands of national technical staff, over 4000 partner-supported technical personnel, tens of thousands of engaged religious leaders, polio survivors and social mobilizers, and hundreds of thousands of trained vaccinators at the local level; a system for standardized, real-time disease surveillance with 16 dedicated laboratories and 51 environmental sampling sites in 7 countries in the African Region with similar statistics in the Eastern Mediterranean Region; a stronger vaccine supply chain and detailed mapping of nomadic and hard-to-reach communities previously unreached by other health services; and robust processes for using data to hold individuals and systems accountable for results based on strong operational data collection, real-time monitoring, and transparent reporting mechanisms. Participants also emphasized the importance of countries taking steps now to document the lessons learned from polio eradication, and taking a coordinated approach to planning the transition of polio's infrastructure into ongoing health programs. They took the opportunity of this session to address what those working on other health priorities hope to gain, or are already gaining, from the polio programme's assets and expertise. They called on African countries to take advantage of the full potential of the polio programme, and build a lasting legacy that will benefit children for generations.

Some of the major issues raised in the panel discussion focused on polio legacy and mainstreaming essential polio functions into ongoing public service programs; using polio infrastructure to strengthen other public health priorities; applying lessons from the fight against polio to other critical health challenges and the question of what other health priorities would want to take from

the polio legacy. The delegates were sensitized on the polio transition planning.

5. Ensuring sustainable resources for immunization in an evolving landscape for health

Ensuring sustainable resources for immunization was one of the most important topics discussed at the Ministerial Conference on Immunization in Africa. Estimates put the cost of fully vaccinating a child at US\$25–\$45 [1,16,17], but even this figure does not take into account non-vaccine costs of delivering the service, training, supervision, monitoring and tracking outbreaks, addressing population demand for services or managing programmes. Several studies suggest that non-vaccine costs represent nearly half of the total cost per child.

To ensure every child receives the required vaccines, governments need to carefully plan and adequately budget for both vaccines and the delivery costs of immunization programmes. While governments have made significant strides to increase funding for immunization programmes over the last five years, further commitment is needed to achieve full financing and national ownership of immunization programmes.

The discussion highlighted the need to ensure sustainable resources for immunization across Africa and how immunization financing is shifting in recent years. Participants shared experiences and lessons learned from working to solve immunization financing challenges, and offered suggestions on how to achieve country ownership of immunization programs in Africa. Opportunities for expanding domestic immunization financing, in view of rising costs of new vaccines and technologies, were also highlighted.

It was noted that between 2016 and 2020, Africa will require US \$17 billion for vaccines and vaccination service delivery. Cost projections indicate that Governments are expected to provide US\$6 billion while the donor community is expected to raise another US\$6 billion, leaving a funding gap of about US\$5 billion. On the other hand, it was stated that African countries are expected to derive the benefits of vaccination equivalent to about US\$224 billion in direct returns and savings from vaccine preventable diseases. It was also argued that countries need to see investment in immunization as a moral issue to assure that the young population is protected for the future, in order to drive the economies. Consequently, sustainable financing for immunization will come about through the realization that investments in immunization payoff, and make economic and moral sense. The Ugandan experience in working toward sustainable financing of immunization was shared. Uganda now spends US\$11 per surviving infant for immunization, with increases in DPT3 coverage. The Immunization Act was passed in 2015 and provides the legal framework for funding. With the high competition for donor resources for many development and emergency relief efforts, countries were called upon to seek innovative funding for immunization, is today a best buy in health.

Though mindful of the fact that countries have multiple priorities for public sector development funding, participants stressed that the cost of vaccines is often no more than 0.5% of the total national budget, and less than 2% of the health budget for most developing countries, which should not be a huge challenge for prioritizing in budgeting and funds disbursement. Countries were encouraged to increase their domestic financing for immunization and improve on the situation where currently 14 countries in Africa are currently not buying their vaccines and that 9 countries do not meet co-funding obligations with the Gavi Alliance [18]. There were also calls for the generation, tracking and sharing of immunization financing and expenditure data in order to track

progress toward achieving the goal of more predictable and sustainable financing for immunization.

6. Immunization delivery and data as a pillar of universal health coverage

Building robust national immunization programmes will be central to ensuring children's health and ensuring the vision of universal health coverage. Central to this effort is an increased understanding of national vaccine coverage, which is critically important for monitoring the performance of immunization programmes, identifying areas within immunization systems that require improvements, and preparing for the introduction of new vaccines. Strengthening immunization data quality and coverage estimates, and using the data for improving immunization program performance, are critical steps toward improving coverage in Africa.

Participants recognized the role of Ministers, the WHO and private sector in improving access to immunization through strong delivery systems and better data collection, and explored the delivery challenges and opportunities around reaching every child in Africa with the vaccines they need by 2020. Within this context, participants discussed how investments in novel delivery approaches and new data and analytics software are driving local and national progress toward reaching immunization goals. Specifically, the long-term goals for strengthening immunization systems and data collection, their strategies to drive African-led R&D and their visions for African-led solutions as pillars of universal health coverage were discussed exhaustively.

The invaluable role of community involvement, and better inter-sectoral coordination was highlighted. Countries emerging from conflict were encouraged to focus on building health systems, maintaining a motivated, well trained health work force and use the available technology to understand and address local needs.

Some of the common themes from this panel discussion were the increasing role of the private sector in developing countries in complementing the public health system. The panel also highlighted the gains in integrating service delivery approaches. Furthermore, the role of technology to facilitate the data capture and management, and the immense challenges of providing immunization and other health service delivery in conflict and emergency contexts were extensively discussed.

There was a call for countries and partners to invest in more robust, transparent and reliable data for monitoring and accountability. Furthermore, countries were called upon to ensure that all contacts with health services are used to provide integrated services to families and finally, governments were encouraged to acknowledge the crucial role of the private sector in service delivery, training, and logistics, among others.

7. Enhancing partnerships to strengthen capacity for immunization and health

Strengthening existing partnerships and creating new ones will be strategic to improving access to immunization in Africa [19]. Examples of such partnerships include cooperation between governments, investment institutions, charitable foundations and regional partnerships. Immunization is a complex health service, requiring many pieces of functioning infrastructure, such as financing sources, supply chains and human resources. Understanding how partnerships function and improve can help us support immunization while also advancing mutual interests between partners.

Finding new approaches to utilizing partnerships has to come as a need from all levels of government and beyond. Policy makers have to open the door for collaboration, and partners have to create

innovative solutions that can expand access to immunization in new ways. Cooperation at the country, regional and global levels can advance our common interest in building a healthier continent. The MenAfriVac meningitis vaccine success story is a proof of the potential of public and private partnerships to improve access to immunization.

Participants examined how African and global institutions can cooperate to increase access to immunization and other health services and drew on specific experiences to develop insights applicable to a range of countries. It was noted that the immunization community and African governments need to translate the commitments made at the Ministerial conference and other meetings into concrete actions, and be held accountable to these commitments. It was recalled that only 6 countries met the Abuja declaration targets 15 years on, and what roles regional partnerships can play to push for these [20]. Discussions focused on the need to base partnership on the needs of the countries and communities; country self-reliance in mobilizing resources for immunization and the role of religious institutions and leaders, as well as civil societies in promoting immunization.

After an elaborate discussion, which saw representatives of different development agencies and immunization partners as well as country delegates expressing their appreciation for strong partnership for immunization in Africa, some key issues emerged to inform the agenda for moving forward. These included the call on countries to decrease their dependency on donor funding, and look at different models to mobilize local resources for immunization. Countries were also encouraged to ensure accountability to the commitments they have entered into and to the global and regional immunization goals. Other issues that emerged include the need for countries to work toward pooling their experiences and resources toward developing their infrastructure and their capacity for vaccine manufacturing; to build strong, sustainable, multi-sectorial and multi-level partnerships based on the needs of the countries and communities. Furthermore, countries and partners were called upon to work toward generating and using subnational and district level data and ensure that religious institutions and leaders, the private sector, the citizenry, community based organizations (CBOs) are part of a strong partnership for the mobilization of resources, as well as advocacy and social change for immunization and for public health in general

8. Consensus and ministerial declarations

The conference reviewed the situation on immunization and vaccines in the African continent and noted that the principal challenge is how to ensure universal and equitable access by all people irrespective of their social class or geographic locations. The theme of this first ministerial conference on immunization in Africa – “Towards universal immunization coverage as cornerstone for health and development in Africa”, was reflected in the agenda which featured panel discussions to interrogate the key issues and challenges as well as side events, in which community/religious leaders, parliamentarians and civil society organizations pledged their support and commitment to a vibrant and sustainable immunization programme in the continent.

Participants were unanimous in their resolution that “this is the time for Africa to rise. In one voice that argued “that African cannot rise if the life of the children and future generation is not guaranteed. One way to guarantee their lives is to invest in life saving vaccines. Great progress has been made but much more needs to be done”.

Participants recognized milestone achievements in immunization in Africa, some of which included the achievement of elimination of meningitis A epidemics in most of the highly affected

countries, and 18 months of a polio-free Africa—and celebrated improvements in immunization coverage and reductions in childhood death and disease. They also recognized the need for greater and sustained demonstration of country ownership and partnership across key African stakeholder groups, and highlighted the challenges of vaccine affordability and the need to expand country health financing.

The conference concluded with delegates endorsing the Ministerial declaration on “*Universal Access to Immunization as a Cornerstone for Health and Development in Africa*”. This declaration committed African leaders to strive toward closing the immunization gap by financing immunization, reducing delivery barriers, ensuring polio transition plans are in place and improving health systems. By this declaration, African leaders unequivocally asserted that immunization saves lives, strengthens economies, and is essential to achieving a healthy future for all. Civil society organizations, religious leaders and parliamentarians also issued declarations at the end of the conference in support of immunization.

The Minister committed themselves, on behalf of their respective countries, to:

- Keeping universal access to immunization at the forefront of our efforts to reduce child mortality, morbidity and disability, and in doing so help our countries achieve their long-term health, economic and development goals;
- Increasing and sustaining our domestic investments and funding allocations, including innovative financing mechanisms, to meet the cost of traditional vaccines, fulfil our new vaccine financing requirements, and providing financial support for the operational implementation of immunization activities by EPI programs;
- Addressing the persistent barriers in our vaccine and healthcare delivery systems, especially in the poorest, vulnerable and most marginalized communities, including the strengthening of data collection, reporting and use at all levels as well as building effective and efficient supply chains and integrated procurement systems;
- Increasing the effectiveness and efficiency, as well as changing the approaches as needed, of our immunization delivery systems as an integrated part of strong and sustainable primary health care systems;
- Attaining and maintaining high quality surveillance for targeted vaccine preventable diseases.
- Monitoring progress toward achieving the goals of the global and regional immunization plans
- Ensuring polio legacy transition plans are in place by end-2016 that will allow future health programs to benefit from the knowledge and expertise the polio program has generated through the eradication initiative;
- Developing a capacitated African research sector to enhance immunization implementation and uptake;
- Building broad political will, working with communities, civil society organizations, traditional and religious leaders, health professional associations and parliamentarians, for the right of every child and every community to have universal access to life-saving vaccines, and by extension the best possible chance for a healthy future;
- Promoting and investing in regional capacity for the development and production of vaccines in line with the African Union Pharmaceutical Manufacturing Plan including the strengthening of national regulatory authorities.

The Ministers thanked his Excellency Hailemariam Desalegn, Prime Minister of the Federal Democratic Republic of Ethiopia, and host country for this Ministerial Conference on Immunization

in Africa, for agreeing to champion the Ministerial declaration and further requested him to present it to the African Heads of States at the 26th Summit of the African Union, to be held in June 2016.

Side-events offered an opportunity for constituencies to have in-depth conversations on specialized topics:

- **The Meningitis Vaccine Project Closure Conference: Ending and New Beginnings:** The Meningitis Vaccine Project (MVP), a partnership between PATH and the World Health Organization (WHO) was launched in June 2001 and formally ended in December 2014. This satellite meeting celebrated successes from the program; shared results, experiences and lessons learned; and planned the next steps to ensure continued support for the remaining vaccination campaigns and a smooth transition into routine immunization programs.
- **Building next-generation immunization supply chains to close the immunization gap:** Co-hosted by WHO, UNICEF, PATH, John Snow Inc, Gavi, the Vaccine Alliance, and the Bill & Melinda Gates Foundation, this event highlighted the work that several African countries are doing today to strengthen their supply chains and improve immunization coverage and equity.
- **Civil Society: Promoting Equity & Holding Governments Accountable:** Organized by several partners, this event provided an opportunity for CSOs to discuss their role in holding governments accountable to improve vaccine access and coverage in Africa in line with the Global Vaccine Action Plan. Through presentations and breakout sessions, participants reviewed current and best practices in community-level immunization advocacy and outreach work and identified ways CSOs can best work together following the conference. An open session of the meeting provided a forum for other stakeholders to join the discussion about the role civil society in immunization. In recognition of the vital role of immunization to health and economic development of Africa the CSO groups pledged to take action on bridging the gap on immunization, utilizing their unique capacities as CSOs to forge connections between communities, health services and the government responsible to the communities.
- **Side Forum of Eminent African Traditional and Religious Leaders and Scholars:** International Interfaith Peace Corps (IIPC) convened 30–40 eminent Muslim and Christian religious scholars and traditional leaders at this closed side forum. The forum provided a space for these leaders to identify strategies to advance and support immunization within their communities. The traditional and religious leaders reaffirmed their support to the Dakar Declaration in relation to vaccinations in Africa.
- In recognition of their pivotal role of budgeting, oversight and formulation of legislations, the parliamentarians committed to support enactment of legislations to ensure sustainable financing of immunization programs.

References

- [1] Ozawa Sachiko, Clark Samantha, Portnoy Allison, Grewal Simrun, Brenzel Logan, Walker Damian G. Return on investment from childhood immunization in low- and middle-income countries, 2011–20. *Health Aff* 2016;35(2):199–207.
- [2] JHSPH. Benefits of childhood immunization 16 to 44 times the investment. <<http://www.jhsph.edu/departments/international-health/news/vaccine-return-on-investment-health-affairs.html>> [Accessed on March 25, 2016].
- [3] Global Vaccine Action Plan. Decade of vaccine collaboration. *Vaccine* 2013;31(Suppl. 2):B5–31.
- [4] Moeti RM. Immunization in the African region. *Afr Health Monit* 2015(19):1.
- [5] Liu L et al. Global, regional, and national causes of child mortality in 2000–13, with projections to inform post-2015 priorities: an updated systematic analysis. *Lancet* 2015;385(9966):430–40.
- [6] World Health Organization (WHO). Global control and regional elimination of measles, 2000–2012. *Weekly Epidemiol Rec* 2014;89(6):45–52.

- [7] World Health Organization (WHO). Report on the status of polio eradication to WHO's Executive Board; 2015.
- [8] Okeibunor JC, Akanmori BD, Balcha GM, Mihigo RM, Vaz RM, Nshimirimana D. Enhancing access to immunization services and exploiting the benefits of recent innovations in the African region. *Vaccine* 2013;31:3772–6.
- [9] Okeibunor JC, Ota MC, Akanmori BD, Gumede N, Shaba K, Kouadio KI, et al. Polio eradication in the African Region on course despite public health emergencies. *Vaccine* 2015. <http://dx.doi.org/10.1016/j.vaccine.2015.08.024>. pii: S0264-410X(15)01146-9.
- [10] Etsano A, Gunnala R, Shuaib F, Damisa E, Mkanda P, Ticha JM, et al. Progress toward poliomyelitis eradication – Nigeria, January 2014 – July 2015. *MMWR* 2015;64(32):878–82.
- [11] WHO. Progress towards regional measles elimination, worldwide, 2000–2014. *Weekly Epidemiol. Rec.* 2015;90(46):623–32.
- [12] Malara M. WHO: Nigeria no longer on polio endemic shortlist. UPI Health News. http://www.upi.com/Health_News/2015/09/26/WHO-Nigeria-no-longer-on-polio-endemic-shortlist/9831443299466/ [Accessed February 29, 2016].
- [13] WHO. Fulfilling a promise: ensuring immunization for all in Africa; 2016. <http://static1.squarespace.com/static/55f7744be4b0e6c5fe73e691/t/56cb4692cf80a16489bb5e9a/1456162452373/immunization+for+All+-+EN.pdf>.
- [14] WHO/UNICEF. Estimates of national immunization coverage; 2015. http://www.who.int/immunization/monitoring_surveillance/routine/coverage/en/index4.html.
- [15] WHO. Improving immunization coverage and equity; 2016. http://static1.squarespace.com/static/55f7744be4b0e6c5fe73e691/t/56c798fef699bb77bd9a8e9/1455921406654/Brief_Coverage_Equity_EN.pdf.
- [16] WHO. Strategy for universal access to health and universal coverage; 2014. <http://www.paho.org/uhexchange/index.php/en/uhexchange-documents/technical-information/26-strategy-for-universal-access-to-health-and-universal-health-coverage/file>.
- [17] WHO, UNICEF and World Bank. State of the world's vaccines and immunization. 3rd ed. Geneva: World Health Organization; 2009.
- [18] Gavi Alliance. Progress report; 2013. <http://gaviprogressreport.org/2013/gavi-alliance-funding-model/>.
- [19] Gavi Alliance. Historic partnership between Gavi and India to save millions of lives; 2016. <http://www.gavi.org/Library/News/Press-releases/2016/Historic-partnership-between-Gavi-and-India-to-save-millions-of-lives/>.
- [20] WHO. The Abuja declaration: ten years on; 2011. http://www.who.int/healthsystems/publications/abuja_report_aug_2011.pdf.