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Strengthening the Partnership Between Routine Immunization and the Global Polio Eradication Initiative to Achieve Eradication and Assure Sustainability

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Abstract

Since the launch of the Global Polio Eradication Initiative (GPEI) in 1988, the number of polio endemic countries has declined from 125 to 3 in 2013. Despite this remarkable achievement, ongoing circulation of wild poliovirus in polio-endemic countries and the increase in the number of circulating vaccine-derived poliovirus cases, especially those caused by type 2, is a cause for concern. The Polio Eradication and Endgame Strategic Plan 2013–2018 (PEESP) was developed and includes 4 objectives: detection and interruption of poliovirus transmission, containment and certification, legacy planning, and a renewed emphasis on strengthening routine immunization (RI) programs. This is critical for the phased withdrawal of oral poliovirus vaccine, beginning with the type 2 component, and the introduction of a single dose of inactivated polio vaccine into RI programs. This objective has inspired renewed consideration of how the GPEI and RI programs can mutually benefit one another, how the infrastructure from the GPEI can be used to strengthen RI, and how a strengthened RI can facilitate polio eradication. The PEESP is the first GPEI strategic plan that places strong and clear emphasis on the necessity of improving RI to achieve and sustain global polio eradication.

Keywords

polio eradication; strengthening routine immunization

Since the launch of the Global Polio Eradication Initiative (GPEI) by the World Health Assembly (WHA) in 1988, the number of polio-endemic countries decreased from 125 to 3 (Nigeria, Afghanistan, and Pakistan) [1], and polio was eradicated from 4 World Health

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Organization (WHO) regions (Pan American Health Organization, WHO Regional Office for Europe, South-East Asia Regional Office, and Western Pacific Regional Office). At the close of 2012, both the number of polio cases and the number of countries reporting cases were at their lowest levels. Wild poliovirus (WPV) type 2 (WPV2) has been eradicated since 1999; only WPV serotypes 1 (WPV1) and 3 (WPV3) remain. WPV3 is close to eradication: only 22 WPV3 cases were reported in 2012, and none in 2013 or so far in 2014. The last WPV3 case in Asia occurred in April 2012 in Pakistan and, in Africa, in November 2012 in Nigeria.

Even with the GPEI's achievements, many challenges remain. Continuing circulation of WPV in high-risk reservoirs in Nigeria, Pakistan, and Afghanistan poses a global threat, especially in areas with low population immunity, as evidenced by the ongoing outbreak in the Horn of Africa. The emergence of insecurity, including attacks on polio vaccinators in Pakistan and Nigeria [2], has compounded the threat to completing WPV eradication. Furthermore, as global WPV case counts dwindle, circulating vaccine-derived poliovirus (cVDPV) cases, especially due to type 2 poliovirus, continue to occur.

To secure the gains made to date and to address the remaining challenges, the GPEI, in consultation with countries, donors, and other stakeholders, developed the Polio Eradication and Endgame Strategic Plan 2013–2018 (PEESP) [3]. In May 2013, the WHA endorsed the plan's 4 major objectives:

1. Stop all WPV transmission by the end of 2014;
2. strengthen routine immunization (RI) systems, and withdraw oral polio vaccine (OPV), beginning with the type 2 component of trivalent oral polio vaccine (tOPV), in all RI programs by mid-2016;
3. certify eradication and containment of all WPVs in all WHO regions by 2018; and
4. plan for the GPEI legacy, including mainstreaming essential polio functions into ongoing public health programs; the target is to implement a strategy by the end of 2015 [4].

In this paper, we focus on the second objective, and describe the relationship and potential links between RI systems and polio eradication programs, as well as the plans for OPV withdrawal and inactivated polio vaccine (IPV) introduction into RI programs. We also discuss a framework for achieving the RI-strengthening component of this objective.

COMPONENTS OF OBJECTIVE 2

From its inception in the Americas, the polio eradication initiative depended on a strong RI program to serve as the base or platform for other additional needed strategies to supplement RI activities. Countries achieved interruption of poliovirus transmission through the addition of strong acute flaccid paralysis (AFP) surveillance combined with OPV vaccination campaigns. While RI is a key GPEI strategy, the integration of polio strategies with RI activities has varied among regions and countries. In the Americas, national Ministries of Health developed and implemented polio control activities within existing RI programs. In

countries such as India and Nigeria, WHO and United Nations Children's Fund (UNICEF) developed infrastructures outside national RI programs to provide focused support to AFP surveillance and OPV campaigns. The PEESP emphasizes the need to improve RI systems worldwide to achieve and sustain global polio eradication by maintaining high population immunity.

Countries with low RI coverage are also those where interruption of polio virus transmission has been the most challenging, and where importations and VDPV emergence have resulted in outbreaks, reestablished transmission, or both. Recent security threats have highlighted the importance of strengthening RI to achieve high population immunity, rather than relying on campaigns, which may not reach insecure or inaccessible areas. The PEESP focuses on using existing polio infrastructure and experience to strengthen RI overall and to increase routine polio coverage in high-risk districts in 10 priority countries (Angola, Chad, Democratic Republic of the Congo, Ethiopia, Nigeria, Afghanistan, Somalia, South Sudan, India, and Pakistan).

Although the last WPV2 case occurred in 1999 in India [5], 7 countries (Afghanistan, Chad, Democratic Republic of the Congo, Kenya, Nigeria, Pakistan, and Somalia) reported type 2 cVDPV outbreaks during 2012, compared with 1 WPV1 outbreak (in Chad). Two outbreaks in Nigeria and Somalia involved transmission of a type 2 cVDPV for more than 36 months in settings with low RI coverage [6]. To stop circulation of type 2 VDPVs, it is necessary to increase vaccination coverage and, eventually, to withdraw all OPV. In November 2012, WHO's Strategic Advisory Group of Experts (SAGE) on immunization recommended that tOPV be replaced with the more immunogenic bivalent OPV (bOPV [types 1 and 3]) in all OPV-using countries by 2016. To prevent gaps in protection against polio type 2, it is critical that this switch be accompanied by the introduction of at least 1 dose of an affordable IPV within the context of strengthened RI systems. IPV will boost immunity to type 1 and 3 poliovirus serotypes and mitigate the risks of paralysis by "priming" the population against type 2 poliovirus and ensuring better immune responses to OPV. Thus, IPV introduction sets the stage for ending OPV use entirely by 2019–2020.

These activities extend GPEI's work beyond polio endemic and outbreak-affected countries to all 124 countries currently using only OPV in their RI programs [7].

HOW GPEI CAN STRENGTHEN RI

As the eradication target approaches, there is renewed thinking about how GPEI can strengthen RI, and how a strong RI program can help achieve the last mile in polio eradication. Studies examining the impact of polio eradication on RI have reached variable conclusions (ie, some have shown a negative impact on the functioning of health services, while others have suggested little or no negative impact [8–11]). Therefore, it is crucial that PEESP review previous assessments to ensure that newly proposed activities are effective.

The PEESP focuses on transferring effective elements of the GPEI to national immunization programs to strengthen RI. For example, the GPEI is unique in its organization. At the global level, it is structured strategically, involving all stakeholders. At country and regional

levels, partners agree on approaches in Interagency Coordinating Committees (ICCs), Emergency Operations Centers (EOCs), National Immunization Technical Advisory Groups (NITAGs), and so forth. Targets and strategies are outlined, indicators are tracked, and dashboards are used to monitor progress. In countries with weaker immunization systems, or particular problems, additional persons are recruited to help implement programs. In contrast, although needed, a global system that coordinates RI has yet to be instituted. Although country-level RI coordination often occurs through mechanisms similar to those for polio eradication, these activities would benefit from technical and operational capacity and funding to make substantive program improvements. While implementation of the Reaching Every District (RED) approach [12] to build district-level capacity and Expanded Program on Immunization (EPI) reviews have improved the collection and use of data [13], the use of RI program data could be expanded beyond their current use for upstream coverage reporting and used to improve programs locally. Most RI systems need to develop the capacity to identify and correct problems encountered in the field, to provide adequate supervision, and to improve the quality of microplans. The GPEI has faced similar problems, and its focused approach to reaching all children, including underserved and marginalized groups, may offer insights on how to improve RI programs. In settings where RI systems are weak and access is a problem, the GPEI infrastructure could potentially be used to improve systems. Here, we summarize key areas where RI can benefit from the GPEI experience.

1. Political commitment and resource mobilization

The 1-disease focus of GPEI has supported targeted, simple messaging; concrete, achievable goals; and realistic budgets. GPEI has generated high-level and broad political commitment from heads of state to local community leaders. The program issues quarterly Financial Resource Requirements, summarizing all anticipated program costs, including needs and shortfalls by budget category [14].

With RI coverage rates leveling off at about 80% globally (http://www.who.int/immunization_monitoring/data/SlidesGlobalImmunization.pdf), focusing on a few high-impact strategies with clear targets may help regain critically needed political support and more predictable financing. A global- and country-level strategic organizational structure involving donors and other partners in key immunization decisions may help consolidate support and political momentum.

2. The collection and use of quality data

Key to GPEI has been AFP surveillance, implementation of outbreak responses, and the collection and use of quality data. Identification of each and every potential polio case resulted in the development of extensive AFP surveillance networks; in many countries, these comprise a cadre of field-based Surveillance Officers, operating separately from other Health Management Information Systems. Recently, new tactics have been developed to better understand polio vaccination campaign quality, such as Independent Monitoring (IM) and Lot Quality Assurance Sampling (LQAS) for supplementary immunization activities (SIAs).

Expanding the scope of AFP surveillance networks to other vaccine-preventable diseases (VPDs), including encephalitis and bacterial meningitis [15–17], has already occurred in many countries [18–20] and has provided valuable lessons (eg, the inclusion of other viral VPDs is feasible while the inclusion of bacterial VPDs remains problematic). In addition, IM and LQAS methods can be tailored to examine RI coverage in high-risk areas. These methodologies can potentially be expanded for other data collection and analysis efforts, such as cold chain–related data collection and monitoring. Surveillance officers can help to train health workers to collect and interpret these data.

3. Communications, social mobilization, and health education

GPEI is very active in assessing community knowledge and attitudes and developing evidence-based communication approaches. As eradication draws closer, it has become more important to understand and address the reasons that some children are not reached by immunization [21]. The program has established mechanisms to collect and analyze data on missed children to make program adjustments or develop new strategies. Numerous field-based social mobilizers provide the human resources to collect and respond to these data. GPEI's close links with community, political, religious, and traditional leaders can be exploited to promote RI and child survival messages, as was done in India [22]. The community involvement of social mobilizers makes them powerful instruments for communication.

4. Vaccine management and supply and cold chain

Although the GPEI has established systems to rapidly forecast, purchase, and deliver large quantities of vaccine, these systems sometimes bypass poorly functioning existing structures, resulting in parallel systems that leave RI programs to solve routine vaccine supply and distribution problems. Although GPEI has not made substantial investment in long-term infrastructure for cold chain and supply chain needs, it has invested in enormous numbers of vaccine carriers and cold boxes to ensure the "last mile" cold chain, and strengthened infrastructure in key locations where vaccine supplies may be stored in advance of campaigns. Field-based GPEI-funded staff and volunteers can provide simple reports on vaccine stocks and cold chain malfunction; such data are practically nonexistent in many RI programs at the periphery. But gathering these data is only useful if coupled with responses to equipment failures, overstocks or stock-outs.

5. In-country management, accountability, and program implementation

In some countries with weak immunization programs, the GPEI elected to implement polio eradication strategies through development of parallel systems, rather than attempt to improve ineffective RI systems. The National Polio Surveillance Project in India and the EOC in Nigeria are 2 examples of a centralized "command structure" that guides a complex program. GPEI has instituted campaign monitoring strategies that include identifying and immunizing missed children by a second team of vaccinators, marking houses that have been visited, and applying a finger mark to children who receive OPV. The PEESP calls for the application of GPEI strategies and resources to RI programs to strengthen the functioning of management systems using data to guide implementation, with mechanisms

to ensure accountability and implement corrective actions. This approach could potentially benefit all immunization program activities.

GPEI has capitalized on advances in geographic information systems through the use of global positioning system devices and Google Maps to identify the exact location of every polio case, and to generate precise maps. These serve as basis for detailed microplans to guide house-to-house SIAs. Some managerial techniques can be used to improve RI. For example, GPEI has employed over 17 000 social mobilizers to raise awareness and acceptance of polio vaccination campaigns in India, Pakistan, Afghanistan, and Nigeria. Typically, these are minimally paid volunteers, operating in their own communities. They could be trained to track newborns and children who have missed immunization doses and monitor the occurrence and frequency of outreach sessions as well as vaccine stock-outs in their villages. Such an approach has been successfully implemented in India, and is currently being rolled out in Nigeria (http://www.polioinfo.org/media_content/global_reports/IMB2012_Q3_report.pdf).

HOW RI CAN STRENGTHEN GPEI

Two components of the second PEESP objective—introduction of an IPV dose and withdrawal of OPV2—are polio specific. While the third—strengthening immunization systems—is more general, it is directed toward polio-focus countries. Many country RI programs have developed key skills that will benefit the GPEI in the planning and introduction of IPV and preparing for the programmatic consequences of the withdrawal of OPV. Four approaches by which RI programs can help GPEI achieve its goal are described here.

1. Working in all countries

During the past decade, the GPEI focused mainly on polio-endemic and reinfected countries, but the endgame phase expands activities to every country. RI programs operate in all countries, with personnel and skills to facilitate the transitions outlined in the PEESP. Although 16 countries have estimated coverage with the third dose of diphtheria-tetanus-pertussis vaccine of <70% (http://www.who.int/immunization_monitoring/data/data_subject/en/index.html), most countries are able to reach at least 80% of their populations with their RI program (http://www.biomedcentral.com/1472-698X/9/S1/S2), and >95% of the population with special efforts (including Child Health Days and sustained outreach activities). The ability to reach the majority of children will be crucial to the success of IPV introduction.

2. Sustaining polio eradication through continuous building of capacity and program infrastructure

Until global polio transmission is interrupted, the RI program will be the key mechanism in ensuring that polio-free areas sustain their status through the ongoing development of immunization personnel, systems, and capacity. Any failure of the routine program to maintain high population immunity will jeopardize the prevention of WPVs or cVDPVs where gaps in population immunity exist. Countries such as India have been able to improve

their RI systems by focusing efforts of all health assets on the RI program when the country moved from being polio-endemic to polio-free and high-intensity polio work decreased [12]. This attention to the RI program has had a profound impact on maintaining polio-free status. In some settings, especially where OPV has been viewed with suspicion, the revitalization of the delivery of all routine vaccinations should encourage parents to reengage with the immunization program. OPV may be viewed less skeptically if it is understood to be part of a comprehensive RI program.

3. Vaccine introduction

In November 2012, SAGE recommended that all countries include at least 1 IPV dose in their RI schedule before initiation of OPV2 withdrawal [23]. As with all vaccine introductions, a carefully sequenced plan is critical. The successful introduction of IPV will depend on the availability of funding, vaccine supply, storage and distribution, ability to administer the vaccine to a large proportion of the population, and a process to monitor the program. This represents an opportunity to improve RI services, as the demand for a "new" vaccine can induce wary caregivers to seek out immunization services again, and boost not only polio immunity but coverage with all vaccines. In the past decade, mainly through funding by the Global Alliance for Vaccines and Immunization (GAVI), 72 of the world's poorest countries, as well as many non-GAVI-eligible countries, have introduced new vaccines into their RI programs. Among the 156 developing (World Economic and Social Survey 2013 Sustainable Development Challenges http://www.un.org/en/development/desa/policy/wess/wess_current/wess2013/WESS2013.pdf) countries of the world, 153 have introduced at least 1 new vaccine into their immunization schedule. These experiences and skills can be of benefit to the GPEI effort to introduce IPV.

4. Comprehensive disease control approaches and service integration

As new vaccines against pneumococcal, rotavirus, and human papilloma virus disease have been introduced, and underutilized vaccines (such as those against cholera) have been more widely recommended, the RI program has increasingly been recognized as one component in a range of disease control interventions. It has expanded the awareness that for many vaccine-preventable infectious diseases, including polio, additional, nonvaccine approaches have a role—sometimes a major one—in disease control. This broader approach to disease control can be applied to polio eradication, whereby the successful vaccination program can be complemented by increased public health attention to clean water and sanitation, food hygiene, and hand washing.

THE WAY FORWARD–A FRAMEWORK FOR POLIO TO CONTRIBUTE TO BROADER IMMUNIZATION GOALS

Using the GPEI infrastructure to support broader immunization goals depends on capitalizing on its strongest skills and expertise as the GPEI achieves its goals and objectives. A framework has been developed (Global Polio Eradication Initiative, Immunization System Management Group, unpublished report, 2013) for making systematic use of the GPEI to strengthen other immunization initiatives over the coming 5 years. The framework builds on GPEI's experience and approaches that have been developed

over the past 25 years. The framework is intended to be compatible with the goals and objectives of the Global Immunization Vision and Strategy (GIVS) [24] and the Global Vaccine Action Plan (GVAP) [25], and was developed with input from countries and global immunization partners. The framework is based on 3 key principles for transitioning polio resources to strengthen RI: working at the country level, where most GPEI assets are currently deployed, commencing with the 10 focus countries in the PEESP; building upon existing national immunization plans and priorities; and developing a flexible package of interventions tailored to country needs and capacities, built around major GPEI areas of expertise.

The process of developing and applying the framework was designed around 4 steps:

Step 1: Assessment of the GPEI experience and development of a framework applicable to GPEI assets and areas of expertise (this step has been essentially completed).

Step 2: Development of support packages that are flexible enough to take into account individual country needs and infrastructure skills and capacities, and that can be applied by existing GPEI infrastructure in focus countries (this work is ongoing).

Step 3: Development and application of the framework through individual countries, with reference to country multiyear plans, national immunization and disease control priorities, and the GPEI infrastructure capacity (this step should be completed by the end of the first quarter of 2014).

Step 4: Monitoring of implementation through quarterly updates, providing an overall picture of progress in GPEI support to broader immunization goals.

Based on the experience in the 10 focus countries, a further roll-out to other countries that could benefit from this systematic approach is envisaged throughout 2014. Within these 10 countries, the supporting partners are assisting with the programming of in-country and GAVI funds to ensure that polio staff work on RI activities. Several countries have received additional donations from the Bill and Melinda Gates Foundation to improve this collaboration. The support to these 10 priority countries is focused on providing adequate routine immunization training to all polio staff. Implementation of this framework in countries with weak RI services will play a dual critical role in sustaining the eventual eradication of polio, and as a new effort to strengthen RI systems.

In summary, new reconsideration of how the GPEI and RI programs can mutually benefit one another will capitalize on how tested activities of the GPEI can be used by immunization program managers to strengthen RI systems. In conjunction with transitioning GPEI-funded human resources to RI activities as polio-specific activities diminish in intensity, significant improvements in RI systems could be anticipated in selected polio endemic countries. Importantly, successful RI strategies can be implemented to strengthen the GPEI. This plan represents a call to action that places strong and clear emphasis on the necessity of improving RI to achieve global polio eradication and sustain this achievement by maintaining high population immunity. Ultimately, this will be critical to not only protect all children from VPDs but to also prepare for the development of the GPEI legacy planning. In

addition, it will ensure that national programs are able to take advantage of the availability of new vaccines as they are developed, and ensure their introduction into national EPI programs.

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References

1. World Health Organization. Poliomyelitis Fact Sheet. Media Centre, April 2013. http://www.who.int/mediacentre/factsheets/fs114/en/. Accessed 14 September 2013.
2. Bokhour Y. Despite tragic setbacks, push to end polio remains strong. MediaGlobal News, 1 February 2013. http://www.mediaglobal.org/2013/02/14/despite-tragic-setbacks-push-to-end-polio-remains-strong/. Accessed 15 September 2013.
3. Global Polio Eradication Initiative. Polio Eradication & Endgame Strategic Plan 2013–2018. http://www.polioeradication.org/Portals/0/Document/Resources/StrategyWork/PEESP_EN_US.pdf. Accessed 16 September 2013.
4. Polio Eradication and Endgame Strategic Plan 2013–2018, 14 April 2013). http://www.polioeradication.org/Portals/0/Document/Resources/StrategyWork/EndGameStratPlan_20130414_ENG.pdf. Accessed 14 September 2013.
5. Centers for Disease Control and Prevention (CDC). Apparent Global Interruption of Wild Poliovirus Type 2 Transmission, 30 March 2001. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5012a2.htm. Accessed 17 September 2013.
6. Global Polio Eradication Initiative. Objective 2: Immunizations Systems strengthening and POV withdrawal. Polio Eradication and Endgame Strategic Plan 2013–2018.
7. Global Polio Eradication Initiative. Polio Eradication & Endgame Strategic Plan Executive Summary. http://www.rki.de/DE/Content/InfAZ/P/Polio/Strategieplan_Endphase.pdf?_blob=publicationFile. Accessed 17 September 2013.
8. Memon I, Fehmina A, Ammanah C, et al. Status of routine immunization in polio patients. Medical Channel 2012; 18:52–4. ProQuest. Accessed 18 September 2013.
9. Loevinsohn B, Aylward B, Steinglass R, Ogden E, Goodman T, Melgaard B. Impact of targeted programs on health systems: a case study of the polio eradication initiative. Am J Public Health 2002; 92:19–23. [PubMed: 11772750]
10. Pan American Health Organization. The Impact of the EPI and the polio eradication initiative on health systems in the Americas. Final Report of the “Taylor Commission.” Washington, DC. 1995. 00003B.
11. Weiss WM, Choudhary M, Solomon R. Performance and Determinants of Routine Immunization Coverage within the Context of Intensive Polio Eradication Activities in Uttar Pradesh, India: Social Mobilization Network (SM Net) and Core Group Polio Project (CGPP). BMC International Health and Human Rights 13 (2013) ProQuest. Accessed 18 September 2013.
12. Vandelaer J, Bilous J, Nshimirimana D. Reaching Every District (RED) Approach: A Way to Improve Immunization Performance. World Health Organization. Bulletin of the World Health Organization 86.3 (2008): A-B.ProQuest. Accessed 18 September 2013.
13. Machingaidze S, Wiysonge CS, Hussey GD. Strengthening the expanded program on immunization in Africa: looking beyond 2015. PLoS Med 2013;10:e1001405. ProQuest. Accessed 18 September 2013. [PubMed: 23526886]
14. http://www.polioeradication.org/Financing.aspx. Accessed 18 September 2013.
15. CDC. Expanding poliomyelitis and measles surveillance networks to establish surveillance for acute meningitis and encephalitis syndromes—Bangladesh, China, and India, 2006–2008. MMWR 2012;61:1008–11. [PubMed: 23235298]

16. Sandhu HS. Expanding poliomyelitis and measles surveillance networks to establish surveillance for acute meningitis and encephalitis syndromes—Bangladesh, China, and India, 2006–2008. JAMA 2013;309:434. ProQuest. Accessed 30 September 2013.
17. Hyde T, Andrus J, Dietz V. Critical issues in implementing a national integrated all-vaccine preventable disease surveillance system. Vaccine 2013; 31S:C94–8.
18. Nsubuga P, et al. Polio eradication initiative in Africa: influence on other infectious disease surveillance development. BMC Public Health 2002; 2: 379–85.
19. Paul RC, Rahman M, Emily S, et al. A novel low-cost approach to estimate the incidence of Japanese encephalitis in the catchment area of three hospitals in Bangladesh. Am J Trop Med Hyg 2011; 85:379–85. [PubMed: 21813862]
20. Yin Z, Wang H, Yang J, et al. and the Acute Meningitis and Encephalitis Syndrome (AMES) Study Group. Japanese encephalitis disease burden and clinical features of Japanese encephalitis in four cities in the People's Republic of China. Am J Trop Med Hyg 2010;83:766–73. [PubMed: 20889863]
21. Obregon R, Chitnis K, Morry C, et al. Achieving polio eradication: a review of health communication evidence and lessons learned in India and Pakistan. World Health Organization. Bull World Health Organ 2009; 87:624–30. ProQuest. Accessed 18 September 2013. [PubMed: 19705014]
22. UNICEF. Communication Quarterly Update. http://www.polioinfo.org/media_content/global_reports/IMB2012_Q3_report.pdf.
23. World Health Organization. Meeting of the Strategic Advisory Group of Experts on immunization, November 2012—conclusions and recommendations. Wkly Epidemiol RecNo. 1, 2013; 88:1–16. http://www.who.int/wer/2013/wer8801.pdf. Accessed 18 September 2013.
24. World Health Organization, UNICEF. Global Vision and Immunization Strategies, the GIVS, 2005–2015. Printed 2005. http://www.who.int/vaccines-documents/DocsPDF05/GIVS_Final_EN.pdf. Accessed 13 September 2013.
25. http://www.who.int/immunization/global_vaccine_action_plan/GVAP_doc_2011_2020/en/. Accessed 7 October 2013.