

# An evaluation of infant immunization in Africa: is a transformation in progress?

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**Objective** To assess the progress made towards meeting the goals of the African Regional Strategic Plan of the Expanded Programme on Immunization between 2001 and 2005.

**Methods** We reviewed data from national infant immunization programmes in the 46 countries of WHO's African Region, reviewed the literature and analysed existing data sources. We carried out face-to-face and telephone interviews with relevant staff members at regional and subregional levels.

**Findings** The African Region fell short of the target for 80% of countries to achieve at least 80% immunization coverage by 2005. However, diphtheria–tetanus–pertussis-3 coverage increased by 15%, from 54% in 2000 to 69% in 2004. As a result, we estimate that the number of nonimmunized children declined from 1.4 million in 2002 to 900 000 in 2004. In 2004, four of seven countries with endemic or re-established wild polio virus had coverage of 50% or less, and some neighbouring countries at high risk of importation did not meet the 80% vaccination target. Reported measles cases dropped from 520 000 in 2000 to 316 000 in 2005, and mortality was reduced by approximately 60% when compared to 1999 baseline levels. A network of measles and yellow fever laboratories had been established in 29 countries by July 2005.

**Conclusions** Rates of immunization coverage are improving dramatically in the WHO African Region. The huge increases in spending on immunization and the related improvements in programme performance are linked predominantly to increases in donor funding.

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Une traduction en français de ce résumé figure à la fin de l'article. Al final del artículo se facilita una traducción al español. الترجمة العربية لهذه الخلاصة في نهاية النص الكامل لهذه المقالة.

## Introduction

Every year more than 10 million children in low- and middle-income countries die before they reach their fifth birthdays. Most die because they do not access effective interventions that would combat common and preventable childhood illnesses.<sup>1</sup> Infant immunization is considered essential for improving infant and child survival. Although global immunization coverage has increased during the past decade to levels of around 78% for diphtheria–tetanus–pertussis-3 (DTP-3),<sup>2</sup> WHO's African Region has consistently fallen behind, reaching only 69% DTP-3 coverage by 2004 (Fig. 1).

In response to challenges in global immunization, WHO and the United Nations Children's Fund (UNICEF) set up the Global Immunization Vision and Strategy (GIVS) in 2003.<sup>3</sup> The chief goal of GIVS is to reduce illness and death

due to vaccine-preventable diseases by at least two-thirds by 2015 or earlier. The Task Force on Immunization in Africa (TFI) recognized from the outset the need for high vaccination coverage to counter the disproportionate burden from vaccine-preventable diseases in the African Region, and therefore set challenging goals for 2001–2005. These goals aimed to ensure that the immunization performance of the African Region caught up with other regions' performance.

The findings of a 1998 review of the Expanded Programme on Immunization (EPI)<sup>4</sup> formed the basis for of the first EPI Regional Strategic Plan (2001–2005).<sup>5</sup> This plan set five key objectives to be met by 2005:

- circulation of wild polio virus to be interrupted in all countries;
- maternal and neonatal tetanus to be eliminated in all high-risk districts;

- hepatitis B vaccine to be introduced into all countries, yellow fever vaccines to be introduced in all countries at risk, and *Haemophilus influenzae* type b vaccine to be introduced in at least half of the countries offering hepatitis B vaccine;
- measles to be controlled in all epidemiological blocks and eliminated in southern Africa; and
- 80% of the countries of the African Region to have reached at least 80% DTP-3 coverage in all districts.

This paper explores the progress made on these objectives.

## Methods

We reviewed national infant immunization programmes in the 46 countries of WHO's African Region. (The WHO African Region does not include every

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country on the continent. Most Arabic-speaking African countries are Member States of WHO's Eastern Mediterranean Region.)

We carried out a literature review of official documents produced by ministries of health, WHO, UNICEF and nongovernmental organizations that related to immunization. WHO staff members subsequently were questioned about their programme areas. We carried out structured interviews with WHO staff members and partners at regional, country and intercountry levels, and conducted face-to-face and telephone interviews with subregional teams.

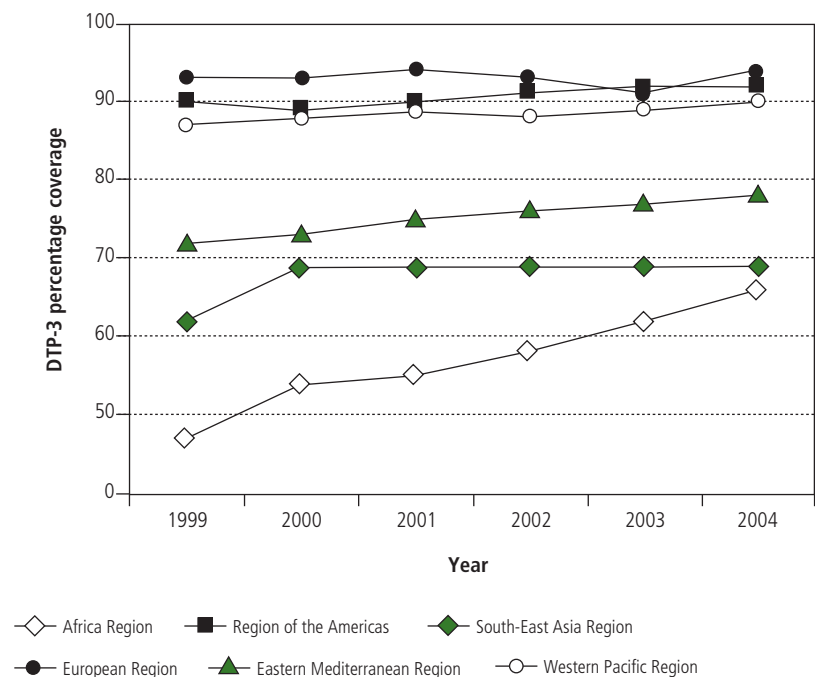
We then analysed the data collected in light of the 25 separate immunization goals and five key objectives of the EPI Regional Strategic Plan. We compared the data and information gathered through the interviews and literature review with these strategic goals in order to determine whether the key objectives had been met; 2000 was considered the baseline year for measurement of performance.

Finally, we collated all routine immunization coverage estimates from the WHO/UNICEF Joint Reporting Forms submitted annually by each country. These reports outline the country's official estimates of vaccination coverage, which are derived in most cases from administrative data collected during vaccination sessions. Coverage was estimated by clustering countries with similar target disease control dynamics weighted by population. One strategy WHO used to improve coverage was to divide countries within the African Region into five epidemiological blocks. The first block, the "Big Four", includes Angola, the Democratic Republic of Congo, Ethiopia and Nigeria. These four countries incorporate 40% of the African Region's population. The region is further divided into the central block (seven countries), eastern block (six countries), western block (16 countries) and southern block (13 countries).

## Findings

In Table 1 (available at: <http://www.who.int/bulletin>) we summarize the progress made towards achieving the strategic goals. We found that although more infants had been immunized by 2005, most of the targets had been missed by at least half of the region's countries. We identified eleven target areas, the findings from which are outlined below.

Fig. 1. Diphtheria–tetanus–pertussis-3 (DTP-3) percentage coverage by WHO Region, 1999–2004



Source: WHO database 2005.

## Routine immunization

Between 2000 and 2004, the African Region made progress in increasing routine immunization coverage (Table 2, available at: <http://www.who.int/bulletin>). Although the region fell well short of the target of 80% of countries achieving at least 80% coverage nationwide, coverage increased in a majority of countries. DTP-3 coverage is widely recognized as a good indicator of the strength of routine immunization services, and this coverage increased from 54% in 2000 to 69% in 2004 across the African Region; 22 (48%) of the countries reported achieving at least 80% DTP-3 coverage in 2004, an increase from 11 countries in 2000. The same number of countries, although not the same list of countries, also reported that 50% or more of their districts achieved DTP-3 coverage of 80% or higher in 2004. As a result, we estimate that the number of nonimmunized children, defined as children who had not received the third dose of DTP-3 by their first birthday, declined dramatically across the region from 1.4 million in 2002 to less than 900 000 in 2004.

Despite these gains, more than one-third of African Region districts did not acquire 50% DTP-3 coverage by the end of 2004. Coverage levels of other

routine vaccines, including measles, oral polio, bacillus Calmette Guerin (BCG) and tetanus toxoid also lagged in many of the same areas. Factors holding back routine immunization services in the African Region included civil unrest, lack of human resources within health ministries, limited funding for routine immunization services, and competition for staff time among individuals involved in polio and measles supplementary immunization activities.

Table 3 (available at: <http://www.who.int/bulletin>) summarizes the achievements made within these areas between 2001 and 2005. During this period, various strategies were implemented to help the Big Four and other low-performing countries increase routine immunization coverage. The Reaching Every District initiative, for example, was implemented in 22 countries between 2002 and 2004.<sup>6</sup> This strategy involves prioritizing low-performing districts by strengthening five important immunization functions at the district level. These functions are planning and management of resources; capacity-building through training and supportive supervision; sustainable outreach; links between communities and health facilities; and active monitoring and use of data for decision-making. A recent

assessment carried out in five of these early implementation countries shows significant improvements in DTP-3 coverage.<sup>7</sup> Other strategies included implementing an ambitious capacity-building programme to improve the management and vaccine logistics of national immunization programmes; integrating routine immunization functions alongside polio and measles activities; building on new vaccine introduction to update routine immunization skills and systems; and streamlining communication and social mobilization activities.

Although a relatively small amount of regional funding is available for routine immunization programmes, resources available to control polio and measles and to introduce new vaccines have been used to support their critical functions. GAVI Alliance (formerly known as the Global Alliance for Vaccines and Immunisation) funding for immunization services became available to many countries after 2001 and has contributed to the positive trend in routine coverage.<sup>8</sup>

### Polio eradication

The Polio Eradication Initiative faced a global crisis between 2001 and 2005, when a resurgence of polio cases occurred across Africa and Asia following the cessation of immunization activities in Nigeria.<sup>9</sup> Nigeria became a major exporter of wild polio virus to many countries, threatening the gains that had so painstakingly been achieved. However, in 2004 WHO brokered an alliance between the government and religious leaders that led to resumed immunization activities in the country's northern area. This was followed by increased investment in the purchasing of vaccines, national immunization days and improved surveillance across countries in the African Region. Although there has been extraordinary progress, it is not yet known when the wild polio virus will be eliminated from the African Region (Table 4, available at: <http://www.who.int/bulletin>).

Between 2000 and 2002, the number of polio-endemic countries declined from 11 in 2000 to 2 in 2002, and reported incidence of polio declined by 89%, from 1863 cases in 2000 to 208 cases in 2002. Polio was endemic in Nigeria and Niger, and possibly in Chad. In September 2003, amid speculation in northern Nigeria that the polio vaccine was contaminated with contraceptive

and infectious agents, immunization activities in endemic states were suspended. Coverage significantly declined in almost all northern Nigerian states, resulting in a resurgence of polio cases with transmission to epidemic levels. Previously polio-free states in southern Nigeria saw the disease's resurgence, and by the end of 2003 transmission had spread to eight African Region countries (Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Ghana and Togo) and to others outside the region. By mid-2005, 18 countries in three WHO regions had reported wild polio virus cases: Angola, Benin, Botswana, Burkina Faso, Cameroon, Chad, Côte d'Ivoire, Eritrea, Ethiopia, Ghana, Guinea, Mali, Niger and Togo (African Region); Saudi Arabia, Sudan and Yemen (Eastern Mediterranean Region); and Indonesia (South-East Asian Region). In addition, five countries had re-established endemic transmission: Burkina Faso, Central African Republic, Chad, Côte d'Ivoire and Mali.

The Nigerian states that had suspended immunization activities subsequently resumed campaigns in July 2004<sup>10</sup> in conjunction with other campaigns across west and central Africa. As a result, surveillance data from the first half of 2005 suggest that polio cases were decreasing in Nigeria, and that previously polio-free countries were no longer being directly infected by the Nigeria-derived virus.

Despite some progress towards improving routine polio vaccine coverage in the African Region, low coverage in several countries was a significant

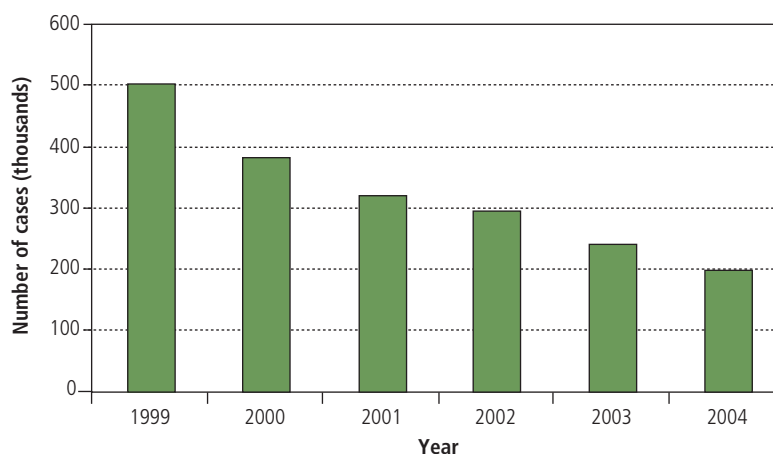
contributory factor to the 2003–2004 regional resurgence of wild polio virus transmission. In 2004, four of seven countries with endemic or re-established wild polio virus had vaccine coverage of 50% or less, and some neighbouring countries at high risk of importation still had routine immunization coverage levels well below the 80% target.

### Measles

According to WHO estimates in 2000, measles accounted for approximately 777 000 deaths worldwide, of which around 60% occurred in sub-Saharan Africa. The number of cases reported to WHO/UNICEF dropped from 520 000 in 2000 to 316 000 in 2005. These data suggest that considerable progress has been made in reducing regional mortality from this disease, although the regional objectives have not yet been achieved. The joint WHO/UNICEF 2001 measles mortality reduction plan focuses on 45 priority countries that account for almost 95% of global measles deaths. With support from the Measles Partnership, a consortium of nongovernmental and UN-based organizations, African Region countries have made outstanding progress towards the World Health Assembly goal of a 50% reduction in measles mortality worldwide. By 2004, there was an estimated reduction in measles mortality of 60% in the African Region from 1999 baseline levels (Fig. 2).

Between 2000 and 2004, significant progress was made in improving routine measles coverage, one of the major strategies for mortality reduction. During this

Fig. 2. Estimated measles mortality in the African Region, 1999–2004



Source: WHO database 2005.

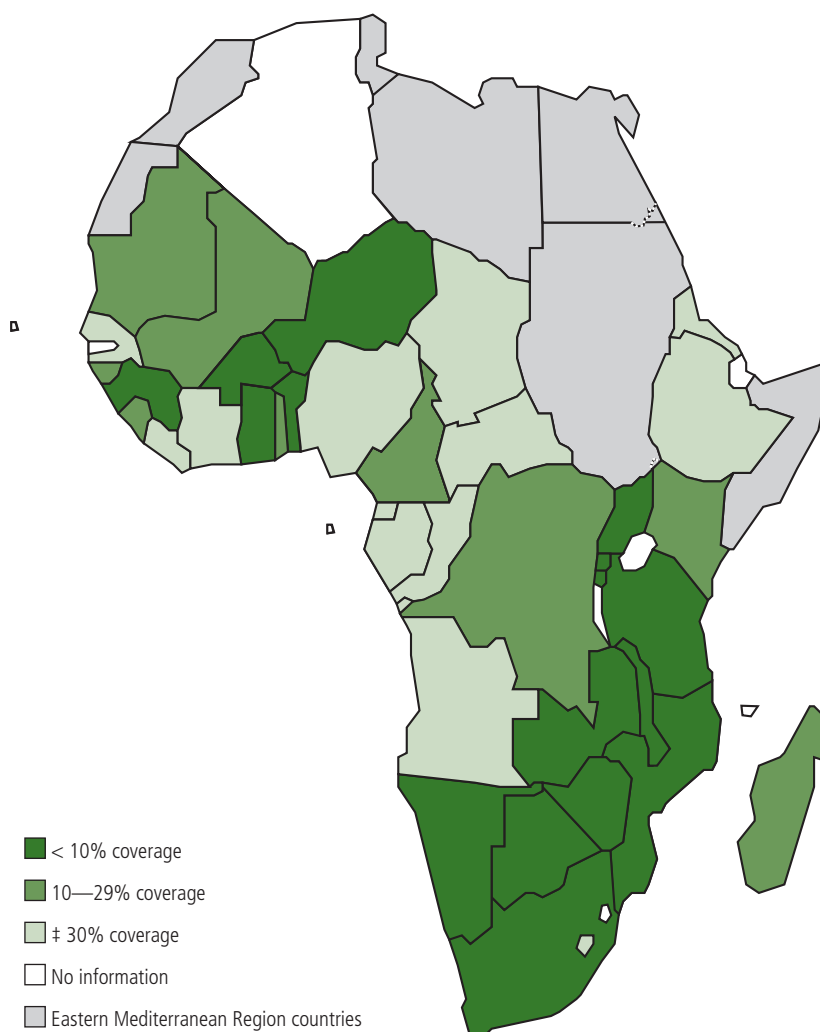
time period, routine measles vaccine coverage increased 14%. In 2004, 17 countries and 30% of districts in the African Region had measles vaccine coverage of 80% or more, and 20% of districts had coverage of 90% or more. However, in 2004 coverage remained low in some countries, with Côte d'Ivoire, Gabon, Liberia and Nigeria achieving coverage of less than 50%. Across the region, available data indicate that more than a third of all districts, most in the Big Four countries, reported routine measles coverage below this level (Fig. 3).

Another successful strategy for measles mortality reduction and control has been to use catch-up and follow-up immunization campaigns. Between 2001 and 2004, country-wide measles catch-up campaigns targeting children aged between 9 months and 14 years were completed in 26 countries and follow-up campaigns in five countries. These strategies resulted in the immunization of 127 million children. During 2005, five additional countries planned to conduct catch-up campaigns, and nine planned to conduct follow-up campaigns targeting children aged between 9 months and 5 years. By the end of 2005, the projected number of children vaccinated as a result of these campaigns was over 200 million. Coverage above 90% was achieved in most campaigns, and has in most of these countries resulted in a dramatic decrease in measles incidence.

Between 2000 and 2003, 82.1 million children were targeted for vaccination during initial campaigns in 12 African countries and follow-up campaigns in seven countries.<sup>11</sup> The average decline in the number of reported measles cases was 91%. In 17 of the 19 countries, measles case-based surveillance confirmed that transmission of measles virus and measles deaths were reduced to low rates. The estimated number of deaths averted in the year 2003 was 90 000. Between 2000 and 2003, there was a 20% decline in annual African Region measles deaths.<sup>11</sup>

Measles campaigns proved to be an important vehicle for the integrated delivery of other essential child health services, including insecticide-treated bednets, oral polio vaccine, vitamin A supplementation and treatment for parasitic infections. Throughout 2004, successful integrated bednet and measles campaigns were carried out in Ghana, Togo and Zambia. Measles outbreaks, some large (for example, 2946 cases in

Fig. 3. Measles coverage by district in the African Region, 2004



Source: WHO database, 2005.

Burkina Faso in 2003) occurred after the catch-up campaigns. These outbreaks provide some important lessons regarding gaps in coverage and the role of unpredictable events. For example, lessons learned from the large and ongoing population movements from Côte d'Ivoire to Burkina Faso and their impact on subsequent vaccination campaigns can be used to improve future regional measles elimination efforts.

### Communication

Effective communication and social mobilization involve a variety of tasks, such as advocacy campaigns among political, traditional and religious leaders, as well as creating community demand for services and encouraging the community to use services. Almost every disease-control initiative we reviewed required increased advocacy of some sort, as well

as counselling of family members and sustained community involvement. Many countries that we reviewed had successful communication campaigns because they received support from WHO and UNICEF country offices and a range of local organizations. We found that only a small number of staff members were dedicated to communication-related issues and that this limited their effectiveness. Since the introduction of the Reaching Every District initiative, however, resources for communication and social mobilization have increased at district and community levels.

### Surveillance and laboratories

Between 2001 and 2005, 30% of districts within the African Region did not report data to WHO and UNICEF. During the period under review, the Polio Eradication Initiative generated

unprecedented regional interest and support for improving surveillance. The quality of regional surveillance for acute flaccid paralysis improved steadily between 2001 and 2005, with a consistent increase in the number of countries attaining and sustaining the two key performance indicator targets. The first indicator is the annual reporting rate; the target set for 2005 was for countries to achieve a reporting rate of non-polio acute flaccid paralysis of at least 1 case per 100 000 among children younger than 15 years old. The second indicator relates to the completeness of specimen collection; the target set for 2005 was to ensure that two adequate stool specimens were collected from at least 80% of children with acute flaccid paralysis. In 2000, only five countries had achieved both these minimum targets; by July 2005, 35 countries had achieved them. In 2004, 38 countries carrying out acute flaccid paralysis surveillance had achieved surveillance rates greater than 1 case per 100 000, and the regional rate was 3 per 100 000. This improvement was largely a result of increased recruitment of surveillance officers to undertake active case-finding. By July 2005, case-based measles surveillance and laboratory confirmation had been initiated in 26 countries. Routine monitoring showed that the quality of measles surveillance improved steadily between 2002 and 2004 (Table 5, available at: <http://www.who.int/bulletin>). In 2004, the annual reported rate of suspected measles cases confirmed with serum specimens was 3.6 per 100 000 population, well above the recommended level of 1 per 100 000.

For diseases such as maternal and neonatal tetanus and yellow fever, significant surveillance gaps remain in most countries. Case-based yellow fever surveillance has been implemented but performance remains poor throughout the region. However, newly created surveillance networks offer opportunities to better understand the health burden of particular diseases, and to monitor the impact of new vaccines for *Haemophilus influenzae* type b, rotavirus and pneumococcal pneumonia.

We found that laboratories initially dedicated to surveillance of acute flaccid paralysis also took on other surveillance roles between 2001 and 2005. Expanding on the polio laboratory network, a network of measles and yellow fever laboratories was established in 29 countries

by July 2005. Training was undertaken and laboratories received accreditation if they met required standards. These laboratories all had initiated testing for measles by 2005, and all had the capacity to confirm and test measles-negative cases for rubella. These laboratories may be able to test for other diseases in the future. By 2005, these laboratories' capacity was expanded to enable outbreak investigations for measles and meningitis. Significant progress was also made in implementing integrated disease surveillance and response.

### Lost emphasis on target diseases

Funded activities for two other target diseases, yellow fever and maternal/neonatal tetanus, in many cases did not receive much-needed in-country attention. Unprecedented financing from donors such as UNICEF occurred between 2001 and 2005 for these diseases. National programmes, however, were focused on the vaccination of diseases considered to be essential, and governments received less donor pressure to vaccinate for yellow fever and tetanus. In addition, there was a worldwide shortage of vaccines for these two diseases. As a result, only half the regional surveillance objectives were achieved for maternal and neonatal tetanus, and tetanus elimination goals were not met. Only 15 (32.5%) of 46 countries achieved a neonatal tetanus incidence rate of less than 1 case per 1000 live births. Only one country achieved coverage of 80% among pregnant women in every district for two or more doses of tetanus toxoid vaccine (TT2+); TT2+ coverage of 50–79% in every district was reported by only three of 46 countries. The remaining 42 countries reported TT2+ coverage of less than 50% in every district.

Despite impressive additional support from the Children's Vaccine Initiative and the GAVI Alliance, yellow fever goals were not met by 2005. Only 22 of 31 at-risk countries had incorporated yellow fever vaccination into their national immunization programmes by the end of 2004, and only four had achieved 80% vaccine coverage by 2004. Surveillance of the disease was also poor, and targets for district-level reporting of suspected cases were not met. Many at-risk countries did not prioritize yellow fever control or were unable to afford the vaccine. Renewed GAVI Alliance

support is expected to improve vaccine availability.

### Vitamin A

While vitamin A deficiency remains a health issue in 44 of 46 African Region countries, the integration of programme delivery with immunization services dramatically improved the situation between 2001 and 2005. Prior to 1998, distribution had been limited to nutritional and maternal and child health clinics. Subsequently, vitamin A began to be administered through routine and supplementary immunization activities in an increasing number of countries.<sup>12</sup> We found that by 2005, only 22 of the 44 at-risk countries had established a policy for integrating vitamin A supplementation with vaccine delivery; 12 of the 22 countries reported the integration of vitamin A distribution with routine immunization services. Between 2000 and 2004, 36 countries in the region reported administering vitamin A during polio campaigns or subnational measles immunization days.

### New vaccine introduction

The region's disease burden of hepatitis B virus infection is considered to be moderate to high. With support from the GAVI Alliance, substantial progress has been made in introducing new and under-used vaccines since 2000, including hepatitis B (HepB) vaccine. However, the key objective of the EPI Regional Strategic Plan 2001–2005 to introduce HepB vaccination programmes in every country was not achieved. In 2000, the vaccine's introduction was limited to Botswana, Gambia, Mauritius, Seychelles, South Africa, Swaziland and Zimbabwe. The reasons for delayed introduction included high vaccine cost, weak infrastructure and low financing priority among donors. By 2005, 28 (61%) countries had reported using the HepB vaccine (Table 6, available at: <http://www.who.int/bulletin>). Coverage ranged from 8% in Nigeria to 100% in Sao Tome, indicating a highly variable degree of implementation. However, most countries that introduced the HepB vaccine had achieved coverage of 60% or higher. Of 28 countries that introduced the vaccine, 17 achieved coverage levels equal to DTP-3 coverage, largely because a combination diphtheria–tetanus–pertussis–HepB vaccine was used.

WHO estimates that between 100 000 and 160 000 children die each

year from *Haemophilous influenzae* type b (Hib) infection in Africa, which remains by far the highest rate in the world. The annual incidence of this infection ranges from 25 to 60 cases per 100 000 among children younger than 5 years old.<sup>13</sup> Data for 1999–2004 from a newly established national laboratory-based surveillance system in South Africa showed a decrease in disease burden among children following conjugate vaccine introduction in 1999.<sup>14</sup> The absolute number of cases in the study among children younger than 1 year decreased by 65%, from 55 cases in 1999–2000 to 19 cases in 2003–2004. The Hib vaccine remains regionally underused because of a lack of awareness of disease burden, high vaccine cost and concern about financial sustainability. The Paediatric Bacterial Meningitis laboratory surveillance network has helped countries to document disease burden; however, by the end of 2004 only ten countries had introduced Hib vaccines. This outcome fell short of the regional objective to introduce Hib vaccination into the programmes of half of the African Region countries. We highlight coverage levels in Table 7 (available at: <http://www.who.int/bulletin>).

### Financial sustainability and waste disposal

The huge increase in spending on immunization and the related improvements in programme performance can be tracked predominantly to donor funding increases, as 38 of 46 countries in the African Region established line items for immunization in their national budgets, 12 countries bought all of their own vaccines and 19 countries that received support from the GAVI Alliance developed financial sustainability plans. Unfortunately, more than a third of the countries that established budget line items did not fund them, and most of the countries with financial plans did not use them to the degree expected. The GAVI Alliance is now developing comprehensive multi-year plans that must be both costed and incorporated into national budgets.

Lastly, we found that countries have not yet paid sufficient attention to the proper disposal of used injection equipment. With the advent of the injection-based measles campaigns, as oppose to the oral vaccines used in the polio campaigns, this has become an important issue. We found that 41 countries distributed safety boxes for the collection

of used syringes and 33 countries reported using some kind of incineration. However, most of the incinerators are single-chamber burners that burn at low temperatures. Many countries adopted the method of open burning of syringes, although environmentalists consider this practice unacceptable.

### Conclusions

Immunization coverage is improving dramatically in the African Region. The huge increases in spending on immunization and the related improvements in programme performance are linked predominantly to increased donor funding. The African Region has witnessed unprecedented successes in its immunization campaigns, in developing surveillance infrastructure, and in its ability to purchase vaccines through external support. Campaigns have enabled phenomenal advances in the control of polio and measles. However, polio's resurgence in Nigeria underlines the need for eradication to be pursued rapidly to ensure that the huge investments made to date are not lost. Failure to achieve this goal will harm immunization programmes across the continent.

Although the analysis of the data presented in our review is accurate, there is less certainty about the validity of the data that we analysed. Some of the analysis of coverage and disease incidence trends was carried out with data submitted by countries through the WHO/UNICEF Joint Reporting Form and was not independently validated or cross-checked. The absolute numbers of deaths averted, infants immunized or cases reported are therefore subject to under- or over-reporting. However, we consider the overall trends more reliable and these consistently point towards dramatic performance improvements by the majority of African Region countries. Although regional surveillance infrastructure has definitely improved tremendously, doubts remain about the quality of data generated. An assessment of the accuracy or validity of official coverage rates was not part of this review.

The official country estimates have several limitations. Although the quality and completeness of the administrative data used to calculate these estimates have improved in recent years, no countries reported on 100% of their districts in any given year. In 2004, for example, Liberia and Nigeria both failed to report

on 30% or more of their districts. In addition, although coverage estimates derived from administrative data are considered to reflect trends in immunization coverage, they are often higher or lower than the actual coverage rates. A recent study of official DTP-3 coverage rates in 45 countries, which included countries in Africa, found higher DTP-3 coverage levels being reported than those reported from household coverage surveys.<sup>15</sup> The size of the difference increased with higher levels of reported coverage. As a result, there are several countries in Africa in which official coverage estimates are considered to be low because populations have been overestimated. Although this may mean that the regional goals are less likely to be reached, reporting problems have been present in all years and we therefore consider trends in coverage over time to be valid.

The GAVI Alliance and the Millennium Development Goals have established ambitious objectives for strengthening national immunization programmes during 2006–2015, providing a road map for the African Region to follow. Although the region has made progress in recent years, there is still much to be done to achieve these new goals. The gains documented in our review show substantial progress, yet these achievements are modest, despite massive investment. The cost of immunization has increased and will continue to increase with the addition of new and more expensive vaccines and technologies, and funding is not yet secured for the coming years.

During the past 5 years the GAVI Alliance, the Polio Eradication Initiative, the Measles Partnership and others have increased resources available for immunization; however, the ways in which countries access and use donor support have changed. The changing donor environment highlights fundamental differences between donors in the way they interact with countries and with each other. There is a real danger that donors with different agendas could bias the immunization agenda, resulting in national health ministries diverting their attention away from their mandate. In addition, coverage rates could fall if donor fatigue again sets in, as it did in the 1990s. Acquiring long-term funding, from both government sources and external partners, will be crucial in

improving immunization coverage. In Table 8 we outline the key issues and future priorities for the African Region during the next 5 years.

Although campaigns have greatly contributed to increased immunization coverage, lasting success will depend on development of robust routine services. The African Region is beginning the transition to a time without polio eradication funds, and creative thinking is urgently needed to maintain the gains previously made. Efforts are needed to build strong and sustainable routine immunization services and improve surveillance capacity before polio-focused resources are withdrawn. Measles control in Africa has the potential to be the successor to polio eradication, and holds the promise of continuing as a major primary health-care intervention and as a magnet for external investment in the coming decade. We hope this initiative will galvanize partner support for immunization and be an important vehicle for other public health initiatives.

Improvements in routine immunization have not kept up with regional advances in other areas of immunization. Many countries in which coverage remains below 50% put initiatives such as polio eradication and measles control at risk. Considerable work is needed to consolidate past gains and effectively address pockets of low vaccination coverage. The Reaching Every District initiative shows potential for invigorating routine services, particularly outreach activities. However, low routine coverage is particularly alarming in the countries like Nigeria where 25% of sub-Saharan Africa's children reside. Here, low routine coverage and the implementation of polio national immunization days have failed to interrupt polio transmission. Other countries where recent outbreaks have occurred may also require extra attention to ensure that routine services are not neglected. The Measles Partnership has agreed to set aside up to 10% of its funding in each country to increase routine measles vaccination and, where appropriate, to help countries introduce a second dose of measles vaccination within the routine programme.

Table 8. Key issues and future priorities in the African Region

Strategic goals	Key issues
Funding	Secure long-term funding sources. Increase government commitment to budget for immunization programmes and to fund them.
Routine coverage	Raise coverage to uniformly high levels, particularly in the Big Four countries.
Surveillance	Integrate and expand surveillance for other vaccine-preventable diseases in conjunction with existing surveillance programmes for acute flaccid paralysis. Work towards incorporating all surveillance programmes into one system.
Polio eradication	Meet targets to eliminate polio, focusing particularly on Nigeria. Transfer the skills and resources developed through the polio programme to other control programmes.
Measles control	Ensure that measles control is at the centre of immunization programmes in the next 10 years.
Vitamin A supplementation	Fully integrate vitamin A distribution with immunization services and focus on reaching wider age groups through new strategies: for example, pre-school programmes.
Immunization strategies	Test strategies that could raise routine coverage and expand these campaigns to improve coverage.
Waste disposal	Find better solutions for the disposal of injection equipment. These solutions must be environmentally acceptable, practical and low-cost.
Staff	Incorporate polio staff into the regular work force before their funding dries up.
New vaccines	Take advantage of new funds to support the introduction of new vaccines and new technologies.

National programmes need to maintain and improve routine immunization services, yet new vaccines and new technologies are waiting to be introduced. Can both be done effectively? Will governments take ownership of running and financing routine services? Instead of being pressured to accept a new vaccine, or being encouraged to introduce a new vaccine because it is politically expedient, countries must base their decisions and applications for new vaccines on solid epidemiological data and on evidence that supports the cost-effectiveness of any new approach. Encouragingly, post-introduction assessments carried out to date in six countries show that the introduction of new vaccines does not cause disruption, but instead stimulates improvements in routine services.<sup>8</sup>

The WHO African Region is at a crucial point in immunization history.

We have already begun to see considerable improvements, and in the next decade we anticipate further progress. We must aim for higher vaccination coverage rates, fewer deaths and cases of vaccine-preventable diseases, a wider range of age groups targeted for immunization and the introduction of new vaccines and new technologies. Immunization donors and regional governments have been instrumental in initiating change, yet continued donor support will be needed if greater improvements are to be made. The enthusiasm, expertise and resources mobilized through the Polio Eradication Initiative, the Measles Partnership, the GAVI Alliance and other initiatives have transformed the immunization scene in Africa, but a more robust and long-term approach to funding is needed to sustain these improvements. ■

**Competing interests:** None declared.

## Résumé

**Vaccination des nourissons : évaluation des progrès réalisés en Afrique**

**Objectif** Evaluer les progrès enregistrés entre 2001 et 2005 dans la réalisation des objectifs du Plan régional stratégique pour l'Afrique du Programme élargi de vaccination.

**Méthodes** Nous avons analysé les informations provenant des programmes de vaccination des nourissons de 46 pays de la Région africaine de l'OMS et celles tirées de la littérature et des sources de données existantes à ce sujet. Nous avons procédé à des entretiens en face-à-face ou par téléphone avec des responsables au niveau régional ou infrarégional de ces programmes, pouvant être utiles à l'étude.

**Résultats** En 2005, 80 % des pays de la Région africaine de l'OMS n'avaient pas réussi à atteindre l'objectif en termes de couverture vaccinale fixé pour cette année, à savoir 80 % au moins. Néanmoins, le taux de couverture par le vaccin antidiphthérique-antitétanique-anticoquelucheux 3 (DTC3) est passé de 54 % en 2000 à 69 % en 2004, soit une augmentation de 15 %. Nous estimons par conséquent que le nombre d'enfants non vaccinés

a baissé de 1,4 million en 2002 à 900 000 en 2004. Au cours de cette dernière année, on a relevé un taux de couverture par le DTC ne dépassant pas 50 % dans quatre des sept pays d'endémie ou de résurgence du poliovirus sauvage et un taux de couverture n'atteignant pas l'objectif de 80 % dans certains pays voisins exposés à un risque élevé d'importation de ce virus. Le nombre des cas notifiés de rougeole est tombé de 520 000 en 2000 à 316 000 en 2005 et la mortalité due à cette maladie a diminué de 60 % par rapport aux niveaux de référence de 1999. Un réseau de laboratoires a été mis en place dans 29 pays pour la surveillance de la rougeole et de la fièvre jaune.

**Conclusion** Les taux de couverture vaccinale augmentent considérablement dans la Région africaine de l'OMS. La très forte hausse des dépenses consacrées à la vaccination et à l'amélioration des résultats programmatiques connexes est liée principalement à l'augmentation du financement par les donateurs.

## Resumen

**Evaluación de la inmunización de los lactantes en África: ¿está cambiando la situación?**

**Objetivo** Evaluar los progresos realizados para alcanzar las metas del Plan Estratégico de la Región de África del Programa Ampliado de Inmunización entre 2001 y 2005.

**Métodos** Estudiamos los datos de los programas nacionales de inmunización de lactantes de los 46 países de la Región de África de la OMS, y analizamos la bibliografía y las fuentes de datos existentes al respecto. Además, llevamos a cabo entrevistas personales y telefónicas con los funcionarios oportunos a nivel regional y subregional.

**Resultados** La Región de África no alcanzó la meta de que un 80% de los países garantizara una cobertura de inmunización de al menos un 80% para 2005. Sin embargo, la cobertura con la vacuna contra la difteria, el tétanos y la tos ferina (DTP3) aumentó en un 15%, del 54% en 2000 al 69% en 2004. En consecuencia, estimamos que el número de niños no inmunizados disminuyó de

1,4 millones en 2002 a 900 000 en 2004. En ese último año, cuatro de siete países con poliovirus salvaje endémico o reintroducido presentaban una cobertura del 50% o menos, y algunos países vecinos con alto riesgo de importación no lograron la meta de vacunación del 80%. Los casos de sarampión notificados cayeron de 520 000 en 2000 a 316 000 en 2005, y la mortalidad por esa causa se redujo aproximadamente en un 60% en comparación con los niveles basales de 1999. En julio de 2005 se había establecido una red de laboratorios para el sarampión y la fiebre amarilla en 29 países.

**Conclusión** Las tasas de cobertura inmunitaria están mejorando extraordinariamente en la Región de África de la OMS. Los enormes incrementos del gasto en inmunización y las mejoras resultantes en la ejecución de los programas se deben sobre todo al aumento de los fondos de donantes.

## ملخص

**تقييم أنشطة تمنيع الرضع في أفريقيا: هل حدث تحول في التقدم المُحرز**

في عام 2002 إلى 900000 طفل في عام 2004. وفي عام 2004 أيضاً حَقَّق أربعة بلدان من أصل سبعة بلدان ينتشر فيها فيروس شلل الأطفال البري، أو عاود الظهور فيها، تغطية بنسبة 50% أو أقل. كما أن بعض البلدان المجاورة المعرضة بشدة لخطر وفادة الفيروس لم تحقِّق هدف تطعيم 80% من السكان. ولوحظ انخفاض عدد حالات الحصبة المبلغة، من 520000 في عام 2000 إلى 316000 في عام 2005، كما انخفض معدل الوفيات بنحو 60% بالمقارنة مع مستوياتها الأساسية في عام 1999. وبحلول تموز/يوليو 2005، أنشئت شبكة من مختبرات تشخيص الحصبة والحمى الصفراء في 29 بلداً. **الاستنتاج:** تحسَّن معدلات التغطية بالتمنيع بشكل ملموس في الإقليم الأفريقي لمنظمة الصحة العالمية. أما الزيادة الكبيرة في الإنفاق على التمنيع، والتحسُّن في أداء البرنامج، فتُعزى أساساً إلى الزيادة في التمويل المقدم من الجهات المانحة.

**الغرض:** استهدفت هذه الدراسة تقييم التقدم المُحرز تجاه تحقيق أهداف الخطة الاستراتيجية الإقليمية الأفريقية، المنقَّدة في إطار البرنامج الموسَّع للتمنيع، وذلك في المدة من عام 2001 إلى عام 2005.

**الطريقة:** تمت مراجعة المعطيات المُستمددة من البرامج الوطنية لتمنيع الرضع في بلدان الإقليم الأفريقي لمنظمة الصحة العالمية، البالغ عددها 46 بلداً، كما تمت مراجعة الدراسات ذات الصلة، وتحليل مصادر المعطيات الحالية. وقد أجريت مقابلات شخصية ومقابلات عن طريق الهاتف، مع العاملين المعنيين على المستوى الإقليمي ودون الإقليمي.

**النتائج:** لم يحقق الإقليم الأفريقي الهدف المتمثل في تحقيق تغطية تمنيعية بنسبة 80% على الأقل في 80% من البلدان بحلول عام 2005. ومع ذلك، ارتفعت التغطية باللقاح الثلاثي للخناق والكزاز والشاهوق بنسبة 15%، حيث ارتفعت من 54% في عام 2000 إلى 69% في عام 2004. يمكننا أن نستخلص من ذلك أن عدد الأطفال غير الممنَّعين انخفض من 1.4 مليون طفل



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Table 1. Level of achievement of strategic goals defined in the EPI Regional Strategic Plan, 2001–2005

Strategic goals	Level of attainment by mid-2005 <sup>a</sup>
<b>Strengthen immunization systems</b>	
At least 80% of the countries to attain at least 80% DTP-3 coverage in all districts	22 countries (48%)
All countries to attain 100% safety of immunization injections	14 countries exclusively use auto-disposable syringes
All countries to assure sustainable funding for EPI Regional Strategic Plan	38 countries have budget lines; 20 have their budgets funded at some level
<b>Polio eradication</b>	
No cases of acute flaccid paralysis associated with wild polio virus	408 laboratory-confirmed cases of wild polio virus reported as of 26 August 2005
No wild polio virus in the African Region, assessed through virological sampling of patients with acute flaccid paralysis and their contacts	Seven countries reporting wild polio virus (Burkina Faso, Central African Republic, Chad, Côte d'Ivoire, Mali, Niger and Nigeria)
The process of independent certification of polio-free status will lead to full regional certification	15 countries were invited to present polio-free certification documentation <sup>a</sup>
<b>Measles control/elimination</b>	
Countries with low immunization coverage (< 50%) and high mortality (case fatality rate > 4%) to reduce measles morbidity by 90% and measles mortality by 95% in comparison with pre-vaccine figures	None of the four identified countries (Côte d'Ivoire, Gabon, Liberia, Nigeria) achieved this objective
Countries with moderate measles routine coverage (50–75%) and low/medium mortality to reach and maintain near-zero measles mortality	Data not available
Countries with high routine measles coverage (> 75%) and low mortality to eliminate indigenous transmission of measles virus	Seven countries eliminated indigenous transmission of measles virus
<b>Maternal and neonatal tetanus</b>	
At least 80% of countries to achieve neonatal tetanus incidence rate of less than 1 case per 1000 live births in every district	14 countries (33%)
At least 80% of countries to attain a minimum of 80% TT2+ coverage among pregnant women in every district	One country (2%)
<b>Yellow fever control in countries at risk</b>	
Increase routine immunization coverage to at least 80%	4 of 33 countries (13%)
At least 80% of districts to report at least one case of suspected yellow fever per year	1 of 33 countries (3%)
Ability to conduct emergency response for all confirmed cases of yellow fever within 3 days of laboratory confirmation	0 of 33 countries
<b>Vitamin A supplementation in countries at risk</b>	
80% of countries at risk for vitamin A deficiency to integrate vitamin A supplementation with routine immunization services	12 of 44 countries (27%)
<b>Introduction of new vaccines</b>	
All countries to include Hepatitis B vaccine into their national immunization programmes	28 countries (61%)
All countries using Hepatitis B vaccine to achieve HepB-3 vaccine coverage equal to coverage for DTP-3	17 of 28 countries (60%)
Half of all countries to include <i>Haemophilus influenzae</i> type b vaccine	10 (22%) countries implemented; 14 (33%) countries approved by the GAVI Alliance
<b>Introduction of injection technologies</b>	
All countries to adopt auto-disable-syringes and/or equally safe injection technologies for all immunization injections	14 countries using auto-disable syringes exclusively; 18 countries using them for some immunizations
<b>Vaccine management policy and waste disposal</b>	
All countries to adopt the multidose vial policy and vaccine vial monitors and to introduce monitoring methods	46 (100%) countries
All countries to adopt and implement technologies and management systems for safe disposal and destruction of injection materials and other sharps	Safe waste disposal remains suboptimal

(Table 1, cont.)

Strategic goals	Level of attainment by mid-2005 <sup>a</sup>
<b>Disease surveillance</b>	
To achieve certified levels of non-polio acute flaccid paralysis in all countries <sup>b</sup>	15 countries invited to present certification papers
To establish case-based surveillance of EPI diseases	26 countries (56%)
To improve the quality of data on routine coverage using simple administrative and reliable assessment methods	Improved
<b>Laboratory systems</b>	
To establish and/or strengthen laboratory services within the EPI Disease Surveillance System	National laboratories in 29 countries have expanded polio functions to cover other diseases

DTP-3, diphtheria–tetanus–pertussis-3; EPI, Expanded Programme on Immunization; HepB-3, third dose of hepatitis B vaccine; TT2+, tetanus toxoid vaccine.

<sup>a</sup> Data are for all 46 countries unless stated otherwise.

<sup>b</sup> Global Polio Eradication Initiative standards state that individual countries cannot be certified as polio-free, only regions.

Table 2. Diphtheria–tetanus–pertussis-3 (DTP-3) coverage in the African Region, 2000–2004

Measurement	Year		
	2000	2002	2004
% regional DTP-3 coverage	54%	55%	69%
N (%) countries achieving national DTP-3 coverage of 80% or higher	11 (24%) of 46	16 (37%) of 46	22 (48%) of 46
N (%) countries that reported DTP-3 coverage of 80% or higher in all districts.	NA	2 (4%) of 46	5 (11%) of 46
N (%) countries in which 50% or more of all districts achieved at least 80% DTP-3 coverage	NA	12 (26%) of 46	22 (48%) of 46
Estimated number of non-immunized children <sup>a</sup>	NA	1.4 million	0.9 million

NA, data not available.

<sup>a</sup> Children aged < 1 year who were not immunized with DTP-3.

Source: WHO/AFRO information database 2005.

Table 3. Immunization coverage in the five epidemiological blocks of the African Region

African Region	Immunization coverage
<b>“Big Four” countries</b>	Each country faced a different set of obstacles to improving and sustaining routine immunization coverage. Angola, Democratic Republic of Congo and Ethiopia made good progress in improving routine immunization coverage. Nigeria started and ended the period with diphtheria–tetanus–pertussis-3 (DTP-3) coverage of approximately 38%. During the 2001 to 2003 time-period, DTP-3 coverage was between 25% and 26% in Nigeria.
<b>Central block</b>	Between 2000 and 2004 coverage of DTP-3 increased by an average of 21% (from 40% to 61%). However, DTP-3 rates remained the same in most central-block countries in 2004. In Gabon, the government failed to purchase vaccines in 2004 and subsequently DTP-3 coverage decreased by 26% (from 63% in 2003 to 37%). Weak health systems and a lack of basic infrastructure were obstacles to improving immunization coverage. As a result, despite the improvements, only three of seven countries had achieved DTP-3 coverage of 50% or more by the end of 2004.
<b>Eastern block</b>	An increase in coverage of 26% was noted across all countries in this block (from 63% to 89%), and four of six countries achieved DTP-3 coverage of 80% or more by the end of 2004. Eritrea reported the lowest DTP-3 coverage (68%) in 2004, and the United Republic of Tanzania reported the highest (95%).
<b>Western block</b>	Three of the 16 countries had civil unrest, making the delivery of routine immunization services difficult in certain areas. Six countries achieved DTP-3 coverage of 80% or more in 2004. Coverage varied dramatically across the countries in this block, ranging from 93% in the Gambia to 31% in Liberia. Countries showing the greatest improvements in coverage were Burkina Faso, Guinea Bissau, Mali, Mauritania, Niger, Senegal and Sierra Leone. All of these countries achieved increases in coverage of more than 30% between 2000 and 2004.
<b>Southern block</b>	Performance by the countries in this block was relatively high in 2001 (75%). All but two countries showed improvements in their DTP-3 coverage. Madagascar, the country with the lowest DTP-3 coverage in the block at the start of the period (40%), reported 87% coverage by 2003. Unfortunately, coverage fell to 75% in 2004.

Table 4. Selected polio eradication indicators

Key indicators	Year					
	2000	2001	2002	2003	2004	2005 <sup>a</sup>
Number of regional cases of acute flaccid paralysis associated with wild polio virus	1863	68	208	443	944	408
Number of countries reporting wild polio virus	11	6	3	10	12	7
Number of polio-endemic countries in the African Region	11	4	2	2	7 <sup>b</sup>	7 <sup>b</sup>
Number of countries with no cases of acute flaccid paralysis associated with wild polio virus	35	40	43	36	34	39
Number of countries with no polio cases in the past 3 years	28	33	37	31	31	30
Number of countries achieving certification-level surveillance indicators for acute flaccid paralysis	5	19	25	31	34	35
Number of countries with an established national Task Force for containment of wild polio virus	0	0	0	31	31	32

<sup>a</sup> Data as of 2 August 2005.

<sup>b</sup> This number includes two endemic countries (Niger, Nigeria) plus five with re-established transmission (Burkina Faso, Central African Republic, Chad, Côte d'Ivoire and Mali).

Source: WHO/African Region information database 2005.

Table 5. Indicators for measles surveillance in the African Region, 2002–2004

Indicator	Year		
	2002	2003	2004
Number of countries under case-based surveillance	15	24	26
Number of suspected measles cases reported	4836	21 199	17 100
% of reported cases in which specimens were collected	77%	72%	85%
% of districts reporting at least one case with a blood specimen	31%	54%	69%
Number (%) of measles cases confirmed by laboratory and epidemiological linkage	1346 (28%)	3851 (18%)	2505 (15%)
Annual rate (per 100 000 population) of suspected measles cases reported with blood specimen	1.8	4.9	3.6
Annual rate (per 100 000 population) of confirmed laboratory and epidemic linkage measles cases	0.64	1.2	0.63

Source: WHO/African Region information database 2005.

Table 6. Vaccination coverage for the third dose of hepatitis B vaccine (HBV-3) by country, 2000–2004

Country	Coverage (%) by year				
	2000	2001	2002	2003	2004
Algeria	NA	NA	NA	NA	81
Benin	NA	NA	15	15	97
Botswana	73	64	46	46	79
Burundi <sup>a</sup>	NA	NA	NA	NA	83
Cape Verde	NA	NA	NA	48	68
Comoros <sup>a</sup>	NA	NA	NA	NA	77
Côte d'Ivoire <sup>a</sup>	NA	10	48	40	50
Eritrea <sup>a</sup>	NA	NA	61	61	68
Gambia	89	84	40	83	90
Ghana <sup>a</sup>	NA	NA	83	80	80
Guinea	NA	NA	100	NA	NA
Kenya	NA	NA	NA	65	65
Lesotho	NA	NA	NA	NA	51
Madagascar <sup>a</sup>	NA	NA	62	62	74
Malawi <sup>a</sup>	NA	NA	64	64	89
Mali <sup>a</sup>	NA	NA	NA	NA	73
Mauritius <sup>a</sup>	88	93	88	88	90
Mozambique <sup>a</sup>	NA	NA	84	84	91
Nigeria	NA	NA	NA	NA	8
Rwanda <sup>a</sup>	NA	NA	88	88	89
Sao Tome <sup>a</sup>	NA	NA	NA	NA	117
Senegal	NA	NA	NA	NA	54
Seychelles <sup>a</sup>	NA	89	100	100	100
South Africa <sup>a</sup>	78	80	77	93	92
Swaziland	NA	78	63	63	78
United Republic of Tanzania <sup>a</sup>	NA	NA	89	95	95
Uganda <sup>a</sup>	NA	NA	42	42	87
Zimbabwe <sup>a</sup>	77	36	55	55	85

NA, data not available.

<sup>a</sup> Countries that reached HBV-3 coverage equal to that of DTP-3.

Source: WHO/African Region information database 2005.

Table 7. Hib vaccine percentage coverage among reporting African Region countries<sup>a</sup>

Country	Coverage (%)
Burundi	83
Gambia	93
Ghana	80
Kenya	65
Madagascar	50
Malawi	89
Rwanda	89
South Africa	93
Uganda	87
Zambia	94

<sup>a</sup> Data collected up to December 2004.

Source: WHO/African Region information database 2005.