

Measles

**Mortality Reduction and
Regional Elimination**

**Strategic Plan
2001–2005**



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Abbreviations

AECI	Agencia Española de Cooperación Internacional (Spanish Agency for International Cooperation)
AFP	acute flaccid paralysis
GAVI	Global Alliance for Vaccines and Immunization
CAREC	Caribbean Region Epidemiology Centre
CDC	Centers for Disease Control and Prevention (USA)
CIDA	Canadian International Development Agency
CRS	congenital rubella syndrome
DFID	Department for International Development, United Kingdom
HIV	human immunodeficiency virus
ICC	interagency coordinating committee
JICA	Japanese International Agency for Cooperation
MCV	measles-containing vaccine
MMR	measles-mumps-rubella (vaccine)
MR	measles-rubella (vaccine)
NIDs	national immunization days
OPV	oral polio vaccine
SIDA	Swedish International Development Agency
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFPA	United Nations Population Fund
UNHCR	Office of the United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WFP	World Food Programme

Glossary

GAVI: Global Alliance for Vaccines and Immunization. GAVI is a partnership dedicated to ensuring that all children, however poor, have equal access to vaccines. It also works to spur the development of new vaccines against major killers that primarily affect the world's poorest people. It is founded on the principle that immunization is a human right and a key step towards overcoming poverty.

Measles control: Reduction of measles morbidity and mortality in accordance with targets; continued intervention measures are required to maintain the reduction.

Measles elimination: The situation in a large geographical area in which endemic transmission of measles cannot occur and sustained transmission does not occur following the occurrence of an imported case; continued intervention measures are required.

Measles eradication: Interruption of measles transmission worldwide as a result of deliberate efforts; intervention methods may no longer be needed. Eradication represents the sum of successful elimination efforts in all countries.

Routine immunization: Regular provision of immunization services to successive cohorts of infants through vaccination at fixed sites, door-to-door canvassing, outreach activities, or periodic pulse campaigns (one or more a year as appropriate). These activities usually involve the screening of vaccination records (selective immunization).

Pulse campaigns: Periodic campaigns, usually conducted at the district level, targeting all children aged over nine months who were born after the last pulse vaccination.

Supplementary immunization: Mass campaigns targeting all children in a defined age group, with the objective of reaching a high proportion of susceptible individuals. Each campaign is conducted over a wide geographical area (e.g. province or country) in order to achieve a rapid reduction in the number of susceptible children. It is not usual to conduct screening for vaccination status and prior disease history (i.e. the campaigns are usually non-selective).

Executive summary

Immunization is essential for children to achieve their right to the highest attainable standard of health.

It is estimated that over 30 million cases and 875 000 deaths still occur every year¹ from measles (1). These deaths represent 50–60% of the estimated 1.6 million deaths caused annually by vaccine-preventable diseases of childhood. Globally, therefore, measles remains the leading cause of vaccine-preventable child mortality. The remaining disease burden is primarily attributable to the underutilization of measles vaccine.

Specific goals for reduction in measles morbidity and mortality were set by the World Health Assembly in 1989 (2) and the World Summit for Children in 1990 (3). Subsequently, target dates of 2000, 2007 and 2010 for its elimination were established for the Region of the Americas, the European Region and the Eastern Mediterranean Region respectively. The aim in the African Region, the South-East Asia Region and the Western Pacific Region is to reduce measles mortality. Lessons learned in the Americas will be invaluable in helping to assess the feasibility of regional measles elimination.

The present Strategic Plan is intended to provide a framework for guiding and coordinating measles mortality reduction and regional elimination activities at the country, regional and global levels. It updates the previous WHO document on measles control in the 1990s (4).

As well as offering the possibility of reducing global mortality caused by measles, the period 2001–2005 provides an opportunity for gaining experience in the implementation of strategies aimed at the interruption of measles transmission and for conducting research into barriers to the effective control and elimination of the disease.

The Strategic Plan seeks to reduce measles mortality worldwide. A new target for the reduction of global measles mortality is presented, together with strategies for achieving it. The following goals are included:

- to reduce the number of measles deaths by half by 2005;
- to achieve and maintain interruption of indigenous measles transmission in large geographical areas with established elimination goals²;
- to review the progress and assess the feasibility of global measles eradication at a global consultation in 2005, in collaboration with other major partners.

¹ WHO preliminary report estimates that in 2000 the number of measles deaths was approximately 800 000 (WHO/EIP unpublished data).

² Including elimination of measles in the Region of the Americas by 2000 and progress towards elimination in the European Region by 2007 and the Eastern Mediterranean Region by 2010.

The strategies recommended for reducing measles mortality include:

- (1) providing the first dose of measles vaccine to successive cohorts of infants;
- (2) ensuring that all children have a second opportunity for measles vaccination;
- (3) enhancing measles surveillance with integration of epidemiological and laboratory information;
- (4) improving the management of every measles case.

This plan endorses a new recommendation on measles vaccination. In addition to the first dose of measles vaccine at nine months of age, there should be a second opportunity for measles vaccination for all children so that a dose can be given to children who have not been vaccinated previously or who have not responded to the first dose (5).

During the implementation of measles control activities, two opportunities should be considered for improving overall child health: (i) provide vitamin A supplementation through immunization services and; (ii) where appropriate, integrate rubella vaccination and surveillance activities with those of measles vaccination and surveillance (6). ▲



A woman health worker gives a measles vaccine to a baby held by his mother at a UNICEF-assisted health centre run by the Irish NGO Trocaire, in a camp for 15 000 displaced people near the small south-western town of Cyanika, Rwanda

1 • Background

The Strategic Plan updates the Plan of Action for Global Measles Control in the 1990s (4). It defines the broad agenda of work needed over the next five years in order to ensure a sustainable reduction in measles mortality and to make significant progress towards the interruption of measles transmission in regions and countries with elimination goals. A framework is provided whereby partner governments and agencies can achieve these goals. Details of each area of work are available in the references provided.

The acceleration of measles control promotes equity in health care by providing measles vaccine to the world's most underserved and vulnerable populations. Immunization is essential for children to achieve their right to the highest attainable standard of health. The regular delivery of vaccine requires a functional health infrastructure. It is important to optimize the impact of measles mortality reduction and elimination efforts on both the provision of immunization services and the development of health systems (7). New measles initiatives should be conducted in a manner that strengthens and builds on existing immunization services and contributes to the development of health systems. In addition, a focused set of strategies aimed at reducing measles mortality can significantly expand and reinforce the impact of immunization programmes, yielding a greater gain overall, with reductions in pertussis and other vaccine-preventable diseases. Significant new resources are required to support countries in meeting these challenges.

1.1 Public health significance of measles and cost-effectiveness of measles vaccination

Measles is a major killer of children in developing countries and accounts for about 875 000

deaths a year³ (1). This represents 50–60% of the estimated 1.6 million deaths attributable to vaccine-preventable diseases of childhood. Consequently, on the global scale, measles is the leading cause of vaccine-preventable deaths in childhood. The measles virus may be ultimately responsible for more child deaths than any other single agent because of complications from pneumonia, diarrhoea and malnutrition.

Of the deaths attributable to measles, 98% occur in developing countries, where vitamin A deficiency is common. Case-fatality rates in these countries are usually estimated to be in the range 1–5% but may reach 10–30% in some situations (8).

It is cost-effective to improve routine measles vaccination (9, 10). Preliminary estimates suggest that the cost per life-year gained for expanding measles coverage from 50% to 80% is US\$ 2.53 (at a 3% discount rate) in areas with high disease incidence and high measles case-fatality ratios (10). It has been estimated that in some countries measles coverage could be increased from around 19% to 84% simply by ensuring that eligible children are vaccinated when they are in contact with health services (11). Other factors that may depress coverage include the inadequacy of social mobilization and of resources for conducting outreach sessions. By tackling these weaknesses and providing extra resources it would be possible to reduce the inequalities of coverage.

1.2 Current status of measles control and regional measles elimination

In 1989 the Forty-Second World Health Assembly committed Member States and

³ WHO preliminary report estimates that in 2000 the number of measles deaths was approximately 800 000 (WHO/EIP unpublished data).

WHO to the global control of measles by a reduction in measles incidence of 90% from pre-immunization levels by 1995 (2). In 1990 the heads of state and other world leaders at the World Summit for Children endorsed “reduction by 95% in measles deaths and reduction by 90% of measles cases compared to pre-immunization levels by 1995, as a major step to global eradication of measles in the longer run” (3). They also set a target of 90% for measles vaccine coverage by 2000 as well as for other vaccines used in the Expanded Programme on Immunization.

Substantial progress towards measles control has been made since 1989. In 1998 the estimated global number of cases and deaths had declined to 31 million and 875 000³ respectively (i.e., reductions exceeding 63% and 83% in comparison with the pre-vaccine era)⁴ (1). Although the coverage goal set by the World Summit for Children has not been achieved at the global level, the targets for morbidity and

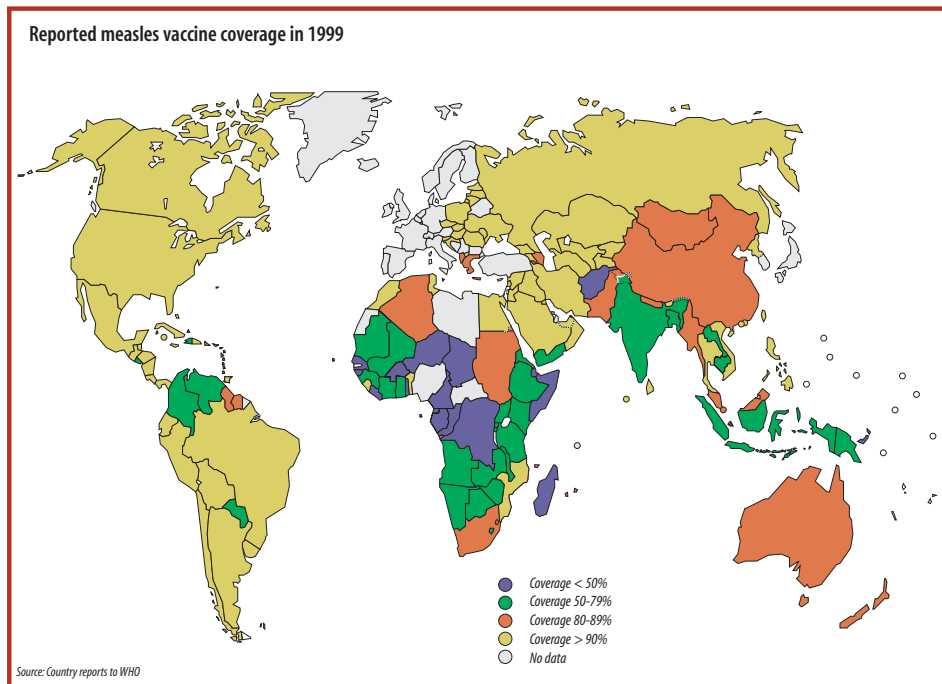
mortality reduction have been reached in the Region of the Americas, the Western Pacific Region and the European Region.

Between 1990 and 1997, reported global routine vaccination coverage with one dose of measles vaccine among children remained at approximately 80%. Reported coverage fell from 82% in 1997 to 74% in 1999. This decline was in part attributable to changes in the reporting system (based on survey data rather than on the administrative method) in a few large countries (12).

In 1999, measles coverage below 50% was reported by 12 countries in the African Region (Burkina Faso, Burundi, Cameroon, Congo, Democratic Republic of Congo, Gabon, Guinea-Bissau, Liberia, Niger, Madagascar, Senegal, and Togo), and three countries in the Eastern Mediterranean Region (Afghanistan, Djibouti, and Somalia).

By 2000, most countries were providing a “second opportunity” for measles vaccination – either through a two-dose routine schedule or through supplementary campaigns covering the entire country during the preceding three

³ WHO preliminary report estimates that in 2000 the number of measles deaths was approximately 800 000 (WHO/EIP unpublished data).
⁴ The number of measles cases during the pre-vaccine era was estimated by WHO on a country-by-country basis and was assumed to be equivalent to 95% of the surviving infants in 1980 for most developing countries, or in 1975 for developed countries. Surviving infants were defined as all live-born infants during a one-year period minus the number of deaths during the first year of life.



© UNICEF/WHO-0027/Jan Holmes Photo taken in Dili, East Timor



*Immunization in Dili, East
Timor, 1999*

years. Only 45 countries had a routine measles vaccination schedule of a single dose at nine months of age. In general, the countries with a single-dose policy reported the lowest routine coverage.

Target dates of 2000, 2007 and 2010 have been set for elimination in the Region of the Americas, the European Region and the Eastern Mediterranean Region respectively. Measles transmission has been interrupted in most countries in the Region of the Americas (13). No global target for measles eradication has been established.

The Region of the Americas was approaching the target of elimination by the end of 2000. As of 30 December 2000, only 1747 measles cases had been confirmed in the region and continuing transmission had been limited to the Dominican Republic and Haiti (14).

Measles transmission is at very low levels or has been interrupted in certain countries in the European Region and in Australia, Mongolia, New Zealand, the Philippines, the Pacific Island Nations, and the Arab Gulf States (15, 16). In six countries of southern Africa which implemented mass vaccination campaigns targeting all children aged nine months to 14 years in 1996–1998, measles mortality was reduced from over 300 reported deaths in 1996 to two deaths between January 1999 and September 2000 (17).

During 1998 and 1999, plans of action were developed in the African Region, the South-East Asia Region and the Western Pacific Region for measles mortality reduction, and in the Region of the Americas, the European Region and the Eastern Mediterranean Region for the elimination of the disease.

1.3 Reasons for high measles disease burden

Failure to deliver at least one dose of measles vaccine to all infants remains the primary reason for high measles morbidity and mortality. Many measles deaths may be preventable by utilizing existing immunization services more efficiently. Poor management, logistical problems and missed opportunities for immunization are among the main reasons for the underutilization of services and high drop-out rates.

In addition, some countries do not provide a second opportunity for measles vaccination. A second opportunity makes it possible to provide immunization to children who have not been vaccinated previously or who have not responded to an initial dose.

Many countries do not have adequate monitoring systems for detecting weaknesses in immunization programmes and guiding programme activities. ▲

2 • The Strategic Plan 2001–2005: objectives and key milestones

The objectives of the Strategic Plan are as follows:

- to reduce the number of measles deaths by half by 2005;
- to achieve and maintain interruption of indigenous measles transmission in large geographical areas with established elimination goals;⁵
- to review the progress and assess the feasibility of global measles eradication at a global consultation in 2005, in collaboration with other major partners.

The key milestones of the plan are indicated below (see Annex 2 for details).

By the end of 2001

- ✓ The Strategic Plan to be finalized and endorsed by partners.
- ✓ All regions to review and update where appropriate their measles control and elimination plans in accordance with the Strategic Plan.
- ✓ All countries⁶ with the highest measles mortality and/or in the high child mortality strata to have developed a 3–5-year strategic plan for achieving and sustaining the measles mortality reduction targets.
- ✓ Interruption of measles transmission to be achieved and maintained in the Region of the Americas.

⁵ Including elimination of measles in the Region of the Americas by 2000 and progress towards elimination in the European Region by 2007 and the Eastern Mediterranean Region by 2010.

⁶ High child mortality countries as defined in the WHO World Health Report 2000 (see Annex 3 for preliminary list).

By the end of 2002

- ✓ All countries with the highest measles mortality and/or in the high child mortality strata to have begun accelerated activities for achieving and sustaining the measles mortality reduction targets.

By the end of 2003

- ✓ Annual global measles mortality to have been reduced by a third, relative to 1999 estimates.

By the end of 2004

- ✓ Countries with high measles mortality to have administered at least one dose of measles vaccine to at least 90% of children aged nine months to four years, in a strategy to be sustained over time (routine or supplemental).

By the end of 2005

- ✓ Annual global measles mortality to have been reduced by half relative to 1999 estimates.
- ✓ WHO and the United Nations Children's Fund (UNICEF), in collaboration with the Centers for Disease Control and Prevention (CDC) and with other major partners to review progress towards achieving the targets for mortality reduction and regional elimination and assess the feasibility of global measles eradication. ▲

3 • Components of the Strategic Plan

There are four strategies for reducing measles mortality:

- high routine immunization: providing the first dose to successive cohorts of all infants;
- provision of a second opportunity for measles vaccination for all children;
- measles surveillance;
- improve management of complicated cases.

Table 1 summarizes measles strategies according to the measles control targets.

In addition to the four strategies, research is essential for addressing key operational and basic scientific questions. WHO's Steering Committee on Research Related to Measles Vaccines and Vaccination has identified the following main areas for measles research (18):

- evaluation of different vaccination and disease surveillance strategies;
- improvement in the understanding of measles immunity, immunopathology and measles virus gene function;
- assessment of alternative routes of vaccination and new products (aerosolized vaccines, needle-free injectors, diagnostic tests);
- evaluation of cost-effectiveness of different measles control strategies.

Research should be conducted into the political and societal commitment to different measles control goals. This work should cover:

- the feasibility and priority of measles elimination;
- economic savings;
- the advantages of a concrete well-defined goal;

- the opportunities to strengthen global partnerships;
- the control or elimination of a disease threat to the population (disease burden reduction) and the expansion of services to those at highest risk of disease (equity and solidarity);
- the political benefits of a measles programme with a tangible impact;
- the potential to improve the capacity and performance of immunization services;
- the capacity to contribute to strengthening public-private partnerships.

3.1 Four strategies for achieving sustainable reduction of measles mortality

The achievement of measles mortality reduction requires improvement in both the coverage and quality of immunization services. Sustainable reduction is possible by implementing the following strategies:

■ *Achieving and sustaining high population immunity*

- 1 Routine immunization: countries should aim to achieve at least 90% routine vaccination coverage in each district and nationally with at least one dose of measles vaccine administered to children who are nine months of age or shortly thereafter.**

High routine immunization coverage of successive birth cohorts can be expected to result in a marked and sustained decline in measles morbidity and mortality.

- 2 Second opportunity: in addition to achieving high coverage with the first**

dose of measles vaccine, countries should ensure the provision of a second opportunity for measles vaccination for all children.

With a one-dose policy and immunization coverage of 80% a proportion of children remain susceptible to measles because they have never received a dose of measles vaccine or have failed to respond to vaccine administered when they were aged nine months.

- 3 Measles surveillance: countries should establish effective surveillance for measles and monitoring of vaccination coverage as defined in WHO surveillance standards (19, 20).**

This is critical for determining the impact of vaccination activities and adapting policies and strategies. Where appropriate, rubella/congenital rubella syndrome surveillance activities should be integrated with those of measles surveillance.

- 4 Improved management of measles cases, including vitamin A supplementation and adequate treatment of complications (21).**

Measles vaccination (both through routine services and supplemental mass campaigns) should be used as an opportunity to administer vitamin A supplement in areas where vitamin A deficiency is prevalent (22). It is intended to implement this strategy in order to achieve further reduction of overall mortality among children aged under five years.

Table 1: Recommended strategies according to measles control targets

Mortality reduction	Elimination
Target	Target
<p>✓ to reduce the number of measles deaths by half by 2005, relative to 1999 estimates.</p>	<p>✓ to achieve and maintain interruption of indigenous measles transmission in large geographical areas with established elimination goals.^b</p>
Strategies for achieving sustainable reduction of measles mortality	Strategies for achieving and maintaining interruption of transmission of indigenous measles virus
<ol style="list-style-type: none"> 1 Routine immunization achieving at least 90% routine vaccination coverage (in each district and nationally) with at least one dose of measles vaccine administered at nine months of age or shortly thereafter. 2 Provision of a second opportunity for measles vaccination for all children through routine^a or supplemental activities. 3 Measles surveillance: establishing an effective surveillance for measles that reports: number of cases by month, age and vaccination status of cases and deaths, conducts outbreak investigations and monitors vaccination coverage. 4 Improved management of complicated cases, including vitamin A supplementation and adequate treatment of complications. 	<ol style="list-style-type: none"> 1 Routine immunization achieving very high (i.e. at least 95%) coverage (in each district and nationally) with the first dose of measles vaccine administered through routine services (keep-up campaigns). 2 Second opportunity for measles vaccination – to maintain the number of susceptible individuals below the critical threshold for herd immunity. 3 Measles surveillance: establishing case-based surveillance with investigation and laboratory testing of all suspected measles cases. Isolation of measles virus should be attempted from all chains of transmission. 4 Improved management of complicated cases, including vitamin A supplementation and adequate treatment of complications.
<p>^a A routine two-dose vaccination schedule is recommended in countries with immunization programmes capable of achieving high coverage and with a system for following up defaulters.</p>	<p>^b Including elimination of measles in the Region of the Americas by 2000 and progress towards elimination in the European Region by 2007 and the Eastern Mediterranean Region by 2010.</p>

Routine immunization

This is the foundation of effective measles control. Increasing and sustaining high measles routine coverage (i.e. over 90%) is essential for achieving a sustainable reduction in measles mortality (23). Routine immunization is defined as the regular provision of immunization services to successive cohorts by means of a combination of strategies (Table 2). The reasons for low coverage should be determined and remedied. Countries and their partners in immunization should use existing tools and guidelines and provide technical support in order to increase immunization levels. Special attention should be given to improving coverage in the districts performing least well.

Successful tactics (Table 2) should be used to improve routine coverage in every geopolitical unit. Supportive supervision and social mobilization activities should be implemented so that coverage is increased in all districts where performance is poor.

Activities to improve routine immunization coverage should include:

- training to improve management of immunization services at all levels;
- enhancement of supervision;
- reduction of missed opportunities and drop-out rates;
- provision of more efficient fixed vaccination sites;

- design and implementation of information, education and communication activities and materials;
- special tactics for reaching the unreached;
- improvement of the quality of services.

The partners under the Global Alliance for Vaccines and Immunization aim to ensure that 80% of developing countries have routine coverage of at least 80% in all districts by 2005 (24). This is an essential first step towards reducing the measles burden. In low-income countries, however, even with 80% routine coverage, measles will remain a significant cause of morbidity and mortality (25). Annex 1 summarizes the impact of different immunization strategies in different circumstances of routine coverage.

Second opportunity for measles immunization

With a one-dose policy, even where immunization coverage is high, a substantial proportion of children will remain susceptible to measles. The average seroconversion rate of 85% following a single dose at nine months of age, the recommended strategy for routine immunization in developing countries, leaves a proportion of children susceptible (26). Furthermore, the routine delivery system in many countries has failed to reach many children at the age of nine months. A second opportunity for measles vaccination is required in order to protect these children. This second opportunity can be delivered, as appropriate, through regular routine or supplemental immunization activities.

Table 2: Tactics for providing routine immunization services

Tactic	Description
Fixed service	Offering immunization services in a health facility. All opportunities should be taken to immunize eligible children attending health facilities.
Outreach	Visiting unserved or underserved locations and offering services in temporary posts or in each household. Visits are made at regular and usually frequent intervals (e.g., monthly or quarterly).
Door-to-door canvassing	Pre-vaccination visits by health workers, preferably accompanied by respected members of the community, to every household in a specified area. Unvaccinated children are referred to health facilities or outreach posts for vaccination. Often used to provide supplemental activities, face-to-face contact is an effective way of promoting routine immunization.
Channelling	Health workers or local volunteers prepare a list of children who are expected to receive measles immunizations during the vaccination day. The names of children who attend are ticked. Parents or volunteers are asked to look for those children who have not attended. Other community members can also help to find and mobilize missing children on the vaccination day.
Pulse campaigns	Special immunization activities designed to reach populations that are not reached by routine fixed or outreach services. They are conducted by teams once, twice or three times a year.

Photo © Wendy Stone



*Planning for mass
campaigns.*

Routine two-dose schedule

The implementation of a routine two-dose vaccination schedule is recommended in countries with immunization programmes capable of achieving and sustaining high coverage and with a functioning system for identifying and following up defaulters. In countries with low to moderate routine immunization coverage, mass vaccination campaigns may be more successful than a routine two-dose schedule in reaching previously unvaccinated children and offering a second dose to children who have received their first dose through routine services.

Inclusion of rubella vaccine

Countries should assess the benefits of preventing rubella and congenital rubella syndrome (CRS) through the use of measles-rubella (MR) or measles-mumps-rubella (MMR) vaccine (28, 29). Additional studies are required to further estimate susceptibility to rubella and CRS disease burden at the national and regional levels, particularly in developing countries. The prerequisites for introducing universal rubella childhood vaccination are as follows (6, 30):

- documented rubella epidemiology;
- ability to achieve high coverage with the routine programme (e.g. higher than 80%);
- ability to sustain high coverage, including resources to maintain the programme;
- initial catch-up immunization of older susceptible adults with a routine dose or a mass campaign (age groups depending on epidemiology);
- implementation of surveillance to monitor the programme, including coverage, rubella disease-reporting, and rubella susceptibility among women of childbearing age.

Mass measles campaigns

The following principles should be considered when planning and implementing mass measles campaigns:

- Mass measles campaigns should only be implemented as part of a long-term comprehensive plan for measles control and mortality reduction. If well implemented, supplementary vaccination campaigns providing a second opportunity for vaccination are an effective method for rapidly increasing population immunity (5).

- Campaigns result in a period when measles transmission is low or absent (Annex 1). Depending on the coverage achieved in campaigns and on the routine vaccination coverage, campaigns need to be repeated at regular intervals. The impact of campaigns is more prolonged when they are conducted in settings where routine coverage is high or improving. Consequently, improvements in routine coverage should be deliberately planned and built into the planning for mass measles campaigns.

- Experience has demonstrated that, in order to achieve the greatest possible impact, campaigns should target large populations (nationwide or equivalent) and should achieve high coverage (at least 90%) with quality services. The age group targeted for mass campaigns should be decided on the basis of the susceptibility profile of the population. This can be determined from the history of measles vaccination coverage, age-specific disease incidence data, and seroprevalence studies. (5, Annex 1). Because a cheap non-invasive method for determining measles immunity is not available, a supplementary dose of measles vaccine should be given, irrespective of prior immunization status, to all children in the target age group. Special efforts should be made to identify and immunize children who have never received measles vaccine (zero-dose children).

- Mass campaigns have to be planned carefully, with particular attention to the logistics component, so that sufficient trained personnel, syringes, needles and vaccines are available. Planning for measles campaigns should take into account the need for improvements in routine services.

- Most intensive oral polio vaccine (OPV) immunization activities are now conducted in polio priority countries with the weakest health infrastructures, usually on a house-to-house basis. When combining OPV and measles vaccine during mass campaigns it is important to ensure that there is sufficient time for planning, sufficient funding, adequate logistical prepara-

tion, adequate supervision and monitoring, and provision for injection safety.

- Training and supervision should be given high priority so as to ensure proper handling and reconstitution of the vaccine, appropriate injection techniques, safe disposal of syringes and needles, and the monitoring of adverse events. It is important to ensure appropriate sharps management through a plan that includes an adequate budget, the use of monitoring tools (e.g. a supervision checklist) during implementation, and the assessment of waste management.
- Mass campaigns should include an assessment component with a view to improving future activities in the field of measles mortality reduction. Countries undertaking mass campaigns should document immunization safety during campaigns and routine services, using recommended assessment tools. Coverage trends before and after campaigns should also be reviewed.

Enhancing measles surveillance and laboratory diagnosis

The routine reporting of communicable diseases (e.g. the disease notification system) is the backbone of measles surveillance. Effective surveillance for measles and the monitoring of vaccination coverage is critical for determining the impact of vaccination activities and adapting policies and strategies (19, 20). Further strengthening of measles surveillance systems is required in all countries.

Measles surveillance should include only the information that is most useful for documenting disease burden and guiding programme activities. The minimum data requirements for measles mortality reduction include:

- measles case counts by month and geographical area;
- age distribution and vaccination status of cases and deaths in both urban and rural areas;
- timeliness and completeness of reporting;
- reports from outbreak investigations and record reviews.

Outbreak investigations are very useful for monitoring changes in measles epidemiology and identifying and remedying weaknesses that have led to outbreaks.

The integration of measles surveillance with functioning acute flaccid paralysis (AFP) surveillance systems can provide an opportunity to strengthen weak measles surveillance systems in several countries. AFP surveillance of high quality should be maintained during this process.

In countries with a target for measles mortality reduction the functions of laboratories are to confirm initial cases during outbreaks and to isolate and analyse wild virus strains from selected cases in order to enable the genetic characterization of circulating measles viruses.

Each country should be served by a proficient/accredited measles laboratory. In addition, regional reference laboratories and global specialized laboratories are needed to:

- develop standards for the laboratory diagnosis of measles;
- support regional and national laboratories in the diagnosis of measles and other illnesses characterized by rashes;
- provide training resources and facilities for staff of regional and national laboratories;
- provide reference materials and expertise for the development and quality control of improved diagnostic tests;
- serve as banks of measles virus isolates for molecular epidemiology and of reference sera for quality control (31).

It is essential that the measles laboratory network, built on the experience gained with the polio laboratory network, be planned in conjunction with regional disease control programmes and established with properly trained personnel and suitable equipment and reagents (38).

Improvement of case management

Many children experience uncomplicated measles and require only supportive measures, including vitamin A treatment, nutritional support and education for mothers about complications (21). However, in an important proportion of measles cases in developing



Wesley Stone

Logistical support during campaigns

countries at least one complication can be expected and some may involve multiple systems.

It is vital that measles cases, whether isolated or in outbreaks, receive vitamin A supplementation as part of the measles treatment. Several studies have shown that the administration of vitamin A during a measles episode reduces case fatality and the severity of measles (38). It is thought that the utilization of vitamin A is impaired during measles infection, irrespective of the total body stores of the vitamin. Vitamin A should be given to all measles cases, irrespective of whether it has previously been administered prophylactically or whether immunization has been given.

Case management is not usually the responsibility of the immunization programme, which should, however, educate and promote adequate case management, including the prevention of nosocomial transmission, as an effective means of reducing measles mortality (21), especially when the incidence of the disease has been reduced.

3.2 Four strategies for achieving and maintaining measles elimination

Elimination is defined as the situation in a large geographical area in which endemic transmission of measles cannot occur and sustained transmission does not occur following the occurrence of an imported case; continued intervention measures are required (32). The interruption of transmission of endemic measles virus is possible if very high population immunity is achieved and maintained.

Measles elimination goals can be set at the national level or above. However, it is recommended that they be planned on a multi-country or regional basis. WHO and UNICEF recommend that measles elimination be attempted only in regions where the interruption of wild poliovirus circulation has been certified.

Achieving and sustaining high population immunity

Measles elimination has been demonstrated in many countries in the Region of the Americas and elsewhere through implementation of the strategies of keep-up (routine vaccination), catch-up and follow-up campaigns (33).

1. Routine immunization

Countries should aim to achieve high (95%) immunization coverage in each district and nationally with the first dose of measles vaccine administered through routine services.

A country undertaking measles elimination should take the opportunity to eliminate rubella through the use of MR or MMR vaccine in its childhood immunization programme and in measles campaigns. The choice of the policy should be based on the level of susceptibility to rubella in women of childbearing age, the status of the immunization programme as indicated by routine measles coverage, infrastructure and resources for child and adult immunization programmes, the assurance of immunization safety, and other competing priorities. All countries undertaking rubella elimination should ensure that women of childbearing age are immune and that routine coverage for children is sustained at 80% or higher (6, 30).

2. Second opportunity for measles immunization

Catch-up campaigns are one-time events targeting multiple cohorts in which susceptible children have accumulated. If coverage exceeding 95% is achieved this is the most effective means of interrupting measles transmission. The target age group depends on the measles susceptibility profile of the population. During a catch-up campaign all children in the target age range receive a supplementary dose of measles vaccine, regardless of prior disease or vaccination history.

Follow-up mass campaigns are conducted periodically (e.g. every 3–5 years) to maintain low levels of susceptibility. The periodicity depends on the routine immunization coverage, the existence of pockets of unprotected children, and/or possible vaccine efficacy problems. The target age group for immunization in these campaigns should include all children aged over nine months who were born after the previous mass immunization (e.g. catch-up campaign).

In countries with immunization programmes capable of achieving and maintaining high coverage through routine services, the elimination of measles can also be achieved through the implementation of a routine two-dose vaccination schedule (34, 35). This approach usually involves administration of measles vaccine at 12–18 months of age and/or at school entry. Without catch-up campaigns, achieving high population measles immunity and thus elimination through routine two-dose vaccination alone requires several years.

Mopping-up campaigns (house-to-house immunization activities) are conducted to identify children who have missed routine immunization and previous mass campaigns. These campaigns take place soon after catch-up or follow-up campaigns in areas known or thought to have many remaining susceptible children (e.g. where campaign coverage is lower than 95%). All children in the target age range are vaccinated, regardless of prior disease or vaccination history.

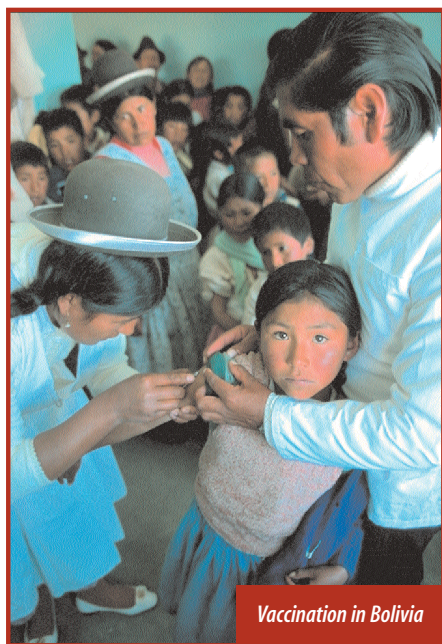


Photo: © AMRO/PAHO

Vaccination in Bolivia

When measles virus transmission has been reduced to very low levels (e.g. after a catch-up campaign and when high routine coverage is achieved and maintained), the age at which measles vaccine is administered in the routine immunization schedule can be increased (e.g. from 9 to 12 months). This makes it possible to benefit from higher vaccine efficacy in a setting with very low levels of measles transmission.

The same principles of quality and safety during mass campaigns described for the mortality reduction stage apply in this stage.

3. Enhanced measles surveillance and laboratory diagnosis

The purpose of surveillance in countries pursuing measles elimination is to identify areas where measles virus is circulating (19, 31). Case-based surveillance (i.e. investigation of every suspected measles case) that integrates epidemiological and laboratory information should be conducted and every case should be reported, investigated immediately and included in the weekly reporting system.

The roles of the laboratory in countries in the elimination phase are to confirm the clinical diagnosis of all suspected cases, to isolate and analyse wild virus strains and monitor their circulation, and, in special circumstances, to monitor the level of measles immunity in the population.

Laboratory specimens should be collected from every suspected case. Suspected measles outbreaks should be confirmed by conducting a serological investigation on the first 5–10 cases. Urine or nasopharyngeal specimens for virus isolation and genetic characterization should be collected from sporadic cases as well as from outbreak cases (about 10 cases from each chain of transmission) to determine viral circulation and importation patterns.

To facilitate virological surveillance, a standardized nomenclature for describing the genetic characteristics and relationships among eight groups of wild-type measles viruses was adopted in 1998 (36).

Rubella surveillance

Countries that have introduced routine rubella vaccination should integrate rubella surveillance with their case-based surveillance for measles. Other viruses causing febrile rash illnesses may be incorporated into this surveillance system (e.g. dengue, parvovirus B19). In these countries and at the regional and global levels a combined measles/rubella laboratory network should be developed (31).

4. Improving adequate case management

The same principles described in the mortality reduction stage should be applied (21).

3.3 Measles control in emergency situations

Measles control programmes in emergency settings – refugee and internally displaced camps – have two major components (8, 37):

- Measles prevention through routine immunization.
- Measles outbreak response.

For all elective and emergency mass campaigns it is recommended that auto-disable syringes and safety boxes be used.

Routine Immunization

A measles immunization programme should be an early priority of emergency relief programmes.

Such a programme will require: trained personnel, vaccine, cold chain equipment (refrigerators, freezers, cold boxes, vaccine carriers, ice-packs etc.), other supplies (auto-disable syringes, safety boxes, monitoring forms: vaccination cards, tally sheets etc.), vaccine administration sites, surveillance system, other activities (e.g. nutritional supplementation and vitamin A, treatment of complications), health education and social promotion materials.

It is important to involve the national immunization programme from the start in any plan or activity.

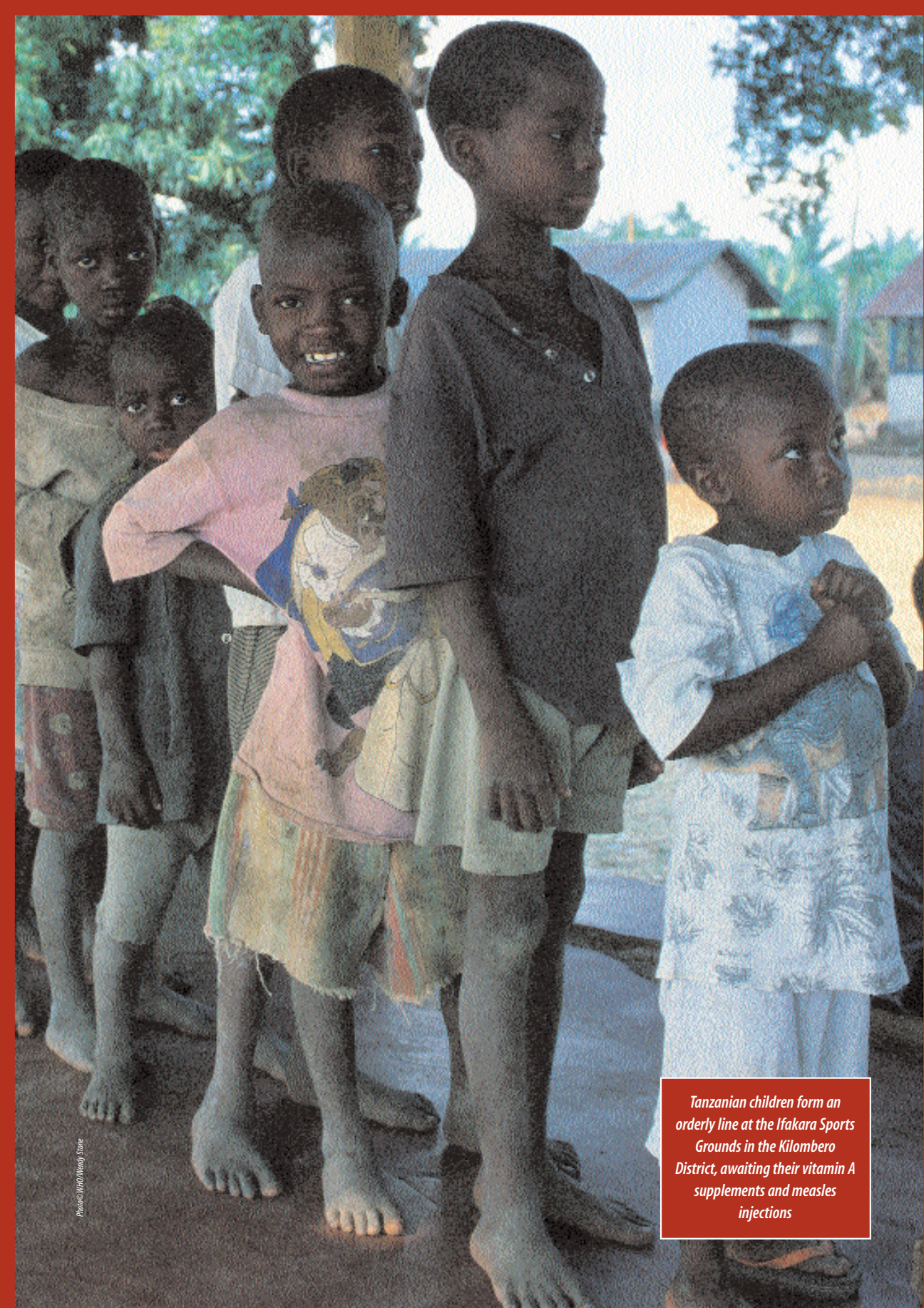
Outbreak response

In the event of an outbreak the main strategy should be to:

- ensure proper case management;
- immunize the population at risk as soon as possible.

The presence of several cases of measles in an emergency setting does not preclude a measles immunization campaign. Even among individuals who have already been exposed to, and are incubating the natural virus, measles vaccine, if given within three days of infection, may provide protection or modify the clinical severity of the illness. Isolation is not indicated and children should not be withdrawn from feeding programmes. ▲

All children aged nine months to five years should be immunized against measles once they are in a refugee or internally displaced persons camp.



Tanzanian children form an orderly line at the Ifakara Sports Grounds in the Kilombero District, awaiting their vitamin A supplements and measles injections

4 • Implementation of the Strategic Plan: priority actions, opportunities and challenges

4.1 Priority actions according to current measles status

This Strategic Plan, recognizing that measles epidemiology and the status of immunization programmes differ between countries, aims to set out a framework for good practice. All countries, regardless of the status of their current measles control programmes, can use the Strategic Plan to reduce measles mortality. WHO and UNICEF recommend that measles elimination be attempted only in polio-free countries.

The implementation of the recommended strategies involves analysing progress with the measles control programme, and, in coordination with the national interagency coordinating committee (ICC), developing a 3–5-year plan for measles control embedded in a comprehensive plan for strengthening immunization services. Improved efficiency and quality in the public health care system can be expected if the measles activities are linked to other health initiatives.

WHO and UNICEF are completing a field guide for measles mortality reduction (27). This guide is intended to assist national immunization managers with the identification of reasons for low coverage and with the selection and planning of the appropriate combination of strategies for reducing measles mortality. The guide will also contain an analysis of different measles control scenarios and information on the options for achieving mortality reduction.

4.2 Coordination with the Polio Eradication Initiative

Poliomyelitis eradication and measles mortality reduction share some basic principles, and

some strategies are complementary. Most importantly, both require supplementary immunization of large age groups regardless of immunization status. Active surveillance of AFP and measles surveillance are based on the same principles, and the existing laboratory network for polio is being expanded for measles diagnosis.

Despite the obvious similarities, however, there are operational differences, particularly in the implementation of immunization strategies. All of these potential difficulties can be overcome if proper phasing and planning of activities is carried out.

Strategies for the reduction of measles mortality should build on the experiences obtained with polio eradication. The adequate implementation of these strategies can facilitate the global polio eradication goal and enhance the benefits of the overall polio eradication initiative and the measles mortality reduction strategies in respect of:

- encouraging the development of long-term national plans for immunization and, reinforcing national interagency coordination and broadening the scope of work of the ICCs;
- strengthening routine immunization, both of which are fundamental to polio eradication and measles control/elimination goals;
- promoting and sustaining the organization of the required surveillance for both diseases and establishing an effective integrated surveillance approach;
- increasing political commitment and popular support for reducing the burden of vaccine-preventable diseases in countries where polio is endemic and those where it is not endemic, and facilitating the mobilization of additional resources.

4.3 Opportunities

Providing vitamin A supplementation

In countries with a vitamin A deficiency problem the provision of prophylactic high-dose vitamin A supplements every 4–6 months gives protection against blindness and reduces the risk of all-cause mortality by 23% (38). However, there is conflicting evidence with respect to the impact of prophylactic administration of vitamin A supplements on measles specific mortality: the Ghana Vitamin A Supplementation Trial study, by far the largest to investigate this matter, found no effect on measles mortality (39).

In order to promote overall improvements in child health, measles vaccination should be used as an opportunity to administer vitamin A prophylaxis in areas where vitamin A deficiency is prevalent. Opportunities for the provision of vitamin A supplements occur:

- at the time of routine measles vaccination (e.g. at nine months of age);
- during national immunization days (NIDs);
- during measles supplementary campaigns.

The supplementary dosage for children aged 6–11 months is 100 000 IU; for children aged 12 months and over it is 200 000 IU.

Table 3: Recommended vitamin A schedule for measles treatment

Age	Immediately on diagnosis	Next day
<6 months	50 000 IU	50 000 IU
6–11 months	100 000 IU	100 000 IU
12 months and over	200 000 IU	200 000 IU

Control of congenital rubella syndrome and rubella

Countries should assess their rubella situation and, if appropriate, make plans for the introduction of rubella vaccination through the use of combined MR or MMR vaccines (6). The choice of policy depends on baseline information concerning the susceptibility profile of women of childbearing age (28, 29, 40). Surveillance for CRS, as outlined in the WHO guidelines, should be initiated (30).

Countries undertaking measles elimination may consider the opportunity to eliminate rubella at the same time. Those that have introduced routine rubella vaccination should integrate rubella surveillance with case-based

surveillance for measles. Additional disease burden studies are required to further estimate susceptibility to rubella and CRS disease burden at the national and regional levels, particularly in developing countries.

Ensuring and monitoring immunization safety

Strict attention to immunization safety is required in activities related to measles mortality reduction and elimination. The administration of millions of doses of measles vaccine during mass campaigns necessitates careful planning and training at the global, national, provincial and district levels, in order to ensure safe injection practices, behavioural change, the availability of sufficient injection safety equipment and the adequate disposal of used syringes and needles.

The safety of immunization during measles control requires attention to behavioural change, the provision of supplies and the management of sharps waste (41).

Sufficient quantities of auto-disable syringes, i.e. syringes that cannot be reused, and of safety boxes should be provided, together with vaccine of high quality for routine immunization and all elective and emergency mass immunization campaigns, including measles control operations (42, 43). Tools have been developed to assist countries in assessing immunization safety and developing and implementing safety plans for routine immunization and mass campaigns (44).

Countries and their partners should ensure that health care workers and the community are familiar with the key messages on immunization safety. The evaluation and documentation of safety and the capability to monitor and manage adverse events following immunization are important elements of the measles control strategy.

Contributing to the development of health systems

The acceleration of measles control promotes equity in health care by providing measles vaccine to the world's most underserved and vulnerable populations. The regular delivery of measles vaccine requires a functional health infrastructure. It is important to optimize the impact of measles mortality reduction and elimination efforts on the provision of immunization services and on health system development (7). New measles initiatives should

Use of safety boxes during a measles campaign in Viet Nam





Photo © Peter Eisenhauer/Infectious Disease Photo Bank

Community mobilization during immunization

be conducted in a manner that strengthens and builds on existing immunization services and contributes to the development of health systems. Indicators of the impact of activities related to measles mortality reduction or elimination on health systems should be included in assessment and monitoring plans (45).

Linking to other health care initiatives

Strategies for measles mortality reduction and elimination include the use of vitamin A as part of adequate case management. This provides the opportunity to strengthen the integration of activities among different initiatives such as the Integrated Management of Childhood Illness, the Micronutrient Initiative and the Expanded Programme on Immunization. When a measles outbreak occurs, priority should be given to reducing measles mortality and strengthening routine immunization, raising awareness of vaccination, and effective case management; the opportunity also arises to provide vitamin A supplementation and increase capacity for investigating and responding to outbreaks (8, 21, 38).

4.4 Major challenges

Ensuring societal and political support for objectives

Political commitment is required at the country, regional and global levels to ensure that measles activities are of high quality. The current measles disease burden and the high priority given to measles by communities in low-income countries underscore the role that all technical partners have in promoting measles mortality reduction and regional elimination.

Advocacy for measles mortality reduction and for the further development of routine immunization services is required in order to ensure that sufficient resources are available to countries where measles mortality is high. In addition, advocacy and political support for measles control is essential in some industrialized countries where routine measles immunization coverage is low and measles remains endemic.

In many areas, resources for routine immunization services declined during the 1990s. Countries and their partner agencies should strengthen their efforts to improve routine immunization coverage as an important step towards achieving the measles control and elimination goals. The countries that qualify

should seek funds available through GAVI (infrastructure support) for strengthening immunization delivery systems.

Ensuring adequate planning and financial resources for measles control

Any country planning to reduce measles mortality or establish a measles elimination goal should develop a comprehensive five-year plan of action as part of a comprehensive programme for strengthening immunization services.

The plan should cover:

- ✓ situation analysis;
- ✓ activities to implement the recommended strategies;
- ✓ rationale for targeting specific age groups or geographical areas in routine and supplementary activities;
- ✓ vaccine supply and quality, and logistics management;
- ✓ training and supervision;
- ✓ indicators for monitoring;
- ✓ immunization safety;
- ✓ disease surveillance and programme evaluation;
- ✓ a time line for implementation;
- ✓ a budget indicating sources of funding and shortfalls.

A country planning supplementary immunization activities should develop an operational plan at least 12 months before the start of the campaign. A country eligible for application for support from the partners in the Global Alliance for Vaccines and Immunization should include activities for measles mortality reduction as part of the proposal submitted to this body.

Ensuring sufficient measles vaccine of high quality

A sufficient quantity of measles vaccine fulfilling WHO standards should be available to meet the requirements of both routine and supplementary immunization activities. In this connection it is vital to increase the effectiveness and timeliness of forecasting of both demand and production capacity at national levels. WHO and UNICEF are currently refining tools for assessing global capacity and the need for vaccines containing measles and rubella (46). The development of accurate forecasting tools and the strengthening of collaboration between agencies and vaccine manufacturers is essential for the achievement of global measles mortality reduction and elimination. ▲

5 • Monitoring

It is intended that countries and partners will employ the following critical indicators for monitoring progress in the implementation of the Strategic Plan.

Impact indicators

- Estimated annual number of measles deaths.
- Number and proportion of countries in regions with measles elimination targets which have interrupted measles virus transmission.

Process indicators

- Proportion of countries with a 3–5-year plan of action for measles control which is embedded in a comprehensive immunization services plan of action.
- Proportion of countries achieving at least 90% measles coverage through routine immunization services: administrative coverage; coverage surveys.
- Proportion of countries in which at least 80% of districts have achieved at least 80% measles/MCV first-dose coverage.

- Proportion of countries that have introduced a second opportunity for measles immunization (supplemental or routine).
- Proportion of countries implementing mass measles campaigns which have assessed the status of injection safety before the campaigns using appropriate guidelines.
- Proportion of countries implementing mass measles campaigns which have conducted complete campaign evaluation.⁷
- Proportion of countries providing standard core data on measles cases (i.e. age and vaccination status).
- Proportion of countries in the measles elimination phase achieving performance standards for all WHO-recommended surveillance indicators (19).
- Proportion of countries with access to a measles-rubella proficient/accredited laboratory.
- Proportion of countries with established measles elimination goals which have assessed their rubella situation and determined the appropriate strategy for rubella and CRS control/elimination. ▲

⁷ Including: campaign coverage, percentage of zero-dose children reached, immunization safety and sharps disposal, impact on measles morbidity and mortality, age distribution of cases and deaths before and after campaigns, routine coverage trends before and after campaigns.

6 • Role of partners

Role of partners under the Global Alliance for Vaccines and Immunization

The launch of GAVI has provided significant opportunities for improvements in funding to vaccination programmes in the developing world. The partners under the Global Alliance for Vaccines and Immunization support the measles goals set by the World Health Assembly and the World Summit for Children, with particular reference to the reduction of measles mortality and morbidity (47).

The GAVI partners include the Bill and Melinda Gates Children's Vaccine Programme, the International Federation of Pharmaceutical Manufacturers Associations (IFPMA), public health and research institutions, national governments, the Rockefeller Foundation, UNICEF, the World Bank and WHO.

GAVI's objective of ensuring that 80% of developing countries have routine coverage of at least 80% in all districts by 2005 is an essential first step in reducing the measles burden. The push towards measles mortality reduction is fully compatible with and contributes to GAVI's overarching purposes of bringing about sustainable access to cost-effective vaccines and focusing on the poorest countries and populations. As measles accounts for 50–60% of deaths attributable to vaccine-preventable diseases of childhood and for 30% of vaccine-preventable deaths when hepatitis B is taken into consideration, measles control is a critical goal for promoting child health.

The partnership for achieving and sustaining measles mortality reduction and regional measles elimination is spearheaded by:

Member countries and territories

WHO Member States and territories are the key partners in the initiatives for measles

mortality reduction and regional measles elimination.

Partner governments play a central role in the implementation of recommended strategies. National resources and infrastructure often represent the most important share of the resources required to provide immunization services. Ministries of health play a vital part in the training and deployment of human resources and the mobilization of financial and human resources for the development and implementation of action plans and secure logistics, whereby access is given to all children, including those in places that are difficult to reach. In addition, national leadership is invaluable in strengthening advocacy, political commitment and the communication of information on measles control.

World Health Organization

WHO has a leading role in strategy development, consensus-building and partner coordination. Through its headquarters and its regional and country offices, WHO provides the overall technical leadership and strategic planning for the management and coordination of the global activities in measles mortality reduction and regional measles elimination. WHO is responsible for ensuring that all components of the Strategic Plan are technically sound and well implemented. The world body has a key role in monitoring and evaluating all aspects of the Strategic Plan, as well as in overseeing the measles laboratory networks, coordination of operational and basic science research, operational support for ministries of health, and the training and deployment of human resources. WHO provides technical assistance to national coordinators in the development of action plans and secure logistics for access to places that are difficult to reach, including countries in conflict. In addition, WHO contributes greatly towards the

strengthening of advocacy, political commitment and the communication of information in relation to measles control.

WHO Steering Committee on Research Related to Measles Vaccines and Vaccination

This committee provides advice to the Department of Vaccines and Biologicals on research priorities for achieving measles mortality reduction and measles elimination. It also prepares the global measles research agenda, reviews research proposals submitted to WHO and contributes to the overall development of the measles strategies.

United Nations Children's Fund

UNICEF is a leading partner in the procurement and distribution of vaccines and supplies for routine and supplementary immunizations. It supports the implementation of intensified supplementary immunization activities and the strengthening of routine immunization at country level. UNICEF also plays a critical role in the promotion and support of: nutrition programmes, breastfeeding and improved child feeding, and control of major micronutrient deficiencies, including vitamin A supplementation. UNICEF gives technical assistance to national coordinators in developing action plans and secure logistics for access to places that are difficult to reach, including countries

in conflict. UNICEF responds in emergencies to protect the rights of children. In coordination with United Nations partners and humanitarian agencies, UNICEF makes its facilities for rapid response available to its partners to relieve the suffering of children and those who provide their care. UNICEF participates in the global process whereby elimination policies and plans of action are developed. It develops materials for training and public information, strengthens social mobilization efforts through its network of communications officers, and provides cold chain support. UNICEF is also an active partner in resource mobilization and advocacy.

United States Centers for Disease Control and Prevention

The Centers for Disease Control and Prevention (CDC) provide technical and financial assistance to countries and partner organizations. CDC participates in strategy development, consensus-building, preparation of plans of action, and the implementation and evaluation of measles control activities. Support is given for the investigation of epidemics and the development and monitoring of surveillance systems, including the laboratory network. CDC also assists with the implementation of supplementary immunization activities and provides long-term staff at the country, regional and global levels.

Academic and research institutions

WHO and UNICEF and their regional offices have received extensive support from academic and research institutions. Academic institutions contribute to the overall development of the measles strategies and participate in the development of new technologies. Academic experts attend global strategic and research meetings, prepare reports and contribute to the development of research capacity by collaborating with researchers throughout the world. They also support the development of policy documents and training materials.

Other key partners

Countries, WHO, UNICEF and their regional offices have received extensive multilateral and bilateral support for measles control and elimination. Collaboration with UNDP, UNESCO, UNFPA, UNHCR and WFP has been invaluable in ensuring the continuation of global measles activities. Bilateral organizations such as AECL, CIDA, DFID, JICA, SIDA and USAID have made significant contributions to regional measles control and

elimination activities. Foundations such as the Rockefeller Foundation, the Kellogg Foundation and the Carnegie-Mellon Foundation, as well as nongovernmental organizations such as BASICS II, the Save the Children Fund, the International Federation of the Red Cross, the American Red Cross and the March of Dimes have been instrumental in the effort to reduce the measles disease burden.

Partner governments play a central role through the provision of both bilateral and multilateral support. Resources have been provided for all aspects of the initiative, including the planning of national measles activities, social mobilization and training, the strengthening of laboratory capacity, and review meetings and evaluations. In addition, WHO and UNICEF maintain close cooperation with vaccine manufacturers and developers, producers of injection safety equipment, and developers of vaccine-related technology in order to ensure the safety, quality, supply and improved technology of the measles vaccine. ▲

7 • Beyond 2005: measles eradication versus further mortality reduction

Control activities resulting in vaccine-induced immunity below the herd immunity threshold for the interruption of measles virus transmission lead to an unstable epidemiological situation with periods of lower measles incidence followed by large outbreaks. For this reason the ultimate goal of measles control is to raise population immunity above the herd immunity threshold and, eventually, to interrupt indigenous measles virus transmission.

Many experts believe that global eradication is feasible on the basis of existing measles vaccine and strategies (48). With regard to shaping elimination initiatives and providing information on the feasibility of a future global eradication goal, invaluable lessons have been learned in the Region of the Americas and other regions with measles elimination goals.

The period from 2001 to 2005 presents an opportunity to reduce global measles mortality. Additional experience will undoubtedly be gained in the implementation of strategies aimed at the interruption of measles transmission. This can be expected to be of value when the goal for measles control beyond 2005 has to be set.

Several questions have to be answered before a decision is made on a new target for measles control (18, 49). Some of them relate to the level of societal and political support for different goals, operational issues, immunization safety concerns, the need for improved routes of administration of measles vaccine, and the impact of the HIV pandemic. It will also be important to document the feasibility, priority, incremental costs, cost-effectiveness and

opportunity costs of different measles control programmes. Clearly, more information and experience are required before the decision on a measles eradication goal can be thoroughly assessed.

WHO and UNICEF, in collaboration with major partners, intend to convene a global consultation in 2005 in order to review progress on measles mortality reduction and assess the technical and political feasibility of global eradication of the disease. When the goal for measles control beyond 2005 is being set a choice will have to be made between a more rigorous mortality reduction target and a global measles eradication target. ▲



Working towards a better tomorrow

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Annex 1: Eliminating measles – no quick fix

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In recent years, a number of countries have had notable success in eliminating measles using a variety of vaccination strategies. Three WHO regions – the Americas, the Eastern Mediterranean and Europe – now have measles elimination goals. In the Americas a strategy based on supplementing high routine coverage with an initial catch-up and periodic follow-up campaigns has achieved a dramatic reduction in measles incidence and interrupted transmission in many areas. (1) Other countries have eliminated indigenous measles transmission with a routine two-dose schedule by reaching coverage of over 95% (e.g. Finland, Hungary, United States). A similar result has been achieved in Canada, Oman and the United Kingdom by following a catch-up campaign with a routine two-dose schedule. The success of these different strategies is based on a common characteristic: they all reduce the proportion of the population susceptible to measles infection to below the level at which infection can remain endemic (the herd immunity threshold), (2) and maintain it there. This causes chains of transmission to die out and prevents sustained transmission from becoming re-established if the infection is reintroduced by an imported case. (3)

Catch-up campaigns that immunize a high proportion of the susceptibles in a population (by targeting the right age group and reaching previously unvaccinated children) have a rapid and dramatic impact on measles transmission. However, campaigns need to be followed by high routine coverage to prevent the reaccumulation of susceptibles to levels that will permit sustained measles transmission. (4) Examples from the Americas illustrate this: inadequate infant coverage has been identified as the main cause of recent measles outbreaks in Argentina, Bolivia and the Dominican Republic despite the implementation of supplemental campaigns. (1) This should serve as a reminder to other countries aiming for measles elimination: it is easier to achieve impressive progress initially than to sustain elimination in the long term.

The WHO strategy for the elimination of measles from the European Region recognizes both theory and experience by setting explicit target levels of susceptibility for each age group. (5) Starting from a knowledge of its own susceptibility profile, each country can design an appropriate vaccination programme to reduce the proportion susceptible below these target levels. In each country, the susceptibility profile can be estimated from vaccination coverage and disease incidence data, but the most direct evidence comes from seroprevalence studies of the type described by Salmaso and colleagues in this issue of the Bulletin (pp. 950–955). Such data provide a firm evidence base for vaccination policy decisions, by identifying susceptible cohorts. Recent developments in methods to detect antibody in oral fluid (rather than blood) facilitate the collection of suitable samples. (6) Having developed appropriate vaccination strategies, the greater challenge is to implement them. This is where much more needs to be done in the European Region to reach the target of elimination by 2007. ▲

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Annex 2: Strategic milestones

The detailed strategic milestones are as follows:

By the end of 2001

- The Strategic Plan to be finalized and endorsed by partners.
- All regions to review and update where appropriate their measles control and elimination plans in accordance with the Strategic Plan.
- All countries with the highest measles mortality and/or in the high child mortality strata⁹ to have developed a 3 to 5-year strategic plan for achieving and sustaining the measles mortality reduction targets.
- Interruption of measles transmission in the Region of the Americas to be achieved and maintained.
- Each WHO/UNICEF region to have a revised 3–5-year strategic plan for measles mortality reduction or elimination, including an immunization safety component based on the three-element strategy (behavioural change, supplies, waste management) with appropriate budgets and monitoring plans.
- All countries planning or implementing supplementary immunization campaigns to have assessed the safety of injections by using appropriate guidelines, and to ensure immunization safety, including appropriate sharps management.¹⁰
- All WHO regions that have established measles elimination goals to assess the rubella situation and determine the appropriate strategy for rubella and CRS control/elimination.
- All countries/regions that have established measles elimination goals to have incorporated rubella surveillance into an integrated rash-fever surveillance system and to have access to a proficient measles-rubella laboratory.
- All countries in the Region of the Americas to have incorporated rubella-containing vaccine into their national immunization programmes. Interruption of rubella transmission and CRS prevention in the English-speaking Caribbean countries (CAREC) to be achieved and maintained.

By the end of 2002

- All countries with the highest measles mortality and/or in the high child mortality strata to have begun accelerated activities for achieving and sustaining the measles mortality reduction targets.
- All industrialized countries, where measles remains endemic which are exporters of the disease to measles-free areas, to have begun implementation of mortality reduction or elimination activities.
- All countries undertaking mass campaigns to document immunization safety during campaigns and routine services using recommended assessment tools.
- All countries organizing supplemental vaccination campaigns to conduct activities for promoting behavioural change in relation to immunization safety among health care workers and the public in order to ensure safe injection practices.

⁹ High child mortality countries as defined in the WHO World Health Report 2000.

¹⁰ Through a plan that includes sufficient budget, use of monitoring tools (e.g. supervision checklist) during implementation, and inclusion of waste management assessment in campaign evaluation.

- Fifty per cent of countries to have a surveillance system in accordance with recognized WHO standards and appropriate to the measles control stage.
- All measles-rubella network laboratories to undergo an accreditation process.
- Two or three additional countries in each WHO region to have implemented, or to be planning to implement, studies to estimate the burden of rubella and CRS in those countries.
- WHO to conduct another survey to review susceptibility to rubella and assess the use of rubella vaccine in Member countries and territories.

By the end of 2003

- Annual global measles mortality to have been reduced by a third relative to 1999 estimates.
- Fifty per cent of the countries with the highest measles mortality and/or the countries with high child mortality to have administered at least one dose of measles vaccine to at least 90% of children aged under five years in a strategy to be sustained over time (routine or supplemental).
- Fifty per cent of the countries with the highest measles mortality and the countries with high child mortality to have advocacy for, and improved access to, adequate case management for measles cases.
- Eighty per cent of countries to have a surveillance system for measles in accordance with WHO guidelines and indicators and to be served by at least one accredited measles-rubella laboratory.
- Eighty per cent of countries planning or implementing supplementary measles immunization campaigns to have assessed their rubella situation and to decide whether to include rubella-containing vaccine in their campaigns.
- WHO and UNICEF to convene a global meeting to review mid-term progress towards achieving the mortality reduction and regional elimination goals, and to assess the rubella situation and update the recommendations on rubella and CRS surveillance and use of rubella vaccine.
- Additional countries in each WHO region to have implemented or to be planning to implement studies to estimate the burden of rubella and CRS in member countries.

By the end of 2004

- Countries with high measles mortality and/or the countries with high child mortality to have administered at least one dose of measles vaccine to at least 90% of children aged nine months to four years, in a strategy to be sustained over time (routine or supplemental).
- All industrialized countries where measles remains endemic which are exporters of measles to measles-free areas to have implemented activities for measles mortality reduction or elimination as recommended in the respective regional plan of action.
- Eighty per cent of countries where vitamin A deficiency is a public health problem to be providing vitamin A supplements through immunization contacts (where there is no other appropriate strategy) and to measles cases.
- All countries planning or implementing supplementary measles immunization campaigns to have assessed their rubella situation and to decide whether to include rubella-containing vaccine in their campaigns.
- All countries with the highest measles incidence rates and/or the countries with high child mortality to have advocacy for and improved access to adequate case management for measles cases.

By the end of 2005

- Annual global measles mortality to have been reduced by half relative to 1999 estimates.
- WHO and UNICEF, in collaboration with CDC and with other major partners, to review the progress and assess the feasibility of global measles eradication at a global consultation in 2005.
- All countries to have introduced a second opportunity for measles vaccination through regular routine or supplemental immunization activities.
- All countries to have a surveillance system for measles in accordance with WHO guidelines and indicators and to be served by at least one accredited measles-rubella laboratory.
- All countries where vitamin A deficiency is a public health problem to be providing vitamin A supplements through immunization contacts (where there is no other appropriate strategy) and to measles cases.
- WHO and UNICEF to convene a global meeting to review progress towards achieving the measles targets for mortality reduction and regional elimination, and to assess the rubella situation and update the recommendations on rubella and CRS surveillance and use of rubella vaccine.
- A revised five-year Strategic Plan for measles and rubella to be finalized and endorsed by partners. ▲

Annex 3: Measles deaths by mortality stratum in WHO regions, estimates for 1999

On the basis of the mortality figures, the World Health Report 2000 presents five mortality strata, ranging from low child and adult mortality to high child mortality and very high adult death rates (1).

Measles deaths are shown in Table 6 by WHO region and mortality strata. Detailed list of countries by stratum is included in the WHO World Health Report 2000. ▲

Table 6: Measles deaths by mortality stratum in WHO regions, estimates for 1999

WHO region	Mortality stratum	Estimated measles deaths	% of global total
Africa	High child, high adult	259 000	29.6
	High child, very high adult	256 000	29.30
Americas	Very low child, very low adult	0	–
	Low child, low adult	1 000	0.1
	High child, high adult	0	–
Eastern Mediterranean	Low child, low adult	8 000	0.9
	High child, high adult	89 000	10.2
Europe	Very low child, very low adult	0	–
	Low child, low adult	4 000	0.5
	Low child, high adult	18 000	2.1
South-East Asia	Low child, low adult	223 000	25.4
	High child, high adult	0	–
Western Pacific	Very low child, very low adult	0	–
	Low child, low adult	17 000	1.9
Total	Very low child, very low adult	875 000	100