

Report on the

**Intercountry meeting on measles and rubella
control/elimination**

Cairo, Egypt,
3–5 December 2007



**World Health
Organization**

Regional Office for the Eastern Mediterranean

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1. INTRODUCTION

An intercountry meeting on the control and elimination of measles and rubella was organized by the World Health Organization (WHO) Regional Office for the Eastern Mediterranean in Cairo, Egypt, from 3 to 5 December 2007. The meeting was attended by national managers from the Expanded Programme on Immunization (EPI) and the Centers for Disease Control (CDC), Atlanta, surveillance focal points and laboratory focal points from 22 countries of the Eastern Mediterranean Region, in addition to members of the Regional Advisory Group, the United Nations Children's Fund (UNICEF), the American Red Cross Society, WHO staff from headquarters, the Regional Office and country offices, and the United Nations Foundation.

The objectives of the meeting were to:

- discuss progress towards the regional measles elimination goal, including achievements, constraints and the way forward;
- discuss progress made towards rubella/congenital rubella syndrome control and elimination;
- discuss new advances and strategies related to measles elimination and rubella/CRS control/elimination.

In his opening address, Dr Hussein A. Gezairy, WHO Regional Director for the Eastern Mediterranean, noted that measles had been a major cause of childhood mortality in the Eastern Mediterranean Region, with more than 100 000 deaths occurring each year prior to implementation of elimination activities. Since the 1997 Regional Committee resolution for measles elimination by 2010, considerable progress had been made, lowering measles mortality to 34 000 deaths in 2006, particularly through the use of supplementary immunization campaigns, in which approximately 147 million children had been vaccinated. The achievement of the 2005 global measles mortality reduction goal was evidence of what could be achieved when country-level political commitment and an effective international partnership continued to work together.

Much of the remaining measles mortality in the Region occurred in Pakistan. A nationwide measles catch-up campaign targeting 64 million children had been initiated in 2007 in rolling phases and was expected to finish early in 2008. In order to sustain this achievement and maintain very low population susceptibility to measles, Pakistan was urged to invest more in strengthening routine immunization activities and in ensuring very high measles immunization coverage figures in all districts, as well as in ensuring a strong nationwide measles case-based surveillance system with laboratory confirmation. The same recommendations applied to those countries that had implemented successful initial catch-up campaigns and where the routine immunization programme had not yet been able to reach the desired coverage. While working on improving access to routine immunization services, alternative recommended strategies, such as regular follow-up campaigns, should be considered whenever and wherever needed, based on a strong monitoring of population susceptibility to measles.

One of the cornerstones of the measles elimination strategy was, without doubt, laboratory surveillance. Dr Gezairy said that he was pleased to note the high quality and efficiency level reached by the regional measles laboratory network, as shown by the different performance indicators; but was still concerned about the relatively low utilization of this network in some countries. It was vital that strong collaboration and coordination were maintained between national EPI programme, the measles surveillance department and the national measles laboratory, to

address this issue. It was particularly important to ensure full participation of laboratory focal points in the measles surveillance process. It was impossible to determine whether measles had been eliminated without serological testing of all patients with suspected disease. In addition, virological surveillance, including isolation and genotyping of virus strains circulating in a country, was an important tool for evaluating progress towards measles elimination.

The programme and list of participants are included as Annexes 1 and 2, respectively.

2. GLOBAL AND REGIONAL UPDATES

2.1 Global progress on measles control and elimination

Dr P. Strebel, WHO/HQ

In January 2007, WHO and UNICEF reported that the 2005 goal to reduce measles deaths worldwide had been achieved on time. At the World Health Assembly in 2005, a more ambitious global measles control goal was established as part of the Global Immunization Vision and Strategy: a 90% reduction in measles mortality by 2010 compared with the 2000–2005 goal achieved.

In 2006, global coverage with the first dose of measles vaccine reached 80% for the first time and more than 136 million children were vaccinated against measles in supplementary immunization activities in 25 of the 47 high-burden countries. As a result of these accelerated control activities, mortality due to measles was reduced by 68%, from an estimated 757 000 deaths in 2000 to 242 000 deaths in 2006. The largest percentage reduction in estimated measles mortality during this period was in the African region (91%), accounting for 70% of the global reduction in measles mortality. Thus, Africa has achieved the 2010 measles mortality reduction goal four years ahead of schedule. Major challenges remain including conducting high-quality catch-up supplementary immunization activities in Pakistan and India, maintaining the gains through strengthening routine immunization services and timely follow-up supplementary immunization activities, and expansion of sensitive and specific case-based measles surveillance with laboratory-confirmation to all priority countries.

Elimination of measles has been achieved in the Americas since November 2002; however, the other three regions with elimination goals (Eastern Mediterranean, European and Western Pacific Regions) all need to accelerate activities to achieve the goal within the remaining three years. Lessons learnt in the Americas include the importance of political commitment at all levels of government, country ownership and financing, and strong programme management that includes ongoing validation of coverage and surveillance information in the field. Despite high reported coverage with two doses of measles vaccine, a number of countries in the European Region have experienced large measles outbreaks in 2005 and 2006. As countries get closer to interrupting measles transmission, detailed outbreak investigations including case–control studies are needed to determine the cause of outbreaks and focus elimination strategies.

2.2 Overview of global laboratory networks

Dr Featherstone, WHO/HQ

A measles and rubella genotype database has been established in WHO headquarters and more than 2500 measles viruses from 59 countries, over all six WHO Regions have been submitted,

though there are still some surveillance gaps. The rubella virus database has only 128 viruses submitted to date, reflecting the fact that much work is required to improve molecular surveillance of rubella virus. Virological surveillance, in parallel with standard epidemiological investigation data, can help document pathways of viral transmission and help determine the effectiveness of control programmes.

In several WHO regions, logistical and financial challenges have discouraged some national laboratories from shipping serum samples to their regional reference laboratories for validation purposes. The global specialized laboratories in CDC, Atlanta and the Health Protection Agency (HPA), London, have evaluated procedures for stabilizing IgM by drying serum onto filter paper. Early evidence shows promising concordance of dried and liquid serum and warrants more comprehensive evaluation under “field” conditions.

2.3 Regional progress towards measles elimination

Dr Mohsni, WHO/EMRO

Reducing measles mortality is a high priority for WHO, UNICEF and Member States in the Region. In 1997, the Regional Committee passed a resolution to eliminate measles virus transmission by 2010. The resolution endorsed a well-recognized strategy to achieve this goal which included:

- achieving and maintaining high routine measles vaccination coverage (>95%) among children aged 1 year;
- conducting a one-time, nationwide, mass immunization campaign or catch-up campaign targeting all children (usually those 9 months to 15 years of age);
- providing a second opportunity for measles immunization, either through periodic follow-up campaigns every 3–5 years targeting all children born since the last campaign, or achieving > 95% routine coverage with a second dose of measles vaccine;
- strengthening measles surveillance;
- conducting optimal case management of children with acute disease.

Considerable progress has been made in the past few years in reducing measles morbidity and mortality in the Region, which has already exceeded in achieving the target set for measles mortality reduction of 50% by 2005 and strategically is approaching to achieve in advance the GIVS target of a measles mortality reduction of 90% by 2010.

2.4 Measles supplementary immunization activities in the Region

The Regional Office is continuing to provide support to countries in planning and resource mobilization for supplementary immunization activities. In 2007, considerable progress was made, lowering measles mortality in Pakistan through a nationwide measles supplementary immunization campaign targeting over 65 million children between 9 months and 13 years. So far, four phases were completed reaching over 31 million children with a high coverage of 98%. The last phase, targeting over 34 million children, is planned to start in March 2008. Similar measles catch-up campaigns have been completed in Somalia and south Sudan. A measles follow-up campaign was completed in Afghanistan and initiated in Sudan and Yemen.

Despite the progress, measles outbreaks occurred in 2006 in a number of countries in the Region, such as Saudi Arabia, Syrian Arab Republic, Kuwait, Qatar, etc. where high measles immunization coverage rates reported. It is encouraging to know that at the end of 2007 all of these countries had implemented corrective measles supplementary immunization activities to fill population immunity gaps following specific recommendation provided during the last intercountry meeting in 2006.

Gains in MCV1 coverage in countries of the Region have continued from 2004 to date after a period of stagnation in 2002 and 2003 (Figure 1). In 2006, 85% MCV1 coverage was reported in the joint reporting form. 14 countries maintain high coverage above 95% (Bahrain, Egypt, Islamic Republic of Iran, Jordan, Kuwait, Libyan Arab Jamahiriya, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Syrian Arab Republic, Tunisia and United Arab Emirates). Yemen achieved over 80% coverage: six countries (Afghanistan, Djibouti, Iraq, Lebanon, Pakistan and Sudan) achieved between 50% and 70%; and Somalia had less than 50% coverage. Challenges and constraints that have affected routine immunization include conflict (south Sudan, Afghanistan, Somalia, Iraq and Lebanon), lack of security and competing priorities, such as polio, and lack of national commitment to oversee the proper implementation of planned activities.

Given the importance of routine immunization in measles elimination activities, participating countries, particularly the priority countries mentioned above, are being encouraged to use the opportunity of a mass campaign to strengthen EPI services, including district-level micro-planning, cold chain facilities, waste disposal mechanisms and safe injection practices.

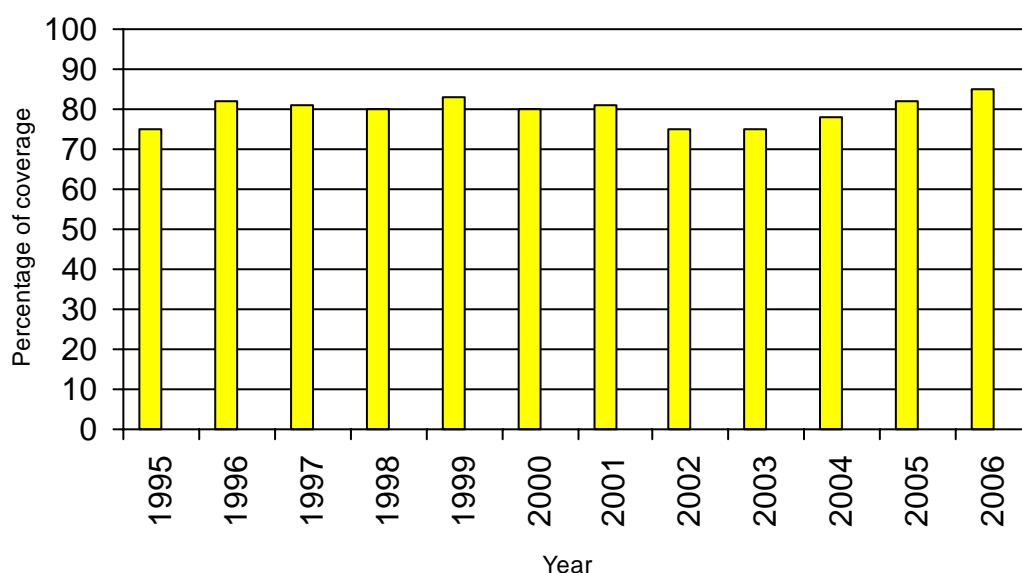


Figure 1. Regional coverage with MCV 1, 1995–2006

2.5 Measles surveillance in the Region

There has been remarkable improvement in measles case-based surveillance by countries of the Region. Surveillance for measles and rubella is a high priority both for the Regional Office and Member States. Many countries maintain high-quality fever and rash surveillance activities, including several countries that have linked measles reporting to surveillance for acute flaccid paralysis (AFP). Almost all countries report measles and rubella surveillance data on a monthly basis. The number of cases reported in 2007 exceeds that of 2006; the main explanation for this is that the number of countries implementing measles case-based surveillance has increased. There were also continued measles outbreaks, e.g. in Egypt and Saudi Arabia. The Regional Office measles bulletin has been helpful in raising awareness and in improving the implementation of measles elimination strategies in countries.

All countries in the Region have well-established measles national laboratories which implement WHO standards requirements regarding maintaining a high level of proficiency and validation system. Eighteen national measles/rubella laboratories have been assessed and all gained accreditation; the four remaining laboratories are planned to be assessed in 2008. An intercountry training workshop on measles and rubella virus isolation and molecular detection was conducted in March 2007 with nine network laboratories represented. Following the workshop, Kuwait, Pakistan, Oman and Qatar were able to identify and genotype wild type measles virus for the first time. Regional reference laboratories in Oman and Tunisia have been identified as the measles sequencing reference laboratories for the Region, and in addition, two subregional laboratories in Pakistan and Egypt were identified to support regional virus sequencing activities.

Discussion

Participants discussed the outbreaks in Ukraine and Romania, which occurred despite a two dose schedule of measles-containing vaccines being conducted. It was noted that a WHO prequalified vaccine was not used in Ukraine, which led to vaccine failure. The Romanian outbreak showed that 72% of cases were not vaccinated and there was a failure to vaccinate marginalized/migrant children. It was agreed that timely and complete surveillance with outbreak investigation are needed to guide programme activities. It was also recommended that the second dose of MCV should be given as soon as possible during the second year of life, otherwise at school entry.

3. COUNTRY EXPERIENCES IN MEASLES IMMUNIZATION

3.1 Afghanistan

High commitment and political support is obtained through strong social mobilization and advocacy. More than 50 000 community health workers, vaccinators and volunteers participated in implementation of the measles campaign which covered 4.9 million children aged 9–59 months; 93% of districts achieved >100% coverage. The measles mortality reduction campaign was conducted in three phases because of the shortages of funds and cold chain management and insufficient skilled staff. Measles supplementary immunization activities have been effective in reducing suspected measles case (cases reduced by 90%). Polio supplementary immunization activities have been used to conduct the measles mortality reduction campaign and results have

been positive from both the measles and polio campaign. A lot of effort is needed to achieve >90% MCV1 coverage in the routine programme and to continue active surveillance. Communication and coordination among all partners has been strengthened. However, a shortage of funds for planned measles supplementary immunization activities in 2009 and insecurity are threatening the programme.

3.2 Egypt

Outbreak guidelines for investigation in Egypt give the definition of an outbreak as five confirmed measles cases in a district. Outbreak investigation guidelines at national and subnational levels have been prepared but have yet to be published. Outbreaks are reported to the Ministry of Health and Population.

The communication strategy for measles elimination includes:

- conducting advocacy and orientation meetings for stakeholders and staff of the Ministry of Health and Population and related ministries
- communicating with the media (television, radio, press) to explain the situation of measles in Egypt and the goal for elimination by 2010
- conducting meetings with community leaders at the level of each district to explain the importance of immunization programmes, including elimination of measles and rubella
- creating communication materials, including strategies for the elimination of measles and the distribution of these materials for the media, community leaders, teacher and students
- appointing a communication focal point in the communicable disease department of the Ministry of Health and Population.

Achievements have included:

- raising the immunity of the community, through high vaccination coverage >95% for both measles and MMR vaccines at national, provincial and district level, changing the vaccination schedule in 2008 for higher efficacy of the vaccine
- establishing a new high vaccination committee
- formulating a task force from the EPI, surveillance officer and staff and laboratory
- adopting measles surveillance indicators, as recommended by WHO
- ensuring high laboratory performance.

The challenges include the large budget needed for the campaigns, the introduction of new vaccines which compete with the campaign budget and the lack of donor support. For surveillance, standardized guidelines for outbreak investigation are lacking, there is a need to train surveillance staff at all levels, guidelines for congenital rubella syndrome are still under preparation and the role of private sector in reporting is weak.

3.3 Lebanon

A measles catch-up campaign was planned for 2006, but postponed to 2007 due to conflict, and then to 2008 due to procurement difficulties. Campaign details are as follows: tentative date,

spring 2008 (early April); duration, two weeks; target population, 925 000; age group, 9 months to 14 years. The antigen to be used is MR. Methodology is fixed sites and community-based.

Preparations include the following activities:

- Finalizing campaign microplans at district levels.
- Holding meetings for already formulated task force
- Advance procurement of vaccines and bundle supplies
- Guidelines to be developed
- Social mobilization
- Training of supervisors and vaccinators.

3.4 Morocco

Vaccination against measles started in Morocco by the beginning of the 1980s. The second opportunity (MCV2) was introduced in 2003–2004. MCV1 is given at 9 months and MCV2 (MR) at school entry (6 years). The MCV1 coverage rate is around 95% and the MCV2 coverage rate has reached about 90%.

Surveillance uses the rash and fever definition and outbreaks are investigated in all districts with data analysis. Since 2007, sentinel case-based surveillance started in 15 sentinel sites in five provinces. Fever and rash cases are confirmed in the accredited national measles laboratory and genotyping is performed since 1999. Indigenous (C2 genotype) and imported like strains (B3, D7 and D8) were reported between 2003 and 2005.

In order to reach the 2010 target, Morocco has planned a catch up campaign for next year (April/May 2008) in order to reduce drastically the number of susceptibles. MR will be given to children under 15 years of age and rubella vaccine will be given to young women (15–24 years old) in order to prevent CRS. Immediately after the 2008 catch-up campaign, MCV1 will be given at 12 months.

3.5 Pakistan

The EPI in Pakistan has embarked upon a massive measles campaign to protect children against the disease. Approximately 65 million children between 9 months and 13 years are being targeted for immunization against measles. Measles is still endemic in Pakistan and is a major cause of childhood illness and death. An estimated 21 000 children die every year in Pakistan from measles and its complications. The measles campaign is a significant milestone in Pakistan's efforts to ensure all children are protected against vaccine-preventable diseases including measles. The measles catch up campaign was scheduled in 5 phases and has completed 4 phases (Table 1).

Table 1. Measles catch-up campaigns, Pakistan

Phase	Year campaign conducted	Target age group	Target population	Type of campaign	% coverage
Phase 1	March 2007	9 m – 15 yrs	2 607 784	Catch-up	96%
Phase 2	July 2007	9 m – 13 yrs	1 033 009	Catch-up	109%
Phase 3	Aug–Sep 2007	9 m – 13 yrs	6 924 323	Catch-up	100%
Phase 4	Nov 2007	9 m – 13 yrs	20 190 875	Catch-up	Data not available
Phase 5	March 2008	9 m – 13 yrs	35 000 000	Catch-up	Planned

The United Nations Foundation has contributed US\$ 30 million to assist this campaign. The Government of Pakistan has financed the purchase of cold chain equipment, e.g. ILR, freezer, cold box, vaccine carrier, icepacks etc, at a total cost of US\$ 1.6 million.

Case-based surveillance has also been initiated in those districts where catch-up campaigns have been completed. Strengthening surveillance is a priority area for the country. Awareness raising among the service providers for reporting suspected measles is planned through training and continuous communication. Laboratory facilities will be expanded at sub-national level and the existing AFP surveillance network will be integrated in measles surveillance. Incidence and reporting indicators for surveillance quality will be regularly monitored at district and provincial level.

The country is fully committed to eliminate measles infection from the country. To sustain the achievement of the catch-up campaign and to reach the goal of measles elimination by 2010, raising MCV1 coverage to the desired level of 95% nationally is critical. Pakistan is falling far behind this threshold. At the same time, maintaining high population immunity by high MCV2 coverage is also important. The following activities are planned to achieve the desired coverage.

- Expansion of RED approach
- Increase capacity building
- Vaccine and store management
- Microplanning
- Expansion of service delivery
- Expansion of cold chain capacity
- Advocacy and communication
- Resource mobilization: by the Government of Pakistan and partners
- Sustaining achievement of catch-up campaigns through periodic follow-up campaigns and timely introduction of MCV2 in routine EPI.

Further, National EPI Advisory Group (NEAG) will be reformed for inclusion of more appropriate members and their TOR will be revised to look after measles elimination progress in the

country. Existing Polio NTAG will be reformed and that's TOR will be revised so that, the same committee can also serve as NTAG for measles elimination in the country.

National Steering Committee for Polio Eradication has already been reformed and TOR revised to make in National Steering Committee for EPI. This committee includes senior federal EPI programme personnel, store officer, laboratory personnel (both polio and measles), WHO colleagues for PEI and EPI, UNICEF colleagues for MCH/EPI, JICA, Rotary International etc. This same committee will act as the measles elimination management team.

3.6 Saudi Arabia

To disrupt the continued measles outbreak, a corrective measure was undertaken by repeating a nationwide catch-up campaign in Saudi Arabia in October–November 2007. The target age group was children 9–59 months, constituting 2 065 566 children, and children from 6 to 18 years, accounting for 4 951 240 school-age children. Two phases were conducted: for 9 to 59 month-olds from 22 October–22 November 2007, and for 6 to 18 years, at the same time inside schools.

Micro-planning meetings and discussions were held with health sectors of ministries of health, ministries of education and the regional EPI coordinator. Social mobilization for the awareness-raising campaign was organized through health education, newspapers, radio, television, posters, leaflets and stands. At the district level, a district coordinating committee was established, meetings were held with health workers involved in the campaign and the education sector, a coordinator was appointed to work with the public and private health sector and team members were trained.

Both fixed and temporary vaccination posts were used. Fixed immunization posts were used to vaccinate children between 9 and 59 months and coverage was 93%, and mobile posts were used for schoolchildren with coverage of 96%.

Challenges included:

- conducting the two phases in parallel (school, preschool) mostly by ministry of health teams and personnel
- gaining adequate private sector participation
- continuing routine vaccination in primary health care at the same time of the campaign
- controlling illegal immigrants in pilgrimage areas.

3.7 Syrian Arab Republic

Outbreaks are reported to the EPI manager, Director of Primary Health Care, Minister of Health and WHO. The communication strategy involves advocacy and social mobilization, increasing awareness of the burden of measles, health education on the risk of measles complications, and increasing the awareness of health workers on the importance of their participation in the measles elimination programme. It includes:

- immediate reporting of suspected measles cases
- enhancing routine immunization

- highlighting the importance of vitamin A in the management of measles to prevent complications
- conducting awareness-raising through all media explaining the symptoms, complications and preventive measures
- distributing brochures about the measles elimination programme
- ensuring health workers' knowledge of case definition
- distributing posters to all health centres on the risk of measles.

Regarding communication materials there is a communication focal point in the EPI programme to communicate with community leaders in high-risk areas. There is a technical advisory group which was established in 2007. They have reviewed measles elimination programme activities and made recommendations to enhance measles elimination programme indicators. The incidence rate of measles cases is still above the recommended rate but some high-risk areas still exist.

3.8 Discussion

There has been an occurrence of outbreaks despite high coverage figures, especially in Saudi Arabia and the Syrian Arab Republic. Enquiries focused on strain used for vaccination, sources of coverage figures, laboratory surveillance and the role of migrants or refugees in outbreaks. From the discussion, it was observed that routine reports are the main sources of coverage figures. It was recommended that coverage figures must be ensured for accuracy through frequent regular assessment. Migrants or refugees were found to constitute a small proportion of cases as is the case in the Syrian Arab Republic. In the presence of a good programme, any outbreak should be small. The laboratory network was identified as being fully involved in measles surveillance. Meticulous outbreak investigation helps in identifying high-risk groups, vaccination status and cases with vaccine failure. Inflated coverage figures, i.e. over 100%, are the result of inaccurate denominators, as in Afghanistan. The Schwartz strain was the used vaccine strain in Saudi Arabia.

Accuracy of coverage figures, role of campaigns in measles reduction, use of social mobilization of polio for measles benefit and use of other polio resources for the same purpose. Participants agreed that an accurate figure of coverage is essential and the use of independent monitoring system is recommended. There was a consensus among participants that campaigns had a considerable impact on lowering measles incidence and limiting outbreak. However, outbreak definition is recommended to be well defined for implementation in different countries.

3.9 Group work: target coverage for measles elimination

Participants were divided into four groups and were asked to discuss and agree on the measles elimination minimum target coverage figures for MCV1 and MCV2 at both national and district level.

Group 1 agreed upon a minimum target coverage for MCV1 and MCV2 at both national and district level and felt that this may be necessary for measles elimination. However, the group expressed that achieving 95% coverage at the district level may not be feasible in the near future in some countries. Recognizing these limitations, it was agreed that every country should, at a

minimum, reach the GIVS target of greater than or equal to 80% coverage in every district for MCV1 and MCV2, by 2010.

Group 2 felt that the most important priority was to raise the coverage with MCV1 to 95% and sustain this gain with MCV2. In addition, the GAVI IRC bases its decision on funding for the second routine dose (for GAVI-eligible countries) on criteria established by respective WHO regional offices. The experience of Yemen should serve as an example that countries should not introduce the second dose without the necessary preparation. Countries need to demonstrate capability of sustaining coverage of at least 80% MCV1 for 1–3 years. Countries that have low MCV1 coverage should focus on improving their MCV1 coverage. Introduction of the second dose (MCV2) does not rule out the need for follow-up campaigns, until 95% coverage with MCV1 and MCV2 is achieved in every district.

Group 3 raised the following issues:

- continuous inflow of migrants
- shortage of personnel
- rapid staff turnover (Kuwait)
- frequent change of childhood immunization schedule (Saudi Arabia)
- weak school-based immunization programme (Qatar)
- chronic refusal to immunize from parents
- lack of a computerized database system
- except Kuwait, all counties are facing major problems from the private sector in terms of vaccine coverage.

Some of the concerns expressed by Group 4 included: the need to enhance laboratory surveillance through appropriate sample collection in order to identify circulating molecular strains; high incidence of outbreaks in spite of high coverage; lack of MMR for second dose in 2006–2007 caused a drop in the coverage (Jordan and Palestine); and the difficulty of achieving 95% coverage at district level.

Discussion

There is a shortage of the MMR vaccine for the second MCV in some countries but the possibility of using monovalent measles vaccine, although the effect on rubella is not yet understood. All participants agreed on the need for 95% coverage for the first and second dose of MCV at national and district level. In hard-to-reach areas or for inaccessible populations the immunization plan should prioritize districts, identify different approaches and mobilize resources to overcome barriers. It was agreed that lowering coverage to less than 95% would lead to large unavoidable outbreaks.

All agreed that the 80% coverage of the first dose recommended by GAVI could be achieved. Validation of coverage figures is of utmost importance through independent monitoring system. Budgeting for such monitoring must be taken into consideration. A comprehensive vaccine management assessment tool is available at the WHO Regional Office and can be used by anyone in the immunization programme.

5. MONITORING MEASLES SUSCEPTIBILITY

5.1 The measles strategic planning tool

Dr P. Strebel, WHO/HQ

The Measles Strategic Planning (MSP) Tool is being developed by WHO in collaboration with PATH, AIM and CDC. The tool is an Excel-based quasi-dynamic model of measles transmission that allows countries to input coverage, surveillance and programme cost information and generate an immunity profile of their population and explore the impact of different vaccination strategies on the future incidence of measles. In addition, the tool generates estimates of the cost-effectiveness of these different strategies which can be useful for advocacy and planning. The validity of the output from the tool is only as good as the accuracy of the input information, especially immunization coverage, measles case-fatality ratios, and programme costs. Limitations of the MSP tool include that it does not capture the cyclical nature of measles and therefore there may be large differences between the reported and tool-generated number of measles cases and deaths for a given year. The tool is undergoing further validation and field testing and the target date for its release is mid 2008.

5.2 Sudan: experience with the MSP tool

The Sudan immunization programme started using the MSP tool immediately after a training workshop organized by the WHO Regional Office in Lahore, Pakistan, in June 2007. Orientation sessions and peer reviews were conducted involving paediatricians and other relevant partners/departments. Different scenarios were run using various options selected among evidence-based measles elimination strategies. One option selected by the country included improving routine MCV1 coverage to reach >90% by the end of 2015, conducting measles supplementary immunization activities every three years starting in 2007 and ending in 2015 targeting children 9 months to < 5 years and reaching 95%. With the option selected, the total measles cases averted between 2006 and 2015 were 5 400 910 and the total measles deaths averted for the same period of time were 71 968, with an 83% reduction in measles mortality compared to 2000 levels. The incremental cost was US\$ 29 415 844. The cost ratios were as follows: cost per measles case averted was US\$ 58.98, per death averted was US\$2188, and per DALY averted was US\$ 51. Among the three options, this one seems to yield the maximum benefits in term of measles cases and deaths averted and reduction in measles mortality and with a lesser cost per DALY averted. However, selection among different scenarios depends on the availability of resources.

Implementation of the option selected started in November 2007 by conducting the first follow up campaign in six states in Sudan targeting 5 million children under 5 years of age as part of the child survival initiative. Activities also included distribution of ITNs, de-worming and distribution of health education messages promoting breastfeeding and personal hygiene. Coverage of phase one was 96% and the follow-up campaign will continue in the first quarter of 2008 depending on the availability of resources.

The major lesson learnt from this experience was that the tool is flexible, user-friendly and very useful for strategic planning and monitoring population immunity. The tool can be used as an advocacy tool, for resource mobilization, and as a decision-making tool. However, its use requires training. Completeness and accuracy of historical/population data are very crucial to yield reliable

and realistic outputs. The experience in Sudan and according to different options selected has shown that there is limited value of changing MCV1 from 9 months to 12 months. This needs to be clarified and revisited, as it contradicts the existing epidemiological assumption on the benefits of shifting age of MCV1.

5.3 Group work: application of the tool

The aim of this session was to apply the algorithm to all countries (one by one) to: assess how far/close countries are from the required elimination criteria; identify remaining gaps in all measles surveillance/investigation components that should be addressed to satisfy the required criteria/indicators; and agree on a simple 1 year operational action plan to fill these gaps.

Discussion

Groups discussed the application of the algorithm, and some participants proposed the inclusion of vaccination coverage and increasing the rate of non-measles febrile rash illness. Some participants recommended that the private sector be involved in surveillance. It was added that investigating fever/rash countries may be costly in some densely populated countries. The size of the outbreak reflects the susceptibility of a population. Finally, it was agreed that the algorithm is a tool used to assess, monitor and maintain quality indicators.

6. RUBELLA/CONGENITAL RUBELLA SYNDROME CONTROL AND ELIMINATION

6.1 Rubella outbreak in Egypt: lesson learnt and next steps

In 2005, 520 confirmed rubella cases were detected. In 2006, 2287 confirmed rubella cases were detected. The incidence rate of rubella was 3.6 per 100 000. In 2007, 11 210 confirmed rubella cases were detected in almost all governorates (incidence rate of 15.2 per 100 000). The vast majority of cases (93.3%) were among patients over 10 years of age and 97% of cases were not previously immunized.

The strategy for measles and rubella reduction and elimination in Egypt was to maintain high routine vaccination coverage (>95%) for M and MMR at national and governorate levels and to achieve > 95 % coverage in each district. Plans include changing the schedule for measles and rubella vaccination, catch-up vaccination in 2 phases and optimized case management. MMR was introduced in 1999 and an MMR school campaign conducted in 2001–2003 at school entry resulted in high immunity in younger age groups (<12 years in 2007) and accumulated susceptibles in older age groups (>12 years); outbreaks then occurred. Use of febrile rash illness surveillance strengthened both measles and rubella surveillance and increased the capability to detect CRS.

Lessons learnt include the importance of: media messages during outbreaks; transparency with media; action in time; strengthening CRS surveillance; establishment of guidelines for outbreak investigation; use of WHO recommended surveillance indicators; strengthening the role of the private sector in reporting; training of the staff on febrile rash illness and outbreak investigations in all governorates and active surveillance for contacts during outbreaks; and health insurance as an important reporting site.

Constraints are: the unavailability of MMR vaccine of good strain with minimal adverse events; mumps outbreak threat if using MR vaccine only in the campaign; long preparation time needed for micro planning; ensuring human resources and training; large target (> 30 million) for campaign; high costs and limited financial resources.

6.2 National strategies for rubella/CRS control and elimination

Islamic Republic of Iran

In December 2003, the Ministry of Health and Medical Education conducted a nationwide mass immunization campaign during a 1 month period. The target population was people 5 to 25 years old (33 000 000). The goals were measles and CRS elimination

CRS elimination strategies were: using rubella-containing vaccine for the catch-up campaign; integration of rubella vaccine in the routine immunization programme; implementation of a two-dose schedule above one year of age, maintaining high rubella-containing vaccine coverage; assessing rubella susceptibility profile among key populations; vaccination of childbearing-age women (according to need); and establishing CRS surveillance.

Major activities were strengthening the EPI programme, conducting a serosurvey, providing rubella-containing vaccine and implementing CRS surveillance

A study on the need for a MR campaign for women above 25 years was conducted by the Ministry with UNICEF support. The rubella antibody level in people aged 25–40 years was monitored. The study focused on 90 rural/urban clusters in 30 districts. 4680 samples were taken in March 2003. Sentinel site assessment was conducted in order to find a better understanding on CRS data.

An assessment of congenital rubella syndrome in eye and heart surgery hospitals in Iran was made in 2007–2008 to find suspected cases of CRS in 7 main sentinel sites, estimate the incidence of congenital rubella syndrome in those sites and estimate the proportion of congenital heart/eye disease due to CRS in selected hospitals. Five cities were chosen that had main referral medical hospitals and clinics for eye and heart surgery for children less than 1 year (Tehran, Mashhad, Shiraz, Isfahan, Zahedan).

For a period of nine months all children admitted to the selected wards will be checked for signs of CRS. A questionnaire will be filled blood sample will be taken from each child to check the IgM for Rubella. An introductory training workshop was held for the hospital's study supervisors. A guideline, designed questionnaire, suspect case ID card and sampling syringes and tubes were sent to each hospital.

During a period of 1 month with good supervision of the case finding process, 20 suspects cases were detected. In each case, a questionnaire was filled and a blood sample was taken after taking informed consent and sent to the central laboratory. The sample results were all negative for rubella. During the pilot phase, selected wards were monitored for proper function every week.

Libyan Arab Jamahiriya

Rubella vaccine was introduced to the immunization schedule (1993) at age of 18 months. A vaccination campaign was conducted in 2005 with two doses of MMR which were given at the ages of 12 months and 18 months. In addition, catch-up campaigns were conducted in 2005. Follow-up campaigns are planned during 2008.

Surveillance includes notification and reporting of measles and rubella, zero reporting and active surveillance. The surveillance of measles and rubella is case based. Laboratory surveillance is conducted through the national measles/rubella laboratory. All samples are tested for both measles and rubella and at least 10% of the samples are sent to the RRL in Tunisia.

Discussion

Participants discussed the various experiences of rubella outbreak in some countries. The noticeable shift to older age groups in outbreak raises the concern of CRS. Susceptibility studies are needed for the changing epidemiology of rubella, to decide the target population for vaccination, taking into consideration to avoid inadvertent vaccination of pregnant females. Participants agreed for the importance to integrate CRS surveillance measles/rubella.

6.3 Setting up a CRS system: country experience, achievements and constraints*Jordan*

MMR was introduced in 2000 with high coverage. From 2003 MMR vaccination was validated at school entry. In 2008, 2 doses of MMR will be given: the first dose at 12 months of age and the second at 18 months of age.

CRS surveillance was established in 2001 and included distribution of case definitions, case investigation forms and technical instruction, advocacy meetings with paediatricians deafness centres, ophthalmologists and maternal and child health staff.

Constraints include competing priorities (polio, measles, other communicable and noncommunicable disease at the district level), limited public health staff at central and peripheral level, lack of funds to implement the proposed activities advocacy, seminars, training, educational materials and high cost of strengthening CRS surveillance.

Proposed activities to strengthen CRS surveillance are: advocacy meetings, seminars for the public and private sectors (ophthalmologists, deafness centres, maternal and child health centres), social mobilization, educational materials (for technical staff and the public), training gynaecologists, obstetricians, general practitioners and midwives, and supervision.

Oman

Strategies implemented for CRS elimination are routine immunization of women of childbearing age and vaccination of all postpartum women and strengthening of active and passive surveillance for CRS through active case finding and the CRS registry.

The surveillance case definition includes suspect case, clinically confirmed, laboratory-confirmed and congenital rubella infection (CRI). A CRS registry was developed at national level and a regional CRS registry was established in 2000 with a commitment of long-term follow-up of all registered cases. It includes a database of CRS cases created through record review (94 cases). In addition, it contains long term follow-up of the cohort required for late manifestation of CRS and rehabilitation issues

CRS roles and responsibilities: the National Headquarters takes the Overall Responsibility with Focal point (Director, Dept. of Communicable Disease Surveillance and Control). At regional (provincial) level there are parallel records in the regions, with a focal point (epidemiologist) in the Directorate, regional staff who have better access to missing information and better facilities for tracing and investigation. Efforts are also being made towards better follow-up and intersectoral collaboration with biannual follow-up by specialities.

Responsibility for diagnosis lies with paediatricians, neonatologists, obstetricians, oto-rhino-laryngologists, ophthalmologists, cardiologists, neurologists, endocrinologist/diabetologists. In conclusion, the CRS registry helped in improving the surveillance of CRS as well as monitoring the complications.

Discussion

It was agreed that there was a need to have standard guidelines for the surveillance of congenital rubella syndrome but that financial considerations needed to be taken into account.

6.4 Measles/rubella laboratory meeting outcomes

Dr H. Ahmed, WHO/EMRO

The Regional Office has established a regional goal to eliminate measles in 2010, and laboratory support of surveillance is an indispensable element of the programme. The laboratory network in the Region has been evolving processes in the past two years; to date all national measles laboratories have full serological capacity. Two regional reference laboratories (RRL), two sub-regional reference laboratories and 22 national measles laboratories have been designated for the diagnosis of measles and rubella.

For measles laboratory diagnosis, it is recommended that measles be diagnosed using serological methods which measure virus-specific IgM antibody in serum sample. Most of existing measles/rubella laboratory network functions well, and there has been a significant improvement in the quality of case-based surveillance and laboratory data. All network laboratories that participated in proficiency testing for measles and rubella serology passed with results $\geq 95\%$ except one. Quality assurance procedures are being implemented at the national measles laboratory and the number of national measles laboratories sending samples for quality control is increasing. 19 NML participated in serum referral to RRLs for validation, obtaining over 90% concordant results. Onsite visits and accreditation reviews were carried out during the past two years and 17 countries passed accreditation review. Regional virus detection and genotyping has been strengthened Recently a workshop on laboratory diagnosis for measles and rubella virus detection and genotyping was organized by the Regional Office and held in the

regional reference laboratory, Muscat, Oman. It was attended by 10 participants from nine countries which have virus isolation or PCR facilities.

Some of the countries in the Region are not fully utilizing the laboratories by not testing >80% of measles suspected cases recommended in the measles elimination phase. 5–10 blood samples are required to be collected from initial cases during outbreaks for laboratory confirmation and to collect specimens for virus isolation/detection and genotyping. Strong communication and cooperation between laboratory professionals and surveillance officers is the key element for the success of any surveillance programme.

Constraints and challenges include: logistic problems with specimen referral from districts to NL and to RRL for quality control; sharing information on a timelier basis and improving collaboration between laboratory staff and epidemiologists; collection of clinical samples during outbreaks for virus isolation in laboratories with sufficient capacity or sending samples RRL to facilitate genotyping of circulating virus; need to establish sub-national laboratories to appropriately monitor and report disease from remote areas and difficult geographical areas. As well, more appropriate alternative sampling like dried blood or dried serum, which has shown good sensitivity and specificity in several studies, needs to be introduced in areas with logistic problems.

The Regional Office will continue to assist in building mechanism for strengthening the laboratory network, linking laboratory data and activities to surveillance, periodically reviewing quality assurance through accreditation and proficiency testing programme, validating results, providing supplies and equipment and feedback on laboratory reports, and building capacity for laboratory personnel.

7. REPORTING ISSUES

7.1 Quality of country measles monthly reports

Mr R. Bekhit, WHO/EMRO

Progress of country reports was presented in terms of reporting regularity, completeness and zero reporting and the establishment of outbreak reporting mechanisms. Problems were highlighted in the areas of data, district reporting of suspects and specimens collected, case finding, indicators and age and vaccination status analysis. Countries are urged to look carefully at the data they are reporting and analyse their country situation in depth.

7.2 WHO/UNICEF Joint reporting form

Dr N. Teleb, WHO/EMRO

The WHO/UNICEF Joint Reporting Form (JRF) on immunization is an annual report for all data pertaining to occurrence of vaccine-preventable diseases and immunization activities in each country. To avoid inconsistency of data reported to each of WHO and UNICEF, the 2 organizations agreed to request that all countries report using copies of the same report, including the same set of data. In past years, an updated copy of the JRF was sent to each country each February, with the request that the filled JRF be returned to regional offices and headquarters of the 2 organizations by

mid April. Review of the data and deriving the best estimate of vaccination coverage was generally not available before September of each year.

It was felt that there is a need to shorten the period of the reporting process of the JRF. This meeting, which was attended by all EPI managers, was taken as an opportunity to agree on new reporting dates. Participants of the meeting shared their concerns about the time needed to collect information from the different peripheral reporting sites. It was finally agreed on the following timeline:

- 17 December 2007: updated blank JRF to be sent by EMRO to the countries
- 29 February 2008: filled in JRF to be sent to EMRO.

Countries promised to send the JRF as early as possible to allow review by EMRO and amendment before forwarding to WHO headquarters.

8. RECOMMENDATIONS

To countries

1. Increase and sustain political and financial commitment to accelerate implementation of activities to achieve and sustain measles elimination by 2010.
2. Monitor susceptibility profiles using their coverage and surveillance data on an ongoing basis and take corrective measures to ensure measles elimination by 2010.
3. Maintain high population-based immunity through administration of two doses of measles vaccine (second dose provided through routine or supplementary immunization) achieving > 95% coverage at the national level in all the lowest administrative units.
4. Adopt an interim goal to achieve >90% MCV1 coverage at the national level and >80% MCV1 coverage in all districts before the year 2010.
5. Adopt the basic strategy to achieve measles elimination by:
 - achieving high population-based immunity by increasing MCV1 coverage
 - conducting high quality supplementary immunization activities that target susceptible cohorts and achieve high coverage (>95%) in all districts
 - conducting follow-up supplementary immunization activities every 3–4 years
 - introducing routine MCV2 after achieving sustainable coverage > 80% (WHO/UNICEF best estimate) for MCV1 for at least 1 year
 - conducting follow-up supplementary immunization activities until they achieve high population immunity with >95% MCV2 coverage in all districts across all cohorts.
6. Validate routine and supplementary immunization coverage data on a regular basis using practical and suitable tools like DQS, DHS/MICs surveys, desk reviews, CES, including validation of coverage at the provider level.

7. Use only vaccines of assured quality. In addition, countries should regularly assess their vaccine central stores and vaccine management systems, using WHO recommended tools. Weaknesses should be picked up and addressed accordingly. EMRO should provide technical support to all countries that request it.
8. Conduct timely and complete investigation (including a detailed age by vaccination status breakdown) of all outbreaks/chains of transmission and that these investigations be used for implementation of corrective measures and that reports are shared with partners at the regional and global level as per recommendations in the IHR. WHO and UNICEF and other partners are requested to assist with outbreak investigations when needed.
9. Start utilizing the proposed surveillance indicators and measles elimination validation algorithm to raise awareness of stakeholders and monitor performance and quality of the measles elimination programme. Programme managers are encouraged to provide feedback on performance indicators on a monthly basis to all levels.
10. Formulate a national committee responsible for monitoring progress in measles elimination. This committee's main goal should be oversight on the degree of implementation of the measles elimination programme, to monitor progress towards elimination and advise on best strategies to reach elimination by 2010. It's highly recommended that this task be added to one of the already existing and functioning national committees, in order to avoid unnecessary multiplication of EPI committees and ensure a basic level of coordination and integration between these committees. Programme managers should provide updates to this committee at least four times a year.
11. Ensure Vero/SLAM cells are used for measles and rubella virus isolation in order to avoid the biohazard of the B95a cell line.
12. Enhance collection of clinical specimen for measles and rubella virus detection and genotyping.
13. In sequencing laboratories in the Region, submit viruses sequence information to the WHO genotype database on a timely basis.
14. For specimen referral for validation or genotyping, submit epidemiological and laboratory data using the shared data transfer Excel sheet.
15. In Egypt, conduct an urgently-needed nationwide MR campaign.

To the WHO Regional Office

16. Provide data management training to countries in need to support streamlining measles surveillance data.
17. Maintain the annual measles and rubella laboratory network meeting.

18. Finalize the regional measles elimination validation process and surveillance guidelines and share them with national measles elimination teams in the next 3 months.
19. Provide training opportunities to countries where staff turnover is a problem and to countries with adequate facility to keep strengthening measles and rubella virus detection capacity.

Annex 1**PROGRAMME****Monday, 3 December 2007**

08:00–09:00 Registration

09:00–09:30 Opening Session

Message from Dr Hussein A. Gezairy, Regional
Director, WHO/EMRO

Election of Officers

Adoption of the Agenda

Session 1. Global and Regional updates

09:30–09:45 Global progress on measles control and elimination

*Dr P. Strebel, WHO/HQ**Dr D. Featherstone,**WHO/HQ*

09:45–10:00 Regional progress towards measles elimination

*Dr E. Mohsni,**WHO/EMRO*

10:00–10:15 Discussion

10:15–10:40 Update on measles aerosol vaccine nebulizers

*Dr A. Restrepo, WHO/HQ***Session 2. Challenges for meeting the 2010 measles elimination goal**11:00–11:15 Measles immunization campaign in Saudi Arabia:
Rationale, achievements, constraints and lessons
learned*National EPI Manager*11:15–11:30 Measles immunization campaign in the Syrian Arab
Republic:
Rationale, achievements, constraints and lessons
learned*National EPI Manager*

11:30–11:45 Discussion

11:45–12:00 Afghanistan experience with maintaining high
population immunity against measles*National EPI Manager*12:00–12:40 Country progress with respect to measles nationwide
immunization campaign:*National EPI Managers*

Egypt

Morocco

Lebanon

Pakistan

12:40–12:55 Discussion

12:55–13:00 Introduction to group work

Dr N. Teleb, WHO/EMRO

14:00–16:30 Group work session 1

Tuesday, 4 December 200708:30–10:10 Presentation and discussion of group work
(15 minutes presentation + 10 minutes discussion for
each group)*Group rapporteurs*10:10–10:30 Regional measles elimination validation process
(draft 1) and introduction to group work session 2*Dr E. Mohsni and Dr N.
Teleb, WHO/EMRO*

11:00–12:30 Group work session 2

12:30–13:00	Monitor measles susceptibility: MSP tool	<i>Dr A. Dabbagh, WHO/HQ</i>
13:00–13:15	Country experience with MSP tool: Sudan	<i>National EPI Manager</i>
13:15–13:30	Discussion	
14:30–14:40	Introduction to group work session 3	<i>Dr N. Teleb, WHO/EMRO</i>
14:40–16:45	Group work session 3	

Wednesday, 5 December 2007

08:30–10:10	Presentation and discussion of group work sessions 2 and 3 (15 minutes presentation and 10 minutes discussion for each group)	<i>Group rapporteurs</i>
Session 3. Rubella/congenital rubella syndrome control/elimination		
10:10–10:20	Rubella outbreak in Egypt: lessons learned and next steps	<i>National EPI Manager</i>
10:20–10:40	National strategy for rubella/CRS control/elimination: Islamic Republic of Iran Libyan Arab Jamahiriya	<i>National EPI Managers</i>
10:40–11:00	Discussion	
11:15–11:35	Setting up a CRS system: country experience, achievements and constraints Jordan Oman	<i>National EPI Managers</i>
11:30–11:50	Discussion	
11:50–12:05	Report on measles laboratory meeting outcomes	<i>Dr H. Ahmed, WHO/EMRO</i>
Session 4. Reporting issues		
12:05–12:25	Quality of country measles monthly reports	<i>Mr R. Bekhit, WHO/EMRO</i>
12:25–13:00	2007 country annual report	<i>Dr N. Teleb, WHO/EMRO</i>
Session 5. Recommendations and closure		
13:00–13:30	Meeting recommendations	
13:30	Closing session	

Annex 2

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