1. Introduction

In 2005, World Health Assembly resolution WHA58.15 endorsed the Global Immunization Vision and Strategies (GIVS) that included a global goal for measles mortality reduction: “by 2010 or earlier, mortality due to measles will be reduced by 90% compared to the 2000 level”. In 2007, the South-East Asia Region (SEAR) Technical Consultative Group for Polio Eradication and Control of Vaccine Preventable Diseases (TCG) endorsed the revised Regional Strategic Plan for Measles Mortality Reduction for 2007-2010, which had this goal.

The key strategies recommended to achieve the goal were:
   a. Improving and sustaining routine immunization coverage;
   b. Providing second dose of measles vaccine through catch-up immunization campaigns and routine second dose/follow up immunization campaigns;
   c. Improving measles surveillance, including tracking and investigation of suspected measles outbreaks;
   d. Improving case management including administration of vitamin A.

Globally, measles mortality has been reduced by 74% in 2007 as compared to 2000. The WHO Region of the Americas achieved regional measles elimination in 2002. The European, Eastern Mediterranean and Western Pacific Regions have made progress towards their measles elimination goal. The African Region achieved 89% mortality reduction. Though the reduction of measles mortality in the South-East Asia Region is a modest 42%, all countries except India have achieved the 90% mortality reduction target.

The progress has generated interest in the possibility of setting a global measles elimination goal. Accordingly, the 125th Session of the WHO Executive Board directed the WHO secretariat to submit a report on the “feasibility of global elimination of measles” to the 126th Executive Board in January 2010. In line with this objective, the High Level Preparatory Meeting (HLPM) for the 62nd session for the SEAR Regional Committee reviewed the measles situation in the Region in July 2009 and recommended that,

- Before setting an elimination goal a thorough understanding of the regional situation, the relevant activities required, the estimated costs, political commitment and sustainability issues need to be understood by Member States.
- Measles should be included as an item on the agenda of the Regional Committee meeting in September 2009, with the outcome of the Regional Consultation on Measles Elimination, 25-27 August 2009, to be provided as an addendum to the working paper on measles.

2. Regional consultation on measles elimination

The regional consultation on measles elimination was held from 25-27 August 2009 in the South East Asia Regional Office of WHO, New Delhi, with the overall objective of developing a consensus on establishing a measles elimination goal in the SEAR.
The specific objectives were to:

- Review progress in achieving the 90% measles mortality reduction goal in Member States;
- Identify the key steps necessary in measles immunization and surveillance to achieve a measles elimination goal;
- Review issues on injection safety (AEFI), vaccine supply, cold chain, funding and others, that need to be addressed in order to achieve measles elimination; and
- Outline a roadmap to reach a measles elimination goal.

All Member States except the Democratic People’s Republic of Korea participated in the consultation. In addition three members of the SEAR Immunization Technical Advisory Group and four partners of the Global Measles Initiative participated in the consultation. The list of participants is available in Annex 1 and the detailed programme in Annex 2. Dr Samlee Plianbangchang, Regional Director, South East Asia Region, inaugurated the consultation with his opening address which is provided in Annex 3. Ms. Shakuntala Gamlin, Joint Secretary of the Ministry of Health and Family Welfare, Government of India, chaired the meeting, with Dr. Piyanit Tharmaphornpilas, EPI Manager, Ministry of Public Health, Thailand, serving as Co-Chair. Dr. Ambujam Nair served as the Rapporteur.

The outcome of this consultation will be presented to the Regional Committee of the SEAR at its meeting in Kathmandu from 7-11 September 2009. The conclusions and recommendations would contribute to the development of the WHO secretariat global report on “feasibility of global measles elimination” to be presented to the Executive Board at its meeting in January 2010.

3 Review of global and regional implementation of the measles mortality reduction strategies

The objectives of the session were to review the progress in achieving the global and regional goal of reducing estimated measles mortality by 90% in 2010 as compared to 2000 estimates, and to identify challenges that must be overcome to achieve this goal by 2010.

The global and regional progress demonstrated that the recommended strategies for measles mortality reduction are highly effective. The contribution of a nation-wide supplementary immunization activity (SIA) in reducing the pool of susceptibles in a short time was particularly impressive. Globally, there has been an overall reduction of 74% in measles mortality from an estimated 750,000 deaths in 2000 to 197,000 deaths in 2007. Four regions have achieved the set goal. The Western Pacific Region achieved a mortality reduction of 73%. The SEAR achieved 42% reduction.

Many challenges remain for SEAR. These challenges include improving routine MCV1 coverage and providing children with a second dose (MCV2). With regard to routine immunization, WHO/UNICEF estimate that 60% of the 21 million children globally who have not received the first dose of measles through routine immunization are from six large countries (India, Nigeria, China, DRC, Pakistan and Ethiopia). Of the missed children, an estimated 7.6 million are from India. Of the 47 high priority countries identified in 2000 by WHO and UNICEF, 46 countries have conducted a nation-wide catch-up campaign by 2009, the exception being India. The SIAs have provided a platform for integrating other health interventions, such as Vitamin A distribution, tetanus toxoid, insecticide-treated bed net distribution, and deworming, etc., in many countries.
The achievements in SEAR are summarized below

Measles routine immunization coverage in the Region increased from 61% in 2000 to 75% in 2008. However approximately 10 million children born in 2008 were not vaccinated against measles. In 2007 Bhutan, DPR Korea, Maldives, and Sri Lanka achieved more than 90% coverage with routine measles vaccination nationally and in at least 80% of the districts. Thailand achieved national coverage of more than 90% but district-level data are not available. Bangladesh, Indonesia, and Myanmar had a national coverage of more than 80%. Coverage in Nepal was 79% and in Timor-Leste 73%. The coverage in India increased from 54% in 2000 to 70% in 2008.

After completion of their measles catch-up campaign, Bangladesh, Bhutan, DPR Korea, Maldives, Myanmar, Nepal and Sri Lanka have started case-based surveillance. Indonesia is implementing case-based surveillance in a phased manner. In Bangladesh, India, Indonesia, Myanmar and Nepal, the polio surveillance networks supported by WHO also assist in measles/rubella surveillance. The regional measles/rubella laboratory network consists of 20 laboratories of which 18 are accredited. The national surveillance systems did not detect any suspected measles outbreak in DPR Korea, Bhutan and Maldives in 2008. In 2008 Bangladesh, Myanmar, Thailand and Sri Lanka have fully investigated all suspected measles outbreaks and confirmed these through the laboratory network. Indonesia investigated 47% of the outbreaks and Nepal investigated 81% of the outbreaks. The six states of India, where measles surveillance has been strengthened, investigated 95% of outbreaks. All Member States, except India, report measles information on a monthly basis. Challenges include the difficulty of linking reported measles cases to the laboratory information.

All countries in the Region except India and Thailand have conducted a nation wide measles catch-up campaign to provide a second dose for susceptible age groups. In the Region, over 120 million children received measles vaccination in these campaigns from 2000-2008. Nepal and Timor-Leste have conducted a follow up campaign in 2008 and 2009 respectively. Bangladesh and Indonesia are planning follow up campaigns in 2009 and 2010. In addition to conducting a catch-up campaign, Bhutan, DPR Korea, Maldives and Sri Lanka are providing a second dose through routine immunization in all districts. Thailand has been providing a second dose through routine services since 1997. India plans to introduce a routine second dose, in 17 states with evaluated routine immunization coverage of more than 80%. In addition, the country’s National Technical Advisory Group for Immunization (NTAGI) has recommended, to conduct a measles catch-up campaign in 10 high priority states from 2009-2012. Thailand is planning to conduct a measles catch up campaign in provinces which are prone to measles outbreaks, as well as in adolescents and young adult populations with focus placed on institutions (i.e. universities, military and factories, etc).

Planning for measles campaigns provided an opportunity to improve routine immunization services through conducting middle level managers and basic health worker trainings, establishing AEFI monitoring system, addressing the gaps in the cold chain and developing a system to dispose the waste accumulated during vaccination sessions.

Countries that have conducted high quality SIAs have reported a sharp, significant reduction in measles cases following the campaigns. High level of measles control in these countries has revealed previously unrecognized high prevalence of rubella, consistent with other countries in the world with effective accelerated measles control.
Measles immunization, together with vitamin A supplementation, is a priority health intervention during and after emergencies. Immunization has to include all children from 6 months through 14 years of age. At a minimum, children from 6 months through 4 years of age must be immunized. The choice of the ages covered will be influenced by vaccine availability, funding, human resources and local measles epidemiology. The major take home message is that national authorities should develop and implement a measles control plan as rapidly as possible, after emergencies.

Conclusions
The consultation concluded as follows:

- The recommended strategies for measles mortality reduction are highly effective in every country which has fully implemented these.

- The regional reduction in measles mortality is 42% and excluding India it is 94% in 2007 compared to 2000 estimates. All countries in the SEAR, except India, have reached or exceeded the 2010 goal of a 90% reduction in measles mortality. India achieved 23% mortality reduction, but accounts for two third of the remaining global mortality from measles.

- The SEAR will not achieve the regional measles mortality reduction goal by 2010. Achievement of the global and regional goal to reduce measles deaths by 90% depends on India, in particular the full implementation of recommended strategies in the 10 states with high burden and low coverage in their country. Based on the provisional plans presented, the earliest date for achievement of this goal is end 2013 assuming full implementation in all high burden states by this date.

- The critical interventions required to achieve and sustain the 90% measles mortality reduction goal in the Region are:
  
  I. Successful implementation of high quality catch-up SIAs in all high burden states of India
  II. Maintaining the gains in other countries through further improvements in routine immunization, timely high quality follow-up SIAs, introduction of routine MCV2 (where appropriate), and epidemiologic and laboratory surveillance that meets performance standards
  III. Strong political and financial commitment by countries and partners to support these activities

4. Introduction to Measles Elimination

The objectives of the session were to introduce the background, concepts and definitions of a measles elimination goal, share the experiences of the WHO regions that have already set a measles elimination goal and to discuss the feasibility of measles elimination.

The WHO Region of the Americas set a goal of elimination of measles by 2000 and achieved regional measles elimination in 2002. The Eastern Mediterranean Region
(2010), European Region (2010) and Western Pacific Region (2012) each have a measles elimination goal.

Since 2000, WHO has worked with technical experts, partners of the Global Measles Initiative to reach consensus on an appropriate definition of measles elimination. In 2008, a consensus document on “Indicators for monitoring progress towards elimination and targets suggestive of having achieved elimination” was developed. It defines measles elimination as “The absence of endemic\(^1\) measles cases for a period of twelve months or more, in the presence of adequate surveillance”.

The consensus document also proposes indicators for monitoring progress towards elimination, and targets suggestive of having achieved elimination, as given below:

- **Vaccination coverage**
  - **Vaccination coverage indicator**: Vaccination coverage of both first routine measles dose (MCV1) and second dose of measles vaccination (routine or SIA)
  - **Vaccination coverage target**: Achieving and maintaining at least 95% coverage with both MCV1 and the second dose of measles vaccination in all districts and nationally.

- **Outbreak size**
  - **Outbreak size indicator**: monitoring of outbreak size of ALL outbreaks including outbreaks in closed settings and outbreaks where interventions have taken place to stop the outbreak
  - **Outbreak size target**: At least 80% of outbreaks should have less than 10 confirmed measles cases

- **Incidence**
  - **Incidence Indicator**: measles incidence per million per year
  - **Incidence target**: Measles incidence of less than 1 confirmed measles case per million population per year excluding cases confirmed as imported

- **Endemic measles virus strain(s)**
  - **Endemic Measles Indicator**: The number of endemic measles virus strains
  - **Endemic Measles Target**: Zero cases of measles caused by an endemic strain for at least 12 months

In April 2009, WHO’s Strategic Advisory Group of Experts (SAGE) concluded that measles eradication is defined as the worldwide interruption of measles transmission and that the simultaneous elimination of measles in all WHO regions would equate to global eradication.

The International Task Force on Disease Eradication in June 2009 concluded that “measles eradication is biologically feasible using tools that are currently available, as already demonstrated in the Americas, although implementation challenges remain in each of the remaining five regions”

\(^{1}\) Endemic measles: indigenous or imported measles virus that persists for a period of 12 months or more in any defined geographical area.
Measles eradication is **biologically feasible** because of the properties of the **virus and the disease**, such as humans are the only host, life-long immunity occurs after natural infection, there is only one serotype, genetically stable virus and no long-term carrier state. The challenges are the highly infectious nature of the disease requiring >93-95% population immunity to stop transmission, factors favouring the transmission such as population growth and density, international travel and the HIV epidemic.

Measles eradication is **technically feasible** because of the properties of the **tools that are available for control**, such as measles vaccines which are safe and effective, and which provide long-term protection against all known genotypes, and the availability of accurate diagnostic tests. The challenges are that the vaccine requires cold chain and sterile injection, vaccine is not effective in early infancy, the occurrence of rare, severe side effects in immuno-compromised individuals and necessity of two doses.

Elimination is biologically and technically feasible and has been achieved in the WHO Region of the Americas. Implementation challenges remain in each of the other three regions which have an elimination goal. The Western Pacific has established a goal of measles elimination by 2012 and there is strong political commitment. The major challenge in that Region is disease in unimmunized adults. Experience with regional elimination shows that in Europe, the risk of adverse events is perceived to be more than the risk of disease. In the Eastern Mediterranean Region, political instability and civil unrest pose challenges for implementation of elimination strategies in some countries.

In SEAR, large birth cohorts, densely populated areas and migration patterns will pose particular challenges to achieving measles elimination throughout the Region.

Data presented from Sri Lanka indicate that measles elimination has been achieved in at least one Member State in the SEAR. Several other countries (Bangladesh, Bhutan, Maldives, DPRK, and Nepal) are approaching elimination or may have already achieved elimination but require additional documentation.

**Conclusions**

The consultation concluded as follows:

- Global and regional experience suggests that measles elimination is biologically and technically feasible in SEAR.
- The SEAR can apply or adapt the definition of measles elimination along with the indicators and targets for monitoring progress towards measles elimination, as described in the HQ consensus document “Indicators for monitoring progress towards measles elimination and targets suggestive of having achieved elimination”.
- In addition to currently planned research to more accurately determine the mortality from measles in the most affected states, research is needed to address the following issues that may influence the biological and technical feasibility of measles elimination in SEAR:
  I. What is the immunogenicity and vaccine effectiveness of measles vaccine at 9 months of age in the districts of Uttar Pradesh and Bihar?
  II. What population immunity is required to stop measles transmission in these same areas for >12 months? and
  III. What vaccine delivery strategies are needed to reach the required level of population immunity?

5. **Important programmatic considerations for measles elimination**
The objective of the session was to understand the programmatic considerations to achieve measles elimination and set the stage for group work.

5.1 Immunization strategies
Immunization strategies necessary for measles elimination were presented. Research has demonstrated the need to have homogenous population immunity of ≥ 93% to achieve measles elimination.

The Strategic Advisory Group of Experts (SAGE) in 2008 recommended that all children receive two doses of measles containing vaccine (MCV), either through the routine immunization system or through supplementary immunization activities (SIAs).

Further to this, the SAGE in 2009 has recommended that:

- Countries with ongoing measles transmission and MCV1 delivered at 9 months of age should administer routine MCV2 at 15-18 months of age.
- In countries with very low measles transmission (that is, those that are near elimination), that thus have a low risk of measles infection among infants, MCV1 can be administered at 12 months of age. The optimum age for administering MCV2 would be either at 15-18 months or at school entry, depending on whichever strategy results in high coverage.
- The interval between SIAs should be determined through an analysis of the susceptible population as a function of routine immunization rates; previous SIA coverage rates, primary vaccination failures and levels of natural infection need to conduct a follow-up campaign when the number of susceptible preschool-age children approaches the size of a birth cohort.
- The criteria for starting routine MCV2 is coverage with MCV1 of ≥80% for 3 consecutive years (WHO/UNICEF estimates).
- The criteria to stop SIAs is MCV1 and routine MCV2 coverage ≥90-95% nationally in countries.

To date, Bhutan, DPRK, Indonesia, Maldives, Sri Lanka and Thailand have introduced MCV2 into their routine immunization programme. However, even in countries with a two dose routine immunization schedule, the use of periodic SIAs to vaccinate accumulated susceptibles will remain necessary until coverage of both doses reaches 95%.

In the SEAR perspective, the immunization requirements necessary to reach measles elimination translate to

- Improving MCV 1 coverage to 95% in Bangladesh, Myanmar, India, Indonesia, Nepal and Timor-Leste.
- Conducting measles catch up campaigns in all sates of India and in geographical areas or for specific age groups based on the disease epidemiology in Thailand.
- Conducting one follow-up campaign in Bhutan and Maldives and periodic follow up campaigns in Bangladesh, Indonesia, India, Maldives, Myanmar, Nepal and Timor Leste. Sri Lanka may also need to conduct a follow up campaign to susceptible age group. i.e. current 10-15 years

India is planning to introduce MR vaccine as a second routine dose in states with MCV1 coverage in excess of 80% for the past three years. It was suggested that SIAs could be
implemented in high burden states (MCV1 <80% and/or large population with past history of low coverage). However, it is important that all states – high, medium or low burden – will eventually need to conduct measles SIAs to reach measles elimination.

High burden measles states, in particular Uttar Pradesh and Bihar, are the focus of continued polio eradication efforts. Significant time and resources of health personnel and communities in these states continue to be spent on polio eradication activities. There was an expressed concern of whether measles SIAs could be conducted concurrently. It was stated that the consideration of whether measles SIAs can be implemented in states with circulating polio virus should not be viewed as an either or decision. The existing infrastructure, capacity, micro-plans and momentum of states conducting regular polio campaigns, will, on the contrary, be beneficial in planning measles SIAs.

A measles strategic planning tool, which is a quasi dynamic model, has been used to project immunization options for SEAR countries for the period 2010-2020. However these projections need to be considered in the context of actual routine immunization coverage, coverage of previous SIAs and disease epidemiology.

Table 1. Projected immunization needs to reach measles elimination by 2020

<table>
<thead>
<tr>
<th>Country</th>
<th>Improve routine immunization coverage above 2008*</th>
<th>Catch-up campaigns</th>
<th>Follow-up campaigns</th>
<th>Introduce routine second dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>06%</td>
<td>Completed</td>
<td>2010</td>
<td></td>
</tr>
<tr>
<td>Bhutan</td>
<td>Achieved</td>
<td>Completed</td>
<td>2011</td>
<td>Introduced</td>
</tr>
<tr>
<td>DPR Korea</td>
<td>Achieved</td>
<td>Completed</td>
<td></td>
<td>Introduced</td>
</tr>
<tr>
<td>India</td>
<td>25%</td>
<td>10 priority states for mortality reduction before 2013 Remaining states: before the target year for measles elimination, Based on the MCV1 coverage, coverage of catch up campaign and disease epidemiology to ensure that number of susceptible do not reach the size of a birth cohort in particular state.</td>
<td>17 states with &gt; 80% coverage in 2009. Other states when MCV1 coverage reach 80%.</td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>12%</td>
<td>Completed</td>
<td>2009-2011(1)</td>
<td>2013-2015(1)</td>
</tr>
<tr>
<td>Maldives</td>
<td>Achieved</td>
<td>Completed</td>
<td>2011</td>
<td></td>
</tr>
<tr>
<td>Myanmar</td>
<td>13%</td>
<td>Completed</td>
<td>2011</td>
<td>2015</td>
</tr>
<tr>
<td>Nepal</td>
<td>16%</td>
<td>Completed</td>
<td>2012</td>
<td>2017</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>Achieved</td>
<td>Completed</td>
<td>2011(3)</td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>Achieved</td>
<td>Completed</td>
<td>2010(4)</td>
<td></td>
</tr>
<tr>
<td>Timor Leste</td>
<td>22%</td>
<td>Completed</td>
<td>2013</td>
<td>2017</td>
</tr>
</tbody>
</table>

* WHO/UNICEF estimates for 2008
(1) Phased campaign by provinces, (2) Expansion to all districts (3)Based on the disease epidemiology (4) Based on disease epidemiology
According to these projections, the additional immunization requirements in SEAR member states over current routine immunization services would be as given in Table 2.

**Table 2. Projected additional number of children (millions) to be vaccinated to reach measles elimination by 2020**

<table>
<thead>
<tr>
<th>Country</th>
<th>R1</th>
<th>SIAs</th>
<th>MCV2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>2.5</td>
<td>54</td>
<td>36.6</td>
<td>90.7</td>
</tr>
<tr>
<td>Bhutan</td>
<td></td>
<td>0.1</td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td>India</td>
<td>67.8</td>
<td>563.4</td>
<td>227.5</td>
<td>791</td>
</tr>
<tr>
<td>Indonesia</td>
<td>5.3</td>
<td>45.4</td>
<td>42.5</td>
<td>87.9</td>
</tr>
<tr>
<td>Maldives</td>
<td></td>
<td>0.1</td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td>Myanmar</td>
<td>1.3</td>
<td>10.4</td>
<td>7.7</td>
<td>18.2</td>
</tr>
<tr>
<td>Nepal</td>
<td></td>
<td>8.1</td>
<td>6.3</td>
<td>14.5</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td></td>
<td>1.5</td>
<td></td>
<td>1.5</td>
</tr>
<tr>
<td>Thailand</td>
<td></td>
<td>3.8</td>
<td></td>
<td>3.8</td>
</tr>
<tr>
<td>Timor-Leste</td>
<td>0.1</td>
<td>0.4</td>
<td>0.4</td>
<td>0.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>77</td>
<td>687.3</td>
<td>321.1</td>
<td>1085.3</td>
</tr>
</tbody>
</table>

5.2 Highly sensitive surveillance system including laboratory support

Surveillance systems must be strengthened to monitor the progress towards the achievement of an elimination goal. The surveillance system must provide the needed sensitivity and specificity to ensure the detection of measles virus.

In the SEAR, 10 of 11 countries are reporting aggregate measles data on a monthly basis. Bangladesh has initiated nationwide case-based surveillance with serological confirmation since 2008. Bhutan, DPR Korea, Maldives, Myanmar, Nepal, Sri Lanka and Thailand conduct case-based surveillance but serology is not done for all cases. Indonesia has phased in case-based surveillance. Case-based surveillance indicators were presented by Bangladesh, Nepal, Myanmar and Sri Lanka. Accordingly the achievements in two indicators related to reporting rate of suspected measles cases and laboratory confirmations of suspected measles cases are reasonably good. Viral detection is not being done in the Region on a regular basis.

The establishment of a regional measles/rubella laboratory network comprising 18 WHO accredited laboratories that perform serology, measles and rubella virus detection and genotyping is a major achievement.

The principle role of the laboratory is to detect/confirm suspected cases and outbreaks and identify circulating measles strains. As countries advance towards measles elimination, enhanced surveillance will be necessary. Considerations of the increased workload, capacity of personnel and additional costs must be taken into account when an expansion of the laboratory network is proposed. The cost of initial implementation
and the recurrent costs must be budgeted. As the greatest proportion of recurrent laboratory costs are those related to consumables (assay kits), good management is necessary to ensure that stock-outs and the expiration of kits do not occur. The WHO LabNet compiles an online library of measles and rubella virus strains and all countries are encouraged to submit virus strain information when possible. Alternative non-invasive sampling techniques may be considered in countries to ensure compliance. The necessity for close collaboration and open communication between surveillance and laboratory personnel and collating and linking laboratory data was highlighted.

When considering measles elimination in India, it was estimated that each state should have its own measles laboratory with the exception of some of the smaller states which could be grouped together.

The Regional Office has published measles and rubella surveillance and outbreak investigation guidelines that provide the relevant technical information to proceed towards measles elimination. To achieve surveillance indicators, Member States need to consider establishing case-based surveillance for all suspected measles cases, integrated within an existing disease surveillance structures. This would include collection and shipment of specimens from the field to the accredited measles laboratories and regular and systematic data transfer from reporting units to districts/national level and feedback.

5.3 Vaccine supply of assured quality

A SEAR elimination goal would require more than one billion children to receive measles vaccination between 2010 and 2020 in addition to the number of children reached through current immunization services. This will have significant impact on global supply and MCV availability. Hence proper planning and forecasting is necessary to provide adequate lead time to increase scale-up production. UNICEF supply division is anticipating three additional producers of measles vaccines in the coming years. Two of these manufacturers may be WHO pre-qualified by 2011.

5.4 Injection safety: Programmatic issues related to injection safety, adverse events after immunization (AEFI) and waste management need to be appropriately addressed when immunization strategies, especially supplementary immunization activities are conducted. Adequate preparations must also be made for the occurrence of rare yet serious AEFI, such as anaphylaxis. Public concerns for such adverse events, will be heightened when the disease incidence is low due to effective immunization activities. With more concerns about environmental safety, the safe disposal of hazardous immunization waste will gain importance.

5.5 Estimated costs of eliminating measles: A conservative estimate of the total cost of measles elimination in SEAR for the period 2009-2020, based on the projected schedule of SIAs and MCV2 introduction presented in Table 2, and current experience with best surveillance practices in the Region, would be as follows:

- MCV2: $186.44 million (India would account for 64%)
- SIAs: $527.71 million (India would account for 72%)
- Field surveillance: US$150 million
- Additionally, scaling up routine immunization to achieve and sustain >95% coverage could require up to 2-3 times the cost of the introduction of MCV2 and
the SIAs, though the major portion of this cost would probably be borne by the national immunization programme with potential support from donors and partners.

The assumptions underlying these estimates are the following:

- Changes in SIA and MCV2 schedule and cost assumptions will alter the cost estimates. It should be noted that the estimates presented likely represent lower bounds on actual costs. These costs do not include cost of scaling up routine immunization program to improve routine vaccine coverage, cost of surveillance, laboratory, and technical assistance. This would require more comprehensive costing analyses in the future.

- Of the 11 SEAR Member States, only two (DPRK and Timor Leste) are heavily dependent on external/donor funding for health -- that is 45-50% of their health expenditure is from outside the country. Four countries (Bangladesh, Nepal, Myanmar and Bhutan) are moderately reliant on donor support (10-15%). The remaining countries including the large countries are essentially self-financing. Of the estimated 714 million USD needed for SIAs to achieve measles elimination in SEAR, 82% is required in countries that are financially self-reliant. Hence, elimination of measles from SEAR will be largely based on political and financial commitment by Member States within the Region. Nevertheless mobilizing external donor funding for the additional funds required to support SIAs in highly dependent and moderately dependent countries (130 million USD over 10 years) should be a priority.

5.6 Availability of funding: Achieving and sustaining immunization and surveillance standards will be challenging particularly for some of the large countries of the Region and will require substantial investment of financial and human resources. Because the international funding available from the Measles Initiative for mortality reduction is substantially reduced for the next biennium, the cost implications need to be carefully considered and attempts need to be made to mobilize resources within countries.

5.7 Lessons from polio eradication: There are important lessons to be learned from polio eradication. These include:

- The importance of government ownership of the programme
- Strengthening routine immunization system to achieve high coverage,
- Achieving high SIA coverage,
- Financial and technical support
- Using polio eradication infrastructure for measles mortality reduction efforts

Failure to reach the target has caused increasing programme fatigue and waning of donor support. A more cautious approach from the onset with a well calculated timeline to guard against the unexpected delays will be important when a measles elimination goal is set.

5.8 Conclusions

The consultation concluded as follows;

2 The measles initiative is a partnership committed to reducing measles deaths globally. The initiative - led by American Red Cross, the United Nations Foundation, the Centers for Disease Control and Prevention, UNICEF and the World Health Organization – provides technical and financial support to governments and communities on vaccination campaigns and surveillance.
• Strong political commitment and full country ownership is required for measles elimination.

• To achieve elimination, immunization programmes must be capable of attaining and maintaining population immunity >93-95% against measles. The programme target is >95% coverage with two doses of measles vaccine in all districts. This can be achieved through a combination of routine services and/or mass campaigns. According to the projected estimates routine immunization services should be scaled up to vaccinate an additional 10 million infants per year, amounting to 100 million for the period 2010-2020. In addition, approximately 321 million children need to be reached through MCV2, and over 680 million children through SIAs.

• Even countries that are giving and maintaining high levels of MCV2 coverage through routine immunization activities would require periodic SIAs to vaccinate accumulated susceptible will be required

• In Bihar and UP in India, the existing infrastructure, capacity, micro plans and momentum of states conducting regular polio campaigns, could be beneficial to planning measles SIAs. If clear dates and targets are set, measles SIAs can be done with polio campaigns.

• Focus of SIAs in India needs to initially be on the high priority states (<80% coverage). In states where MCV2 coverage is provided through routine immunization, SIAs could be scheduled in line with the target year of elimination.

• High quality of surveillance system that meets surveillance performance indicators needs to be ensured. Laboratory strengthening is an essential component of measles elimination strategies. There is a need for close collaboration and linking laboratory and surveillance data. The surveillance systems must be strengthened to monitor the progress towards the achievement of this goal. The surveillance system must provide the needed sensitivity and specificity to ensure the detection of measles virus. The surveillance system needs to achieve the following targets
  
  Reporting Rate
  o At national level to detect at least two non-measles suspected measles cases per 100,000 population,
  o More than 80% districts of the country to detect at least one non-measles suspected measles case per 100,000 population per year

Laboratory confirmation
  o 80% of the suspected measles cases are tested in a WHO-accredited laboratory for measles IgM,

Viral Detection
  o Virus detection from 80% of the transmission chains (outbreaks)

• Adequate resources (equipment, staff, training and supervision) are need to be provided to ensure safe injection practices and waste disposal

• A comprehensive analysis of the costs required to scale-up routine immunization to >=95% in every district is needed to complete the cost analysis for measles elimination. Countries need to be aware that scaling up routine immunization is a requirement for achieving and maintaining measles elimination.
• A system for monitoring and responding to Adverse Events Following Immunization (AEFI) should be put in place. This system is required for vaccine delivered through either routine or SIAs

• There is a possibility of decreased external funding as measles mortality reduction/elimination progresses and hence the need for domestic funding to sustain activities.

• The experience with polio eradication in the region highlighted the need to expect that difficulties will arise and that the process of measles elimination may be long and complex.

• With these in mind, measles elimination efforts in the SEAR should plan for the following:
  • Ongoing research to better understand measles virus and disease in the highest risk settings and refinement of control tools and strategies
  • Thorough assessment of the resources required (financial, human, and materials)
  • Building a diverse, strong partnership to sustain efforts through crises
  • As far as possible, upfront funding commitments from large governments and major donors to ensure sufficient supplies and human resources
  • An advocacy and communication strategy that is tailored to key audiences (general public, politicians, technical experts etc.)

6 Reviewing country situation towards measles elimination goal

Prior to the meeting, the Regional Office shared a template of the document “programme feasibility of measles elimination” with Member States (Annex 4). Most of the Member States completed the template by the time of the regional consultation. During the group work, each Member State reviewed the contents of this template and determined the readiness to set a measles elimination goal. In the plenary after the group work, each Member State gave a brief presentation on programme feasibility of measles elimination.

Of the 11 countries in the SEAR, all countries agreed that measles elimination is a technically feasible and achievable goal. Regarding programmatic feasibility of measles elimination, eight countries (Bangladesh, Bhutan, Indonesia, Maldives, Sri Lanka, Myanmar Nepal and Thailand) agreed that it was programmatically feasible for them to eliminate measles by 2015, while Timor Leste agreed the feasibility by 2020. Although DPR Korea was unable to attend the consultation, that country already is implementing the recommended strategies for measles elimination, and in all likelihood, has achieved or is near measles elimination. Following much debate, India also agreed that a measles elimination goal would be feasible in that country by 2020, given that the country would have achieved its revised 90% measles mortality reduction goal by 2013.

Almost all countries envisaged substantial operational and financial challenges to achieve the elimination goal. For most countries the costs associated with their EPI programme are funded from internal resources. However adding the second dose of
measles will require additional resources in EPI for those countries which have not done this.
Substantial investments will have to be made in capacity building of human resources especially in countries with maturing immunization programmes (e.g. India, Timor Leste) or countries who have had no experience in conducting SIAs.

Most countries anticipated that high level political commitment will be available for measles elimination, despite competing priorities from continuing polio eradication activities and other infectious diseases. Some countries with very low levels of measles incidence (Sri Lanka, Thailand) foresaw that convincing parents and medical community alike will be major communication challenges.

The cost estimates presented by the Member States based on the country reports to achieve elimination by 2020 are provided in table 3. These estimates contrast with estimates which were done by using a simulator model and presented in section 4.5. Both estimates are lower bounds of the costs. This area requires further review by Member States who observed that actual costing needs more time and the involvement of concerned national departments.

Conclusions

The consultation concluded as follows

- All countries agreed on the technical feasibility of measles elimination. However the programmatic feasibility and time line of achieving elimination varied.
- Eight countries (Bangladesh, Bhutan, Indonesia, Nepal, Thailand, Myanmar, Maldives and Sri Lanka) agreed that a goal for achieving measles elimination by 2015 would be feasible, whereas Timor Leste agreed that this would be feasible by 2020.
- MCV1 coverage in states of India ranged from 47% -99%. Although, setting a national goal for measles elimination was thought not to be practical for India, after debate and due consideration. India agreed that a target year of 2020 was feasible. India is preparing to offer MCV2 starting from 2010 either through routine immunization or through campaigns in order to achieve its revised 90% measles mortality goal by 2013. States that have achieved and sustained high MCV1 coverage and have low measles mortality have the potential to implement strategies to achieve elimination by 2015.
- As part of assessing programmatic feasibility, countries identified needs for technical and/or financial assistance.
- Most countries indicated that an elimination goal would be met by high level political and societal support.
- While most countries identified measles as a national priority, some acknowledged that there were other competing priorities.
Table 3: Estimated cost of measles elimination by 2020 in SEAR Member States

<table>
<thead>
<tr>
<th>Member State</th>
<th>SIA Costs (USD million)</th>
<th>Surveillance costs incl. Lab (USD million)</th>
<th>MCV2 in EPI (USD million)</th>
<th>Other costs</th>
<th>Country Total (USD millions)</th>
<th>Other shared costs (USD millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>30.00</td>
<td>2.40*</td>
<td>24.00</td>
<td></td>
<td>56.40</td>
<td>30.00</td>
</tr>
<tr>
<td>Bhutan</td>
<td>0.20</td>
<td>0.52</td>
<td>0.80</td>
<td>3.30 (Programme monitoring)</td>
<td>4.82</td>
<td>0.80 (MCV1)</td>
</tr>
<tr>
<td>DPR Korea</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>380.00</td>
<td>250.00</td>
<td>119.00</td>
<td></td>
<td>749.00</td>
<td></td>
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<td>Indonesia</td>
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<td>Maldives</td>
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<td></td>
<td></td>
<td>0.50</td>
<td>0.27 (EPI)</td>
<td></td>
</tr>
<tr>
<td>Myanmar</td>
<td></td>
<td></td>
<td></td>
<td>15.00</td>
<td></td>
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<tr>
<td>Nepal</td>
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<td>10.00</td>
<td>2.50</td>
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<td>0.89</td>
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<tr>
<td>Thailand</td>
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<td>0.80</td>
<td></td>
<td>5.00</td>
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<tr>
<td>Timor Leste</td>
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<td>0.28</td>
<td></td>
<td>1.32</td>
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<td></td>
</tr>
</tbody>
</table>

*Shared Costs
Blank cells indicate that information is incomplete or not currently available.
Source: Country reports presented during the Regional Measles Consultation
6. Recommendations

The following are the key overall recommendations of the meeting.

1. Given that all countries agree that measles elimination is technically feasible, a regional goal for measles elimination should be set for SEAR for 2020 or sooner, recognizing that most of India would have achieved measles mortality reduction goal by 2013.

2. Countries of the region that have already achieved more than 90% measles mortality reduction compared to 2000 should set a target for measles elimination by 2015.

3. India should rapidly implement plans for 90% measles mortality reduction by 2013.

4. India should soon explore setting measles elimination targets in states that have achieved sustained high MCV1 coverage, have low measles mortality and will be introducing MCV2 in 2010.

5. National measles elimination plans should include the key components of improving and sustaining routine immunization, conducting supplementary immunization activities, attaining adequate surveillance standards and ensuring injection safety.

6. Countries should develop plans and include adequate budgets to strengthen and sustain routine immunization, noting that 2 to 3 times the targeted program costs for measles SIAs could be required to improve routine immunization services.

7. Country plans to achieve measles elimination should be presented to a regional consultation to be convened in 2010.

8. The definition for measles elimination should be in line with the global consensus document:

   The absence of endemic measles* cases for a period of twelve months or more, in the presence of adequate surveillance.

   *Endemic measles is defined indigenous or imported measles virus that persists for a period of 12 months or more in any defined geographical area.

9. Indicators for monitoring progress towards elimination and targets suggestive of having achieved elimination should be:

   a. Vaccination coverage
      Vaccination coverage indicator: Vaccination coverage of both first routine measles dose (MCV1) and second dose of measles vaccination (routine or SIA)
**Vaccination coverage target:** Achieving and maintaining at least 95% coverage with both MCV1 and the second dose of measles vaccination in all districts and nationally.

b. **Outbreak size**
   **Outbreak size indicator:** monitoring of outbreak size of ALL outbreaks including outbreaks in closed settings and outbreaks where interventions have taken place to stop the outbreak
   **Outbreak size target:** At least 80% of outbreaks should have less than 10 confirmed measles cases

c. **Incidence**
   **Incidence Indicator:** measles incidence per million per year
   **Incidence target:** Measles incidence of less than 1 confirmed measles case per million population per year excluding cases confirmed as imported

d. **Endemic measles virus strain(s)**
   **Endemic Measles Indicator:** The number of endemic measles virus strains
   **Endemic Measles Target:** Zero cases of measles caused by an endemic strain for at least 12 months