REPORT OF
REGIONAL EXPERT GROUP MEETING
ON PREVENTION OF BIRTH DEFECTS
IN SOUTH-EAST ASIA

13th - 15th December 2011
New Delhi, India
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Organised by
Genetics Unit, Department of Pediatrics
WHO Collaborating Centre for Training in Clinical and Laboratory Genetics
All India Institute of Medical Science, New Delhi, India
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BACKGROUND

The decline in infant and childhood mortality rates in most countries in the 20th century is a public health achievement. The "health transition" that many countries in the South East Asia Region (SEAR) are undergoing has initially been marked by a decline in infant and under-5 mortality from infectious diseases and malnutrition, which predominate the early years of life (World Bank 1993). At the same time, however, the mortality from birth defects has remained constant. As countries develop, this has resulted in birth defects assuming a greater proportional cause of infant mortality. With improvements in the management of infection and asphyxia, birth defects are increasingly seen as a major cause of stillbirths and neonatal deaths. In addition, an increasing number of infants with potentially disabling conditions, who would previously have died undiagnosed, now survive and require medical and supportive interventions.

At the same time, there is an unprecedented opportunity to prevent many birth defects and reduce the consequences of those that occur, and to do so at reasonable cost. For example, the incidence of neural tube defects can be dramatically reduced if women have an adequate intake of folic acid before and during early pregnancy. This can be accomplished at low cost by fortifying a widely consumed food staple, such as wheat or corn flour or be provided as supplements in areas where fortification is not yet available. Similarly, impaired mental development due to iodine deficiency can also be prevented at relatively low cost through the iodization of salt. Congenital rubella syndrome can be prevented through the immunization of children and women. Public health education and preventive health care services can reduce the incidence of Down syndrome. Strategies include offering antenatal screening for aneuploidies, counseling about the possible impact of marriages between relations and the in utero effects of alcohol and encouraging abstinence for women who are pregnant or planning a pregnancy. Haemoglobinopathies are a major public health problem in many countries in the SEAR with very high carrier frequency in certain areas. With the availability of prenatal diagnostic facilities, prevention by carrier detection, counseling and prenatal diagnosis is feasible.

Improvements in the care of children with birth defects can be made even with limited resources. Affordable medications, surgical treatments, and community-based rehabilitation can help these children lead more normal lives. This care can be made accessible through existing primary health services, which can make referrals to, and receive support from, secondary and tertiary care facilities.

In the present scenario with improving health statistics in many SEAR countries, the time is ripe to initiate preventive programs. To initiate any preventive programs, the first step is to generate epidemiological data regarding birth defects. However, the epidemiological data on birth defects in the SEAR countries is available to a limited extent only. Review of available data and information in the member countries on prevalence of birth defects and on the availability of preventive and management strategies for birth defects needs to be carried out to understand the present situation. With this background, a Regional Expert Group Meeting on birth defects in the SEAR was planned. To generate background data it was planned to carry out a desk review of available data on prevalence of birth defects and existing reporting / surveillance mechanisms programmes for prevention and management of birth defects from the member countries.

Objectives of the Meeting

1. To review the current situation related to birth defects in the South East Asia Region
2. To identify the regional priorities in the area of Birth Defects
3. To identify and discuss possible strategic directions for prevention and management of Birth defects in the Region
SUMMARY OF PROCEEDINGS

Day 1: Tuesday, 13 December 2011

Inaugural Session

Dr. VK Paul (AIIMS) welcomed the participants to the meeting organized with WHO and CDC support. He outlined birth defects prevention as a global, South-East Asia regional priority issue, as well as for India. He shared with the participants that Delhi was a historic city and All India Institute of Medical Sciences (AIIMS) a historic institution that was established in 1956, and is India’s apex institution for medical research, teaching, and care. WHO Collaborating Centre for Training in Clinical and Laboratory Genetics, AIIMS, New Delhi has been working in this technical area to support research in addition to provide services.

Ms. Aliki Pappas Weakland (CDC) thanked hosts, organizers, and participants. She emphasized CDC’s commitment to the development of regional strategic directions and development of capacity, partnerships and CDC's evolving global efforts. In addition, she expressed CDC’s particular focus on addressing prevention of neural tube defects and externally observable birth defects.

Dr. Neena Raina (WHO-SEARO) reviewed the objectives of the meeting, which were to review the current birth defects situation in SEAR, identify regional priorities in SEAR and identify and discuss strategic directions for birth defects prevention. She said that there is a need to take a public health approach to prevention of birth defects and focus on priorities. Dr. Raina also recognized and thanked participants, AIIMS and CDC.

The meeting opening concluded with a lamp lighting ceremony and address by Dr. RC Deka (Director AIIMS). Dr. Deka welcomed the support of CDC, partners, SEARO, and SEARO countries to address birth defects, which he highlighted as a significant public health issue. He detailed issues in birth defects detection and surveillance, and also the role of hospitals, specifically rural hospitals, in tackling the problem. He expressed the need for skills, information, and technology to be made available to health professionals to address birth defects. The inaugural session concluded with introduction of participants by Dr. Neena Raina.

Day 1 Co-chairs and Rapporteur

Professor Pornswan Wastad (Thailand) and Dr. Lorenzo Botto (International Clearinghouse for Birth Defects (ICBD)) were introduced as co-chairs for the day’s sessions. Dr. Neerja Gupta (AIIMS) was appointed Rapporteur.

Overview of burden of birth defects and prevention strategies

Birth defects prevention global activities

Dr. JP Peña-Rosas (WHO-HQ) introduced global activities on prevention birth defects. He introduced WHO’s research strategy for nutrition-preventable birth defects, which is reflected in the adjoining graphic. He briefed on WHO’s evidence-informed 9 step process for guideline development processes, their use of the Cochrane Handbook for Systematic Reviews of Interventions collaboration process that allows open-access to reviews and the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach.

For prevention of neural tube defects, WHO recommends that all women, from the moment they begin trying to conceive until 12 weeks of gestation, should take a folic acid supplement. Women who have had a fetus diagnosed as affected by a neural tube defect (NTD) or have given birth to a baby with an NTD should receive information on the risk of recurrence, be advised on the protective effect of periconceptional folate supplementation and be offered high-dose supplementation. A review of five trials, involving 6105 women (1949 with a history of a pregnancy affected by a NTD and 4156 with no history of NTDs), shows the protective effect of daily folic acid supplementation in doses ranging from 0.36 mg (360 μg) to 4 mg (4000 μg) a day, with and without other vitamins and minerals, before conception and up to 12 weeks of pregnancy, for preventing the recurrence of these conditions.
The WHO Guideline suggested scheme for intermittent iron and folic acid supplementation in menstruating women recommends the following:

- **Supplement composition:** Iron: 60 mg of elemental iron and Folic acid: 2800 μg (2.8 mg)
- **Frequency:** One supplement per week
- **Duration and time interval between periods of supplementation:** 3 months of supplementation followed by 3 months of no supplementation after which the provision of supplements should restart. If feasible, intermittent supplements could be given throughout the school or calendar year
- **Target group:** All menstruating adolescent girls and adult women
- **Settings:** Populations where the prevalence of anaemia among non-pregnant women of reproductive age is 20% or higher

Dr. Peña-Rosas then outlined other WHO suggested schemes for daily iron and folic acid supplementation in pregnant women and non-anæmic pregnant women, and intermittent iron supplementation for preschool and school-aged children. The schemes for pregnant and non-anæmic pregnant women are reflected in the following tables:

<table>
<thead>
<tr>
<th>Suggested scheme for daily iron and folic acid supplementation in pregnant women</th>
<th>Suggested scheme for intermittent iron and folic acid supplementation in non-anæmic pregnant women</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supplement composition</strong></td>
<td><strong>Supplement composition</strong></td>
</tr>
<tr>
<td>Iron: 30–60 mg of elemental iron*</td>
<td>Iron: 120 mg of elemental iron*</td>
</tr>
<tr>
<td>Folic acid: 400 μg (0.4 mg)</td>
<td>Folic acid: 2800 μg (2.8 mg)</td>
</tr>
<tr>
<td><strong>Frequency</strong></td>
<td><strong>Frequency</strong></td>
</tr>
<tr>
<td>One supplement daily</td>
<td>One supplement once a week</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td><strong>Duration</strong></td>
</tr>
<tr>
<td>Throughout pregnancy, iron and folic acid supplementation should begin as early as possible</td>
<td>Throughout pregnancy, iron and folic acid supplementation should begin as early as possible</td>
</tr>
<tr>
<td><strong>Target group</strong></td>
<td><strong>Target group</strong></td>
</tr>
<tr>
<td>All pregnant adolescents and adult women</td>
<td>All non-anæmic* pregnant adolescents and adult women</td>
</tr>
<tr>
<td><strong>Settings</strong></td>
<td><strong>Settings</strong></td>
</tr>
<tr>
<td>All settings</td>
<td>All settings</td>
</tr>
</tbody>
</table>

*10 mg of elemental iron equals 150 mg of ferrous sulphate heptahydrate; 50 mg of ferrous fumarate; or 250 mg of ferrous gluconate.

Dr. Peña-Rosas then reviewed the WHO’s Guidelines on Weekly Iron-Folic Acid Supplementation (WIFS) in women of reproductive age and its role in promoting optimal maternal and child health. These Guidelines state that:

- The weekly supplement should contain 60 mg iron in the form of ferrous sulphate (FeSO₄.7H₂O) and 2800 μg of folic acid.
- The rationale of providing 7 times the recommended daily dose to prevent NTDs is based on the limited experimental evidence demonstrating that this dose can improve red blood cell folate concentrations that have been associated with a reduced risk for NTDs.

Dr. Peña-Rosas introduced the WHO-Food and Agriculture Organization (FAO) guideline on food fortification with micronutrients. Fortification of staple foods (i.e. wheat flour) can improve the nutritional status of a large proportion of the population, requires no changes in dietary patterns and no individual decision for compliance. He emphasized that when appropriately implemented, food fortification is an effective, simple, and inexpensive strategy for supplying vitamins and minerals to the diets. The Guideline focuses on key nutrients, i.e. iron, folic acid, zinc, vitamin B 12 and vitamin A.

He stated that wheat and maize fortification with folic acid increases the intake of folate by women and can reduce the risk of neural tube and other birth defects. Fortification can also be integrated with other interventions in the efforts to reduce vitamin and mineral deficiencies like iron, zinc, vitamin B 12, vitamin A. Finally, fortification is most effective if mandated at the national level.

Dr. Peña-Rosas concluded with a briefing on the Evidence-informed Policy Network (EVIPNet) that promotes systematic use of evidence in policy-making in low and middle-income countries, and the WHO/CDC logic model for micronutrient interventions in public health.
Birth defects prevention CDC activities

Ms. Aliki Pappas Weakland (CDC) provided a presentation on CDC/National Center for Birth Defects and Developmental Disabilities’ (NCBDDD) strategies and activities related to birth defects. The NCBDDD strategic priorities are to:

- Prevent major birth defects attributable to maternal risk factors
- Enhance surveillance and research for autism and other developmental disabilities
- Prevent and control complications resulting from hemoglobinopathies (sickle cell disease & thalassemia)
- Prevent death and disability due to venous thromboembolism
- Reduce disparities in obesity and other health indicators in children, youth, and adults with disabilities

The Strategic Directions specific for the priority to prevent major birth defects attributable to maternal risk factors are to:

- Eliminate folic acid-preventable NTDs through fortification of high penetration staples and other means
- Reduce alcohol-exposed pregnancies through implementation of alcohol screening and brief intervention for women of reproductive age and their health care providers
- Prevent congenital heart defects and other birth defects associated with specific medications used during pregnancy

Ms. Weakland presented CDC’s global efforts on birth defects. Collaborative international Birth Defects Surveillance Program includes maintenance of International birth defects databases that is enhanced by ICBD (International Clearinghouse for Birth Defects Surveillance and Research). The database focuses on:

- Selected birth defects frequency database
- Surveillance of adverse fetal effects of medications (SAFE-Med) database
- Multimodal cases database
- International Perinatal Database of Typical Oral Clefts

She also informed about the “Awareness Project” that is a collaboration between ICBD, WHO, March of Dimes, and CDC and supports surveillance of risk factors, prevention of birth defects, and effectiveness of prevention interventions. She then outlined the CDC/NCBDDD Global Initiative to Eliminate Folic Acid-Preventable Neural Tube Defects (GIENFTD). GIENFTD is aimed at reducing infant and child mortality and childhood morbidity resulting from NTD-affected births worldwide, contributing to the achievement of the Millennium Development Goal 4 (under-five mortality) and supporting the 63rd World Health Assembly resolution on birth defects. There are three key components of GIENFTD:

- Policy: Educate and inform on the benefits of fortification policies and partner to expand the number of low- and middle-income countries with fortification policies
- Program & Partnerships: Assist with the development, implementation and evaluation of strategies to increase folic acid intake in women of reproductive age
- Science: Strengthen surveillance of NTD (and other external birth defects) and improve biomarker monitoring and improve laboratory capacity for NTD prevention

Ms. Weakland concluded with goals of the CDC/NCBDDD-SEARO collaboration, which are to support development of a regional framework for birth defect prevention, a Situational Analysis of birth defects in SEARO, and to support the execution of an Expert Group Meeting and a Programme Managers Meeting. In addition, the collaboration will support enhancing the capacity for birth defects surveillance in the region through birth defects surveillance training and development of guidelines.

Dr. RJ Berry, CDC followed with a briefing on early neural tube defect work in India and the CDC Sino-American Project to Prevent NTDs. The India study, a randomized control trial that was conducted by the Indian Council of Medical Research (ICMR) in 1988 – 1991, looked at neural tube defect recurrence using a multivitamin containing 4 mg folic acid showed a 58.5% reduction at the time the trial was stopped. He also noted the trial was stopped early when it showed significant positive results. The China study showed that the periconceptional use of 400 µg of folic acid/day alone without other vitamins reduced a woman’s risk of having an NTD-affected pregnancy.
Birth defects activities in SEAR

Dr. Neena Raine (SEARO) provided an overview of birth defects in SEAR. In the first part of the presentation, she informed the current status of the infant, under-five, and neonatal mortality rates in the Member States of the Region. Only Maldives and Timor Leste have achieved the Millennium Development Goal (MDG) 4 target to reduce the child mortality by two-thirds by 2015, while Bangladesh, Bhutan, Indonesia, Nepal and Thailand are on track to attain the target and there is slow progress in Bhutan, Democratic People’s Republic of Korea, India, Myanmar and Sri Lanka. As a whole, South East Asia Region is not on track to achieve MDG 4. Under-five mortality rate varies from a low of 13 per 1000 live births in Thailand to a high of 63 per 1000 live births in India and 66 per 1000 live births in Myanmar. The decline in infant and childhood mortality in most countries in the last two decades is a significant public health achievement. However, neonatal mortality has been declining at a slower rate and it contributes to 60-70% of infant mortality in the Member States in our Region. Within countries, child mortality is higher in rural areas, and among poorer and less educated families.

Dr. Raina discussed the major causes of death in children under-five (pneumonia and diarrhoea being the major killers) and neonates (infections, prematurity and birth asphyxia) in the South-east Asia Region. Overall, in the Region, birth defects are estimated to be responsible for 4% of under-five mortality. In countries where infant mortality is very low (like Thailand, Maldives and Sri Lanka), the proportional mortality due to birth defects is much higher. Hospital based data suggests that 18% of neonatal mortality in Sri Lanka and about 10% in India is due to birth defects. The picture in the case of stillbirths and foetal losses is not clear because of lack of data.

Dr. Raina noted that, as per the available estimates, SEARO tops the global list for birth defects prevalence, but very little is being done to address the issue at a large scale. She discussed data indicating that major causes of mortality shift as child mortality levels decline, with birth defects assuming much greater importance as a cause of child deaths in comparison to infections and birth asphyxia. She presented prevalence estimates from the 2006 March of Dimes report as follows:

<table>
<thead>
<tr>
<th>Country</th>
<th>Children born with birth defects annually</th>
<th>Total</th>
<th>Neural Tube Defects</th>
<th>Birth Defects of CV system</th>
<th>Pathological Haemoglobin</th>
<th>Down Syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>25,221</td>
<td>58.6</td>
<td>4.7</td>
<td>7.9</td>
<td>0.7</td>
<td>1.6</td>
</tr>
<tr>
<td>Bhutan</td>
<td>4,378</td>
<td>58.4</td>
<td>4.7</td>
<td>7.9</td>
<td>0.0</td>
<td>2.1</td>
</tr>
<tr>
<td>DPR Korea</td>
<td>20,295</td>
<td>54.1</td>
<td>4.7</td>
<td>7.9</td>
<td>0.0</td>
<td>0.8</td>
</tr>
<tr>
<td>India</td>
<td>1,613, 502</td>
<td>64.3</td>
<td>4.7</td>
<td>7.9</td>
<td>1.2</td>
<td>1.6</td>
</tr>
<tr>
<td>Indonesia</td>
<td>263,154</td>
<td>59.3</td>
<td>0.7</td>
<td>7.9</td>
<td>0.8</td>
<td>1.4</td>
</tr>
<tr>
<td>Maldives</td>
<td>670</td>
<td>60.8</td>
<td>2.0</td>
<td>7.9</td>
<td>6.4</td>
<td>1.7</td>
</tr>
<tr>
<td>Myanmar</td>
<td>68,587</td>
<td>58.5</td>
<td>0.7</td>
<td>7.9</td>
<td>4.0</td>
<td>1.7</td>
</tr>
<tr>
<td>Nepal</td>
<td>49,180</td>
<td>59.9</td>
<td>4.7</td>
<td>7.9</td>
<td>0.2</td>
<td>2.1</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>20,652</td>
<td>62.2</td>
<td>2.0</td>
<td>7.9</td>
<td>0.6</td>
<td>1.9</td>
</tr>
<tr>
<td>Thailand</td>
<td>70,045</td>
<td>59.9</td>
<td>0.7</td>
<td>7.9</td>
<td>5.6</td>
<td>1.5</td>
</tr>
<tr>
<td>Timor Leste</td>
<td>140</td>
<td>60.3</td>
<td>0.7</td>
<td>7.9</td>
<td>1.0</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Source: March of Dimes Birth Defects Foundation 2006
She emphasized that the etiology of birth defects is many times multi-factorial. Notable causes include: inadequate periconceptional intake of folic acid, maternal iodine deficiency, the low coverage for vaccination against rubella, the prevalence of women giving birth after 35 years of age, high rates of exposure to tobacco and secondhand smoke during pregnancy, alcohol consumption during pregnancy, use of teratogenic medications, consanguineous marriages and the lack of prenatal diagnosis and options for termination of pregnancies where the fetus is known to be severely affected. The underlying determinants of birth defects include high fertility, poverty, poor educational levels, limited access to health services and epidemiological transition.

Dr. Raina shared the World Health Assembly Resolution on Birth Defects (EB126.R6) and discussed its guiding principles. She then outlined existing opportunities for prevention of birth defects in public health programmes in SEAR. These include:

- Strong Maternal, Neonatal and Child Health (MNCH) Programmes in Member States
- Established adolescent health programmes in the countries
- Family Planning Services
- Iodine deficiency prevention and micronutrient supplementation programmes
- Strong Immunization programmes: Rubella vaccination programmes
- NCD prevention programmes
- Congenital Syphilis elimination
- Review of still births

She noted that intervention packages that reduce birth defects need to be and can be integrated into existing public health programmes. Dr. Raina listed SEAR programmatic needs for birth defects prevention, which include:

- Strengthen Vital Registration System (Information and Accountability for UNSG Strategy for Women’s and Children’s Health)
- Development of surveillance system (preferably integrating with existing HMIS and DHS mechanisms) including Birth Defects Registries
- Prevention services for birth defects that can be packaged with existing public health and nutrition services
- Screening and early diagnosis of birth defects and timely referral
- Capacity-building of multilevel and multidisciplinary workers/care providers
- Research and documentation
- Networking and partnerships
- Establishing/Up-scaling of genetic/diagnostics facilities
- Access to referral and rehabilitation services: Early and appropriate management/treatment including surgery

Dr. Raina concluded with an outline of SEARO future plans for birth defects prevention, which will include advocacy for birth defects surveillance and preventive strategy, strengthening of partnerships, development of a network of experts and institutions, development of a Regional Strategic Framework for prevention and management of birth defects, and capacity building in Member States.

**Discussions:**

Discussion on the session highlighted a number of issues on birth defects and neural tube defects prevalence; the suffering caused by birth defects and social and economic burden on families; and issues around fortification, including suggested folic acid levels for flour fortification and flour fortification implementation.

**SEARO Member States’ presentations on current situation and opportunities**

Participating Experts representing SEARO Member States presented their current situation and opportunities related to birth defects prevention. The Member States presented:

- Demographic information about the country
- Organization of health services
- Information on Birth Defects
  - Frequency and sources
• Country response to Birth Defects including
  0 Genetic services
  0 Screening programs
  0 Prevention programs
  0 Services for care of people with birth defects

Based on the standard presentation template the participating Experts from the countries shared the information on current situation on birth defects. The presentations highlight the range of surveillance and interventions, successes, capacity and challenges. In summary, SEAR Member States' current information on birth defects is very limited. While birth defects are recognized as a cause of mortality and morbidity in Member States, and opportunities for prevention were highlighted, it is clear much more needs to be done for developing programmes for prevention of birth defects.

Discussion:

Discussion focused on country data presented and specifics of services and programs in countries for genetics, screening and care. It was noted that it is important to build teams at country levels, across associations and organizations, to advocate for birth defects prevention. There has been a focus on birth defects as a cause of neonatal mortality, but stillbirths continue to be invisible since these are not recorded in the system and birth defects may be an important cause of a significant proportion of stillbirths. Strengthening of vital registration system would be an essential step for capturing live births and stillbirths as well as all newborn and later deaths with cause of death assigned properly. Finally, there was recognition for the need for prioritization and high level advocacy by SEARO on birth defects prevention in the Region.

Birth defects surveillance

Dr. Lorenzo Botto (ICBD) presented on birth defects surveillance needs, the types of surveillance and using surveillance for reporting, policy/program development and evaluation. He began by providing background on ICBD and detailing a training program on surveillance and prevention of birth defects and preterm births. He described the need for public health surveillance to do three things: provide information for action, maximize value and provide a global approach with local solutions.

He also described public health surveillance as a cyclical process that must be ongoing, timely, accurate and purposeful (see graphic, above). Birth defects surveillance system should be designed to provide information on global burden of disease (e.g., birth defects, preterm births, low birth weight/Intra Uterine Growth Retardation (IUGR), stillbirth and intellectual disability) and modifiable risk factors (e.g., folic acid use, infections, medications, smoking, diabetes and obesity), in addition to information on national policies and status of birth defects intervention programmes.

Dr. Botto presented on the Awareness Project, which provides surveillance of birth defects risk factors under a collaboration between ICBD, CDC, WHO and March Of Dimes. Dr. Botto reported on the status of the Awareness Project components (see Table below):
<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes, pregestational</td>
<td>Finished</td>
</tr>
<tr>
<td>Obesity, high body mass index</td>
<td>To be started</td>
</tr>
<tr>
<td>Folic acid supplement use</td>
<td>Updated 2011</td>
</tr>
<tr>
<td>Folic acid recommendations, policies</td>
<td>Updated 2011</td>
</tr>
<tr>
<td>Blood folate status (low)</td>
<td>Advanced</td>
</tr>
<tr>
<td>Medications (potentially teratogenic)</td>
<td>Advanced</td>
</tr>
<tr>
<td>Pregnancy unplanned or mis-timed</td>
<td>Started</td>
</tr>
<tr>
<td>Smoking</td>
<td>Started</td>
</tr>
<tr>
<td>Alcohol</td>
<td>To be started</td>
</tr>
<tr>
<td>Rubella (seronegativity)</td>
<td>Updated 2011</td>
</tr>
<tr>
<td>Toxoplasmosis (seronegativity)</td>
<td>Updated 2011</td>
</tr>
<tr>
<td>Varicella (seronegativity)</td>
<td>Finished</td>
</tr>
</tbody>
</table>

Dr. Botto discussed the elements of surveillance as those that define a public health problem and purpose(s) of surveillance, define area and population, define information needs, develop a process to obtain and analyze the data. He also stated the need for “form to follow function” and that one should start small with a clear vision and focus on high quality. Then you can plan for expansion but do so only after careful planning.

He then described hospital-based surveillance systems that collect data on cases and births from select hospitals in a defined area. These can be convenient and efficient, but also have problems because of referral patterns, bias and a lack of representativeness. Population-based surveillance systems collect data on cases and births from entire resident populations. They are accurate and less prone to bias, but also resource-intensive and sometimes difficult to organize.

Dr. Botto then discussed passive, active and hybrid surveillance systems. In passive systems the sites report to center. They can be useful but may be incomplete and also difficult to validate. In an active system, a center sends staff to find cases. An active system is resource intensive because of staffing needed and sometimes distances travelled. A hybrid system contains a bit of both and is efficient and feasible. The ideal system is a hybrid system. However, the real key to a successful surveillance system is to have a champion: a leader and staff at a site who are committed to the program. In deciding what kind of system to implement, one needs to take into account factors like availability of resources (the number of staff needed, and funds), and the legal authority to collect sensitive data and the required reporting mechanism.

Dr. Botto stated that public health surveillance provides “massive opportunities” to collect and transform health data into information for public health action, provide evidence of a problem and evaluate the effectiveness of solutions, monitor quality and cost of the programme, reduce variability and eliminate waste, and to promote teamwork. Now, more than ever, better communication is available. High quality is also more available at an affordable cost. There is a need to plan carefully, promote teamwork through networking, and leverage existing local resources. High value, high quality surveillance provides a system to measure, learn, and improve. Dr. Botto recommended starting small, piloting, achieving success and then growing.

Although the surveillance system follow a global approach to ensure consistency and comparability and reduce variability but it must be locally optimized and customized to ensure effectiveness and sustainability. Dr. Botto concluded by saying that, “High value, high quality surveillance is possible nearly everywhere.”

**Discussions:**

Discussion focused on types of surveillance systems and implementation issues. The participating Experts recognized the need for a comprehensive policy and strategy for birth defects prevention in SEAR with surveillance as an essential part of it and ensuring ownership of the government.
Organizing Birth Defects Registry of India (BDRI) – gains and challenges

Dr. S Suresh (India) presented on Birth Defects Registry of India (BDRI). BDRI was established in 2001 by Fetal Care Research Foundation. Initially it had the participation of a few selected hospitals and has since grown to a network of 750 enrolled hospitals.

Dr. Suresh reported that that are six components of BDRI’s pillars:

- Identify prevalence
- Plan strategies
- Reduce incidence
- Institute infrastructure
- Improve skill
- Improve public confidence in healthcare system

In the first phase, BDRI’s mission is to: ascertain nationwide prevalence of birth defects; establish birth defects registries throughout India; provide guidelines and assistance to the upcoming centers for uniform methods of data collection; and to collect, analyze and disseminate birth defects surveillance data. In the second phase, BDRI’s mission is to: reduce birth defects incidence, form support through preventive and supportive strategies that create awareness and educate the public regarding birth defects, and form support groups.

Dr. Suresh described BDRI’s registry methodology as being a hospital-based, passive reporting system using prevalence estimates. The denominator for data collection is Live Born (LB) plus Intra Uterine Fetal Demise (or) Still Births (IUFD/SB) + Medical Termination of Pregnancy (MTP) The classification is based on ICD-10 (Q00.0 – Q99.9) and only looks at structural and chromosomal anomalies.

Dr. Suresh presented in detail BDRI’s methods of functioning, online reporting system, coverage in 27 States, and results over 10 years analyzing 900,000 births. In addition to other data, he briefed on the proportion of system anomalies and prevalence of the top 10 major anomalies (see charts above and below), with NTDs comprising almost 25% of all anomalies.
Dr. Suresh indicated several limitations in the birth defects registries’ data collection. First, he stated that prevalence is underreported, probably because minor anomalies were rarely reported and that the passive reporting system approach may not reflect the population prevalence and is estimation from a non-random sample of hospitals.

He also noted several challenges. First, BDRI must deal with a very large geographic area and track 25 million births each year. There is a need to create awareness for the need for birth defects registries and motivate local leadership. Second, there is a manpower shortage. Large hospitals lack staff to conduct the registry. Hospitals are often unwilling to appoint staff exclusively for this registry, so it is left to students who are usually rotating through assignments, resulting in a serious lack of continuity.

Third, there is also a technical knowledge gap. There is a large knowledge deficit about anomalies, obstetricians do not have the necessary skills, and there are very few dysmorphologists, perinatal pathologists and geneticists. There is also a problem of “blind labelling” (e.g., all short long bones are labeled “achondroplasia” and there is a blind labeling of “multiple congenital anomalies”). Fourth, there is the challenge of the attitude of health professionals; they have no time to fill out forms and are overburdened and do not see the personal benefit of supporting a registry. There is also the challenge of sustaining the interest after the initial excitement phase and eventual transfer of personnel. There is a need for continuous advocacy for reporting birth defects by organizations.

Finally, Dr. Suresh spoke about the final challenge being the need to “spark a fire”, identifying responsible professions, whether it is obstetricians, fetal medicine specialists, pediatricians, dysmorphologists, etc. as well as coordinating a team effort and the need “to rise above personal prejudices”

**Discussions:**

Discussion in this session focused on what kept people motivated in BDRI and steps to ensure quality of data.
Review of strategies for prevention of birth defects

Dr. Lorenzo Botto (ICBD) reviewed evidence, measurement and metrics, and approaches for prevention of birth defects. Dr. Botto explained that in considering birth defects strategies, risk factors should be recognized for preconception and lifelong prevention. Measurement and metrics are aimed at evaluating evidence, setting priorities and focusing surveillance effort. Prevention approaches focus on the health impact pyramid.

Dr. Botto presented global data on congenital conditions in under-5 mortality. He stated that three congenital conditions—birth defects (malformations, genetic conditions, developmental disabilities of prenatal origin), preterm birth/IUGR, and birth asphyxia—account for 25%-60% of under-five mortality and share many risk factors (see chart below)

In determining what evidence is helpful to address modifiable risk factors for birth defects, Dr. Botto outlined several considerations. First, in determining the strength of evidence, you must look for multiple studies with different designs and consistent findings. The magnitude of risk, including the relative risk (how many times higher compared to unexposed), absolute risk (the actual chance of birth defect exposed) should be considered - the higher the risk, the higher the number of affected babies.

Frequency of exposure among women of childbearing age is another factor - more common the exposure, the higher the number of potential cases. It should also be considered which types of birth defects are associated with more negative health outcomes. The potential for preventing other birth defects or pediatric disorders should also be considered. Finally, one should look at the evidence for effectiveness of interventions and the potential for high impact such as fortification versus supplementation.
Dr. Botto then detailed data showing that multiple risks are associated with selected modifiable risk factors and that this points to a certain approach to primary prevention and health promotion for neural tube defects (see chart below), with the most important risk factors being non-use of folic acid/multivitamin, diabetes (pregestational), select medications, fever/flu and smoking.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Causes NTDs</th>
<th>Relative Risk</th>
<th>Common Exposure</th>
<th>Additional Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non use of folic acid, multivitamin</td>
<td>Definite</td>
<td>++</td>
<td>+++ (++&gt;50%)</td>
<td>Probable (some clefts, ?CHD)</td>
</tr>
<tr>
<td>Diabetes (pregest.)</td>
<td>Definite</td>
<td>+++</td>
<td>++ (1-6%)</td>
<td>Definite (many birth defects, other)</td>
</tr>
<tr>
<td>Select medications</td>
<td>Definite</td>
<td>++</td>
<td>+</td>
<td>Definite (NTD, clefts, other)</td>
</tr>
<tr>
<td>Fever/flu</td>
<td>Probable</td>
<td>++</td>
<td>+++ (6-10%)</td>
<td>Possible (CHD)</td>
</tr>
<tr>
<td>Smoking</td>
<td>Possible</td>
<td>++</td>
<td>+++ (10-20%)</td>
<td>Definite (clefts, preterm/IUGR)</td>
</tr>
</tbody>
</table>

Dr. Botto then discussed use of the health pyramid in implementing approaches to each of the infections, diabetes, smoking and folic acid risk factors. Illustrating the use of evidence, metrics, Dr. Botto discussed how recommendations for folic acid supplementation had limited or no effect in Europe in a 2005 study.
Day 2: Wednesday, 14 December 2011

Day 2 Co-chairs and Rapporteur

Dr. Md. Shahidullah (Bangladesh) and Ms. Aliki Pappas Weakland (CDC) were appointed as co-chairs for Day 2 sessions. Dr. Seema Kapoor (Professor of Pediatrics, Maulana Azad Medical College, New Delhi) was appointed Rapporteur.

Review of Day 1

The day’s session began with a review of Day 1 by Dr. Rajesh Mehta (SEARO).

Neural Tube Defects (NTD) prevention: Food fortification and supplementation with folic acid

Role of folic acid fortification and supplementation in NTD risk reduction and prevention of other birth defects Dr. RJ Berry, CDC presented on food fortification and supplementation with folic acid related to NTD Prevention. He said that there are an estimated 300,000 NTD-affected births globally each year, and that NTDs occur widely in diverse populations, in different geographic areas and at many levels of economic development. NTDs are a significant, preventable cause of mortality and morbidity, especially considering that in low-income countries, 29% of neonatal deaths are due to NTDs. CDC conducted a Pareto analysis to understand the distribution of the global burden of neural tube defects, which Dr. Berry presented (see below).

Global NTD Burden By Country

![Graph showing global NTD burden by country](image)

Dr. Berry stated that the role of folic acid in preventing neural tube defects is well known. The majority of NTDs are preventable with folic acid. Specifically, to prevent NTDs, it is recommended that all women capable of becoming pregnant consume at least 400 μg folic acid daily in the periconceptional period.
Dr. Berry explained that folate is a generic term for two different forms of vitamin B9. One is naturally occurring food folate, or polyglutamate form, found in legumes, beef liver, green leafy vegetables, some fruits and whole grains. The other is synthetic folic acid, or monoglutamate form, which is provided in enriched cereal grain products (such as breads, pasta, rice), ready-to-eat cereals, and supplements. Synthetic folic acid is about two times more bioavailable than food folate (1.0 μg of folic acid = 1.7 μg of Dietary Folate Equivalents (DFEs) food folate).

There are three Dietary Reference Intakes (DRIs) for folate. The Dietary Allowance (RDA) and Estimated Average Requirement (EAR) are expressed in μg DFEs. The RDA for adults is 400 μg DFEs (280 μg folic acid). The RDA for pregnant women is 600 μg DFEs (430 μg folic acid). The Tolerable Upper Intake Level (UL) is expressed in μg of folic acid. The UL for adults is 1,000 μg folic acid. The recommendation to prevent NTDs is 400 μg folic acid.

Dr. Berry emphasized key points regarding Dietary Reference Indicators (DRIs) for folate. Development of DRIs was based only on nutritional deficiency, not on prevention of NTDs. Folate insufficiency or sufficiency should be used to describe the relation between folate status and NTDs. He also informed that it is not possible to define folate sufficiency or to define optimal blood folate concentration to prevent NTDs at this time. Blood folate concentrations to define folate deficiency do not apply to NTDs and importantly, absence of folate deficiency does not mean that NTDs would not occur.

Dr. Berry described three approaches to increasing intake of folate and/or folic acid:

- Through diet: Consumption of natural foods such as vegetables, fruits, beans, yeast, liver
- Through pills: Consumption of folic acid-containing dietary supplements
- Through fortification: Adding folic acid to foods such as flour, rice, pasta and breakfast cereals

The problem with the diet approach is that it would require massive and unrealistic amounts of food to get the Daily Intake Equivalent of 400 μg of folic acid, such as four slices of fried beef liver, 44½ medium ripe tomatoes, or 5½ cups of black beans.

Dr. Berry then summarized evidence for the reduction in risk of NTDs with folic acid. The evidence has been demonstrated in more than 20 years of research studies that include observational, non-randomized intervention, and double blind randomized controlled trials that show statistically significant reductions in risk for NTDs ranging from 59% to 100%.

Dr. Berry explained that daily folic acid intake has been shown to play a significant role in preventing neural tube defects. In some countries, women of reproductive age do not have adequate levels of folic acid intake and there is lack of access to common, readily available fortified staple food products.

Dr. Berry presented monitoring data showing that 54 countries have policies to fortify at least one type of flour with folic acid. He then emphasized how fortification of wheat and maize flour can address the global problem of micronutrient malnutrition by reducing rates of neural tube defects and decreasing the extraordinary burden of micronutrient deficient disease and death. He explained how flour milling makes fortification a technologically easy and sustainable way to provide micronutrients.

Currently, only 30% of the 400 million tons of wheat that humans consume each year is fortified. Worldwide there are limited numbers of global micronutrient fortification programs that include folic acid. In some countries, women of reproductive age do not have access to a common, readily available source of folic acid, such as fortified staple products.

In comparison, efforts to increase the consumption of food folates in the population have had little or no success, as that requires not only behavior change, but also improved accessibility affordability, and sustainability. Supplements are given once the woman is pregnant, are often not culturally acceptable, or are costly for governments to purchase for a big population. Only 30-40% of childbearing age women report taking FA containing supplements daily, even when education efforts were made to promote the increased use of supplements. Because approx 50% of pregnancies are unplanned and only about 10% of women know that FA...
needs to be consumed prior to conception, supplements alone have not been an effective approach.

Dr. Berry stated that expanding folic Acid fortification could lead to the prevention of 150,000-210,000 NTDs per year, and could prevent an estimated 13% of neonatal deaths currently attributed to congenital anomalies in low-income countries. This potential is demonstrated by the experience of Chile, South Africa and others (see chart, right). In addition, folic acid fortification programs have been shown to be cost-effective interventions in countries with varying levels of economic development.

He stated that one of the challenges is not knowing when we have eliminated all FA-preventable NTDs, as we do not know when women reach a specified consumption level or a pre-defined blood folate concentration.

Dr. Berry summarized his session with the following points:

- NTDs are life-threatening and cause life-long disabilities.
- 50%-70% of NTDs can be prevented with 400 μg FA acid daily.
- Fortification of flour and foods with FA is a feasible, economical, safe, and effective public health policy to provide FA and to prevent NTDs worldwide.

Rice fortification

Dr. Sadhana Bhagwat (GAIN) presented on rice fortification issues. She explained that rice is the main staple for half of the global population (see pie chart, right). The bulk of world rice consumption is in the form of white, milled rice. Unfortunately, in white rice, most of the nutrients are lost in the milling process. Regardless, fortification of rice has great potential to reduce vitamin micronutrient deficiency. A multi-micronutrient formula including iron, zinc, folic acid, other B vitamins, vitamin A, E and selenium can be used to fortify rice.

Dr. Bhagwat informed there are isolated initiatives and no large-scale commercial operations to fortify rice have been implemented so far. There are three potential mechanisms for fortification of rice: through commercial channels, public distribution, and through mandatory fortification. She also described rice fortification methods, emphasizing that rice fortification is not as simple as wheat and maize flour fortification. Wheat and maize flour fortification technologies cannot be applied to rice fortification. There are four technologies for fortifying rice:

- Hot extrusion (fortified rice kernels)
- Cold extrusion (fortified rice kernels)
- Coating (fortified rice kernels)
- Dusting
For all these technologies the point of fortification becomes important and requires large-scale operations. She also said that the incremental cost of fortified rice is negligible for large-scale operations. While the efficacy and acceptability of rice fortification is strong, it is primarily based on iron fortification studies, and more studies are needed for rice fortification with folate and other micronutrients.

Dr. Bhagwat concluded her presentation with a description of Rice Fortification Resource Group (RIFORG). She also explained that GAIN has been working on developing a global rice fortification strategy articulated around three key elements:

- Advocacy through RIFORG and promotion of WHO international rice fortification guidelines;
- Technology Validation through a fortified rice kernels stability study; and
- Commercialization (phase I) though a commercial pilot project (Brazil) and trading fortified rice kernels.

These efforts are aimed at a replicating model, e.g. in Bangladesh (at phase II stage) and developing a new innovative model to commercialize fortified rice at large scale.

**Discussions:**

There was discussion on the feasibility and effectiveness of rice fortification in different countries, as well as discussion about centralized fortification. WHO guidelines on rice fortification are under finalization and would be released in 2012. In addition, there was discussion about salt fortification, and concerns that this would encourage higher intake in conflict with the chronic disease prevention recommendations on salt intake.

**Review of fortification and supplementation of folic acid and other micronutrients in the SEA Region**

Dr. Rajesh Mehta (WHO-SEARO) began his presentation with an overview of folate (Vitamin B9), an integrated approach towards effective anemia control, the role of folic acid in the prevention of birth defects and issues around wheat & maize flour fortification with iron and folic acid. He shared the status of wheat flour fortification with iron and/or folic acid in the South East Asia Region of the World Health Organization, which was based on the Flour Fortification Initiative (FFI) report:

- Two SEARO countries have mandatory fortification.
  - Indonesia has mandatory wheat flour fortification that includes iron, zinc, folic acid and other B vitamins, but the standards need to be revised in accordance with current WHO guidance for maximum public health impact.
  - Nepal has mandatory wheat flour fortification that was enacted in 2011 and includes iron, folic acid, and vitamin A. The law only applies to the industrial mills that produce 20 to 30 percent of the flour in Nepal. The remaining flour in the county is produced by small-scale mills where fortification is more technically challenging.

- India. Several states or territories have fortification programs for wheat flour from industrial mills distributed through the public distribution system. Fortification discussions are taking place among other mills in other states. One challenge is to expand the fortification program to flour in the open market, not just the public distribution system.

- Sri Lanka. Two flour milling companies provide at least 90 percent of the wheat flour consumed in the country, and one mill, with a smaller market share, is voluntarily fortifying its flour. The government currently is promoting consumption of domestically grown rice and has not expressed interest in mandating flour fortification.

- In Bangladesh, Myanmar, Bhutan, Maldives, Timor Leste, the Democratic People’s Republic of Korea efforts vary. A salt company in Bangladesh has announced plans to fortify salt with both iron and iodine,
and other small-scale efforts to fortify wheat flour have taken place there. Several wheat flour millers have expressed interest in fortification. The situation is similar in Myanmar. However, both of these countries have quite low wheat flour consumption. Bhutan, Maldives and Timor Leste import the majority of their flour and have little or no domestic milling industry. The Democratic People’s Republic of Korea receives fortified wheat flour as food assistance, but little is known about its domestic wheat milling industry and opportunities for fortification.

Dr. Mehta noted that the two common challenges throughout this region are the large number of small mills and large rural populations. Fortification at small mills, sometimes called chakki mills, is challenging because fortification equipment and nutrient mixes are generally prepared for large, industrial mills. However, food made with flour from large mills does not always reach people living in rural areas.

Furthermore, in many Asian countries, the staple cereal is rice, but the technology for rice fortification is still evolving. These countries could fortify flour, but very often the notion that people do not eat many wheat products keeps a country from considering flour fortification. In reality, wheat flour consumption is increasing throughout Asia, often in the form of instant noodles, and flour fortification could often be a viable strategy to improve nutrient status among these populations.

Dr. Mehta reported that FFI has conducted a study to determine consumer acceptability of typical Asian foods made with fortified wheat flour. A series of tests was conducted on 15 kinds of noodles and breads made with flour fortified with at least iron, folic acid, and vitamin B12 at levels recommended by the WHO. Some foods were also fortified with vitamin A, thiamine, riboflavin and zinc. The results, published in 2011, show that:

- Fortified foods were acceptable in all cases
- Several iron compounds could be used successfully in these foods
- Nutrients appear to be retained throughout the food preparation process.

The chart below indicates the population, amount of wheat consumed per day, and an estimated number of pregnancies affected by neural tube defects (NTDs) in the country. These countries do not have NTD surveillance systems, and the estimates here are from the global March of Dimes report.

<table>
<thead>
<tr>
<th>Country</th>
<th>Population</th>
<th>Wheat Consumption (g/capita/day)</th>
<th>NTDs estimated per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>148,692,000</td>
<td>40.26</td>
<td>20,135</td>
</tr>
<tr>
<td>Bhutan</td>
<td>726,000</td>
<td>204</td>
<td>353</td>
</tr>
<tr>
<td>DPRK</td>
<td>24,346,000</td>
<td>50.64</td>
<td>1,819</td>
</tr>
<tr>
<td>India</td>
<td>1,224,614,000</td>
<td>164.94</td>
<td>118,026</td>
</tr>
<tr>
<td>Indonesia</td>
<td>239,871,000</td>
<td>58.96</td>
<td>3,108</td>
</tr>
<tr>
<td>Maldives</td>
<td>316,000</td>
<td>179.57</td>
<td>22</td>
</tr>
<tr>
<td>Myanmar</td>
<td>47,963,000</td>
<td>15.9</td>
<td>821</td>
</tr>
<tr>
<td>Nepal</td>
<td>29,959,000</td>
<td>103.92</td>
<td>3,859</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>20,860,000</td>
<td>120.85</td>
<td>664</td>
</tr>
<tr>
<td>Thailand</td>
<td>69,122,000</td>
<td>41.32</td>
<td>819</td>
</tr>
<tr>
<td>Timor-Leste</td>
<td>1,124,000</td>
<td>14.11</td>
<td>1</td>
</tr>
</tbody>
</table>


2 Food and Agriculture Organization of the United Nations, FAOSTAT 2007 Food Supply: Crops Primary Equivalent http://faostat.fao.org (unless otherwise noted)

Dr. Mehta then presented the WHO guidelines for Weekly Iron and Folic Acid Supplementation (WIFS). He stated that these guidelines are effective for ensuring iron status of women where food-based strategies are not yet fully implemented. The weekly supplement should contain 60 mg iron in the form of ferrous sulphate and 2800 μg folic acid. At present, the evidence for the effective dose of folic acid for weekly supplementation is limited and the recommended dose is based on rationale of providing 7 times the recommended daily dose. The limited experimental evidence suggests that this dose can improve red blood cell folate concentrations to level that has been associated with a reduced risk for NTDs. WIFS strategy provides an additional opportunity for ensuring adequate folate status before pregnancy and in the very early stages of pregnancy particularly for those who may become pregnant or do not know that they are already pregnant and are not covered by other programs. Once the woman becomes pregnant she should be shifted from WIFS to the current WHO recommendation of daily supplementation with 60 mg iron and 400 μg folic acid for pregnant women.

Discussions:

Discussion in this session focused on the need for integrating folate fortification and supplementation efforts into ongoing programs and looking at opportunities where programs are being planned. In addition, it was noted that folate was added to WIFS guidelines to improved folate status and for preparation of nutritional status of the women to support pregnancy.

Safety of folic acid fortification

Dr. R.J Berry (CDC) presented the evidence base, potential mechanisms by which folic acid might lead to adverse outcomes, issues of high intake of folic acid, and potential adverse outcomes of folic acid.

Since 1991, when folic acid was first recommended to prevent neural tube defects (NTDs), several governmental and independent advisory agencies have conducted reviews of the evidence-base on the safety of mandatory fortification of staple foods with folic acid and issued reports. Each of these reviews included comprehensive literature searches and objective presentations of the findings. All six agencies concluded that mandatory fortification of staple foods was safe and effective, and recommended that their respective countries implement a plan to fortify food with folic acid.

The studies reviewed the source of folate (food folate and folic acid), the intake required to achieve higher blood folate concentrations, randomization of use of folic acid (such as multivitamin-users vs. non-users) and the design limitations of the studies included in the review.

Sources of folic acid include mandatory fortification, which is a major source relevant to developing new fortification policies for populations, limited use of ready-to-eat breakfast cereals (RTE) in many areas of the world, and supplements containing folic acid, which is an important source in United States but limited in other areas of the world.

In evaluating studies, Dr. Berry explained that the quality of studies was ranked using a ranking pyramid (see graphic below). CDC has also been following the literature related to the safety of folic acid. They recently examined studies published between January 2007 and March 2011. Many relevant human studies have been published during these past 5 years related to various mechanisms and adverse effects issues.
In looking at the evidence base, the potential mechanisms by which folic acid might lead to adverse outcomes, issues of high intake of folic acid and potential adverse outcomes of folic acid have been considered. Dr. Berry explained that for potential mechanisms, the indirect effects of folic acid on masking and vitamin B12 deficiency and DNA methylation and synthesis have also been considered. In summarizing the review of “masking” studies, Dr. Berry reported that of 255 case reports contained in 23 articles:

- 155 cases had neurological manifestations, which are the same as those that are complications of pernicious anemia (PA);
- Most had a diagnosis of PA before being switched to folic acid
- There was no way to confirm that patients with undiagnosed PA were involved;
- There was no way to distinguish between preexisting damage from PA and damage attributed to use of high-dose folic acid; and
- The studies were limited to case reports and case series.

Dr. Berry then addressed the issue of concern of DNA Methylation and synthesis where it is hypothesized that folic acid could both prevent and promote cancer. In summary, he stated that the study concludes that there is no evidence of harm to date, but it is biologically plausible and further research may be needed. Dr. Berry addressed the concern that a high intake of folic acid may have adverse effects on anemia, cognition and antenatal folic acid in populations with low vitamin B12 status. Dr. Berry presented the findings from the literature and explained that there is no evidence that folic acid at current intake levels has masked vitamin B12 deficiency or harmed individuals with vitamin B12 deficiency or pernicious anemia.

Dr. Berry presented the definition of the Tolerable Upper Intake Level (UL) propounded by the Institute of Medicine, USA: “Maximum daily intake levels at which no risk of adverse health effects is expected for almost all individuals in the general population-including sensitive individuals-when the nutrient is consumed over long periods of time.” It applies only to synthetic folic acid. He explained that the UL is not a level beyond which potential risk begins and does not reflect direct toxicity.

He then discussed the findings on high intake of folic acid and cognitive decline. He stated that elevated blood homocysteine concentrations, low blood folate concentrations, or low folate intake have been associated with increased rates of dementia in many studies, including randomized controlled trials, but not in all. Patients with low blood vitamin B12 concentrations but relatively high blood folate concentrations scored worse on memory tests. It remains unresolved whether this is due to interference of folic acid with vitamin B12 metabolism, or because of preclinical pernicious anemia in supplement takers who absorb folates but fail to absorb vitamin B12. He noted that 97% of those with normal vitamin B12 and high blood folate concentrations had evidence of improved cognition. He said it could be concluded that there is no evidence of harm and there is some evidence of benefit. The reports in literature are conflicting to some extent.

He then reviewed in detail the studies on high intake of folic acid (antenatal), including a study on insulin resistance in children exposed during pregnancy (Yajnik, India). In summary, he said that with respect to the Yajnik (India) study, the data are observational and should not be used to make causal inferences. Regarding a study on antenatal micronutrient supplementation (Stewart, Nepal), the data are from a follow-up of a randomized control trial, in which antenatal use of folic acid was randomized.

In his summary and conclusions, Dr. Berry emphasized that folic acid fortification is intended to prevent neural tube defects. It is unlikely for usual intake to exceed the UL and to result in high blood folate concentrations. In addition, we need to evaluate strength of evidence in newly published studies and that continued monitoring and research are needed. He highlighted the fact that data does not indicate that intake of folic acid causes harm at levels in fortified foods or at the dose recommended to prevent NTDs, but that the data is not yet clear on supplements of more than 400 μg/day. Finally, he emphasized that an estimated 150,000 NTDs each year could be prevented worldwide by adequate fortification of foods with folic acid.

**Discussions:**

Discussion ranged from the conduct of folic acid animal studies and “safe” levels of dosage, and a reemphasis that there has never been a dose found that has been shown to be harmful. We need to consider context for folic acid fortification in developing countries and that higher folic acid doses are more reflective of the situation in higher income countries.
Prevention of other birth defects

Dr. Lorenzo Botto (ICBD) presented on issues related to other birth defects, focusing on cleft lip and cleft palate, upper and lower limb deficiencies, and congenital heart defects (CHDs). He reviewed the evidence on modifiable risk factors for cleft lip and cleft palate, limb deficiencies and congenital heart defects as well as the challenges in interpreting the data for effects, in particular, heterogeneity in structure, pathogenesis, etiology and outcomes.

Dr. Botto stated that the strong modifiable risk factor for increase in oral clefts is smoking. Addressing smoking among women of childbearing age and pregnant women could prevent 20% of cases of clefts. Other modifiable risk factors for oral clefts are less clear including micronutrients, with many open questions, such as high dose vs. low dose and multivitamins vs. folic acid.

The established modifiable risk factor for limb deficiencies is use of Thalidomide. Data on use of multivitamin and folic acid exposure for decreased risk are inconsistent. He stated that regarding CHDs, they are common, high impact, costly and heterogeneous. The known modifiable CHD risk factors: diabetes, medications and phenylketonuria (PKU). Other risk factors are suggestive, but not conclusive, including decreased risk for exposure to folic acid and multivitamins.

In summary, Dr. Botto said that there are several known modifiable risk factors for these three categories of birth defects: smoking, diabetes and some medications. The evidence for protective effect of folic acid is less clear for birth defects other than NTDs. The reasons for this have to do with differences among studies, genetic factors in different populations, the need for high folic acid dose to impact these other birth defects and the need for use of multivitamins rather than folic acid alone. These issues point to the need and opportunities for surveillance and etiologic studies.

Thalassemia prevention in SEAR

Dr. Suthat Fucharoen (Thailand) presented on Thalassemia prevention in SEAR with specifics on efforts in Thailand. He detailed regional prevalence data, reflected in the mapping on the right.

Dr. Suthat then reviewed in detail information on Bangladesh, DPRK, India, Indonesia, Maldives, Myanmar and Sri Lanka, including demographics, prevalence of Thalassemia and haemoglobinopathies and issues related patient registries and prevention activities.

Dr. Suthat stated that the best strategies for prevention and control of Thalassemia are to provide the best treatment for existing cases and preventing new cases. Conventional treatment includes blood transfusion and iron chelation. Other treatments include hemoglobin F stimulation, treatment of complications due to infections, heart failure and other conditions. Cure treatments include bone marrow and stem cells transplantation and possibly gene therapy.

Dr. Suthat then discussed the differences in diagnosis protocols in SEARO countries as well as treatment programmes, noting that India, Maldives, India and Thailand report having national treatment programmes.

He then presented in detail thalassemia prevalence, studies and prevention and treatment activities in Thailand.
Dr. Suthat reported on projections on the costs of treating thalassemia in selected countries, several of them represented in the South-East Asian Region, from the 2003 study, noting that there are screening and counseling protocols for treatment. He then reviewed the National Program on the Prevention and Control of Thalassemia in Thailand.

Dr. Suthat concluded with an observation that addressing thalassemia in developing countries is impacted by their communicable disease burden; limited data on prevalence; and lack of data on economic issues, lack of awareness amongst governments and NGOs; and ethical, social, religious and legal issues. Furthermore, at the global level there is a need for north-south and south-south partnerships to support training and technology transfer, identification of local mutations and to establish national control programs. In conclusion, Dr. Suthat recommended setting up a SEARO working group on haemoglobinopathies.

Newborn screening

Dr. Madhulika Kabra (AIIMS) reviewed newborn screening efforts in SEAR, and shared detailed information on experience in India. She emphasized that newborn screening is a comprehensive system and is not just screening for the birth defects. It includes the whole range of secondary prevention activities like diagnosis, management, education, follow up and evaluation and rehabilitation. Newborn screening can be sustained within public health systems and often challenged by economic, political and cultural considerations. Dr. Madhulika then reviewed the status of mortality rates in SEAR countries (chart below), highlighting low neonatal deaths in certain countries. In SEAR countries only Thailand has an existing country-wide Newborn screening program, other countries either have no screening or have pilot programs.

Dr. Madhulika then discussed barriers to establishing and sustaining comprehensive newborn screening programmes in developing countries, such as unique socio cultural issues, the high number of home deliveries, absence of laboratories and trained personnel, non- availability and high cost of corrective treatment, creating political will and awareness, lack of financing, and challenge of integration with the existing programmes. She proposed “11 T system” for newborn screening programme:

1. Technology (equipment)
2. Training (Personnel)
3. Taking (Specimen collection)
4. Transportation
5. Testing
6. Treating
7. Telling (Reporting)
8. Totaling (Cost)
9. Tracking (Confirmation)
10. Teaching (Counseling)
11. Tracking (Follow-up)
In initiating a newborn screen program, Dr. Madhulika recommended implementing a pilot program first to assess the feasibility and cost effectiveness of newborn screening. She advised to prioritize such birth defects for screening that have relatively high incidence and are easily manageable without high cost. Other factors in deciding which conditions to screen are that it is an important health problem and facilities for diagnosis and treatment are available, is acceptable to the population, its natural history is adequately understood, and it is cost effective. Phenylketonuria (PKU) and haemoglobinopathies are good examples. After the pilot program is completed it is important to disseminate results widely among professionals, policy makers, and media. Advocacy, media campaign and public education, training of the health personnel for management of these disorders are essential components. She also emphasized the need to integrate with existing health care systems.

Dr. Madhulika emphasized the importance of learning from small scale programmes for development of policies and legislation. Existing programs should have methodical record keeping, active management and follow up as well as quality control.

She concluded with a briefing on newborn screening in India.

**Role of regional and national networks for newborn health**

Dr. V K Paul (AIIMS) presented on the role of national and regional networks for newborn health and the need for research groups and research networks. The regional network emerged from the earlier experience from the National Neonatal-Perinatal Database (NNPD) in India. The NNPD had collected and analyzed information on intramural (delivered in the institution) and extramural (delivered outside the institution) newborn admissions in the network institutions.

**Intramural set of newborns:**

- Causes of maternal, perinatal and neonatal deaths
- Incidence of LBW and prematurity
- Incidence and outcome of birth asphyxia
- Organisms causing infections in neonates
- Antibiotic resistance pattern of neonatal infections
- Incidence of other morbidities: hypothermia, respiratory distress, hyperbilirubinemia, intraventricular hemorrhage etc.
- Incidence and profile of birth defects
Extramural set of newborns:

- To describe the profile of morbidity and mortality of extramural neonatal admissions at the Network institutions.
- To use the data on neonatal-perinatal health generated through the Network for quality improvement of newborn care at the participating centres.

Dr. Paul shared the NNPD’s protocols for Intramural Livebirths (Protocol “A”), Still Births (Protocol “B”) and Extramural Babies (Protocol “C”). He also provided detailed information on results from the NNPD work, including major neonatal outcomes, perinatal outcomes and morbidity trends. He highlighted that NNPD created a coalition of professionals, academic institutions, and ICMR, and brought together disparate institutions. It was able to develop and implement common protocols even without additional funds. It collected high quality data; was sustained over multiple cycles; and was able to analyze, synthesize, and publish the information. Furthermore, NNPD developed capacity for multi-centre research, developed various protocols that established Indian standards of fetal growth and guidelines on short course treatment for newborn sepsis and delivery room management of meconium stained neonates. He lamented that the NNPD activities have not been sustained and that there have been unmet expectations for analyses of data that was collected.

Based on the positive experience of the India NNPD WHO CC at AIIMS developed the Regional Neonatal Perinatal Database with the support of WHO/SEARO. The network included selected institutions from Bangladesh, Indonesia, India, Nepal, Sri Lanka and Thailand. The goal of the database was to establish a SEAR Network for Neonatal-Perinatal Database to generate prospective information on neonatal/ perinatal morbidity and mortality. He presented results from the database on major neonatal, perinatal and maternal outcomes, demographic profiles, major neonatal morbidity and mortality among intramural births and extramural admissions. Malformations were reported as primary cause of 22% of neonatal deaths in the network institutions. Encouraged by the limited experience with 6 centers of excellence from five member countries WHO-SEARO has supported expansion of the Regional Network and initiated establishment of National Networks of institutions in the member countries. The scope of Network is also broadened to include research, education and training on newborn health in addition to the standard database. Results and recommendations from the Regional Network Meeting Strengthening Newborn Health Care, Education and Training Capacity organized by WHO CC at AIIMS in March 2011 with the support of WHO-SEARO.

In conclusion, Dr. Paul emphasized the challenges of sustainability of such networks like the need of funding, human resource, organizing periodic meetings of the Network, development and refining of protocols, initiating new studies and trials, publication of papers, and strengthening of research capacity.

Need for regional and national networks for genetic services

Dr. Shubha Phadke (India) presented on the need for regional and national networks for genetic services and provided information on the India genetics screening programs.

Dr. Phadke elaborated on the need for a focus on prevention of birth defects. Effective prevention includes screening for common genetic disorders. She noted the role of genetic centers & laboratories in providing services for prenatal diagnosis, management, genetic counseling and referral services when required. In addition, population based screening programs for prevention need involvement of health care system and awareness amongst primary care physicians, obstetricians and pediatricians. She then highlighted the role of networking of genetic centers in the country and the Region.

Dr. Phadke shared information on medical genetics education programs in India. These programs have been improving the availability of geneticists and centers, providing a DM (Medical Genetics) degree program, one-year fellowships, training of clinicians and medical college teachers and many other short-term workshops. In addition, an IMCR initiative has also been improving genetics education in medical curricula.

She presented initial findings from a project, “To create a newborn screening program for preventable causes of mental retardation, and create awareness about it among doctors and women of rural Uttar Pradesh” that was funded by Government of India. There has been screening for congenital hypothyroidism, biotinidase deficiency
and galactosemia. She noted a reliance on district level systems for newborn screening that link into existing program and resources, such as Janani Suraksha Yojna, a conditional cash transfer scheme, to incentivize women to give birth in a health facility, and ASHAs, village level health workers. Dr. Phadke emphasized that public awareness is key for the success of newborn screening. Other prevention programs focus on beta thalassemia major, Down syndrome, neural tube defects and deafness.

**Discussions:**

Discussion in this session was on the need of active role of geneticists in evolving public health approaches for prevention of common genetic birth defects in resource poor settings. The need for a blueprint for thalassemia elimination was noted. A need for better understanding of ethical issues in newborn screening was underlined by the participating Experts.
Day 3: Thursday, 15 December 2011

Day 3 Co-chairs and Rapporteur

Co-chairs for Day 3 proceedings were Dr. I C Verma (India) and Dr. R J Berry (CDC). The rapporteur was Dr. Neerja Gupta (AIIMS).

Dr. IC Verma presented a summary of proceedings from Day 2.

Prioritization of birth defects in SEAR

Dr. Rajesh Mehta (WHO-SEARO) facilitated a plenary discussion on the prioritization of birth defects in SEAR. Guided brainstorming was carried out on the important programmatic issues of need, challenges and support required for birth defects surveillance, and how to position birth defects prevention as a high priority in the Member States.

The Experts were unanimous on the need for establishing large scale birth defect prevention programmes in the countries to reduce newborn and child morbidity and mortality and mitigate social and financial burden related to birth defects on families and society at large. The country Experts provided a short list of high priority birth defects in their countries based on the prioritization principles calling attention to the need to address birth defects that affect many people, for which evidence-based prevention and treatment is available, and for which available interventions are feasible, cost-effective and scalable. In addition, it was emphasized that prioritization was not a matter of saying other birth defects are not important, but a way of developing phased national programmes. The suggested high priority list included NTDs, facial clefts, limb deformities, congenital heart diseases and haemoglobinopathies.

It was followed by facilitated discussions on birth defect surveillance. After initial discussion that established surveillance for birth defects as a priority, country experts were encouraged to share their assessment of state of readiness for birth defect surveillance in their countries. All countries indicated a need and willingness to establish national registries and some level of readiness, but expected several challenges and expressed the need for support on standard methodologies, technologies and guidelines.

The Experts reinforced the view that surveillance systems should start small and expand gradually with experience. Need for a definite focal person for coordinating birth defect surveillance activities in the ministry of health in each country was emphasized. There was also discussion that monitoring and evaluation of program would consist of different activities specific for the two functions.

In the last section, Dr. Mehta facilitated a discussion on capacity building needs of birth defect prevention programmes in the country. In addition to the need for support to develop birth defects surveillance mechanisms, capacity-building needs were identified in the following areas:

- Policy advocacy
- Public education
- Orientation and training of program managers
- Programme planning and management skills
- Programme monitoring and evaluation with a focus on quality and cost,
- Training of healthcare providers, and other service providers
- Development of lab services
- Development of knowledge and institutional networks

The need for birth defect prevention programme to follow a public health approach and integration of birth defect intervention in the existing “continuum of care” service under reproductive health programmes was highlighted for effectiveness and sustainability. It was agreed that “packages for services” for birth defect prevention would be introduced in a phases. The role of a regional and national network of institutions for birth defects was also underlined. These networks should be able to provide for advocacy, social mobilization, behavior change
management, sharing knowledge and experience, education and training, and research and resource mobilization. Outcomes from these discussions are captured in the Meeting Conclusions and Recommendations presented in a later section.

Review of Draft regional strategic directions

WHO-SEARO proposes to develop a Regional strategic framework for prevention and control of birth defects to provide guidance to Member States in the Region to develop national programmes for birth defects. CDC is actively supporting this endeavor. This framework would be developed collaboratively with the experts and programme managers from the Member States. Mr. Burke Fishburn (CCI Consultant) presented an outline of the Draft Regional Strategic Framework. This work in progress was shared with the participating Experts from Member States in this meeting to obtain their inputs. He informed that the next draft would be presented in the Regional Program Managers Meeting in March 2012 to take inputs from the national programme managers from the Member States.

Mr. Fishburn presented the following elements of the proposed Regional Framework:

- Vision: Elimination of folic acid-preventable neural tube defects and the significant reduction of other birth defects in the South-East Asia Region
- Purpose: Guide national policies, programs, expertise and resources to achieve this vision
- 10 principles that mainly derived from World Health Assembly Resolution on birth defects (WHA 63/10)
- Strategic Directions:
  1. Develop or strengthen birth defects surveillance and evaluation capacity
  2. Promote & advocate for national folic acid and iron fortification, and supplementation activities
  3. Establish or scale-up national birth defects [policy and] programmatic initiatives
  4. Foster and expand birth defects collaborative and coordinated activities in South-East Asia Region.
  5. Expand and strengthen birth defects program management capacity

Participating Experts were divided into three working groups. Dr. Rajesh Mehta (WHO-SEARO) tasked the Group 1 to review vision and purpose, Group 2 to reviews the principles and Group 3 to review strategic directions. The working groups were requested to report back their suggestions/ revisions in the plenary session.

Group 1: Vision and purpose

There was significant discussion about the positioning of folic acid-preventable neural tube defects and broader category of birth defects as well as the difference between elimination and eradication. The plenary group agreed that the vision statement should include elimination of preventable birth defects that contribute to mortality, morbidity and disability. The Group recommended three main conditions: NTDs, Congenital Hypothyroidism and Thalassemia. After discussion of purpose and proposed objectives by the working group, it was agreed that the objectives presently included in the draft were quite broad and look more like goals and should be revised to be more specific and short term. The Group advocated to recognize that birth defect prevention would contribute to achievement of MDG 4 and the interventions should be integrated with the existing public health and nutrition programmes. They also underlined the need to build expertise and mobilize additional resources to achieve and sustain the birth defect programmes.

Group 2: Principles

The Group provided the following feedback:

1. Birth defects prevention would contribute to the overall health and development of the nation and contribute to the continuum of care approach for achieving the MDG 4 goals
2. Birth defect prevention is more cost effective than management and treatment of these conditions
3. Birth defects preventive programmes should be implemented through existing policies, strategies and programmes
4. As the type of birth defects vary across countries, the birth defects programme would need a country specific approach
5. Cross country collaborations and networking would be essential for building up birth defects programmes in this region
6. Birth defects prevention would require extensive public health awareness, advocacy and communication at different levels using multidisciplinary, multi-partner approach
7. Birth defects programmes should involve stakeholders across society and to be guided by principles of equity and ethical considerations.
8. Birth defects programmes should strive towards convergence across sectors within and outside the health sector
9. Essential for birth defects prevention, is the establishment of surveillance, monitoring and evaluation mechanism. The other principles are relevant and may be incorporated in the overall framework document.

Group 3: Strategic Directions

The strategic directions were generally accepted, with the need for partnerships and policy development to be explicitly stated in the directions. The Group emphasized usefulness of identification of existing infrastructure in countries, constitution of a national working Group & steering committee, training program for all health care levels, generate local information and evidence as well as to develop an implementation roadmap for 3-5 years. The group conveyed a strong need for a sustained knowledge management process on birth defects in the Region through activities like, establishing networks, Website, E-forums, Share resources, expertise, technology & information, annual meetings supported by SEARO-WHO-CDC. The need for strong monitoring and evaluation component in the birth defect programmes was also noted.

Outcomes from these discussions are captured in the Meeting Conclusions and Recommendations.

Closing session

Dr. RJ Berry (CDC), Ms. Aliki Pappas Weakland (CDC), Dr. Neena Raina (WHO-SEARO) and Dr. Madhulika Kabra (AIIMS) gave closing remarks. All thanked the participants, experts, the organizer and others. It was noted that effective collaboration had started off at the meeting and would continue. All agreed that many challenges are ahead, but it was possible to start small, stay focused and build on the successes.
CONCLUSIONS AND RECOMMENDATIONS

Dr. Neena Raina (WHO-SEARO) presented the conclusions and recommendations of the meeting.

Conclusions

- Experts recognize the importance of addressing prevention and control of birth defects to accelerate progress towards achieving MDG 4 and beyond as well as reducing morbidity and social burden on affected families.

- Experts agreed that public health approach would be followed in the Region to develop/strengthen policies and implement interventions for prevention and control of birth defects.

- Recommend integration of interventions for prevention of birth defects in the existing RMNCAH (Reproductive, Maternal, Newborn, Child and Adolescent Health) and other related programmes like nutrition, immunization, non-communicable diseases, tobacco and alcohol control that are being implemented in the countries.

- Experts recognized that there are multiple risk factors for occurrence of birth defects and would necessitate a multi-sectoral approach.

- Strengthen vital registration system including the recording and reporting of foetal deaths and stillbirths.

- Interventions for prevention and control of birth defects will help strengthen the continuum of care across life course by ensuring focus on period before marriage, preconception, antenatal and perinatal periods.

- Experts endorsed the need of the proposed Regional Strategic Framework to support national efforts in prevention and control of birth defects.

- Experts emphasized the need for developing national policies, strategic plans and implementation plans for prevention and control of birth defects in the Member States.

- There is a need for establishing/strengthening birth defect surveillance mechanisms for obtaining quality information and for action.

- Strengthen existing information systems like vital registration systems, HMIS and DHS in line with the recommendations of Information and Accountability Commission of the UNSG Strategy for Women’s and Children’s Health for monitoring progress towards achieving MDGs 4 and 5.

- Need for a monitoring and evaluation framework to guide the birth defect programmes was emphasized.

- Member States would need assistance for capacity building for surveillance, strengthening laboratories, human resource training, infrastructure, and planning and program management.

- For NTD prevention food fortification and supplementation strategies are recommended for countries for large scale implementation according to feasibility and acceptability. Partnerships would be required to take the implementation forward.

- Establishment of working groups and networks at the national and sub-national levels would help to take the birth defects prevention and control program forward.

- The need for research on evidence and implementation in the context of prevention and control of birth defects was emphasized.

- Experts underlined the need for advocacy and social mobilization in support of birth defects prevention programmes.
Recommendations

For Member States

- To initiate the program for prevention of birth defects, a country focal point in MoH supported by appropriate working and steering groups should be appointed.

- Based on local evidence, advocate for a policy review, and develop strategic plan and an implementation plan on prevention and control of birth defects as a part of the national policy.

- Develop and strengthen surveillance mechanisms for birth defects and establish national registries with plans for a systematic scale up of the surveillance efforts.

- Accelerate and strengthen efforts for vital registration with a focus on still births and miscarriages.

- Prepare monitoring and evaluation framework to measure progress in implementation of preventive and control efforts for birth defects.

- Member States should invest in capacity building for policy advocacy and social mobilization, surveillance, prevention, laboratory support, and program capacity.

- Mobilize appropriate resources and partnerships for prevention and control of birth defects. Partnerships should be built with a multi-sectoral approach for prevention of risk factors and implementation of food fortification programmes.

- Member States should support establishment of Regional – National Networks for supporting birth defect programmes.

Recommendations for WHO and Partners

- To support high level advocacy and resource mobilization for birth defect programmes at Regional and National levels.

- To provide support and guidance for developing strategies for birth defect prevention and control at Regional and National levels.

- To support capacity building needs of Member States.

- To support development of Regional-National Networks for supporting birth defect programmes.

- Establish thematic Inter-Country Working Groups to support national level efforts on birth defects.

The participating Experts unanimously supported these conclusions and recommendations from the meeting.
## Annexure 1

**Expert Group Meeting on Prevention of Birth Defects in South-East Asia**  
13-15 December 2011, New Delhi

### PROGRAMME

**Day 1: Tuesday, 13 December 2011**

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<td>V K Paul, AIIMS&lt;br&gt;Neena Raina, WHO SEARO&lt;br&gt;Aliki Weakland CDC, Atlanta&lt;br&gt;R C Deka, AIIMS</td>
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<td><strong>1000 - 1030</strong></td>
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<td><strong>1030 - 1130</strong></td>
<td>Overview of Burden of Birth Defects and Preventive Strategies&lt;br&gt;Global: WHO research strategy for nutrition preventable birth defects&lt;br&gt;CDC&lt;br&gt;WHO/SEARO&lt;br&gt;Discussions</td>
<td>JP Pena-Rosas, WHO-HQ&lt;br&gt;Aliki Weakland&lt;br&gt;Neena Raina</td>
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<td><strong>1330 - 1430</strong></td>
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<td>Lorenzo Botto, International Clearing House on Birth Defects</td>
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<td>Birth Defects Surveillance&lt;br&gt;Surveillance needs&lt;br&gt;Types of surveillance&lt;br&gt;Using surveillance for reporting, policy/programme development and evaluation&lt;br&gt;Discussions&lt;br&gt;Organizing Birth Defect Registry – Gains and challenges&lt;br&gt;Discussions</td>
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<td>Review of strategies for prevention of birth defects:&lt;br&gt;Maternal risk factors&lt;br&gt;Evidence (risk factors and prevention)&lt;br&gt;Large-scale programmes for prevention-Existing opportunities in health services&lt;br&gt;Discussions</td>
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<td><strong>Rapporteur:</strong> Seema Kapoor</td>
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<td><strong>NTD Prevention:</strong> Food fortification and supplementation with Folate</td>
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<td>• Role of folic acid fortification and supplementation in NTD risk reduction</td>
<td>Sadhna Bhagawat</td>
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<td>• Prevention of other birth defects</td>
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List of Participants

COUNTRY EXPERTS

BANGLADESH

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