Joint National/International Expanded Programme on Immunization and Vaccine Preventable Disease Surveillance Review

Democratic Socialist Republic of Sri Lanka
16–26 October 2015
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### Acronyms

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<th>Definition</th>
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<tr>
<td>ACCD</td>
<td>Advisory Committee for Communicable Diseases</td>
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<tr>
<td>AEFI</td>
<td>adverse events following immunization</td>
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<tr>
<td>AFP</td>
<td>acute flaccid paralysis</td>
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<tr>
<td>aTd</td>
<td>adult tetanus and diphtheria</td>
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<tr>
<td>BCG</td>
<td>bacillus Calmette-Guerain</td>
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<tr>
<td>bOPV</td>
<td>bivalent oral polio vaccine</td>
</tr>
<tr>
<td>CCP</td>
<td>Consultant Community Physician</td>
</tr>
<tr>
<td>CDC</td>
<td>United States Centers for Disease Control and Prevention</td>
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<tr>
<td>cMYP</td>
<td>comprehensive multi-year plan</td>
</tr>
<tr>
<td>CRS</td>
<td>congenital rubella syndrome</td>
</tr>
<tr>
<td>DGHS</td>
<td>Director General of Health Services</td>
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<tr>
<td>DHS</td>
<td>Department of Health Services</td>
</tr>
<tr>
<td>DT</td>
<td>diphtheria–tetanus vaccine (Pediatric formulation)</td>
</tr>
<tr>
<td>DTP</td>
<td>diphtheria–tetanus–pertussis vaccine</td>
</tr>
<tr>
<td>DTP1/DTP3</td>
<td>first dose of DPT/third dose of DPT</td>
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<tr>
<td>The Endgame Plan</td>
<td>Polio Eradication and Endgame Strategic Plan 2013-2018</td>
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<tr>
<td>EPI</td>
<td>Expanded Programme on Immunization</td>
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<tr>
<td>EVM</td>
<td>effective vaccine management</td>
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<tr>
<td>Gavi</td>
<td>Gavi, the Vaccine Alliance</td>
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<td>GNI</td>
<td>gross national income</td>
</tr>
<tr>
<td>GVAP</td>
<td>Global Vaccine Action Plan</td>
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<tr>
<td>HCW</td>
<td>health-care worker</td>
</tr>
<tr>
<td>HepB</td>
<td>hepatitis B vaccine</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
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<td>--------------</td>
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<tr>
<td>HepB3</td>
<td>third dose of HepB</td>
</tr>
<tr>
<td>Hib</td>
<td><em>Haemophilus influenzae</em> type b</td>
</tr>
<tr>
<td>HIS</td>
<td>health information system</td>
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<tr>
<td>HPV</td>
<td>human papillomavirus</td>
</tr>
<tr>
<td>ICNO</td>
<td>Infection Control Nurse Officer</td>
</tr>
<tr>
<td>IEC</td>
<td>information, education and communication</td>
</tr>
<tr>
<td>IgM</td>
<td>immunoglobulin M</td>
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<tr>
<td>ILI</td>
<td>influenza-like illnesses</td>
</tr>
<tr>
<td>IPV</td>
<td>inactivated poliovirus vaccine</td>
</tr>
<tr>
<td>JE</td>
<td>Japanese encephalitis</td>
</tr>
<tr>
<td>MCV</td>
<td>measles-containing vaccine</td>
</tr>
<tr>
<td>MCV1</td>
<td>first dose of measles-containing vaccine</td>
</tr>
<tr>
<td>MCV2</td>
<td>second dose of measles-containing vaccine</td>
</tr>
<tr>
<td>MCH</td>
<td>maternal and child health</td>
</tr>
<tr>
<td>MOH</td>
<td>Medical Officer of Health</td>
</tr>
<tr>
<td>MNTE</td>
<td>maternal and neonatal tetanus elimination</td>
</tr>
<tr>
<td>MR/MMR</td>
<td>measles–rubella/measles–mumps–rubella vaccine</td>
</tr>
<tr>
<td>MMR2</td>
<td>second dose of MMR</td>
</tr>
<tr>
<td>MRI</td>
<td>Medical Research Institute</td>
</tr>
<tr>
<td>NCCPE</td>
<td>National Certification Committee for Polio Eradication</td>
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<td>NIDs</td>
<td>national immunization days</td>
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<td>NIP</td>
<td>National Immunization Programme</td>
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<tr>
<td>NMRA</td>
<td>National Medicines Regulatory Authority</td>
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<tr>
<td>NT</td>
<td>neonatal tetanus</td>
</tr>
<tr>
<td>NUVI</td>
<td>new and underutilized vaccines implementation</td>
</tr>
<tr>
<td>ODPC</td>
<td>Office of Disease Control and Prevention</td>
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<tr>
<td>OPD</td>
<td>outpatient department</td>
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<tr>
<td>OPV</td>
<td>oral poliovirus vaccine</td>
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OPV3  third dose of oral poliovirus vaccine
PAB  protected at birth
PCV  pneumococcal conjugate vaccine
Penta  pentavalent vaccine
PHC  Primary Health Care
PHI  Public Health Investigator
PHM  Public Health Midwife
POA  period of amenorrhea
Polio  poliomyelitis
RCCPE  Regional Certification Commission for Polio Eradication
RDHS  Regional Director of Health Services
RE  Regional Epidemiologist
Regional Office  World Health Organization Regional Office for South-East Asia
SEAR-ITAG  The South-East Asia Regional Technical Advisory Group on Immunization
SIA  supplementary immunization activity
Sri Lanka  Democratic Socialist Republic of Sri Lanka
TB  tuberculosis
tOPV  trivalent oral poliovirus vaccine
TT  tetanus toxoid
TTb  booster dose of tetanus toxoid
UNICEF  United Nations Children’s Fund
VPDs  vaccine-preventable diseases
WBIIS  web-based immunization information system
WHO  World Health Organization
WRA  women of reproductive age
Acknowledgement

The review team would like to gratefully acknowledge the support provided by the Epidemiology Unit, Department of Health Services, Democratic Socialist Republic of Sri Lanka, the World Health Organization Country Office for Sri Lanka, and Regional Office for South-East Asia. Their provision of administrative, management and technical assistance were critical to the successful implementation of the mission. The team would also like to acknowledge the long list of persons throughout Sri Lanka in multiple offices and agencies who shared their time and gave insights into the status of the Expanded Programme on Immunization and vaccine-preventable disease surveillance in Sri Lanka. The review team would particularly like to acknowledge the commitment and interest of the Director General of Health Services who, in addition to attending briefing and debriefing meetings, found time in his busy schedule for a two-hour meeting with the review team to discuss findings and recommendations.
Executive summary

Background

The Expanded Programme on Immunization (EPI) in the Democratic Socialist Republic of Sri Lanka (Sri Lanka) has achieved considerable success in preventing and controlling most vaccine-preventable diseases (VPDs). Sustained high coverage has resulted in a reduction of more than 90% cases of diphtheria, pertussis, tetanus, and neonatal tetanus in comparison with the period prior to the implementation of the EPI. In addition, in recent years the programme has successfully introduced a number of new vaccines: the *Haemophilus influenzae* type b (Hib) vaccine (in a pentavalent vaccine formulation) (2008); the live Japanese Encephalitis (JE) vaccine (2009); the measles-mumps-rubella (MMR) vaccine (2011); and the inactivated poliovirus vaccine (IPV) (2015), and intends to introduce the human papillomavirus (HPV) vaccine in 2017. However, the country faces new challenges as it graduates from eligibility for financing from Gavi, the Vaccine Alliance (Gavi) and must finance all vaccines except IPV itself. Furthermore, despite impressive decreases in the overall morbidity and mortality from VPDs and excellent performance of the EPI system, Sri Lanka has experienced VPD outbreaks in the past five years, including a rubella outbreak in 2011 resulting in an increase in congenital rubella syndrome (CRS) cases to 12 in 2012 and an ongoing measles outbreak with about 4,000 suspected cases reported through end-2014.

To share best practices in immunization from Sri Lanka with other countries and identify opportunities to further strengthen Sri Lanka’s EPI, the World Health Organization (WHO) and the Government of Sri Lanka’s Department of Health Services (DHS) collaborated to conduct the first joint national/international EPI/VPD surveillance review in Sri Lanka on 16–26 October 2015. This review was part of systematic reviews scheduled to be carried out in all countries of the WHO South-East Asia Region.
Objectives of the review

The EPI reviews being conducted in the WHO South-East Asia Region share some common objectives, which are to:

- provide a snapshot to public health programme directors and public health policy-makers on the status of the EPI programme and VPD surveillance;
- assess progress in meeting the key national, regional, and global goals; and
- share best practices and lessons learned with other countries.

The objectives specific to Sri Lanka were also developed. These were to:

- identify successes and key elements in EPI at the core of health systems strengthening, placed in the setting of overall government support for the programme;
- review Sri Lanka’s approach to life course vaccination with emphasis on school-based immunization;
- consider the country’s approach towards measles elimination as part of the Region’s flagship programme; and
- share best practices from and considerations around new and under-utilized vaccines implementation (NUVI).

Methodology

The Epidemiology Unit of Sri Lanka and the WHO Regional Office for South-East Asia (the Regional Office) and the WHO Country Office for the Democratic Socialist Republic of Sri Lanka collaborated to form a review team of 84 members: 69 Sri Lankan members drawn from national, regional and district levels, as well as 15 international members comprising representatives of India and Indonesia’s immunization programmes, WHO, United Nations Children’s Fund (UNICEF), and the United States Centers for Disease Control and Prevention (CDC), as well as independent consultants. The team addressed the core objectives through a desk review of relevant policies and guidelines; secondary analysis of available data; interviews with key stakeholders, policy-makers and programme staff; and direct observation of programme implementation at field sites throughout Sri Lanka. Joint field teams including one international and one national-level staff person joined
staff from regional and district levels to visit 20 of Sri Lanka’s 26 districts, as well as the national level during 18–23 October 2015. Each field team visited Medical Officer of Health (MOH) offices, immunization clinics, and public hospitals while some teams also visited schools and private hospitals. The Medical Research Institute (MRI), which functions as the national laboratory, was also visited by a senior laboratorian.

**Key findings**

**Government support**

Sri Lanka enjoys an extremely high level of government support for EPI. There is a line item for vaccines in the national budget, and in 2014 the country paid for 94% of the cost of vaccines used in the country, and 93% of the costs for routine immunization. The programme is underpinned by proactive and broad reaching policies. Evidence-based vaccine-related decisions are made by the Advisory Committee for Communicable Disease (ACCD), chaired by the Director General of Health Services (DGHS). All vaccines used in the country must be licensed by Sri Lanka’s National Medicines Regulatory Authority (NMRA), which has recently become operationally independent from the DHS. The NMRA has recently been reviewed. Vaccine is procured annually by the central government following a tender process; with the exception of a short stock-out of Diphtheria Tetanus (DT) vaccine in 2015\(^1\), the country has not experienced stock-outs in years. The country underwent an Effective Vaccine Management (EVM) review in 2015; this report is available elsewhere\(^2\). Sri Lanka also has a strong adverse-events-following-immunization (AEFI) reporting and investigation system.

Electronic data management systems have been initiated to improve the efficiency of VPD surveillance and EPI management, and the launch of e-surveillance reporting has been well received. The roll-out of electronic data management systems (i.e. computers, provision of training) is being conducted in a phased manner.

Sri Lanka has an extremely well-trained and dedicated group of health professionals at all levels of the public health system. However, insufficient

\(^{1}\) This was due to a misunderstanding between the procurement agency and supplier and was linked to vaccine suspension many years ago. This vaccine suspension had followed concerns around safety and quality.

numbers of frontline staff (e.g. public health midwives) were observed in many areas visited, while the Epidemiology Unit was also noted to have inadequate numbers of staff in terms of consultants\(^3\), medical officers and data managers. Some staff shortages were also noted at the MRI. While the government has taken steps to address inadequacies of frontline staff, the impact of these efforts will not be felt for another 18 months or so. Although medical infrastructure was generally good, at some sites visited clinics were held in rented buildings and clinic vehicles were old, donated cars.

In 2010, Sri Lanka emerged from a period of internal conflict which most severely affected the two northern districts of Killinochchi and Mullaitivu. These areas have received intensified government and donor support resulting in extensive improvements in infrastructure. These improvements include rebuilding and renovating MOH offices, maternal and child health (MCH) clinics and upgrading of hospitals and cold chain equipments. A reflection of the government support and continued population trust in immunization has been the persistence of vaccine coverage above 90% in these districts.

**VPD surveillance**

VPD surveillance is an integral part of the evaluation process to ensure that a country is delivering high-quality vaccination services to the entire population. Evaluation of high-quality surveillance data allows countries to recognize gaps in the routine immunization programmes (for example, through outbreaks affecting unvaccinated populations) as well as allowing countries to evaluate and refine vaccination strategies. Elimination and eradication goals require that countries raise their surveillance standards and their use of surveillance data to levels beyond those needed for disease control alone. Surveillance has a particularly important role to play in Sri Lanka because service delivery is so strong that any remaining programme gaps are likely to be difficult to detect through supervision alone.

While VPD surveillance in Sri Lanka is certainly strong enough to detect outbreaks, the review team found several areas that would benefit from further attention, including increasing specimen collection for suspected cases, strengthening links between epidemiologic and laboratory data, and increasing use of surveillance data for decision-making at the district level. An important aspect of surveillance is laboratory confirmation of suspected cases of VPDs. However, the

\(^{3}\) In the Sri Lankan context ‘consultant’ refers to senior physicians with specialist training.
laboratory support that the MRI offers to surveillance is hampered by irregular supplies of reagents and, at times, inadequate staffing.

**Life course approach to immunization**

Sri Lanka gives a number of vaccines after infancy, and achieves high coverage with all. Of particular note is the country’s School Health Programme that serves as an excellent example of life course vaccination integrated into health screening and promotion activities. This school programme should also serve as an effective programme for the upcoming HPV vaccination.

**Progress in reaching global and regional goals**

*Poliomyelitis eradication*

Since the country reported its last poliomyelitis (polio) case in 1993, continued efforts have been made to maintain polio-free status both before and after the regional certification, which occurred in March 2014. Reported coverage with the third dose of oral poliovirus vaccine (OPV3) has remained very high in all provinces and districts. While acute flaccid paralysis (AFP) surveillance continues not to achieve the operational reporting target of the Region, there is no indication that the performance levels have decreased in a well-coordinated system with high levels of zero reporting and case searches in silent areas. However, emphasis needs to be placed on adequate stool specimen collection, sensitization of health-care workers to the reality that global polio eradication is not yet achieved and that the risk of reintroduction therefore remains, and strengthening the involvement of the private and informal health sectors. Polio oversight committees and technical expert groups have remained active and preparations for the global synchronized switch from trivalent oral poliovirus vaccine (tOPV) to bivalent oral poliovirus vaccine (bOPV) are on track, including poliovirus laboratory containment. As such the country is meeting the requirements of the Polio Eradication and Endgame Strategic Plan 2013–2018 (the Endgame Plan).

*Maternal and neonatal tetanus elimination*

Sri Lanka’s last neonatal tetanus (NT) case occurred in 2010. Although the country has not been externally evaluated for maternal and neonatal tetanus elimination (MNTE), it has a rigorous internal system to evaluate all neonatal deaths; this includes evaluations for NT.
Rubella/CRS elimination

Sri Lanka introduced the rubella vaccine in 1996, targeting women aged 16–44 years and girls aged 11–15 years. In 2001, measles-rubella vaccine (MR) was introduced as the second dose of measles containing vaccine (MCV2), given at the age of three years. In 2011, Sri Lanka experienced an outbreak of more than 400 reported cases of rubella, predominantly among men aged more than 15 years, suggesting that susceptibility remains among adult men. This may contribute to ongoing circulation of the rubella virus. During 2013–2014, a combined total of eight cases of CRS were reported.

Measles elimination

Sri Lanka introduced the measles vaccine in 1984. Following a large outbreak of measles in 1999–2000, Sri Lanka introduced a second dose of measles vaccine in 2001, as well as conducting measles supplementary immunization activities. Despite achieving extremely high two-dose coverage since 2001, in 2013 Sri Lanka began to experience an outbreak which is ongoing with about 4 000 suspected measles cases reported through end-2014. Case distribution mirrors modelled population susceptibility, with most cases found in those aged 1 year or less, aged 16–21 years, and aged more than 30 years. Surveillance for measles is hampered by inadequate specimen collection, as well as by delays in reporting back specimen results and linking these to epidemiological data. In addition, the team noted many opportunities for nosocomial transmission as measles cases are routinely hospitalized in large, open wards.

New and underutilized vaccines implementation

Sri Lanka has an excellent data-driven process to make decisions around vaccine introduction. Since 2008 (inclusive), Sri Lanka has successfully introduced four new vaccines, rapidly reaching high coverage with each. In 2016, it plans to switch from tOPV to bOPV as part of a global, synchronized approach, as well as introducing the human papillomavirus vaccine. In 2010, Sri Lanka considered introduction of the rotavirus vaccine, but, following burden of disease and economic analyses, decided not to do so at that time. The country is currently completing further studies to inform the advisability of introducing the pneumococcal vaccine.

Private sector

The vast majority of vaccines are administered in Sri Lanka through the public sector. The 2011–2016 comprehensive multi-year plan (cMYP) for Sri Lanka
estimates that, nationwide, approximately 1–2% of the population receives vaccines through the private sector. More up-to-date estimates were not available. Vaccines administered through the private sector include vaccines that are not part of Sri Lanka’s EPI (‘non-EPI vaccines’). Although Sri Lanka’s Immunization Policy applies to all vaccines administered both through public and private sectors, non-EPI vaccines have no mandatory reporting requirement. Furthermore, no immunization schedule, which integrates both EPI and non-EPI vaccines, is currently published by the Ministry of Health. While the Ministry of Health has the legal authority to inspect private vaccination sites and mandate reporting of VPDs from private facilities, these powers appear to be inconsistently exercised.

**Key recommendations**

**Government support**

Recommendations for government support are to:

1. Continue to protect Sri Lanka’s investment in public health by ensuring that members of the public health community are represented in discussions around allocation of health funding;
2. Continue current efforts to expand recruitment for frontline workers. In addition, consideration should be given to provide incentives to retain individuals in high-turnover positions. For example, a cost of living adjustment or living quarters could be considered for individuals working in areas in which housing is particularly costly;
3. Staff for the Epidemiology Unit and MRI should also be augmented; and
4. Ensure that new electronic reporting systems are mutually compatible and can be linked and synchronized to maximize efficiencies and ensure data validity while avoiding conflicts and confusion as well as duplication of efforts.

**VPD surveillance**

In general, Sri Lanka’s VPD surveillance system would benefit from further attention to specific facets of the programme in order to more fully support and inform Sri Lanka’s excellent vaccine service delivery programme. This could be done by:

1. Strengthening focus on improving timeliness and completeness of notification of all reportable cases;
(2) strengthening and encouraging specimen collection for all suspected VPDs, particularly those which Sri Lanka’s EPI vaccines protect against;

(3) strengthening laboratory ability to test every sample in a timely manner;

(4) improving linkage of laboratory results and epidemiologic cases, allowing all suspected cases to have a final classification. The creation of a unique identifier could facilitate this linkage; and

(5) encouraging analysis of VPD surveillance data (including outbreak data) at the district level, with findings used for programmatic improvement and rapid response.

**Progress in meeting global and regional goals**

**Polio eradication**

Recommendations to support the maintenance of polio-free status are to:

(1) continue to emphasize the need for adequate stool specimen collection;

(2) ensure that health-care workers remain sensitized to the reality that global polio eradication is not yet achieved and that the risk of reintroduction therefore remains;

(3) strengthening the involvement of private and informal health sectors; and

(4) continue to support active polio oversight committees and technical expert groups have remained active to ensure that the country continues to meet the requirements of the Polio Endgame Plan.

**Rubella and CRS elimination**

Recommendations to support reaching rubella and CRS elimination are to:

(1) integrate a more detailed review of the rubella and CRS elimination programme with any measles-specific consultation which takes place;

(2) consider expansion of rubella vaccination among adults to include men;

(3) ensure that as many cases of CRS as possible are laboratory – and not only clinically confirmed; and
ensure that surveillance data are used to identify any common characteristics among CRS mothers that could be used to strengthen the rubella vaccination programme, for example, geographic clustering.

**Measles elimination**

Recommendations to support reaching measles elimination are:

1. a measles-focused consultation allowing a detailed review of surveillance data and a discussion of vaccination options would be advisable if the measles outbreak continues. This has been requested by the Chief Epidemiologist and is supported by the review team;

2. to strengthen surveillance (see VPD surveillance recommendations above);

3. to conduct analysis of age in months by vaccination status (0, 1, 2 doses of vaccine) to guide possible vaccination options to end the current outbreak;

4. to conduct a case control study to look for common characteristics in older age groups to guide targeted vaccination strategies;

5. to attempt to decrease nosocomial transmission by triaging rash and fever illnesses away from the main hospital, only admitting gravely ill patients, and isolating patients that are admitted; and

6. to consider mandating proof of vaccination or immunity to measles among residents of group facilities (institutions, army barracks, boarding schools), university students, and health-care workers.

**NUVI**

The review team recommended the following in terms of NUVI:

1. to continue to use evidence-based decision-making when considering what new vaccines to introduce, taking into account the full spectrum of costs to the society in Sri Lanka (including morbidity, mortality and hospitalization data); and

2. to continue to advocate to ensure the financial sustainability of already introduced vaccines and to increase financing for new vaccines, realizing that what may be considered cost-effective may evolve if Sri Lanka’s economic situation continues to improve.
Private sector

The review team made the following recommendations with regard to the private sector:

1. track the extent of the private vaccine market in Sri Lanka;
2. strengthen and regularize the oversight of vaccine administration, reporting and VPD reporting from the private sector; and
3. standardize and publish a schedule that includes non-EPI vaccines administered through the private sector.

Conclusion

In conclusion, Sri Lanka has a remarkable EPI which has been able to reach extremely high coverage with all EPI antigens throughout the country. This is underpinned by strong and proactive government support, highly-trained and dedicated staff, and exceptional literacy rates (including female) among the population. Sri Lanka offers many examples of best practices to share with other countries, including its integration of immunization with primary health care and its practices in NUVI. However, to maintain its outstanding programme, it is important that the country continue to emphasize primary health care and ensure adequate human resources. Further refinements in Sri Lanka’s immunization programme are likely to depend on data gathered from VPD surveillance. In order to maximize the usefulness of surveillance data, laboratory and epidemiologic aspects of surveillance need to be more closely linked and the use of surveillance data for programme action at the district level needs to be further strengthened. Finally, although a small percentage of vaccinations are currently delivered through the private sector, this percentage is likely to continue to increase. Efforts should be made to strengthen and regularize oversight of vaccine administration, reporting, and VPD reporting from the private sector.
1. Introduction

The Expanded Programme on Immunization (EPI) in the Democratic Socialist Republic of Sri Lanka (Sri Lanka) has achieved considerable success in preventing and controlling vaccine-preventable diseases (VPDs). The sustained high level of coverage has resulted in a reduction of more than 90% in cases of diphtheria, pertussis and tetanus in comparison with the period prior to the implementation of the EPI. The last confirmed wild poliovirus case in Sri Lanka was in 1993. Reporting of the EPI target diseases (poliomyelitis (Polio), tetanus and neonatal tetanus (NT), tuberculosis (TB), whooping cough, diphtheria, measles, meningitis, viral hepatitis\(^4\), Japanese encephalitis (JE), rubella/congenital rubella syndrome (CRS) and mumps) is compulsory in Sri Lanka and is based on clinical and/or laboratory evidence. However, historically, laboratory confirmation has, at times, been limited due to lack of laboratory facilities.

In spite of the impressive decreases in the overall morbidity and mortality of VPDs and excellent performance of the EPI system, Sri Lanka has experienced several outbreaks of VPDs in the past five years. These include a mumps outbreak which peaked in 2012 with more than 3000 cases (measles-mumps-rubella vaccine (MMR) was only introduced in 2011; prior to that measles-rubella vaccine (MR) was used), and a rubella outbreak which peaked in 2011 with 416 cases, resulting in a bump in CRS cases to 12 in 2012. Following a decade during which the country reported fewer than 150 measles cases annually, a measles outbreak began in 2013 and is ongoing, with almost 4 000 cases reported through end-2014.

Sri Lanka subscribes to the key strategic objectives of the Global Vaccine Action Plan (GVAP) and the global goals of the Decade of Vaccines (2011-2020)\(^5\): (1) achieve a world free of polio, (2) meet vaccination coverage targets, (3) reduce child mortality, (4) meet global and regional elimination targets, and (5) develop and introduce new vaccines. Additionally, Sri Lanka

\(^4\) Notification requirements for Sri Lanka specify ‘viral hepatitis’ but not causative organism (e.g., hepatitis A or B

has committed to regional immunization targets as outlined by the World Health Organization (WHO) Regional Office for South East Asia (Regional Office)\(^6\) as well as its own national goals articulated by the Department of Health Services\(^7\).

The South-East Asia Regional Technical Advisory Group on Immunization (SEAR-ITAG) recommends that each country should conduct periodic joint national-international programme reviews in addition to their own regular internal programme monitoring. Sri Lanka has not previously conducted a broad national-international programme review.

Joint national/international EPI reviews conducted in the WHO’s South-East Asia Region, including this one, have three broad objectives to:

- provide a snapshot to public health programme directors and public health policy-makers on the status of the EPI Programme and VPD surveillance;
- assess progress in meeting key national, regional and global goals; and
- provide an opportunity to share lessons learned with other countries and sharing the same goals for preventing and controlling VPDs.

This document reports on the findings and recommendations of the Joint National-International EPI and VPD Surveillance Review held in Sri Lanka on 16–26 October, 2015. Recommendations are found at the end of each topic area.

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\(^6\) WHO Regional Office for South-East Asia. South-east Asia Region Immunization Strategic Plan, 2014-2017 (Draft)

2. Background

General

Sri Lanka is an island in the Indian Ocean covering a land area of approximately 65 600 km². It is administratively divided into nine provinces with 26 districts.

In 2015, the population of Sri Lanka was estimated at 22 million with a growth rate of approximately 0.84%. Approximately 18% of the population lives in urban areas. Colombo, with a population of approximately 700 000, is the largest city in the country. About 75% of citizens are Sinhalese; 11% of the population is Sri Lankan Tamil; Sri Lankan Moors represent approximately 9% of the population and Indian Tamils approximately 4%. Sinhala and Tamil are both national languages while English is commonly used in the government. Buddhism is the official religion and approximately 70% of Sri Lankans are Buddhists, 13% Hindu, 10% Muslim, and 7% Christian. Twenty-five per cent of the population is aged 0–14 years, and 15% aged 15–25 years. The birth cohort is approximately 376 000. Ninety-three per cent of the population is literate, and school life expectancy in the population is 14 years (13 years for males, and 14 years for females). Primary school enrolment (% gross) was last measured by the World Bank in 2012 and was found to be 98.8%.  

Sri Lanka is considered a lower middle-income country. During 1983–2009, the government was in conflict with the Liberation Tigers of Tamil Eelam. The whole population of Sri Lanka has suffered from the consequences of the conflict, but the north-east, which makes up about 24% of the Sri Lanka’s land area and contains about 10% of its population, and adjacent to the north-east, bore the brunt of the conflict. The government has been pursuing large-scale reconstruction and development projects in disadvantaged areas and areas affected by the conflict.

**Health services and EPI in Sri Lanka**

In Sri Lanka, both public and private sectors provide health care. Although the public sector provides free health care for nearly 60% of the population, over 90% of all vaccines are delivered through the public sector. The Department of Health Services (DHS) and the Provincial Health Sector encompass the entire range of preventive, curative and rehabilitative health care provision. The private sector provides mainly curative care. The EPI in Sri Lanka is an integral component of the public health system. The main objective of the country’s EPI is to reduce mortality and morbidity associated with VPDs. A unique feature of the immunization services in Sri Lanka is that, for more than three decades, these have been integrated with other primary health care services at all levels, resulting in the routine sharing of service providers, facilities, etc. Although a countrywide network of health facilities exists with health care provided free of cost by the government, relatively underserved geographical areas and population groups still exist.

Immunization services in Sri Lanka are managed within the Epidemiology Unit of the DHS (established in 1959), under the overall leadership of the Director General and Deputy Director General (Public Health Services). The Epidemiology Unit handles control of all communicable diseases, including VPDs and surveillance of vaccine-preventable and other priority communicable diseases and programmes, with the exception of vertical campaigns for malaria, filaria, sexually transmitted diseases and TB.

*Feb. 9 2016*
The Sri Lankan immunization programme has a long and well-documented history, as outlined below:

- 1886 – vaccination against smallpox introduced
- 1949 – bacille Calmette–Guérin (BCG) vaccination for adults
- 1961 – introduction of diphtheria–pertussis–tetanus vaccine (DPT) vaccine
- 1962 – introduction of oral polio vaccine (OPV)
- 1963 – BCG for new-borns
- 1969 – tetanus toxoid (TT) vaccine for pregnant mothers
- 1978 – launching of EPI
- 1984 – introduction of measles containing vaccine
- 1991 – introduction of five-dose TT schedule for pregnant women
- 1995 – launching of national immunization days (NIDs) to eradicate polio
- 1996 – introduction of rubella containing vaccine for women of reproductive age (WRA)
- 2001 – introduction of new immunization schedule
  - DPT at 2, 4, 6 months
  - Second dose of MR at 3 years of age
  - Adult tetanus-diphtheria vaccine (aTd) at 13 years
- 2003 – introduction of hepatitis B vaccine (HepB), and rubella vaccine in Grade 8 for girls
2007 – formalization of a school health programme (diphtheria-tetanus (DT) in grade 1, aTd in grade 7, rubella in grade 8 for all children)

2008 – introduction of *Haemophilus influenzae* type b (Hib) vaccine as part of a pentavalent vaccine formulation

2009 – introduction of live JE vaccine

2011 – Introduction of MMR in place of MR (at 3 years) and advanced the age of the first dose of measles-containing vaccine (MCV1) to age at 1 year (in place of measles at 9 months)

2015 – Introduction of inactivated poliovirus vaccine (IPV)

The country has a cMYP⁹. This document outlines the following objectives for the country’s EPI:

- eradication of polio;
- elimination of measles, rubella, CRS, NT and diphtheria;
- reduction of morbidity and mortality due to whooping cough, hepatitis B, Hib, mumps, tetanus, TB and JE;
- prevention and control of burden of selected diseases through introduction of new vaccines.

**National EPI schedule**

Sri Lanka’s current EPI schedule is summarized below.

---

Table 1: National EPI schedule, Sri Lanka

<table>
<thead>
<tr>
<th>Age</th>
<th>Vaccine</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4 weeks</td>
<td>BCG</td>
<td>Before leaving hospital, preferably within 24 hours of birth. If a scar is not present, a second dose may be offered after 6 months up to 5 years.</td>
</tr>
<tr>
<td>On completion of:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 months</td>
<td>Pentavalent (D, P, T, Hep B and Hib vaccine), OPV (first dose)</td>
<td>For a defaulter or for an unimmunized child minimum 6–8 weeks between doses is adequate.</td>
</tr>
<tr>
<td>4 months</td>
<td>Pentavalent (D, P, T, Hep B and Hib vaccine), OPV (second dose); IPV</td>
<td></td>
</tr>
<tr>
<td>6 months</td>
<td>Pentavalent (D, P, T, Hep B and Hib vaccine), OPV (third dose)</td>
<td></td>
</tr>
<tr>
<td>9 months</td>
<td>MMR (first dose)</td>
<td>On completion of 9 months.</td>
</tr>
<tr>
<td>12 months</td>
<td>Live JE vaccine</td>
<td>On completion of 1 year.</td>
</tr>
<tr>
<td>18 months</td>
<td>DPT &amp; OPV (fourth dose)</td>
<td>On completion of 18 months</td>
</tr>
<tr>
<td>3 years</td>
<td>MMR (second dose)</td>
<td>On completion of 3 years.</td>
</tr>
<tr>
<td>5 years</td>
<td>DT &amp; OPV (fifth dose)</td>
<td>On completion of 5 years.</td>
</tr>
<tr>
<td>12 years</td>
<td>aTd (adult tetanus diphtheria)</td>
<td>On completion of 11 years.</td>
</tr>
<tr>
<td>15–44 years females</td>
<td>rubella containing vaccines (MMR)</td>
<td>One dose of MMR should be given to all females between 15–44 years of age who have not been immunized with rubella-containing vaccines earlier.</td>
</tr>
<tr>
<td>Age</td>
<td>Vaccine</td>
<td>Remarks</td>
</tr>
<tr>
<td>--------------------</td>
<td>----------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>A. first dose</td>
<td>tetanus toxoid</td>
<td>During first pregnancy, after 12 weeks of period of amenorrhea (POA).</td>
</tr>
<tr>
<td>B. second dose</td>
<td>tetanus toxoid</td>
<td>During first pregnancy, 6–8 weeks after the first dose.</td>
</tr>
<tr>
<td>C. third dose</td>
<td>tetanus toxoid</td>
<td>During second pregnancy, after 12 weeks of POA.</td>
</tr>
<tr>
<td>D. fourth dose</td>
<td>tetanus toxoid</td>
<td>During third pregnancy, after 12 weeks of POA.</td>
</tr>
<tr>
<td>E. fifth dose</td>
<td>tetanus toxoid</td>
<td>During fourth pregnancy, after 12 weeks of POA.</td>
</tr>
<tr>
<td>F. One booster dose of tetanus toxoid (TTb)</td>
<td></td>
<td>During the first pregnancy, with written evidence of previously being immunized with 6 doses of tetanus toxoid as per the National EPI schedule (3 doses of DPT in infancy + DPT at 18 months + DT at 5 years + aTd at 12 years) during childhood and adolescent and a gap of 10 years or more after the last tetanus toxoid containing immunization.</td>
</tr>
</tbody>
</table>
| G. tetanus toxoid immunization not indicated | | 1. Mothers who have received 5 doses of tetanus toxoid during previous pregnancies are protected and do not need further tetanus toxoid immunization for the present pregnancy.  
2. Mothers who have received 6 doses of tetanus toxoid according to the national EPI schedule during childhood and adolescence and if the gap between the last tetanus toxoid containing immunization and the present pregnancy is less than 10 years, are protected and do not need further tetanus toxoid immunization for the present pregnancy.  
3. Mothers who have received 6 doses of tetanus toxoid according to the National EPI schedule during childhood and adolescence and have received at least 1 booster dose of tetanus toxoid during pregnancy or due to trauma within the last 10 years are protected and do not need further tetanus toxoid immunization after the present pregnancy. |
EPI service delivery

Since the programme’s inception, EPI services have been integrated as a component of comprehensive health-care services. Immunization is carried out along with the maternal and child health (MCH) services. MCH programmes are delivered through Medical Officer of Health (MOH) offices and MCH clinics. Almost all MCH clinics are conducted by the MOH who work under the regional directors of health services (RDHSs). In some hospitals, maternity homes, and central dispensaries, institutional medical officers conduct the clinics with the assistance of field health staff. A school-based vaccination delivery programme is in place and conducted by the MOH of the relevant area with the assistance of field-level public health staff.

Private hospitals and general practitioners also provide immunization services to the community. Private practitioners receive EPI vaccines from the government free of charge upon request. Vaccinees receiving these vaccines are only charged for professional services. The private sector also offers non-EPI vaccines.

Financing of immunization programme

Financial indicators reported to WHO for years 2012, 2013 and 2014 are below. In 2012 and 2013, Sri Lanka received co-financing from Gavi for Hib vaccine delivered as one of the antigens in a pentavalent formulation. In 2014, this co-financing was no longer available resulting in increased governmental costs.

Table 2: Financial indicators reported to WHO, Sri Lanka, 2012–2014[^10].

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2014</th>
<th>2013</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are there line items in the national budget specifically for the purchase of vaccines used in routine immunizations?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>What amount of government funds are spent on vaccines?</td>
<td>4 514 300</td>
<td>1 961 203</td>
<td>2 040 225</td>
</tr>
</tbody>
</table>

Joint National/International Expanded Programme on Immunization and Vaccine Preventable Disease Surveillance Review

<table>
<thead>
<tr>
<th>Indicator</th>
<th>2014</th>
<th>2013</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the total expenditure (from all sources) on vaccines used in routine immunization?</td>
<td>4 812 650</td>
<td>4 772 203</td>
<td>5 264 025</td>
</tr>
<tr>
<td>Percentage of total expenditure on vaccines financed by government funds</td>
<td>94</td>
<td>41</td>
<td>39</td>
</tr>
<tr>
<td>What amount of government funds are spent on routine immunization?</td>
<td>6 139 013</td>
<td>13 913 997</td>
<td></td>
</tr>
<tr>
<td>What is the total expenditure (from all sources) on routine immunization?</td>
<td>6 595 363</td>
<td>13 953 000</td>
<td></td>
</tr>
<tr>
<td>Percentage of total expenditure on routine immunization financed by government funds</td>
<td>93</td>
<td>100</td>
<td>97</td>
</tr>
</tbody>
</table>

**EPI Programme Performance**

WHO and the United Nations Children’s Fund (UNICEF) best estimates for vaccine coverage in Sri Lanka show extremely high programme performance over the past three years, as evidenced in the table below.

**Table 3: WHO and UNICEF best coverage estimates, Sri Lanka, 2012–2014**

<table>
<thead>
<tr>
<th>Antigen</th>
<th>2014</th>
<th>2013</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCG</td>
<td>99</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>DTP1</td>
<td>99</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>DTP3</td>
<td>99</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>HepB3</td>
<td>99</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>MCV1</td>
<td>99</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>MCV2</td>
<td>99</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>Pol3</td>
<td>99</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>PAB</td>
<td>95</td>
<td>95</td>
<td>95</td>
</tr>
</tbody>
</table>

VPD surveillance

Sri Lanka conducts integrated national surveillance for 28 diseases, of which the following are targeted by Sri Lanka’s EPI vaccines: polio, measles, rubella/CRS, whooping-cough-like illness/pertussis, tetanus/neonatal tetanus, diphtheria, mumps, viral hepatitis\textsuperscript{12}, meningitis, Japanese encephalitis and tuberculosis.

Status of VPDs

The table below outlines VPD morbidity reported to WHO for 2012–2014.

\textit{Table 4: Morbidity due to selected VPDs in Sri Lanka, all ages, 2012–2014\textsuperscript{13}}

\begin{tabular}{|c|c|c|c|c|}
\hline
Rank & Disease & 2014 & 2013 & 2012 \\
\hline
1 & Mumps & 383 & 1274 & 3558 \\
\hline
2 & Measles & 1686 & 2107 & 51 \\
\hline
3 & Pertussis & 38 & 67 & 61 \\
\hline
4 & JE & 21 & 70 & \\
\hline
5 & Rubella & 10 & 24 & 54 \\
\hline
6 & Tetanus, excluding NT & 9 & 19 & 8 \\
\hline
7 & CRS & 3 & 5 & 12 \\
\hline
8 & Diphtheria & 0 & 0 & 0 \\
\hline
9 & NT & 0 & 0 & 0 \\
\hline
10 & Polio & 0 & 0 & 0 \\
\hline
\end{tabular}

\textsuperscript{12} As mentioned previously, notification requirements for Sri Lanka specify ‘viral hepatitis’ but not causative organism (e.g., hepatitis A or B)

\textsuperscript{13} http://www.who.int/immunization/monitoring_surveillance/data/en/ Accessed Nov. 16, 2015
3. **Review Objectives**

The Sri Lankan EPI programme shows evidence of functioning extremely well with low VPD morbidity and mortality and high vaccine coverage reported both administratively and through surveys. In light of these findings, this review focused on providing a snapshot of the current status of the programme, assessing progress towards current regional and national goals, reviewing preparations made to date for meeting potential future challenges and providing an opportunity to share lessons from Sri Lanka with senior EPI staff from neighbouring countries. In addition to the EPI and VPD Surveillance Review, in 2015 Sri Lanka also completed both an Effective Vaccine Monitoring (EVM) as well as a National Medicines Regulatory Authority (NMRA) review. In order to avoid redundancy, these topic areas were omitted during the EPI review.

In this context, the review focused on five core areas:

- **government Support:**
  - financing and governance;
  - health systems, with focus on human resources and information systems;
- VPD surveillance, with focus on the extent to which the surveillance system is able to adequately inform and guide the EPI programme;
- life course vaccination, with emphasis on school-based immunization;
- progress in reaching global and regional goals, with particular emphasis on measles elimination; and
- lessons from and considerations around new and underutilized vaccines implementation.

4. **Methodology**

The DHS, the Regional Office and the WHO Country Office in Sri Lanka collaborated to assemble a review team of 84 members (69 Sri Lankan
members from national and subnational levels as well as 15 international members), including representatives from India’s and Indonesia’s immunization programmes, as well as from WHO, UNICEF, and CDC. Annex 1 lists all national and international participants. The team addressed the core questions through a desk review of relevant policies and guidelines; secondary analysis of available data; interviews with key stakeholders, policy-makers, and programme staff; and direct observation of programme implementation at field sites throughout Sri Lanka.

Joint field teams of one international staff, one or more Sri Lankan staff from the national level, and varying numbers of Sri Lankan staff from regional and district health services visited 20 of the 26 districts as well as reviewing national functions from 18–23 October 2015. Each field team visited district and subdistrict health facilities. Field sites were selected in conjunction with the Ministry of Health. Site visits by a senior laboratorian were made to the Medical Research Institute (MRI).

Upon returning to Colombo, the field teams presented their assessments and related their findings relative to the five core topic areas through extensive discussions on October 23 and 24. The consensus conclusions and recommendations were shared on 26 October at a forum led by the DGHS and attended by government public health programme directors and policy-makers from the national, regional, and district levels as well as other key stakeholders.
5. Limitations

A two week review can only reveal a relatively limited view of a country’s EPI. Sites visited may not be fully representative of all immunization sites. In such a short period of time, international reviewers cannot hope to fully appreciate the subtleties of Sri Lanka’s approach to public health and immunization. In addition, specific topics may require more analysis than is possible being given the breadth of the review. Nonetheless, such a review can provide assistance in identifying programme gaps, bring new perspectives and experience from other settings, and identify topics that merit more in-depth follow up.
6. **Findings and key recommendations by topic area**

**General**

In general, Sri Lanka has a remarkable immunization programme notable for its excellent service delivery, exemplary integration with other preventive and primary health care services, well-trained and dedicated staff, and demand generation in the population. Nonetheless, this review has identified additional approaches, which the DHS may wish to consider further strengthening Sri Lanka’s EPI and safeguarding the programme’s successes.

**Government support**

**Context**

Government support is critical to a well-functioning immunization system. This includes high-level advocacy for the programme; dedicated and adequate funding; strong governance and policies; vaccine licensing, procurement and management; development and roll-out of information systems; and provision of adequate human resources and facility infrastructure.

**Findings**

**Advocacy and financing**

Advocacy: Sri Lanka’s EPI benefits from high-level advocacy through the DGHS. The DGHS chairs the Advisory Committee for Communicable Disease (ACCD), which makes decisions on vaccine introduction and schedules (see below). The DGHS’s commitment to EPI was evidenced by his very active participation in this review.

Financing: Financial resources for publicly-funded health care mainly come from the government through general tax revenue and donor-assisted external sources. In 2009, government financial resources covered 45.5% of total health expenditures. The remaining 54.2% was financed privately through out-of-pocket payment, employer-sponsored benefits, and insurance. Immunization services are overwhelmingly provided from the
public sector with only 1–2% of the population receiving vaccines in the private sector, although this number is higher in Colombo.

The EPI, as part of integrated maternal and child Primary Health Care (PHC) services, shares logistics and recurrent costs with other preventive and curative health services. As Table 2 shows, the vast majority of EPI costs are borne by the government, and a line item exists in the national budget for vaccines. Although pentavalent vaccine was co-financed with Gavi in the past, Sri Lanka has graduated from eligibility for Gavi support and must finance all vaccines from 2016 onward (with the exception of IPV). Financial sustainability is a serious consideration for the government when deciding whether or not to introduce new vaccines.

**Policy and governance**

Immunization policy: In 2014, Sri Lanka developed the country’s Immunization Policy. This far-reaching document provides broad policy direction for the country’s immunization programme and covers a full range of immunization-related issues, including provision of immunization services (by private as well as public providers), availability of efficacious, safe and quality vaccines, introduction of new vaccines, implementation of the National Immunization Programme (NIP), financial sustainability, advocacy and promotion of the NIP, and the implementation of the National Immunization Policy. The next step will be to develop strategy documents to ensure that objectives contained in the immunization policy are reached. Many objectives of the immunization policy have already been met.

National and subnational plans: The country’s most recent cMYP covers the period 2011- 2016. An annual work plan is also developed at national level. In addition, each district develops a micro plan for EPI.

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ACCD: The decision to introduce a new vaccine as well as the selection of vaccine schedules is made by the ACCD, a committee constituted of Directors of different communicable disease control programmes in the DHS as well as nationally-recognized subject matter experts. It includes paediatricians, public health experts, epidemiologists, infectious disease experts, and immunologists. As noted above, the committee is chaired by the DGHS. The committee has formal terms of reference, meets quarterly, and members must reveal any conflicts of interest. The decision to introduce a vaccine is made following a review of burden of disease studies and economic analyses conducted by the Epidemiology Unit or in academic settings throughout the country.

**Adverse events following immunization (AEFI) investigations and risk communication**

All AEFI that are detected are reported according to issued guidelines to the Epidemiology Unit. Serious AEFI that are reported to the Epidemiology Unit through this AEFI surveillance network are investigated. Causality is determined by a committee of national experts, generally guided by pathologic analysis. A comprehensive report is written on each case. Although compensation per se is not offered, costs of medical or other care required as a result of the adverse event are offered through the national health system.

Risk communication: After adverse events occurred following the introduction of pentavalent vaccine in 2008 and two adolescent deaths following the introduction of school-based rubella vaccination in 2009, the Epidemiology Unit worked closely with UNICEF on risk communication to mitigate the negative impact of these events on coverage with EPI vaccines. A protocol currently exists for risk communication which centralizes communication with media to the Epidemiology Unit with support from the Media Unit within the Ministry of Health.

**Vaccine licensing, procurement, and management**

Vaccine licensing: All vaccines used in the country (regardless of whether or not they are included in the EPI) must be licensed by the NMRA. Until 2014, licensing authority fell under the DGHS; however, the NMRA has
recently been established as an independent entity. The NMRA has recently been separately reviewed and therefore, will not be further discussed here.

Vaccine procurement: Vaccine is procured annually by the central government following a tender process managed by the Epidemiology Unit. The government has also arranged a back-up procurement mechanism through UNICEF. The country also holds six months of vaccine as a buffer at the national level, as well as three months of vaccine as a buffer at the district level. Following many years without stock outs, the country experienced a brief stock out of DT earlier in 2015. This was the result of a misunderstanding with the supplier based on events which occurred years earlier when vaccine was suspended due to safety concerns. However, due to the existence of buffer stocks, most immunization posts were able to continue supplying the vaccine. Sri Lanka is likely to introduce human papillomavirus (HPV) vaccine in 2017, and, as a country graduating from eligibility for funding from Gavi, Sri Lanka is eligible for reduced vaccine pricing for the introduction of the vaccine.

Effective vaccine management: In July 2015, Sri Lanka participated in an EVM Review\(^\text{15}\). Although several recommendations were made to further improve Sri Lanka’s vaccine management, the report notes that “(Sri Lanka) has clearly addressed all major issues relating to vaccine management, supply chain and logistics. Furthermore, it is managed as a graduating country in a financially conscious manner with strong recognition of measures for long-term sustainability”. In light of this comprehensive EVM review, vaccine management was not assessed during the EPI review.

**Information systems**

A description of the VPD surveillance system is below (see “VPD Surveillance”). EPI performance monitoring data are generated at immunization clinics by frontline public-health workers and processed up the monitoring cascade, from MOH office to RDHS to the central office, in the same manner as that for VPD surveillance. The VPD surveillance and EPI data management systems, particularly at the local and divisional levels, are currently paper-based and involve multiple forms which, at times,
include apparent redundancies. Although staff appears familiar with the necessary forms, reporting is labour-intensive. Perhaps as a result, some incompleteness and delays in reporting were noted by reviewers.

Electronic data management systems (e.g. CD online reporting as “e-surveillance” and the web-based immunization information system (WBIIS) have been initiated to improve the efficiency of VPD surveillance and EPI management, and the launch of e-surveillance reporting has been well received by workers in the field. The Epidemiology Unit has also developed software for VPD and AEFI surveillance. The provision of computer facilities at the regional and divisional levels is being conducted in a phased manner. DHS has started the training of central level officers on electronic data management, and is extending the training to the district and divisional levels. In addition to communicable disease online reporting and WBIIS, other electronic reporting systems for EPI data reporting exist, including one for dengue reporting and some district-specific systems.

Human resources

Nationally, leadership and oversight for the EPI rests within the Epidemiology Unit, which is also responsible for virtually all communicable disease control. This Unit is staffed by five medical epidemiologists, four medical officers, three information and technology assistants and one temporary data manager. The current cadre allows for ten epidemiologists, but five positions currently remain unfilled. Frontline primary care, including immunizations, is offered by public health midwives (PHMs). Public health investigations are completed by public health investigators (PHIs). In addition to actually administering vaccines, staff play a critical role in raising awareness of the need for vaccinations and tracking defaulters. Responsibilities of PHMs have recently been expanded to include care of elderly individuals and those with chronic diseases. This has led to a decrease in the catchment area that each PHM is responsible for.

Insufficiencies in terms of numbers of staff involved in EPI and VPD surveillance were observed in many areas visited. In these areas, frontline staff was over-stretched and the quality of work was maintained with difficulty. In some instances, staff posts were available, but vacancies remained unfilled. However, in other areas, staff posts and target population were not appropriately matched.
Several different solutions to these staffing difficulties are currently being implemented. In some cases, retired PHMs are being re-hired to fill service gaps, and service areas are being re-allocated among the limited number of existing staff. In addition, the DHS has recently revised admission requirements for PHM training, resulting in an increase in applicants. However, the impact of these changes will not be felt until these applicants complete required training, or approximately 18 months.

**Infrastructure**

In most places visited, clinic infrastructure (buildings, equipment, vehicles) appeared adequate or more than adequate.

The two northern districts of Killinochchi and Mullaitivu represented a special case. As noted above, in 2010, Sri Lanka emerged from a period of internal conflict during which these two districts were the most severely affected in the country. These have since received intensified government and donor support targeting improved infrastructure. Killinochchi has four MOH areas; of these, two have been re-built and two renovated. This district has 25 MCH clinics, 18 of which have been renovated and 17 newly built. In Mullaitivu, there are five MOH areas. Three of these have new offices, while two have offices under construction. In Mullaitivu, fifty MOH clinic centres are functioning, of which 14 are newly constructed, 26 have been renovated, and the remaining 10 are either under construction or have repairs planned. The two major hospitals in these districts have also been upgraded, as have the cold chain facilities which now include walk-in cold rooms. A reflection of government support and continued population trust in immunization in these districts has been the persistence of vaccine coverage above 90%.

Despite this overall positive picture, nationwide a few infrastructure challenges were observed, e.g. use of rented buildings for clinics in Jaffna and use of old, poorly-functioning, donated cars in Killinochchi and at least one other place visited.
**Key strengths and best practices**

Sri Lanka has many strengths and best practices in the area of government support. These include:

1. longstanding and strong commitment to EPI, as evidenced by the consistently high coverage achieved with all antigens across all districts;
2. stable funding: Sri Lanka’s dedicated budget line for vaccines and the percentage of vaccine and routine immunization costs borne by the government provide a strong financial base for the programme;
3. a proactive, broad vision for EPI as evidenced by the nature of the Immunization Policy;
4. a well-established and competent decision-making body in the ACCD;
5. recognition of the need for, and accomplishment of the early stages of, the roll-out of electronically-based information systems; and
6. an extremely well-trained and dedicated work force from the highest level to frontline staff.

**Key issues and challenges**

Key issues and challenges in the area of government support include:

1. ensuring that primary healthcare in general and the EPI in particular remain a priority of the DHS as investments continue to be made in Sri Lanka’s health sector;
2. financial sustainability: although Sri Lanka has taken a very conservative approach to vaccine introductions in order to ensure financial sustainability, vaccine-associated costs will continue to increase with the likely introduction of HPV vaccine in 2017 and the eventual phase-out of Gavi funding for IPV in 2018. Providing computers and training to introduce
and extend the electronic data management system will also take additional financial support;

(3) maintaining an adequate frontline workforce – which currently serves as the lynchpin of Sri Lanka’s exceptional primary health care programme;

(4) ensuring that new electronic systems are mutually compatible and are able to be linked and synchronized; and

(5) maintaining trust in the EPI. Although Sri Lanka has developed skill in risk communications, in an era of social media further high profile adverse events may be difficult to counter.

**Recommendations**

In general, the DHS seems well aware of the challenges outlined above and has already taken steps to address many of these.

Specific recommendations from the review team are to:

1. ensure that members of the public health community form part of decision-making bodies on allocation of health funding at every level of the allocation process;

2. consider standardizing economic analyses for new vaccine introductions, if possible taking a societal perspective;\(^16,17\)

3. strengthen staffing in the Epidemiology Unit by filling currently vacant epidemiology positions and expanding the cadre for medical officers, computer programmers and data managers; consider augmenting staffing for the MRI in specific areas (see below under “VPD Surveillance”); continue current efforts to expand recruitment for frontline workers. In addition, consideration should be given to incentives to retain individuals in high-turnover positions. For example, a cost of living adjustment or living quarters could be considered;


(4) ensure that new electronic reporting systems are mutually compatible and can be linked and synchronized to maximize efficiencies, and ensure data validity while avoiding conflicts and confusion as well as duplication of efforts. Consider eventually extending the electronic data management systems to private sector health providers to improve completeness of surveillance and national programme monitoring. However, this extension may be conducted in a phased manner and may allow clinic management to volunteer to use electronic (as opposed to paper-based) reporting; and

(5) monitor social media and proactively address anti-vaccine sentiments identified.

**VPD surveillance**

**Context**

VPD surveillance is an integral part of the evaluation process to ensure that a country is delivering high quality vaccination services to the entire population. Evaluation of high quality surveillance data allows countries to recognize gaps in the routine immunization programmes (for example, through identifying outbreaks affecting unvaccinated populations) as well as allowing countries to evaluate and refine vaccination strategies. Elimination and eradication goals require that surveillance standards and the use of surveillance data be raised to levels beyond those needed for disease control alone. Surveillance has a particularly important role to play in Sri Lanka because service delivery is so strong that any remaining programme gaps will be difficult to detect through supervision alone.

Currently, Sri Lanka, by law, conducts national surveillance for 28 diseases; of these, the following are considered to be targeted by the EPI: polio (surveillance for which is done by monitoring acute flaccid paralysis (AFP), measles, rubella and CRS, whooping-cough like illness/pertussis, tetanus/NT, diphtheria, mumps, viral hepatitis, meningitis, and encephalitis. In addition, special studies are ongoing for invasive bacterial diseases and rotavirus surveillance at one site in Colombo. A special study of radiologically-confirmed pneumonia in children is also underway to provide further guidance on the likely burden of disease from pneumococcus.
**Findings**

Overall, surveillance appears to perform better for severe diseases, such as AFP, tetanus, CRS, meningitis/encephalitis, and would benefit from further strengthening for diseases that can have milder presentations. In most areas, the preventive and curative sectors are relatively well-coordinated with good links between the RDHS/MOH and the hospitals.

**Case notification**

Cases appeared to be almost exclusively notified from hospitals, with little reporting seen from outpatient departments (OPD) and the private sector. OPD sites may be missing mild cases of notifiable diseases, however this was difficult to evaluate because detailed patient records were not available. Notification from wards is done daily to the Infection Control Nurse Officer (ICNO)/Public Health Unit of the hospital. ICNOs also participate in ward rounds and review registers for missed in- or outpatient cases of notifiable disease. Although diseases for which surveillance is performed have surveillance case definitions, in reality the likelihood that a case will be notified depends primarily on the attending physician’s clinical diagnosis rather than whether the case meets the surveillance case definition. Data from sites visited indicated that most cases that are diagnosed as having a notifiable disease are indeed reported.

**Timeliness**

Evaluation of surveillance forms showed that notification is sometimes done at the time of patient discharge, rather than at patient admission. Hospitals reportedly send notifications daily by post to the MOH. On average, five days are needed for the posted notification form to reach the MOH. A review of measles data in two districts showed that it took on average 14 days from the time of measles onset to the time that a PHI was notified. In two different districts, two AFP cases were not notified for eight days. Some hospitals use telephones to improve timeliness of reporting, however, this is not routine. Once notified of a disease, the PHIs understand their role and responsibilities, and conduct investigations in a timely manner. The new e-surveillance system has improved timeliness of weekly reporting from the MOH to the Regional Epidemiologist (RE) and nationally.
Data quality

Some data discrepancies were noticed between forms, log books, and registers, specifically with regards to dates.

Completeness

Data on the form “Notification of a Communicable Disease, Health 544” appeared complete in most areas. Some data on the special investigation forms, most frequently the laboratory results, were incomplete. Although at the national level, 80% of reported suspected measles cases had special investigation forms, in some areas, such as Puttalum, only 50% of clinically-compatible cases appear to have had a special investigation conducted.

Sensitivity of the system to detect selected VPDs

AFP: Nationally, the country has been meeting the global indicator of >1/100 000 cases of AFP in children under 15 years of age. However, performance is not uniform throughout the country, and AFP reporting rates are decreasing in some areas (Annex 2). At some sites visited, the RE conducts active surveillance at major hospitals in order to identify cases of paralysis in those aged less than 15 years. However, clinicians are unlikely to suspect polio as an aetiology of paralysis because Sri Lanka’s last polio case was more than 20 years ago. In cases of AFP below 15 years of age, diagnosis is frequently made through relatively sophisticated methodologies (e.g., nerve conduction tests) and stool samples are not always sent in a timely manner. Nonetheless, in 2014, adequate stool samples were collected for 80% of AFP cases nationally although there was variance in provincial performance.

Measles/rubella: Despite a two-year long national measles outbreak impacting every province, suspicion for measles remains low in some areas, and it appears likely that mild cases of measles are not being notified, particularly as few chains of transmission are identified. Please see below under “Measles” for further discussion of measles surveillance. Serum collected from suspected measles cases which are negative for measles Immunoglobulin M (IgM) is tested for rubella; many but not all reported rubella cases are identified in this way.
CRS: Surveillance sensitivity for CRS appears high, as CRS routinely requires specialty care that can only be done at a few hospitals where awareness of the need to report CRS cases is high. Given the universal access to free healthcare, most cases of CRS are likely being detected. Monthly perinatal audits serve as one forum for diagnosis of CRS. Please see below under “Rubella/CRS” for further discussion of surveillance for CRS.

Tetanus/NT Tetanus surveillance continues to identify sporadic cases of tetanus. It is difficult to evaluate the sensitivity of tetanus surveillance, but universal access to free health care suggests that most patients are likely to present for medical care. Similarly, as most new-borns receive multiple visits from health-care providers in the first six weeks of life, any cases of neonatal tetanus are likely to be detected. Teaching hospitals also conduct monthly perinatal audits which would allow cases to be identified.

Laboratory

Sri Lanka’s MRI conducts all laboratory testing for VPDs in Sri Lanka. The MRI is a WHO-accredited regional reference laboratory for polio and a national reference laboratory for measles and rubella. In the field, specimen collection kits are sufficient in most places to support specimen collection from suspected cases of disease. However, due to the difficulty and expense of transporting specimens from distant clinics and hospitals to MRI there are, at times, delays in sending samples to MRI for laboratory testing. Hospital and district staff also report some delays in receiving results from the laboratory.

The MRI is challenged by the lack of a reliable supply of reagents and test kits due to delays in procurement and difficulties with customs clearance. These challenges can lead to delays in testing of specimens and a lack of timely feedback to health-care providers. However, if supplies are available, samples are tested and results either carried by ambulance or posted soon after they become available. The MRI is also challenged by having both staff shortages and inexperienced staff, which prevents the laboratory from running at full capacity. Finally, the courier bidding process results in delays in sending samples for advanced testing to regional reference laboratories outside of the country. The laboratory has good record-keeping practices.
Outbreaks

At some RE offices visited, complete and updated case-based line lists were not maintained, making outbreak analysis difficult.

Key strengths and best practices

Sri Lanka has a number of accomplishments in terms of surveillance. These can be summarized as follows:

1. Generally high awareness of diseases that require notification, and of the notification process;
2. Good completeness of data (with the exception of laboratory results); and
3. A WHO-accredited regional reference laboratory for polio and national reference laboratory for measles and rubella.

Key issues and challenges

Sri Lanka’s VPD surveillance system is also facing a number of challenges. Given the very well-trained and dedicated staff in the country as well as good national infrastructure, the country should be able to surmount these challenges to bring its VPD surveillance to the same extremely high level as its EPI service delivery. These challenges include:

1. A need to increase timeliness of reporting and laboratory diagnosis to permit timely response;
2. A need to increase rates of specimen collection, most obviously for measles;
3. Internal issues within the MRI, namely in terms of procurement of reagents and adequate staffing. These issues appear to affect timeliness of testing and feedback;
4. Timely final case classification, presumably due, at least in part, to lack of laboratory results;
(5) incomplete ownership and use of data to inform programme at the district level; and

(6) a heavy burden of paperwork, which may discourage reporting.

**Recommendations**

The review team made the following recommendations to address existing challenges and strengthen VPD surveillance by:

(1) increasing focus on improving timeliness and completeness of notification of all reportable cases through:

(a) engaging heads of hospitals to ensure that timely notification is conducted for all notifiable diseases;

(b) having notification of diseases occur on patient admission, rather than at patient discharge;

(c) considering annual review meetings in hospitals on EPI and VPD surveillance; notification with support from Provincial Consultant Community Physician (CCP) and RE; and

(d) sensitizing in- and outpatient doctors to the current measles outbreak, the suspected measles case definition, and notification requirements.

(2) strengthening sample collection: Samples should be collected on all AFP, suspected measles/rubella cases, and encephalitis cases. As the MRI gains capacity to test for other VPDs, samples should be collected for other VPDs such as whooping cough-like illness and mumps. In addition

(a) a system should be created to ensure that all results are reported back to the field to both doctors and public health officials;

(b) doctors may need further education on Sri Lanka’s eradication and elimination goals, and the importance of collecting samples for public health purposes; and
(c) the RE should monitor quality of surveillance indicators and report these at quarterly EPI review meetings.

(3) strengthening laboratory ability to test every sample in a timely manner by:

(a) re-visiting the clearance system for VPD-related laboratory items by the NMRA and customs to help combat delays in supplies entering the country;

(b) modifying the courier bidding process so that bidding does not need to occur for each shipment but rather for a defined time period;

(c) considering the need for a subnational laboratory(s). An economic evaluation could be done to see if this is the optimal course of action;

(d) considering adding a new MRI staff member dedicated to measles to increase sample testing capacity; and

(e) ensuring that new MRI staff receives required training.

(4) improving linkage of laboratory and epidemiologic cases, allowing all suspected cases to have a final classification. This linkage could be facilitated in the following ways:

(a) considering creation of unique identifiers to facilitate epidemiologic and laboratory linkage;

(b) at the national level, considering the addition of a data manager to the Epidemiology Unit to help ensure that all epidemiologic data are complete and linked to laboratory data, ensure timely data analysis, and help to resolve any issues that arise with new online systems;

(c) maintaining updated case-based line lists at the hospital and RE, including complete data on cases (laboratory results and final case classification);
(d) when measles/rubella samples arrive at MRI, MRI should fax the request memo to the Epidemiology Unit. At this point, the Epidemiology Unit could assign a unique identifier to permit easy linking of epidemiology and laboratory data; and

(e) undertaking an evaluation of the feedback system of results from MRI to understand where the breakdown in communication of results occurs.

(5) encouraging analysis of VPD surveillance data (including outbreak data) at the district level, with findings translated into programmatic improvement and rapid response; and

(6) considering decreasing paperwork and increasing timeliness through expanding the online e-surveillance to include data entry of case-based data. This would also decrease the data entry burden at the national level.

Life course approach to immunization

Context

As described in the GVAP, a “life-course” approach is needed in order to make the benefits of immunization available to those at risk in all age groups. The Plan describes the need to boost immunity beyond the first year of life, in order to sustain the gains made from infant immunization. In addition, vaccines that are beneficial for school children, adolescents, adults at special risk (e.g., health workers, immunocompromised, animal handlers, the elderly) are now available, including vaccines for human papillomavirus, influenza, rabies, and pneumococcus). Successful efforts to eliminate maternal and neonatal tetanus with tetanus vaccine and the benefits of influenza vaccination during pregnancy have increased interest in the development of other “maternal” vaccines for use during pregnancy (e.g., group B streptococcus, respiratory syncytial virus vaccines) and after delivery (e.g., exploration of the benefits of “cocooning” for mothers and caretakers of infants of pertussis vaccine). Optimizing vaccine use beyond the first year of life will mean creating strategies for reaching eligible

persons throughout the life course, communicating with them effectively to create demand, and developing plans for monitoring implementation progress, measuring coverage, and assessing impact. Finally, as noted by the GVAP, new vaccines targeted against causes of major diseases such as cervical cancer, pneumonia, diarrhoea, and dengue “can be used as a catalyst to scale up complementary interventions and that beyond the mortality gains, these new vaccines will prevent morbidity with resulting economic returns”.\textsuperscript{18}

\textbf{Findings}

\textbf{History}

Historically, immunization programmes have focused on immunizations in the first year of life. The life course approach expands beyond this to consider immunization beyond the first year of life. In Sri Lanka, coverage for vaccines given AFTER infancy listed below has reached high coverage, and did so within a short time after introduction:

- DPT, OPV booster at 18 months of age;
- MMR 2 at 3 years of age;
- DT, OPV at age 5 years of age;
- aTd at 12 years of age (grade 7);
- Rubella containing vaccine for women aged 15–44 years;
- TT use in pregnancy, facilitated by identification of “eligible couples” by PHMs in their catchment areas.

\textbf{School health programme}

Sri Lanka has a long history of a strong school health programme, another example of a life course strategy. The school health programme includes three integrated components (immunization, health screening for several conditions (e.g., vision, growth measuring/monitoring, and dental screening) and health promotion activities (diet, exercise, sanitation). The school health programme has achieved high immunization coverage for aTd in Grade 7 (age 12). Additionally, the school health programme will serve as an effective platform for the upcoming HPV vaccine introduction.
High risk groups

Immunization in other high−risk groups has occurred in Sri Lanka, including HepB for health workers, and recently, MMR for health workers during a measles outbreak. During a recent H1N1 influenza outbreak, vaccine was offered to pregnant women and those with co-morbidities.

Decision-making

Evidence-based review of data is important in order to make cost-effective and appropriate decisions about vaccines for high risk groups. Sri Lanka has forums and processes for decisions about vaccine use. An immunization summit held every two years provides a forum for discussion and presentations about vaccine use. The national ACCD meets quarterly and makes recommendations regarding vaccine-related issues. Additionally, professional provider groups provide input into discussions regarding vaccine use.

Key strengths and best practices

Sri Lanka has seen many successes in the area of life course vaccination, including:

(1) introduction of vaccines at multiple ages across the life course, with high coverage reached soon after introduction;

(2) use of vaccination as a platform for other health interventions (MMR2 at 3 years of age); and

(3) a remarkable School Health Programme integrating many components of preventive health care, including vaccination with aTd. This will also serve as an excellent platform for HPV vaccine introduction.
**Key issues and challenges**

Vaccination beyond infancy (and vaccination of high-risk sub-groups in particular) faces challenges which are specific to the approach rather than to Sri Lanka. These include:

(1) identifying strategies for social mobilization of sub-groups;

(2) identifying sub-group specific approaches to monitoring coverage. As opposed to infants where the denominator for calculating coverage is based on the birth cohort, denominators to calculate coverage in sub-groups may be more difficult to estimate; and

(3) observing and quantifying impact of vaccines for diseases with long latency (e.g., HPV vaccine to avert cervical cancer).

**Recommendations**

As Sri Lanka continues to expand its life course vaccination, consideration may be given to the following:

(1) prior to introduction of new vaccines targeting older ages or specific population subgroups, spending time developing strategies to:

   (a) define eligible subgroups;

   (b) develop targeted communication strategies customized for specific subgroups. (best be done by involving advocates); and

   (c) plan monitoring approaches for vaccines in advance of introduction.

(2) Using vaccines as a catalyst to support complementary interventions (e.g., HPV vaccine and Papanicalaou smears for cervical cancer, pneumococcal conjugate vaccine (PCV) and early pneumonia treatment, typhoid vaccines and water, sanitation and hygiene strategies and early treatment with oral rehydration salts).
(3) Monitoring global recommendations for “maternal” vaccines during pregnancy e.g., group B streptococcal and respiratory syncytial virus vaccines and after delivery, and considering whether these could be introduced in Sri Lanka.

**Progress in meeting global and regional goals**

*Polio*

Since the country reported its last polio case in 1993, continued efforts have been made to maintain polio-free status both before and after regional certification, which occurred in March 2014. Reported OPV3 coverage has remained very high in all provinces and districts. AFP surveillance continues not to achieve the operational reporting target of the Region; however, there is no indication that performance levels have decreased in a well-coordinated system with high levels of zero reporting and case searches in silent areas. Nonetheless, emphasis needs to be placed on adequate stool specimen collection, sensitization of health-care workers to the reality that global polio eradication is not yet achieved and that the risk of reintroduction therefore remains, and strengthening the involvement of the private and informal health sectors. Polio oversight committees and technical expert groups have remained active and preparations for the global synchronized switch from tOPV to bOPV are on track, including poliovirus laboratory containment. As such the country is meeting the requirements of the Polio Endgame Plan.

*Maternal neonatal tetanus elimination*

Sri Lanka achieved maternal neonatal tetanus elimination (MNTE) in 1999. Since 2011 (inclusive) it has reported no cases of neonatal tetanus. Please see comments above under “VPD Surveillance” regarding surveillance for MNTE.

*Measles and rubella/CRS*

**Context**

In 2013, all Member States in the WHO Regional Committee for the South-East Asia Region resolved to eliminate measles and control rubella and CRS
by 2020. Regionally-established measles elimination and rubella/CRS control targets are as follow:

- fewer than five measles cases per million population by 2015 and fewer than one case per million population by 2020;
- fewer than 10 rubella cases per million population by 2020; and
- fewer than one CRS case per 100,000 live births by 2020.

The WHO South-East Asia Region endorses the following strategies to reach measles elimination and rubella/CRS control goals:

- maintain high two-dose immunization coverage;
- active, case-based surveillance;
- outbreak prevention and adequate investigation of outbreaks; and
- adequate case management.

Sri Lanka itself has as goals both measles and rubella/CRS elimination, defined as fewer than 1 rubella case per 100,000 population by the year 2020, and zero CRS cases per 100,000 live births by the year 2020. Sri Lanka first introduced single-antigen measles vaccine (M) as a single dose at 9 months of age in 1984. In 1996, rubella began to be offered to women aged 16–44 years, as well as to girls aged 11–15 years. In 2001, a decision was made to add a second dose of measles-containing vaccine (MCV2) and to incorporate rubella for both sexes into the routine immunization system through offering MR at 3 years of age. In 2011, Sri Lanka replaced both M and MR with MMR, and moved the first dose of this to age 12 months, while retaining 3 years of age for the second dose of vaccine. In April 2015, in the context of the measles outbreak discussed below, the age for administration of the first dose of MMR was moved back to 9 months. This history is summarized in Table 5.
Table 5: History of measles- and rubella-containing vaccine use in Sri Lanka

<table>
<thead>
<tr>
<th>Year of introduction</th>
<th>Vaccine</th>
<th>Age of administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>Measles</td>
<td>9 months</td>
</tr>
<tr>
<td>1996</td>
<td>Rubella</td>
<td>Women aged 16–44 years and girls aged 11–15 years</td>
</tr>
<tr>
<td>2001</td>
<td>MR as MCV-2</td>
<td>3 years (second dose)</td>
</tr>
<tr>
<td>2011</td>
<td>MMR replacing both MR (given as MCV 2) and Measles (given as MCV 1)</td>
<td>First dose: 12 months; second dose: 3 years</td>
</tr>
<tr>
<td>2015 April</td>
<td>MMR</td>
<td>First dose changed from 12 to 9 months</td>
</tr>
</tbody>
</table>

In addition to doses of vaccine offered through the routine immunization system, the country has also conducted periodic supplementary immunization activities (SIAs) to reduce immunity gaps for measles and rubella. In 2003, Sri Lanka conducted a nationwide MR SIA targeting individuals aged 10–14 years, and reached 95% reported coverage in the target population. This was supplemented in 2004 by an MR SIA targeting those aged 16–20 years, which reached 72% reported coverage. Finally, in 2013, as a measure to contain measles circulating in those aged less than one year, Sri Lanka conducted an SIA in infants aged 6–12 months and reportedly reached 99% coverage. This history is summarized in Table 6:

Table 6: History of measles and measles/rubella SIAs, Sri Lanka

<table>
<thead>
<tr>
<th>Year</th>
<th>Vaccine</th>
<th>Target age</th>
<th>Reported Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>MR</td>
<td>10–14 years</td>
<td>95%</td>
</tr>
<tr>
<td>2004</td>
<td>MR</td>
<td>16–20 years</td>
<td>72%</td>
</tr>
<tr>
<td>2013</td>
<td>Measles</td>
<td>6–12 months</td>
<td>99%</td>
</tr>
</tbody>
</table>
Since introducing measles and rubella vaccines into the routine immunization system, Sri Lanka has maintained high coverage with both vaccines. Reported cases of both measles and rubella have significantly decreased as a result, as evident from the figures below.

**Figure 2:** Incidence of reported measles cases vs MCV coverage, Sri Lanka, 1951–2012

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19 Extracted from “EPI/VPD Surveillance Review”, presentation made by Dr P. Palihawadana on October 2016 in Colombo to the review team.
However, despite very high coverage, following years of few measles cases the country began to experience an outbreak of measles in 2013, which was ongoing at the time of this review; by end-2014 approximately 4000 suspected cases had been reported. This outbreak is discussed in more detail below.

In 2011, Sri Lanka experienced an outbreak of 410 reported cases of rubella, the majority of which were in adult males. More than 95% of all cases were in individuals aged 15 years or above. The outbreak was contained through active outbreak response.\textsuperscript{20}

**Rubella and CRS**

*Findings*

Sri Lanka’s rubella strategy initially focused on women of child bearing age and adolescent girls. In 2001, MR was introduced in the EPI for both males

and females at 3 years of age. In 2003 and 2004, a MR SIA targeting both sexes aged 10–15 and 16–20 was conducted; these SIAs reached 95%, and 72% coverage respectively. Being given this vaccination history and as indicated by the 2011 outbreak, it is likely that susceptibility to rubella remains among adult males in Sri Lanka.

Rubella cases in Sri Lanka are most frequently diagnosed following negative measles testing for serum submitted from maculopapular rash and fever cases, although rubella is a notifiable disease when suspected by a physician and such notifications do occur. Approximately 30% of suspected measles cases (which can be seen as rash and fever cases) do not have serum specimens submitted. Sri Lanka is likely to be underdiagnosing rubella both because it appears rare that physicians have a primary clinical suspicion for rubella, and because some cases of rash and fever do not have specimens submitted for laboratory testing.

Sri Lanka has reported the following number of CRS cases to WHO over the past three years: 12 (2012), 5 (2013), 3 (2014). This is a very marked reduction from the mid-1990s when the country reported 275 cases of CRS in 1994 and 212 cases in 1995. Nonetheless, the existence of the recent cases remains concerning.

Unfortunately, due to time limitations, the review team was unable to conduct as in-depth a review of CRS cases and their mothers as would have been optimal.

**Key strengths and best practices**

Sri Lanka has a number of accomplishments in the area of rubella and CRS elimination including:

1. establishing strong immunity to rubella in those aged less than 15 years in 2011 (now aged less than 19 years), largely as a result of the very high coverage reached with the infant immunization programme. This immunity is apparent in the age distribution of the 2011 rubella outbreak;
(2) substantial progress in reducing susceptibility in women of child-bearing age, as evidenced by numbers of CRS cases following the 2011 outbreak relative to the number of CRS cases following the outbreak in the mid-1990s; and

(3) establishing good CRS surveillance.

Key issues and challenges

Challenges for Sri Lanka in the field of rubella and CRS elimination include:

(1) susceptibility in adult men which may fuel ongoing transmission of rubella in the population; and

(2) ensuring a clear understanding of the source of reported CRS cases, and what programmatic changes can be made to address any existing programme gaps.

Recommendations

Recommendations for the rubella and CRS programme include:

(1) integrating a more detailed review of the rubella and CRS elimination programme with any measles-specific consultation which takes place;

(2) consideration of expanding rubella vaccination among adults to include men, for example through referral at the time of eligible couple screening and through mandatory proof of immunity (through vaccination records or serological testing) or vaccination for men working, studying or living in large groups (barracks, universities, etc.);

(3) consideration of checking maternal immunity at the time a child is delivered and vaccinating non-immune mothers to prevent CRS cases as products of later pregnancies;

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(4) continuing the current practice of carefully reviewing and laboratory testing babies of mothers suspected of having had rash illness, or babies with congenital abnormalities that can be associated with CRS and classifying IgM positive cases according to regional guidelines; and

(5) continuing to describe the CRS baby’s mother’s vaccination and demographic characteristics, such as:

(a) age;

(b) vaccination history (by patient’s history or card);

(c) geographical location;

(d) ethnicity; and

(e) whether the mother is originally from or has been living in a country where rubella vaccination is not practiced.

A major purpose of such description is to identify any common characteristics that could highlight programmatic gaps to be targeted;

(1) conducting periodic viral isolation of rubella virus to determine circulating genotype.

**Measles**

*Modelled population immunity*

Modelling of population immunity based on national vaccination history and coverage achieved through routine immunization and SIAs reveals gaps in population immunity in those aged 17–21 years, and those above 31 years of age. Many (although, surveillance data would suggest, not all) of the latter age group are likely to have been protected by natural immunity (see second graph below). Figure 4 shows the population of Sri Lanka that is modelled to be unprotected by vaccination, whereas Figure 5 shows the population of Sri Lanka that is modelled to be protected by vaccination.
Figure 4: Modelled population unprotected by measles vaccination, Sri Lanka, 2015

Figure 5: Modelled population immunity, Aged 0–34 y, Sri Lanka, 2015

Population immunity by serosurvey

Sri Lanka also conducted a serosurvey for measles in 2014. In this serosurvey, 800 serum samples were collected from Kegella, Monevagala, Vivuniya and Colombo. Results (below) are similar to modelled findings:
Figure 6: Population immunity by serosurvey, selected sites, Aged 0–39 years, Sri Lanka, 2014

Laboratory-supported surveillance

Please see the general observations regarding surveillance under “VPD Surveillance”. In addition, the review teams made the following measles-specific observations regarding laboratory-supported surveillance:

- some clinicians did not see the need for laboratory confirmation as they considered the case-definition for measles to be adequately specific for diagnosis;

- measles cases are not always linked to laboratory results, resulting in some incomplete investigation forms at the central level;

- incomplete awareness of the definition of a measles outbreak existed in areas visited; and

- in some of the areas visited, no documentation could be found of active case searches for measles, or contact tracing. In contrast, active case searches and contact tracing appeared to be routinely engaged in for dengue.

Rates of laboratory investigation of suspected measles cases for 2010 through July 2015 for Sri Lanka are below (the recommended regional standard is 80%).
Table 7: Rates of laboratory investigation of suspected measles cases, Sri Lanka, 2010–July 2015

<table>
<thead>
<tr>
<th>Year</th>
<th>Laboratory investigation rate (of all reported suspected measles cases)</th>
<th>Positivity rate (of specimens tested)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>33%</td>
<td>5.9%</td>
</tr>
<tr>
<td>2011</td>
<td>44%</td>
<td>2.3%</td>
</tr>
<tr>
<td>2012</td>
<td>35%</td>
<td>8.3%</td>
</tr>
<tr>
<td>2013</td>
<td>62%</td>
<td>75%</td>
</tr>
<tr>
<td>2014</td>
<td>67%</td>
<td>74%</td>
</tr>
<tr>
<td>2015 (as of July)</td>
<td>60%</td>
<td>81%</td>
</tr>
</tbody>
</table>

The regional quality of measles and rubella surveillance indicators exist with associated targets; Sri Lanka’s indicators, when compared against these targets, suggest areas requiring further strengthening. (Annex 3). Epidemiologic and laboratory results are currently linked at the Epidemiologic Unit. However, the lack of a unique identifier complicates the linking of these results. Reportedly, measles surveillance guidelines are currently being updated.

Current measles outbreak

At the time of the review, the country was experiencing an ongoing measles outbreak with almost 4000 cases reported in 2013 and 2014 alone.
Figure 7: Number of suspected measles cases reported by week, Sri Lanka, 2013–wk. 40, 2015.

Although many cases were clustered in the western province, cases were also seen scattered throughout the country. It was difficult to tell the extent to which differential underreporting may exist in peripheral areas.

The age break down of all suspected measles cases with laboratory specimens revealed that most suspected cases were either below 12 months of age, in the 16–21 year age group, or over 30 years of age. The age break down of suspected cases in the graph above is as follows: less than 1 year of age: 2573; 1 year of age through 2 years of age: 798; 3 years of age through 14 years of age: 478; 15 years of age through 27 years of age: 1681; 28 years of age and older: 1994. This age distribution is consistent with the country’s immunity profile (see above) and the age distribution of suspected cases identified during the field visit.

The government has taken the following steps to contain the outbreak:

1. conducting a one-time SIA targeting all children aged 6–12 months;

2. conducting one-time vaccination of all individuals in group settings (army barracks, boarding schools, children’s homes, prisons, etc.). However, at the time of the review, no ongoing requirement for mandatory checks of vaccination or proof of immunity at entry existed;
(3) conducting one-time vaccination of health-care workers. However, at the time of the review there was no ongoing requirement for mandatory checks of vaccination or proof of immunity at time of entry to service; and

(4) reducing the age for MCV1 from 12 to 9 months in April 2015.

During the review, measles cases were seen to be admitted to large open wards, suggesting that substantial nosocomial transmission is taking place.

Genotype of measles virus in Sri Lanka

The circulating genotype in Sri Lanka in 2010 and 2011 was reported as D8. In 2014, B3 was reported to be circulating.

Key strengths and best practices

Sri Lanka has an excellent measles programme in terms of service delivery, achieving extremely high two dose coverage throughout the country in age groups eligible for two doses of vaccine. The current outbreak is linked predominantly to lack of immunity in those aged less than 1 year, and in two older age groups: those aged approximately 16–21 years who were not targeted by SIAs and received a single dose of MCV through the routine programme, and those aged 30–34 years who were young at the time that MCV was introduced to Sri Lanka.

Key issues and challenges

Key issues and challenges for measles elimination in Sri Lanka include:

(1) strengthening surveillance for measles;

(2) better understanding the epidemiology of measles cases to determine possible vaccination approaches to decreasing susceptibility to measles in the population and ending the existing outbreak;

(3) nosocomial transmission that appears widespread; and
(4) the need to ensure very high population immunity in adult group settings and among health-care workers.

**Recommendations**

Measles-related recommendations are to:

(1) consider a measles-focused consultation allowing a detailed review of surveillance data and a discussion of vaccination options if the outbreak continues. This has been requested by the Chief Epidemiologist and is supported by the review team;

(2) strengthen surveillance through:

   (a) increasing awareness among clinicians of the need for serological testing of suspected measles cases and ensuring that the private sector reports cases;

   (b) exploring ways to increase community-based reporting;

   (c) strengthening links between epidemiology and laboratory in order to allow laboratory data to be fed back and integrated with epidemiology data for timely final case classifications;

   (d) establishing a unique identifier for each case to allow easy linkage of cases and laboratory results;

   (e) monitoring measles surveillance indicators at district level;

   (f) strengthening case investigations through standardized instruction on contact tracking and case investigations; and

   (g) conducting viral isolation in accordance with the Regional Office measles surveillance recommendations.

(3) conduct analysis of age in months (i.e., 1 month, 2 months, 3 months) by vaccination status (0, 1, 2, unknown doses) for children aged 3 years and less. This will clarify vaccination options (e.g., whether to consider a “zero” dose of measles vaccine at six months; how many cases are due to late immunization, etc.). It would be optimal to analyse cases occurring during the period that MCV1 was given at 12
months separately from the analysis of cases occurring after the first dose of MCV1 was moved to 9 months of age;

(4) conduct a case control study to look for common characteristics in older age groups that could then guide targeted vaccination strategies in these age groups;

(5) attempt to decrease nosocomial transmission by triaging rash and fever illnesses away from the main hospital, only admitting gravely ill patients, and isolating patients that are admitted; and

(6) mandate proof of vaccination or immunity to measles among residents of group facilities (institutions, army barracks, and boarding schools), university students, and health care workers.

NUVI

Context

Sri Lanka has a strong immunization programme with coverage of more than 90% achieved in all districts, but with relatively few antigens. The country has taken a conservative approach to introducing new and underutilized vaccines to ensure financial sustainability. In general, the country has an excellent data-driven decision-making process around vaccine introduction as well as a strong decision-making body in the ACCD. Vaccine introductions are preceded by economic analyses conducted by the Epidemiology Unit or academic institutions within Sri Lanka.

Sri Lanka introduced Hib vaccine as one antigen in a pentavalent formulation in 2008, live JE vaccine in 2009, MMR in 2011 and IPV in July 2015. In 2016, the country plans to switch from tOPV to bOPV as part of a global synchronized approach, as well as introducing HPV vaccine in 2017. The HPV vaccine will be procured at the reduced price available to countries graduating from eligibility for financing from Gavi.

Neither pneumococcal nor rotavirus vaccines are currently part of Sri Lanka’s EPI, although both are available through the private sector. Sentinel site surveillance for pneumococcus has yielded very few cases of disease, most probably due to the current practice of treating patients with
antibiotics prior to specimen collection, particularly if these individuals are referred to hospitals from primary-care practitioners. In an effort to further evaluate pneumococcal burden of disease, a study of x-ray-proven pneumonia is underway. The percentage of pneumonias found in other studies to be attributable to pneumococcus will then be applied to the total number of pneumonias found. An economic study of rotavirus in Sri Lanka as well as a literature review was conducted and presented at the Immunization Summit held in 2010\textsuperscript{22}, which resulted in a decision not to introduce the vaccine at the moment. Finally, Sri Lanka is currently experiencing a high incidence of dengue fever. In the event that a dengue vaccine becomes available, the country would prioritize evaluation of this vaccine for introduction.

**Findings**

As noted above, Sri Lanka has introduced four new vaccines since 2008. District officials stated that, once the central level decides to introduce a new vaccine, implementation is smooth with an initial circular disseminated from the central level, refresher trainings conducted with health workers, and vaccines received in a timely fashion at the health facilities.

All districts visited had successfully introduced IPV in July 2015, rapidly reaching high coverage. Districts began training on and raising awareness of the new vaccine as much as a year before the vaccine was actually introduced, thus creating public demand for the vaccine. Posters on IPV, including information on the vaccine’s schedule and benefits, were visible in all facilities visited.

Hib vaccine was introduced in the form of pentavalent vaccine in 2008. This vaccine was particularly warmly welcomed by parents, as it decreased the number of injections from two (Hep B + DTP) to one, while adding protection from an additional disease. Introduction of pentavalent vaccine was followed by several adverse events (including deaths), which led to temporary suspension of the vaccine’s use. However, investigation of these deaths did not indicate that they had been caused by pentavalent vaccine. Public education by health-care workers allowed the vaccine to be re-introduced in 2009.

\textsuperscript{22} http://www.slideshare.net/lankansikh/immunization-summit-rota-2010 Accessed November 26, 2015.
All central, district and MOH level facilities have adequate cold chain capacity and temperature monitoring mechanisms to accommodate the new vaccines. Instructions on administering and storing vaccines are clear and visible throughout the health centres.

**Key strengths and best practices**

Sri Lanka’s key strengths and best practices in terms of NUVI include:

- excellent forward planning, training, and information, education and communication (IEC) materials and implementation resulting in smooth NUVI rapidly reaching very high coverage. Initial planning for HPV vaccine has already started;

- high acceptance of new vaccines by health professionals and parents, likely as a result of IEC and the level of trust of the general population in the vaccine programme; and

- a good system in place enabling rapid response to any serious AEFI, including any associated with new vaccines.

**Key issues and challenges**

Despite Sri Lanka’s successes, challenges remain, including:

- Sri Lanka, as a country graduating from eligibility for Gavi financial assistance, will have to fully finance all antigens from 2016 onwards, as Gavi co-payments end in 2015;

- reduced HPV vaccine pricing for countries graduating from Gavi eligibility will only be available for five years; this may make the long term financing of HPV vaccine challenging. In addition, even with reduced pricing, the cost of this new vaccine is comparatively high; and

- developing more evidence for PCV introduction.
Recommendations

Recommendations for Sri Lanka’s EPI with regards to NUVI are:

- continue to use evidence-based decision-making when considering what new vaccines to introduce, using standardized study approaches to allow easy comparability and taking into account the full spectrum of costs to society in Sri Lanka (including morbidity, mortality and hospitalization data);

- continue to advocate to ensure financial sustainability of already introduced vaccines and to increase financing for new vaccines, realizing that what may be considered cost-effective may evolve if Sri Lanka’s economic situation continues to improve;

- envisage economic studies (including curative cost saving) for introduction of PCV;

- consider re-doing the economic analysis evaluating rotavirus vaccine introduction, as several factors have changed since the analysis was done, as outlined below:
  - there is a global recommendation for use of rotavirus\(^{23}\);
  - the UNICEF cost per dose has fallen to USD 2.53\(^{24}\), less than half the price used in the 2010 analysis;
  - it is likely that hospital costs have gone up; and
  - Sri Lanka’s GNI per capita has increased since 2010. A rule of thumb frequently used is that a cost-effectiveness ratio of less than three times the GNI per capita is a worthwhile investment overall.\(^{25}\)

- ensure well-organized social mobilization activities for HPV vaccine introduction to minimize any possible social resistance.


\(^{25}\) WHO. Vaccine Introduction Guidelines. Adding a vaccine to a national immunization programme: decision and implementation. WHO/IVB/05.18
Private sector

Context

The vast majority of vaccines are administered in Sri Lanka through the public sector. The 2011–2016 cMYP estimates that, nationwide, approximately 1–2% of the population receives vaccines through the private sector. This figure is higher in urban settings, with the latest estimate available from a 2010 household survey conducted in western Province. The source of vaccination varied according to vaccine; however, of all vaccines received by surveyed infants, 8% were received in the private sector.

Private providers receive EPI vaccines free of charge from the government, in return for which providers are required to report numbers of children vaccinated. However, the administering facility may charge a vaccine administration fee. Vaccines not available in the EPI (e.g., PCV) are available through the private sector. Sri Lanka’s Immunization Policy covers vaccines administered both through public and private sectors. However, non-EPI vaccines have no mandatory reporting requirement. Furthermore, no immunization schedule which integrates both EPI and non-EPI vaccines is currently published by the Ministry of Health.

Findings

The review team devoted little time to reviewing the private sector. However, several facilities were visited which showed a range of practices in terms of reporting VPDs. Although the Ministry of Health has the legal authority to inspect private vaccination sites and mandate reporting of VPDs, these powers appeared to be exercised with some inconsistency.

Key strengths and best practices

In the best facilities, record keeping, reporting, storage facilities, and availability of vaccines all appeared to be excellent. However, being given the focus of the review, it was hard to ascertain how widespread such excellent practices were in private facilities.

26 Sri Lanka DHS, Epidemiology Unit. Report on EPI Coverage Assessment Survey, Western Province, 2010
Key issues and challenges

Key issues and challenges are as follows:

(1) quantitative data on the extent of the private vaccine market in Sri Lanka date from nearly five years ago;

(2) oversight of the private sector exists, but is not yet standardized and regularized; and

(3) at present there is no comprehensive immunization schedule which integrates EPI and non-EPI vaccines.

Recommendations

Recommendations with regard to the private sector are to:

(1) track the extent of the private vaccine market in Sri Lanka. This could be done by periodically conducting a household survey in major cities (as was done for Western Province) to identify major private clinics from which individuals receive vaccines, and tracking volume and type of vaccine administered through the major clinics over time. It would also be possible to gain a general idea of the volume of non-EPI vaccines being administered by contacting vaccine providers;

(2) strengthen and regularize oversight of vaccine administration, reporting and VPD reporting from the private sector; and

(3) standardize and publish a schedule that includes non-EPI vaccines administered through the private sector.

Conclusion

In conclusion, Sri Lanka has a remarkable EPI, which has been able to reach extremely high coverage with all EPI antigens throughout the country. This is underpinned by strong and proactive government support, a highly-trained and dedicated workforce, and exceptional literacy rates (including female) among the population. Sri Lanka offers many examples of best practices to share with other countries, including its integration of immunization with primary health care and its practices in NUVI. However,
to maintain its outstanding programme, it is important that the country continues to emphasize PHC and ensure adequate human resources for this programme. Further refinements to Sri Lanka’s immunization programme are likely to depend on data gathered from VPD surveillance. In order to maximize the usefulness of surveillance data, laboratory and epidemiologic aspects of surveillance need to be more closely linked and the use of surveillance data for programme action at the district level needs to be further strengthened. Finally, although a small percentage of vaccinations are currently delivered through the private sector, this percentage is likely to continue to increase. Efforts should be made to strengthen and regularize oversight of vaccine administration, reporting, and VPD reporting from the private sector.
Annex 1

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<thead>
<tr>
<th>Name</th>
<th>Position</th>
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<th>Ministry of Health</th>
<th>Country</th>
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<tbody>
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<td>Dr Sisi Wiyarahthna</td>
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Annex 2

Non-Polio AFP rate and stool specimen collection rate by province, Sri Lanka, 2014

<table>
<thead>
<tr>
<th>Province</th>
<th>Non polio AFP Rate per 100 000 &lt;15 year old population</th>
<th>Stool Collection Rate %</th>
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<tbody>
<tr>
<td>Western</td>
<td>1.4</td>
<td>86</td>
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<tr>
<td>Southern</td>
<td>1.4</td>
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<tr>
<td>Central</td>
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<tr>
<td>Sabaragamuwa</td>
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<tr>
<td>North Western</td>
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<td>North Central</td>
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<tr>
<td>Uva</td>
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<tr>
<td>Northern</td>
<td>0.7</td>
<td>100</td>
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# Annex 3

## Quality of measles surveillance indicators, Sri Lanka, 2012–2014

### Table 9: Quality of field and laboratory surveillance for measles and rubella, 2012-2014

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Suspected Measles</th>
<th>Case classification (number)</th>
<th>Measles</th>
<th>Rubella</th>
<th>Indicators</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lab-confirmed</td>
<td>Ep-linked</td>
<td>Clinical</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2012</td>
<td>147</td>
<td>7</td>
<td>117</td>
<td>23</td>
<td>54</td>
</tr>
<tr>
<td>2013</td>
<td>4,060</td>
<td>1,750</td>
<td>-</td>
<td>966</td>
<td>508</td>
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<tr>
<td>2014</td>
<td>3,117</td>
<td>1,560</td>
<td>-</td>
<td>126</td>
<td>553</td>
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Source: SEAR Annual EPI Reporting Form, 2014

No–No data
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<tr>
<th>Year</th>
<th>% Serum specimen collected from suspected measles cases</th>
<th>Total Serum Specimen received in Laboratory</th>
<th>% serum specimens tested</th>
<th>Specimen Positive for Measles IgM</th>
<th>Specimen Positive for Rubella IgM</th>
<th>% Results within 4 of receipt</th>
<th>% Outbreak tested for viral detection</th>
<th>Genotypes detected</th>
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<tbody>
<tr>
<td>2012</td>
<td>57</td>
<td>84</td>
<td>100</td>
<td>7</td>
<td>8</td>
<td>23</td>
<td>50</td>
<td>ND</td>
</tr>
<tr>
<td>2013</td>
<td>81</td>
<td>3,299</td>
<td>72.1</td>
<td>1,759</td>
<td>74</td>
<td>20</td>
<td>4</td>
<td>ND</td>
</tr>
<tr>
<td>2014</td>
<td>69</td>
<td>2,151</td>
<td>98.7</td>
<td>1,560</td>
<td>73</td>
<td>10</td>
<td>11</td>
<td>ND</td>
</tr>
</tbody>
</table>

Source: SCAI Annual EPI Reporting Form, 2014

ND = No data
### Annex 4

**Sri Lanka in the context of immunization goals and targets**

<table>
<thead>
<tr>
<th>GVAP strategic objectives</th>
<th>Key indicators to monitor progress at national level</th>
<th>Status of Sri Lanka</th>
</tr>
</thead>
<tbody>
<tr>
<td>All countries commit to immunization as a priority</td>
<td>• Presence of a legal framework of legislation that guarantees financing</td>
<td>• Separate budget line for vaccines&lt;br&gt;• Long standing</td>
</tr>
<tr>
<td></td>
<td>• Presence of an independent technical advisory group</td>
<td></td>
</tr>
<tr>
<td>Individuals and communities understand the value of vaccines and demand immunization as both their right and responsibility</td>
<td>Level of public trust in immunization as monitored through knowledge, attitude and practice surveys</td>
<td>Formal KAP survey not available, but strong community support for vaccinations as evidenced by high coverage</td>
</tr>
<tr>
<td>The benefits of immunization are equitably extended to all people</td>
<td>• Percentage of districts with &lt;80% DPT3 coverage&lt;br&gt;• Coverage gaps between the lowest and highest wealth quintile</td>
<td>• 0%&lt;br&gt;• Unknown. Given extremely high coverage nationally, likely to be small.</td>
</tr>
<tr>
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<td>Key indicators to monitor progress at national level</td>
<td>Status of Sri Lanka</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------------------------------</td>
<td>------------------</td>
</tr>
</tbody>
</table>
| Strong immunization systems are an integral part of a well-functioning health system | • DPT1 to MVC1 dropout rates  
• Quality of immunization data | • <2% based on cluster survey of 2013  
• Reliable, except in former conflict areas which have seen large population shifts. Data triangulation used to assess denominators. Coverage surveys routinely conducted. |
| Immunization programmes have sustainable access to predictable funding, quality supply and innovative technologies | Percentage of routine immunization costs financed through government budgets | • In 2014, 93% of routine immunization costs and 94% of vaccine costs for the public sector were borne by the government of Sri Lanka. Approximately 1-2% of children nationally are estimated to receive vaccines through the private sector. |
| Country, regional and global research development innovations maximize the benefits of immunization | • Capacity for vaccine manufacturing  
• Capacity to conduct clinical trials  
• Capacity to conduct relevant operational research | • No vaccines manufactured  
• JE vaccine trial conducted 2006-8  
• Strong capacity in government institutions and academia |
<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>Sustain polio-free status through high quality AFP surveillance and high population immunity</td>
<td>Polio-free status maintained since 1993; in 2014, non-polio AFP rate = 1.6/100,000 &lt;15 years; adequate stool sample collection rate = 80%; OPV3 coverage = 98.7%</td>
<td></td>
</tr>
<tr>
<td>Achieve DTP3 coverage target – 90% national level and 80% in every district level</td>
<td>• Achieved</td>
<td></td>
</tr>
<tr>
<td>IPV introduction in all countries by the end of 2015 and switch to bOPV in April 2016 as per the polio endgame plan</td>
<td>• Completed in 2015</td>
<td></td>
</tr>
<tr>
<td>Elimination of measles and control of rubella/CRS by 2020</td>
<td>• Ongoing measles outbreak with almost four thousand cases of measles reported in 2013 and 2014. • 3 cases of CRS reported in 2014.</td>
<td></td>
</tr>
<tr>
<td>Elimination of MNT by 2015</td>
<td>• There has been no external review, but there is an internal review process for all neonatal deaths. The last neonatal tetanus case identified was in 2010.</td>
<td></td>
</tr>
<tr>
<td>Introduce new and under-utilized vaccines as appropriate</td>
<td>Since 2008, introduction of MMR, live JE vaccine, IPV. Planned introduction of HPV vaccine in 2017 and planned switch from tOPV to bOPV April 2016.</td>
<td></td>
</tr>
</tbody>
</table>