MEETING ON ROTAVIRUS DISEASE PREVENTION THROUGH IMMUNIZATION IN THE WESTERN PACIFIC REGION
11 to 12 December 2018, Manila, Philippines
MEETING REPORT

ROTAVIRUS DISEASE PREVENTION THROUGH IMMUNIZATION
IN THE WESTERN PACIFIC REGION

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NOTE

The views expressed in this report are those of the participants of the Meeting on Rotavirus Disease Prevention through Immunization in the Western Pacific Region and do not necessarily reflect the policies of the conveners.

This report has been prepared by the World Health Organization Regional Office for the Western Pacific for Member States in the Region and for those who participated in the Meeting on Rotavirus Disease Prevention through Immunization in the Western Pacific Region in Manila, Philippines from 11 to 12 December 2018.
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Immunization / Immunization programs / Vaccines / Rotavirus
SUMMARY

Participants from 25 Member States and territories along with representatives from 11 partner agencies attended the meeting to discuss global and regional rotavirus disease burden, vaccine impact, recent vaccine developments, country experiences implementing rotavirus vaccination and barriers for countries considering vaccine introduction. There were an estimated 185 000 rotavirus deaths globally in 2017. Almost every child will be infected with rotavirus by the age of 5 years irrespective of where they live, and 30–40% of diarrhoeal hospitalizations in this age group are due to rotavirus. Although improvements in sanitation and safe water are recognized to reduce the risk of bacterial and parasitic enteric infections, it is much less understood that clean and safe water environments are not strongly protective against rotavirus infections.

Vaccination is the principal preventive strategy against severe rotavirus infections, and WHO recommends that rotavirus vaccine be introduced into all national immunization programmes. Vaccine introduction should be a high priority in countries with high diarrhoeal disease mortality rates. Globally, 48% of Member States have introduced rotavirus vaccine into their national immunization programmes, but in the Western Pacific Region, only 26% have done so. Some high-income countries in the Region have achieved high rotavirus vaccine coverage through the private sector (Japan and the Republic of Korea). The WHO Global Rotavirus Surveillance Network is transitioning to a more comprehensive paediatric diarrhoeal disease surveillance system that monitors all causes of diarrhoea with improved diagnostics (Taqman Array Card). Further, comprehensive integrated vaccine-preventable disease surveillance systems are envisaged. Over 500 laboratories participate in the Region’s rotavirus laboratory network of national and subnational sentinel surveillance, with quality assurance monitored by regional reference laboratories. External quality assessments have found high levels of concordance (> 95%).

The Asian Intussusception Surveillance Network is describing the epidemiology of intussusception and investigating potential infectious aetiologies. It also will undertake self-controlled case-series studies after rotavirus vaccine introduction in selected countries. Maintaining strong sustainable surveillance networks will require greater country ownership and financing in the longer term. There are four WHO-prequalified rotavirus vaccines (Rotarix, Rotasil, RotaTeq and Rotavac) and two nationally licensed vaccines (China and Viet Nam). Nine countries in the Western Pacific Region are planning rotavirus vaccine introductions in the next several years: Samoa, Tonga, Tuvalu and Vanuatu with financial support from the Asian Development Bank; the Lao People’s Democratic Republic and Solomon Islands with Gavi support; and Cook Islands, Nauru and Tokelau with support from Rotary International. Middle-income countries in particular need to look for alternative ways to financially support new vaccine introduction. Three working groups developed action points directed to Member States and the WHO Secretariat related to surveillance, economic evaluations and programmatic implementation of rotavirus vaccine.

Surveillance recommendations included continued support from WHO for sentinel diarrhoeal surveillance with propagation of standardized protocols and laboratory support. All Member States were encouraged to share their surveillance data with WHO for more comprehensive collation of data and to consider integrating existing diarrhoeal surveillance activities into more comprehensive vaccine-preventable disease surveillance systems, together with the establishment of immunization registries. Ensuring financial sustainability of the national surveillance programmes is important, as is the role that economic evaluations play in informing rotavirus vaccine introduction decisions. Better understanding of country requirements for economic evaluations is needed to enable increased
standardization of assessment tools. Greater transparency of vaccine prices can be enhanced if all countries increase data reporting to the Joint Reporting Form. It was acknowledged that a regional vaccine pooled procurement mechanism could lower vaccine prices and increase transparency. Using processes that better translate evidence into actionable policy and defining cost-effective thresholds could also enhance the decision-making for new vaccine introductions. Adopting budget line items that secure financing for vaccines and related costs was noted as important.

Country experiences with programmatic implementation of rotavirus vaccination highlighted the WHO role in sharing technical expertise with product selection and upgrading of cold chain and infrastructure. The importance of early product selection relates to vaccine supply, its procurement and appropriate product information for training purposes. Preparation for vaccine introduction includes ensuring infrastructure capacity (cold chain, transport) and undertaking health worker training as well as social mobilization through media and public communication. During and following vaccine introduction, staff monitoring, supervision and quality control are also required. The meeting clarified why the countries in the Western Pacific Region have been less active to introduce rotavirus vaccine and highlighted some of the real and perceived financial and programmatic barriers affecting vaccine introduction and in-country access.
1. INTRODUCTION

1.1 Meeting organization

Rotavirus is the most common cause of severe diarrhoeal disease in young children, contributing to the global mortality of an estimated 215,000 children under 5 years of age in 2013. In the Western Pacific Region, around 30–40% of diarrhoeal hospitalizations among children aged under 5 years are attributable to rotavirus infection. The World Health Organization (WHO) recommends that rotavirus vaccine be introduced into all national immunization programmes (NIPs); in countries with high diarrhoeal disease mortality rates, introduction is considered a high priority. Countries that have introduced rotavirus vaccines in their NIPs have experienced up to 92% reduction in rotavirus-related hospitalizations and up to 55% decrease in the number of hospitalizations related to all causes of diarrhoea. Studies show that national rotavirus vaccination programmes are usually highly cost-effective.

Compared with other WHO regions, fewer countries in the Western Pacific have introduced rotavirus vaccines into the NIPs. As of 2018, only 26% of countries and areas in the Region have introduced the rotavirus vaccine into their NIPs. Such a delay may be due to lack of recognition of the burden of rotavirus disease, suboptimal cost-effectiveness results of rotavirus vaccination, competing priorities in the introduction of new vaccines and concerns about financial sustainability of the immunization programmes following the introduction of additional new vaccines. This Meeting on Rotavirus Disease Prevention through Immunization in the Western Pacific Region aimed to highlight the burden of rotavirus disease, national immunization policies and programmes of the Region. Recent developments on rotavirus vaccines to be used for prevention and control of the disease were also discussed along with the financial and programmatic implications of the vaccine introductions. Country representatives from the Western Pacific Region shared their experiences and lessons learnt on overcoming barriers for practical and sustainable introduction of rotavirus vaccine.

1.2 Meeting objectives

The objectives of the meeting were:

1) to review and discuss rotavirus disease burden and impact of introduction of rotavirus vaccine into the national immunization programmes in the Western Pacific Region; and
2) to discuss country experiences in implementing rotavirus vaccination and identify potential barriers for countries in the Region considering introducing rotavirus vaccine into their NIPs.

2. PROCEEDINGS

Dr Yoshihiro Takashima, Expanded Programme on Immunization (EPI) Coordinator, WHO Regional Office for the Western Pacific, welcomed participants and urged them to collectively work with the WHO Secretariat to move forward with efforts to decrease the regional rotavirus disease burden through immunization.

The purpose of this meeting is to increase awareness on the following issues: 1) the global and regional disease burden through surveillance activities, 2) recent vaccine developments, and 3) the financial and programmatic implications for introduction of rotavirus vaccine into NIPs in the Western Pacific Region. Country-level experiences and lessons learnt were shared for practical and sustainable introduction of rotavirus new vaccine introduction (NVI). National counterparts and
observers participated in three working groups to formulate action points on: 1) surveillance, 2) cost-effectiveness, and 3) programmatic issues.

2.1 Opening session, background and objectives of Meeting on Rotavirus Disease Prevention through Immunization in the Western Pacific Region

Dr Yoshihiro Takashima, EPI Coordinator, WHO Regional Office

The Global Vaccine Action Plan, endorsed by the World Health Assembly in 2012, outlines 20 strategies to be achieved through 85 activities. The WHO Regional Framework for Implementation of the Global Vaccine Action Plan in the Western Pacific, developed two years later, has eight regional immunization goals to be achieved by 2020: 1) sustaining polio-free status; 2) measles elimination; 3) rubella elimination; 4) maternal and neonatal tetanus elimination; 5) accelerated control of hepatitis B; 6) accelerated control of Japanese encephalitis (JE); 7) introduction of new vaccines; and 8) meeting regional vaccination coverage targets. The Western Pacific Region has had strong immunization programmes, exemplified by the Region’s polio eradication in 2005, which was achieved almost a decade prior to the proposed target. The Region also has worked towards accelerated control of hepatitis B and JE.

To date, 98% (181) of Member States globally have introduced Haemophilus influenzae type B (Hib) vaccine into their NIPs, with 96% (26) of countries in the Western Pacific Region doing so by 2018. Pneumococcal conjugate vaccine (PCV) has been introduced in the NIPs of 71% (138) of WHO Member States and 63% (17) in the Region. Human papillomavirus (HPV) vaccine is included in the NIPs of 41% (80) of Member States globally and 48% (13) in the Region. In contrast, rotavirus vaccine is in 48% (94) of global NIPs but in only 26% (7) of those in the Region.

Why the Western Pacific Region has been less active to introduce rotavirus vaccine is unclear, but it could relate to lack of data and information on disease burden, resulting in lack of awareness or understanding of vaccine effectiveness and potential impact. There may also be real and perceived financial and programmatic barriers, and limited appreciation of cost-effectiveness analyses (CEAs). The objective of this meeting is to narrow this awareness gap by discussing the global and regional rotavirus disease burden as well as the lessons learnt from the vaccine’s introduction within and outside the Region.

2.2 Rotavirus disease and epidemiology

Dr Daniel Payne, Senior Scientific Advisor, Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, United States Centers for Disease Control and Prevention (US CDC)

Rotavirus infections account for 37% of all diarrhoeal deaths worldwide among children aged under 5 years, with 90% of these deaths estimated to occur in countries eligible to receive Gavi funding. Rotavirus gastroenteritis is a systemic disease with viraemia occurring in 90% of affected children. Rotavirus infections generate natural immunity, with a child’s first natural rotavirus infection 77% protective against subsequent rotavirus diarrhoea. This natural protection increases to 83% after two infections and 92% after three infections. Live, attenuated rotavirus vaccines mimic these natural immune responses, but without causing severe symptoms.

The Global Enteric Multicenter Study (GEMS) is a population-based case-control study of acute, medically attended, moderate to severe diarrhoea cases in children aged under 5 years residing in four
sub-Saharan African countries (Mali, Gambia, Kenya, Mozambique) and three South Asian countries (Bangladesh, India, Pakistan). Children with diarrhoea were followed over a three-month period. Rotavirus was the most common pathogen in children below 2 years of age and was the second most common cause of infection among children aged 2–5 years. Children with rotavirus diarrhoeal infection had an 8.5 times increased risk of death from any cause following two months of infection. This is a significant indication of systemic impairments following rotavirus infections. Rotavirus gastroenteritis also contributes to protein energy malnutrition, child growth faltering and stunting, cognitive delays, and increased vulnerability to further infections. Three studies have shown that rotavirus-vaccinated children have a significantly lower risk of seizures: United States (18–21% reduction in the year following vaccination), Australia (36–38% reduction in the following two years) and Spain (16–34% reduction).

Improvements in sanitation and safe water are recognized to reduce the risk of bacterial and parasitic enteric infections. However, what is much less understood is that clean and safe water environments are not strongly protective against rotavirus infections, as rotavirus is stable and present throughout the human environment and only a small infectious dose is needed for infection. Furthermore, surveillance shows that over the last decade, the proportion of hospitalizations due to rotavirus infections has not significantly changed in those countries that have not introduced the vaccine, while countries introducing rotavirus vaccine have shown favourable outcomes in infant and child health indicators related to rotavirus. In severe rotavirus cases, dehydration can outpace oral rehydration efforts, coverage of oral rehydration therapy is often lower in high mortality settings, and antibiotics are not effective in treating rotavirus. For these reasons, immunization is the most effective public health intervention to prevent the burden of disease from rotavirus gastroenteritis.

It is also important to recognize the significant effects of rotavirus infections on the family’s income. Studies conducted in Bangladesh, Malaysia and Uganda have quantified the cost of a rotavirus hospitalization as a proportion of the family’s average monthly income as being 10%, 85% and 25%, respectively.

In summary, extensive evidence shows that rotavirus is the greatest cause of negative health outcomes due to diarrhoea in young children. Besides diarrhoea, rotavirus gastroenteritis is associated with systemic infection, seizures, cognitive deficits, growth faltering and economic impacts. Vaccination against this preventable disease is the principal preventive strategy against severe rotavirus infections.

2.3 Global rotavirus surveillance and laboratory network

*Dr Adam L. Cohen, Medical Officer, Expanded Programme on Immunization, WHO headquarters*

Surveillance data can be generated before and after the NVI. The data can describe national disease burden and provide information for the vaccine introduction. Once a surveillance system is established, it can provide insight into the impact of the vaccine as well as long-term monitoring of the disease. The Strategic Advisory Group of Experts (SAGE) recommends that countries establish surveillance systems for all vaccine-preventable diseases (VPDs) including rotavirus.

In 2018, WHO updated the VPD surveillance standard to include rotavirus, cholera, mumps, non-neonatal tetanus, typhoid and varicella, in all accounting for 20 VPDs (1). There are many types of surveillance systems: nationwide case-based surveillance, nationwide aggregate surveillance, sentinel case-based surveillance and other surveillance systems. Each is tailored to different VPDs. It is recommended that rotavirus surveillance be case-based at sentinel sites that monitor hospitalized children with acute diarrhoea. To date, many countries conduct some type of surveillance for rotavirus.
Eighty countries participate in the WHO-coordinated Global Rotavirus Surveillance Network and receive technical support from WHO headquarters in Geneva, Switzerland. There are regional, national and subnational laboratories that function within the global laboratory network. Regional or national reference laboratories also monitor prevalent circulating rotavirus genotypes.

To date, the Global Rotavirus Surveillance Network has tested over 400,000 samples collected from children hospitalized with acute watery gastroenteritis in 80 countries. Global paediatric diarrhoea surveillance was established to monitor all causes of diarrhoea – that is, acute watery diarrhoea and also persistent and bloody diarrhoea. Forty-four percent of diarrhoea specimens collected in the Western Pacific Region have tested positive for rotavirus. The Region of the Americas has the current lowest rotavirus prevalence, and high vaccine coverage has been maintained since the expedited introduction of the vaccine in many countries in the Region.

The laboratory network has leveraged rotavirus surveillance and started to look at other disease etiologies using a new laboratory test, the Taqman Array Card (TAC), which has been piloted in four regional reference laboratories. Around 100 paediatric diarrhoea cases were tested using TAC, which can identify more than 30 different pathogens and their strains. Results showed that rotavirus was the most common cause of acute gastroenteritis during 2017–2018. These surveillance data confirm that rotavirus remains the most common cause of paediatric diarrhoea globally despite NVI, although there was a 40% decrease in prevalence of the virus after vaccine introduction. Norovirus and Shigella are the second and third most prevalent gastrointestinal infections, respectively.

WHO disseminates surveillance reports to network members twice a year. In conjunction with the Regional Office for the Western Pacific, WHO headquarters is developing an online data management tool known as the WHO Immunization Information System (WIISE) that coordinates surveillance and vaccine coverage data among participating countries to help inform immunization programmes at regional and global levels. The WHO costing guidance for VPD surveillance helps countries understand the costs of maintaining a surveillance programme while encouraging the analysis of surveillance data.

Surveillance for rotavirus and paediatric diarrhoea is critical for global and country-level policy and to evaluate the disease burden along with assessing the vaccine impact after introduction. Countries should be supported as necessary to maintain rotavirus and paediatric diarrhoea surveillance with capacity-building supported by national and external funding.

2.4 Rotavirus surveillance network in the Western Pacific Region

Dr Nyambat Batmunkh, Technical Officer, Expanded Programme on Immunization, Division of Communicable Diseases, WHO Regional Office

In 2008, WHO global sentinel rotavirus surveillance network was standardized across all six regions. Initially, these surveillance networks were supported through different funding sources. In 2013, the Western Pacific Region formalized rotavirus surveillance using WHO standards for VPD surveillance. The main objective was for all countries in the Region, regardless of their introduction status, to determine the rotavirus epidemiology, strain prevalence, infection outcome and seasonality. Countries that have not yet introduced the rotavirus vaccine are encouraged to generate and use surveillance data as supporting information. Countries that have, on the other hand, should utilize the data to monitor impact of vaccine and epidemiology of circulating strains. To date, 61 Member States participate in the global rotavirus surveillance network and eight (Cambodia, China, Fiji, the
Lao People’s Democratic Republic, Mongolia, Papua New Guinea, the Philippines and Viet Nam) are within the Western Pacific Region.

The rotavirus surveillance network in the Western Pacific Region consists of 35 sentinel surveillance sites, of which 19 are in China, 7 in the Philippines, 4 in Viet Nam, and 1 each in Cambodia, Mongolia, Papua New Guinea, Fiji and the Lao People’s Democratic Republic. Case definition for suspected rotavirus diarrhoea includes acute watery diarrhoea for 14 days or less, defined as three or more loose or watery stools within 24 hours in children under 5 years of age. Data are collected at hospitals and then shared with the WHO Regional Office where they are validated and communicated to WHO headquarters on a quarterly basis. There are two data entry systems: an offline version that is used by the majority of countries and a new web-based system. The Regional Office’s updated surveillance manual recommends that other variables such as gender, date of birth and address be collected. Vaccination history should also be collected in introducing countries along with other additional information if the country is participating in the Global Paediatric Diarrhoea Surveillance network where bloody diarrhoea and persistent diarrhoea are also reported. These four countries (China, Fiji, the Lao People’s Democratic Republic and Viet Nam) annually send 100 randomly selected stool specimens for additional TAC testing. Surveillance performance indicators include consistent reporting of a minimum of 100 suspected cases, specimen collection within two days of admission and test specimens for rotavirus by enzyme-linked immunosorbent assay (ELISA). Some countries are struggling to collect specimens, but overall the Region is performing well according to these indicators.

In 2017, more than 6000 stool specimens were collected by the Global Rotavirus Surveillance network and were tested using ELISA. Following Africa and Europe, the Western Pacific Region had the third largest number of tested cases. Forty-four percent of specimens were rotavirus positive, which was the highest percentage of positive cases of the six WHO regions. The seasonality of infections was typically in colder winter periods (northern hemisphere between November and February), but Mongolia’s infection peaks start before other countries. The Lao People’s Democratic Republic and the Philippines had similar seasonal peaks, but seasonality was less pronounced in countries with subtropical climates, such as Fiji and Papua New Guinea. Surveillance data from Cambodia, China, Mongolia, the Lao People’s Democratic Republic, the Philippines and Viet Nam have been published in peer-reviewed journals (3–8).

The major cause of diarrhoea in young children in the Western Pacific Region is rotavirus, followed by norovirus and other pathogens. Most surveillance sites in the Region were well-performing, and it will be very important to sustain these activities to ensure that quantitative evidence is available for NVI and infection monitoring. Countries are encouraged to use the web-based data reporting systems. It is necessary to maintain strong sustainable surveillance networks that in the longer term are supported by greater country ownership and financing. In addition, countries should aim to coordinate, harmonize and integrate their diarrhoeal surveillance activities with comprehensive VPD surveillance systems.

2.5 Rotavirus regional laboratory network

Ms Varja Grabovac, Scientist, Expanded Programme on Immunization, WHO Regional Office

There are over 500 laboratories that participate in the Western Pacific Region laboratory network. WHO’s coordination of the laboratory network follows a three-tiered pyramid structure, where national and subnational sentinel surveillance sites collect data, conduct primary testing, ensure
quality assurance and share samples with regional reference laboratories for further characterization. Global specialized laboratories provide technical advice and research new technologies and testing methods, while the regional reference laboratories in the network monitor the practice of standardized data management and provide hands-on training as well as on-site performance reviews of national rotavirus surveillance programmes. Ten countries (Australia, Cambodia, China, Fiji, the Lao People’s Democratic Republic, Mongolia, Papua New Guinea, the Philippines, the Republic of Korea and Viet Nam) participate in the Region’s laboratory network and three countries (Australia, China and the Republic of Korea) house regional reference laboratories. There is strong integration of laboratory functions where laboratories in resource-limited settings share their experiences and equipment to support and strengthen the network.

The laboratory network is able to monitor annual shifts in the prevalence of rotavirus genotypes. In 2017, out of 1472 confirmed circulating genotypes collected, strains G1P8 and G9P8 were the most prevalent. Performance of laboratories is validated through annual proficiency testing and assessment visits that are conducted to strengthen surveillance. External quality assessments were conducted in 32 laboratories in the Western Pacific Region which were all found to be highly proficient. National laboratories had ELISA and genotyping results that were 95% concordant. Test results between global and regional reference laboratories have also been highly consistent (98%).

Despite these positive performance outcomes, challenges remain. Samples sent to regional reference laboratories are sometimes delayed because of transportation issues, import permits and document processing. Countries should prepare for sample shipments in advance to ensure that reference laboratories can share test results with WHO headquarters to enable generation of report summaries. High staff turnover is also a challenge, affecting the national capacity and proficiency in laboratory testing. Regional or on-site staff trainings are organized by WHO in the Region to address this issue. Donor funding for rotavirus surveillance has been decreasing over the years, and some activities and data generation may be reduced as a result. To avoid a weakening of the surveillance system, countries should strive for financial ownership of their national surveillance programmes.

2.6 Rotavirus vaccines and immunization: opportunities and challenges

Professor Mathuram Santosham, Department of International Health and Pediatrics, Johns Hopkins University

“We have powerful rotavirus vaccines that work extremely well and need to make sure that these vaccines reach every child. Vaccines do not save lives, immunization saves lives and therefore, these vaccines will not save lives unless the children that need it most are immunized”.

Currently, there are half a million deaths caused by diarrhoea, but these numbers are only 10% of the mortality 30 years ago. The current mortality equates to one diarrhoeal death every minute and rotavirus is the most common cause of gastroenteritis. In 2013, there were an estimated 215 000 deaths worldwide caused by rotavirus, and updated estimates for 2017 were 185 000 deaths. Almost every child will be infected with rotavirus by the age of 5 years irrespective of where they live. Roger Glass has argued that rotavirus is a democratic disease, affecting both poor and rich children, indiscriminate of socioeconomic status.

The GEMS study, as previously noted, confirmed that rotavirus is the leading cause of diarrhoea among children under the age of 1 year and that rotavirus-infected children are 6–8 times more likely to die within the two months after the infection. Rotavirus hospitalizations have fallen dramatically in
countries that have introduced the vaccine. To date, 96 countries have introduced the vaccine either nationally or subnationally, but tens of millions of children still lack access to the vaccine.

Asia, in particular, is lagging with rotavirus vaccine introduction. Only seven countries have introduced it nationally and one subnationally. In the South-East Asia Region, India has introduced the vaccine in 11 states and Thailand has introduced it subnationally. There are four WHO prequalified (WHO-PQ) vaccines: Rotarix, Rotasil, RotaTeq and Rotavac. All vaccines are given in three-dose primary series except for Rotarix, which follows a two-dose series.

Pan-American Health Organization (PAHO) countries, which were early adopters of rotavirus vaccines, have shown a consistent reduction in gastroenteritis mortality. Mexico introduced the vaccine in 2007, and diarrhoea deaths in children aged under 5 years had fallen by 65% by 2009; Brazil introduced the vaccine in 2006, and diarrhoea deaths had fallen 39% by 2008. Rotavirus vaccination also resulted in marked reductions in diarrhoea hospitalizations in these countries. In high-income countries, there have been impressive reductions in rotavirus hospitalizations ranging from 45% to 94%, which have been accompanied by significant economic benefits – for example, US$ 1 billion savings in the United States of America after four years of vaccine introduction.

Communication efforts should move away from describing vaccines as only life-saving. Messages should increasingly highlight immunization as a health intervention that decreases morbidity and the hospitalization of children. More emphasis should be placed on the economic effects imposed by hospitalization. As previously noted in Malaysia, for example, 35% of a family’s income is spent on one diarrhoea disease hospitalization. Cross-protection has not been well communicated, and the vaccine’s lower efficacy in developing countries has masked the very positive public health impact of the rotavirus vaccine in preventing diarrhoea in low-income settings.

Vaccine financing is also a major issue as more Gavi countries graduate and become ineligible to receive Gavi support. Countries that were never eligible to receive Gavi funding have experienced challenges in introducing the rotavirus vaccine because of insecure funding and high vaccine prices. One idea would be for the Western Pacific Region to explore developing a pooled procurement mechanism similar to that in the Region of the Americas. To successfully move this forward, countries will need to have strong political will and support the bulk purchase of vaccines at a cheaper price.

Vaccines should be part of a comprehensive approach to the control of diarrhoea. Other modes of prevention, such as breastfeeding, should also be promoted. Beyond vaccine introduction, efforts should also be geared towards ensuring that rotavirus vaccine coverage is adequate. Major progress has been made in the last decade, and many countries have introduced rotavirus vaccine, but the poorest children are still disadvantaged, making equity and access to vaccination a top priority. Rotavirus vaccination should be integrated into a comprehensive diarrhoea control strategy to improve children’s health. Alternate financing mechanisms should also be further explored to improve countries’ access to vaccines.
2.7 Reports from countries on rotavirus disease burden

2.7.1 Disease burden of rotavirus acute gastroenteritis in Japan

Dr Hajime Kamiya, Senior Researcher, Infectious Disease Surveillance Center, National Institute of Infectious Diseases, Japan

Data from two acute gastroenteritis surveillance sources were reported: the National Epidemiological Surveillance of Infectious Diseases (NESID) system and research-based surveillance. The former is a passive surveillance system with designated sentinel sites nationwide. Although information on age and gender are collected through this surveillance system, the pathogen responsible for infection is not identified. The latter is an active surveillance study undertaken at two sites in Mie Prefecture that provide data on pathogens to calculate population-based rates.

Since 1999, disease trends have been monitored through 3000 paediatric sentinel sites, of which 10% collect stool samples for analysis (NESID). In 2013, more than 500 key medical institutes were designated as sentinel sites to report hospitalized gastroenteritis caused by rotavirus infection. Rotavirus acute gastroenteritis infections start to increase in late December to early January, peaking in February to March, and later declines by May. The trends of hospitalized cases resemble this trend.

Rotarix was introduced into the private sector in 2011 and RotaTeq in 2012. Neither vaccine is included in the routine NIP, and parents pay approximately US$ 280 out of pocket for the complete vaccine series. Despite these costs, coverage is around 70%.

Research-based surveillance has been conducted at the city hospitals in Tsu and Ise since 2007. Data collected enable incidence estimates to be calculated; by extrapolating these results to the whole of Japan, an estimated 710 000 outpatient visits and 25 000–30 000 hospitalizations were due to rotavirus infections each year.

Data were collected only from the two cities in Mie Prefecture, which might not accurately reflect the disease burden for the rest of Japan. Rotavirus gastroenteritis infections have significantly decreased since the introduction of rotavirus vaccine in the private sector. Despite high vaccine coverage rates in the private sector, the goal is to include rotavirus vaccine in Japan’s NIP.

2.7.2 Rotavirus diarrhoea among hospitalized children in Vientiane capital, Lao People’s Democratic Republic

Professor Douangdao Souk Aloun, Professor of Paediatrics and Deputy Directory, Mahosot Hospital, Ministry of Health, Lao People’s Democratic Republic

The Lao People’s Democratic Republic is a landlocked country with a population of 7 million. Although under-5 mortality is decreasing, it was still 46 per 1000 live births in 2017. Diarrhoea is the leading cause of deaths among children aged under 5 years, second to respiratory deaths. Rotavirus is the most common cause of diarrhoea, and the vaccine has not yet been introduced into the NIP.

From January 2009 to December 2015, samples were collected from hospitalized children under 5 years of age with watery diarrhoea for less than 14 days. Parents were interviewed by physicians, and samples were tested using ELISA for rotavirus. Over the 5–6-year period of surveillance, 1756 samples were collected, of which 982 (56%) were positive for rotavirus and 41% of these positive samples were in children aged 12–23 months. Sixty-two percent of the rotavirus positive cases were male. Dehydration, diarrhoea duration, vomiting duration and overall severity were greater in the rotavirus-positive patients.
Genotype strain G1P8 (41%) was the most prevalent during the surveillance period, followed by G2P4 (26%). Seasonal distribution of hospitalized rotavirus cases followed the same trend as non-rotavirus cases with an annual peak in winter from January to March.

It is recommended that surveillance efforts continue so that the impact of rotavirus disease can be monitored among children under 5 years of age. These data will allow assessment of the impact of the implementation of rotavirus vaccination in the NIP.

2.7.3 Rotavirus surveillance in Mongolia, 2009-2018

Dr Narangerel Dorj, Director of Surveillance and Emergency Division, Ministry of Health, Mongolia

Mongolia is a landlocked country between China and Russia with a population of 3 million and 400 000 children aged under 5 years. Digestive system diseases were the second most prevalent among children < 5 years, where 23.8% of these cases are attributable to enteric infections. Mongolia’s laboratory capacity for hospital-based rotavirus surveillance was developed according to WHO surveillance standards, with laboratory equipment and kit reagents supplied by the WHO Regional Office.

Two laboratory tests are performed on each sample: antigen and genotype tests. Three rotavirus sentinel surveillance sites have been initiated since 2009, but due to budget constraints, two sites ceased participation in 2016. From 2009 to 2016, Mongolia’s laboratory sent 1362 samples to the WHO Regional Reference Laboratory for molecular characterization. ELISA tests and genotyping results were 96–100% and 38% congruent, respectively. In 2017, another 240 stool samples were sent to the Regional Reference Laboratory, and ELISA results were 100% congruent. Data for 140 variables are collected from the hospital-based sentinel surveillance sites.

Overall, 42% of diarrhoea hospitalizations were caused by rotavirus. Almost half (48%) of these rotavirus hospitalizations were among children aged 6–11 months, and 26.7% of rotavirus infections were among children aged 12–23 months. Relatively few infants aged 0–5 months were admitted. Dehydration was noted in 92% of infected cases. Genotype distribution showed a predominance of strain G3P8 (49%), followed by G9P6 (15%). The majority of cases occurred during winter (September through to the end of December).

Mongolia aims to further strengthen its molecular laboratory diagnostic capacity and improve government ownership to ensure a sustainable rotavirus surveillance system. Consideration should be given to the introduction of the rotavirus vaccine, despite having other vaccine introductions in the pipeline (PCV and HPV).

2.7.4 Viral diarrhoea surveillance in China

Dr Duan Zhaojun, Deputy Director, Institute for Viral Disease Control and Prevention, Chinese Center for Disease Control and Prevention (China CDC)

In 2008, China joined WHO’s global rotavirus surveillance network by standardizing and operationalizing WHO’s generic protocol for rotavirus surveillance and testing suspected cases with the same case definition. The surveillance network in China consists of 26 hospitals located in 19 provinces. Chinese authorities have also included outpatient information in their national rotavirus surveillance protocol. The case definition includes diarrhoea lasting less than 14 days. Annually, 300 specimens are collected at hospitals within each province and tested using ELISA with genotype characterization conducted using polymerase chain reaction (PCR). Annually, randomly selected samples are sent to China CDC for retesting.
Rotavirus is shown to be the leading cause of acute gastroenteritis among children aged under 5 years, accounting for 34% in overall diarrhoea cases (38% in inpatient and 27% in outpatient). Ninety-three percent rotavirus-positive diarrhoea cases were in children aged under 2 years, with 15% in children under 6 months. The highest rotavirus positivity rate (44%) was among children aged 12–17 months.

Norovirus was identified as the second most common cause of acute gastroenteritis. Although vaccination status is not currently collected, there are plans in the future to combine surveillance data with vaccine status data to monitor the vaccine impact. Active surveillance of intussusception also needs to be established.

Seasonality over the 10-year period shows that most cases occur from October to February. Genotype distribution shows that G3P[8] was the most prevalent from 2009, but this has subsequently changed to G9P[8]. Only one province had a different dominant circulating rotavirus strain.

There are two licensed vaccines in the Chinese private market: the Lanzhou vaccine licensed in 2001 and RotaTeq licensed in October 2018. Trivalent reassortant Lanzhou vaccine has finished Phase III trials, and licensure is anticipated in the coming 1–2 years. Rotavirus vaccine coverage is low in China but highest in the eastern region of China. The Government might consider nationwide introduction of rotavirus vaccine in the future.

### 2.8 Rotavirus introduction in the Western Pacific Region

Dr James Heffelfinger, Technical Officer for the Expanded Programme on Immunization, World Health Organization Western Pacific Regional Office

Dr Heffelfinger provided an overview of NVI, with a focus on introduction of rotavirus vaccine in the Region. He discussed the WHO guidance on vaccine introductions published in 2014, which describes the concepts and considerations on implementing and monitoring NVI and the main recommendations of the 2013 WHO position paper on rotavirus vaccines. Rotavirus vaccine has been introduced in 99 (51%) countries globally, and in eight (30%) countries and three areas (30%) in the Region. The types and schedules of rotavirus vaccines used by countries and areas in the Region were listed, in addition to the progress towards achieving the Regional Framework for Implementation of the Global Vaccine Action Plan in the Western Pacific target of introducing at least one new vaccine in all low- and middle-income countries between 2010 and 2020. From 2010 to 2018, 11 (73%) countries in the Region introduced at least one new vaccine (either Hib, HPV, PCV or rotavirus vaccine): eight (89%) lower middle-income countries but only three (50%) upper middle-income countries. There is no disparity in introduction of the Hib vaccine by income status of countries, but most countries that have introduced HPV and rotavirus vaccines have been high-income countries and most countries that have introduced PCV have been either high-income or lower middle-income countries. Coverage of last dose of rotavirus vaccine during 2013–2017 has varied by country and area.

Experiences of rotavirus vaccine introduction in one country (Australia) and one area (Guam) were discussed. Australia introduced both Rotarix and RotaTeq in 2007 after recommendation by its Technical Advisory Group. A number of stakeholder recommendations and comments related to national planning for introduction, communication strategies, training material for providers and the public, education, infrastructure, financing, and future surveillance were mentioned. Guam introduced RotaTeq with funding from the US CDC Vaccines for Children Program. According to WHO/UNICEF Estimates of National Immunization Coverage data from 2013 to 2017, vaccine
coverage has been below the recommended 90%. The Lao People’s Democratic Republic and Solomon Islands are planning rotavirus vaccine introductions in 2019.

There are nine countries that are planning to introduce rotavirus vaccine in the next several years, of which four countries (Samoa, Tonga, Tuvalu and Vanuatu) will receive financial support from the Asian Development Bank, two from Gavi (Lao People’s Democratic Republic and Solomon Islands) and three (Cook Islands, Nauru and Tokelau) from Rotary International. Countries in the Western Pacific Region continue to make progress including new vaccines in routine immunization programmes, though upper middle-income countries lag substantially behind lower-income and lower middle-income countries. Middle-income countries need to look for alternatives to financially support NVI. Upper middle-income countries lag in rotavirus NVI compared to other income groups. WHO in the Region is collaborating with the Chinese University of Hong Kong on a study to assess the interest of national counterparts in establishing a regional pooled procurement mechanism. Measuring the impact and effectiveness of vaccines and measuring cost or cost-effectiveness can support commitment to vaccination programmes.

2.8.1 Experiences from countries that have introduced rotavirus vaccine

National EPI managers and counterparts from Fiji, Kiribati, the Philippines and Vietnam discussed the successes and challenges in introducing or plans to introduce rotavirus vaccine. Each session outlined the country’s rotavirus (or acute gastroenteritis) surveillance, disease burden, seasonality and the results gathered from analysing the vaccine’s effectiveness, cost-effectiveness and impact.

2.8.1.1 Fiji’s experience in the introduction of the rotavirus vaccine

Ms Litiana Volavola, EPI National Programme Manager, Ministry of Health, Fiji

The Government of Fiji spends 4.8% of its national revenues on health. There are 902,000 inhabitants and a birth cohort of 19,650 infants. Approximately 84% of children are fully immunized. Rotavirus vaccine was introduced in 2012. During the vaccine’s introduction, Seth Berkley, Gavi’s chief executive officer, applauded Fiji’s efforts in being the first country to introduce three new vaccines (PCV, HPV and rotavirus) at the same time.

Disease burden studies have supported the introduction of rotavirus vaccine in Fiji, but part of its successful introduction was related to exploring alternative vaccine financing. Being ineligible to receive Gavi support, the procurement of rotavirus vaccine had to go through a tender process and its costs paid by the government. In response to having limited resources, Fiji’s Ministry of Health and Medical Services and the Australian Government agreed to share the cost of the vaccines, with government contributions annually increasing until the total cost is paid by the Fiji Government. GlaxoSmithKline (GSK) won the three vaccine tenders, and the manufacturer also agreed to make six shipments of the vaccines each year to relieve some of Fiji’s cold chain shortage constraints. Fiji was able to successfully introduce the three vaccines by having political support from the national government and partnership with Australian Aid and GSK.

Prior to rotavirus introduction (2007–2011), 40% of gastroenteritis hospital admissions in children aged under 5 years were caused by rotavirus. Rotavirus peaks in July during the cold season. A rotavirus vaccine impact study has shown a 29% decline in diarrhoea hospital admissions after vaccine introduction.

Cold chain remains a challenge for Fiji because of its warm and tropical environment. The introduction of three new vaccines at the same time also imposed pressure on the cold chain. An
Effective Vaccine Management (EVM) assessment was conducted in May 2018 and provided insight to Fiji’s Ministry of Health on the need to redistribute the cold chain resources.

Major vaccine introduction activities include expanding health-care workers’ capacity through trainings. Introduction efforts gathered 1000 nurses for training within an eight-week period, briefing them on the presentation of the vaccine to ensure it was orally administered. Introduction strategies also included social mobilization to sensitize the public by communicating the disease burden and health benefits of vaccination.

Despite the maritime geographic challenges, nurses know how to reach their target population and are well prepared for the vaccine’s introduction. Fiji’s experience shows that multiple new vaccines can be introduced at the same time into low middle-income countries. However, innovative financing solutions were required and financing challenges remain since NVI can utilize a sizeable portion of the total health expenditure.

2.8.1.2 Comprehensive package to improve child survival in Kiribati: rotavirus vaccine introduction

Ms Tiroia Teikake, Public Health Specialist, Ministry of Health and Medical Sciences, Kiribati

Prior to vaccine introduction, 40% of diarrhoeal hospitalizations in Kiribati were attributable to rotavirus infections. The country comprises three island groups with 100,000 inhabitants, but half the population lives on the main island. A rotavirus outbreak in July 2013 was responsible for 1118 cases, 108 hospitalizations and six deaths. During September–October 2014, 2513 children suffered from acute gastroenteritis, and there were seven deaths.

In 2014, the UNICEF country office submitted a proposal requesting that UNICEF Australia support the introduction of rotavirus vaccine. Inclusion of rotavirus vaccine into the national comprehensive child survival plan (2015–2017) was recommended, and the vaccine was included in the NIP in 2015. The introduction process included training community health-care workers and youth groups using the WHO/UNICEF community-based maternal and child health guidelines for immunization. Community support groups were also established in many villages to promote sanitation initiatives that were integrated with rotavirus vaccine introduction with the intent of engaging the community with the vaccine introduction. The Government introduced the vaccine with Gavi support but will absorb the cost of the vaccine after graduating from Gavi. As a result of these efforts, Kiribati’s rotavirus vaccine introduction proved successful by attaining high vaccine coverage.

Prior to vaccine introduction, 16% of under-5 mortality was due to acute gastroenteritis. This proportion dropped to 6% post-introduction. Other assessments evaluating EVM showed that 70% of WHO recommendations were achieved and completed. Strengthening the cold chain was part of the comprehensive package of the country as well as monitoring and supervision, which contributed to the successful introduction of the vaccine.

Ongoing challenges include lack of standard case definitions, suboptimal documentation of EPI and child health data, and geographical barriers affecting vaccine distribution. Recommendations for further action include the development of a primary health strategy, strengthening of national VPD surveillance and inclusion of severe acute malnutrition reporting in the list of standard illnesses.
2.8.1.3 Rotavirus vaccine introduction in the Philippines

Dr Anna Lena Lopez, Director, Institute of Child Health and Human Development, University of the Philippines (presented on behalf of Dr Maria Wilda Silva, Medical Specialist, Department of Health)

Diarrhoea is the second leading cause of death among young children in the Philippines. Rotavirus surveillance started in 2012 and expanded to seven sentinel surveillance sites that use a standard case definition. In 2010, the Department of Health launched an agenda addressing universal health care, also known as Kalusugang Pangkalahatan, which included provisions for free vaccination for the poorest families. An estimated 4.2 billion pesos were allotted for this programme, which included the introduction of rotavirus vaccine in 2012 for 700,000 children from the lowest economic quintile. The target population was identified by the Department of Social Welfare and Development, but there were challenges with the vaccine’s nationwide distribution. In 2014, vaccine introduction was limited to the Caraga region where the vaccine was co-administered with oral polio vaccine (OPV) and the pentavalent vaccine. By 2015, vaccine coverage was close to 90% in the province of Agusan del Sur within this region but subsequently decreased due to shortage of vaccine supply.

An impact assessment was conducted to provide additional information for policy-makers. Results showed a decline in all diarrhoeal consultations and hospital admissions in areas where the vaccine was introduced. A test negative case control vaccine effectiveness study reported 60% effectiveness irrespective of the number of vaccine doses administered. In 2015, a cost-effectiveness study on rotavirus vaccine introduction used an age-stratified dynamic transmission model. Results showed that introduction of rotavirus vaccine would not be cost-effective at the current tender prices used in the model.

Lessons learnt from this experience include the need for a multi-year plan to ensure that funds are secured for a sustained programme and the importance of a consistent vaccine supply. Community mobilization also needs strengthening to successfully target the infant population distributed throughout the 7100 islands. Rotavirus vaccine introduction remains a national priority, but its cost remains a major challenge for the Government.

2.8.1.4 Towards rotavirus vaccine introduction in Viet Nam

Dr Dang Duc Anh, Director, National Institute of Hygiene and Epidemiology, Viet Nam

Rotavirus vaccine is not yet included in Viet Nam’s NIP, but there are plans for its introduction. Viet Nam’s population of 95 million includes 1.7 million children aged under 1 year. There is hospital-based surveillance with four sites monitoring acute and watery diarrhoea admissions. Since 2012, approximately 2000 samples have been tested annually and 30–50% of diarrhoea admissions are rotavirus positive, of which 36% are from children aged 6–11 months. Circulating genotypes have varied, with 82% being the G1P8 strain in 2013 and the prevalence of the G2P4 strain increased to 36% of positive cases in 2014.

In 2012, POLYVAC, a local vaccine manufacturer, licensed ROTAVIN-M1, which is based on an attenuated G1P8 strain. The vaccine presentation is in liquid form, a one-dose 2 millilitre vial, stored at –20 °C. There is a new formulation undergoing a clinical trial that can be stored at 2–8 °C. Approximately 1 million doses have been disbursed in Viet Nam’s private sector. An immunogenicity study comparing ROTAVIN-M1 with Rotarix revealed that seroconversions were comparable among children using the locally manufactured vaccine. Surveillance for intussusception has been undertaken in more than 200,000 children vaccinated with ROTAVIN-M1 since 2017. No safety concerns have been identified. Rotarix and RotaTeq are also licensed in Viet Nam and are available in the private
sector with approximately 590,000 doses imported since 2017. In 2018, an estimated 9% of the birth cohort received rotavirus vaccines based on data reported to the NIP.

The Government approved in 2017 the introduction of rotavirus vaccine into Viet Nam’s NIP by September 2019 with Gavi support. ROTAVIN-M1 will be offered to children aged under 1 year through a two-dose schedule, vaccinating infants at 2 and 4 months. In 2021, the vaccine will be available in limited geographic locations (difficult-to-reach and mountainous areas) with expansion of coverage during 2022–2024 to achieve countrywide access by 2025. In 2021, the national government will cover 80% of the vaccine cost and Gavi the remaining 20% as well as all operational costs. By 2022, all costs will be covered by the Government. The National Immunization Technical Advisory Group (NITAG) recommendations will be a vital part of the procedure to introduce the vaccine along with operationalizing the Government’s 2021–2025 plan and ensuring secured financing for the new vaccine.

Viet Nam still faces a number of challenges related to rotavirus vaccine introduction, including ensuring a sustainable budget allocation consisting of national and local government contributions. There are in-country variations related to the vaccine’s operational costs where local investments will differ by province. Also, other competing health priorities make securing financing difficult, such as that rotavirus introduction coincides with Viet Nam’s requirement to self-finance, the pentavalent vaccine due to its graduation from Gavi support in 2020. This means that the NVI grant application must be submitted to Gavi before September 2019. Cold chain capacity also needs to be expanded with the introduction of rotavirus vaccine. There is hope that the new formulation of Rotavin will be licensed and available prior to the vaccine’s nationwide introduction, facilitating cold chain management and storage.

Given the high diarrhoea disease burden among children aged under 5 years and a locally manufactured vaccine, the introduction of rotavirus vaccine is cost-effective in Viet Nam. Having a local manufacturer is advantageous in ensuring national and regional vaccine security. There should be ongoing advocacy activities for the vaccine introduction and further preparation and submission of the comprehensive multi-year plan to the Ministry of Health, Ministry of Finance and central government.

### 2.9 Rotavirus introduction in the European Region

*Dr Liudmila Mosina, Immunization Technical Advisor, WHO Regional Office for Europe*

The European Region is made up of 53 Member States with diverse economic classifications, including some of the richest countries worldwide, but also poorer countries. Some Western European and most Gavi countries in the Region have introduced the vaccine, while countries with high rotavirus mortality rates located in Central Asia have yet to introduce the vaccine. The European rotavirus surveillance network shows that typically 30–50% of children hospitalized for acute gastroenteritis were positive for rotavirus.

Impediments for vaccine introduction include low recognition of diarrhoea as a public health priority. Non-introducing countries have competing priorities, such as other new vaccines as well as measles and rubella elimination and polio eradication efforts. Concerns about rotavirus vaccine safety and anti-vaccination lobbies have also affected introduction of the vaccine. Many countries do not have accurate rotavirus disease burden data due to lack of standardized surveillance. Misinterpretation of surveillance data in some countries leads to underestimation of the burden of rotavirus diarrhoea. Some countries do not have sufficient capacity to collect data on rotavirus vaccine cost-effectiveness.
that would support advocacy efforts geared towards the vaccine introduction. High vaccine prices and ineffective procurement systems are additional bottlenecks hindering rotavirus vaccine introduction in the Region.

WHO in the Region supports countries in making informed decisions on rotavirus vaccine introduction and preparing for the introduction by: strengthening in-country capacity in evidence-based decision-making, providing technical assistance to collect of local evidence (that is, disease burden data and cost-effectiveness analysis or CEA) and supporting studies to demonstrate the impact and effectiveness of the vaccine.

An impact analysis conducted in Germany showed substantial reductions in acute gastroenteritis hospitalizations following vaccine introduction. Similar reductions in hospitalizations were also observed in Belgium. Moldova has demonstrated high vaccine effectiveness in preventing severe rotavirus diarrhoea. Albania conducted a CEA showing that rotavirus vaccine at the price US$ 11 per dose was highly cost-effective.

Some middle-income countries in the Region report relatively low rotavirus vaccine coverage after the introduction. Post-introduction evaluations revealed that the main reasons for lower coverage were parental refusals from all vaccinations due to safety concerns, scepticism of the vaccine’s benefits among health-care providers, false contraindications and population mobility. Since 2014, three national and regional training workshops for medical workers on vaccine safety and contraindications have been conducted. This work should be continued to address coverage issues in the Region.

2.9.1 Experiences from Armenia

Dr Gayane Sahakyan, National Immunization Programme Manager and Adviser to the Director-General, National Center for Disease Control and Prevention of Armenia

Armenia has a birth cohort of 37 000 infants. The country is classified as upper middle-income since 2017, making it a Gavi-graduating country that is now required to self-procure its vaccines. Rotarix was included in the NIP in 2012. Coverage is high for the first vaccine dose but still below other traditional vaccines, for which coverage is above 95%.

Prior to vaccine introduction, surveillance showed that 38% of acute gastroenteritis hospitalizations were caused by rotavirus. In 2009, genotypes G1P8 and G1P4 represented 82% of circulating strains, each accounting for 41%. In 2016, the prevalence of G1P8 decreased to 5% and of G1P4 increased to 58%, and G9P8 emerged and accounted for 28%. Intussusception surveillance started in November 2012 with vaccine introduction.

A cost-effectiveness study using vaccine Gavi prices concluded that the vaccine was highly cost-effective. Results suggested that 25 000 rotavirus infections, 3000 outpatient visits, 1000 hospital admissions and eight deaths could be averted with vaccine introduction at high coverage. These data were presented in NITAG meetings, which led to the decision to introduce the vaccine in November 2012. Other studies have also shown the vaccine’s positive impact with a significant decline in rotavirus hospitalizations among the vaccinated cohort, demonstrating an overall 69% decline in infections among all children aged under 5 years, while also providing indirect protection to unimmunized children. Vaccine effectiveness was shown to be 62% among children aged 6-23 months and 68% among children aged 6–11 months.

The Armenian experience showed that communication plays an important role in reaching high coverage. Before vaccine introduction, health-care workers were trained in two stages. Consultations
took place with academic staff, health-care practitioners not involved in immunization, professional associations, social media groups and parents. Despite these efforts, several challenges remain regarding vaccine implementation, including ongoing efforts to communicate to health-care workers and parents about the vaccine’s safety and benefits. The anti-vaccination movement has been rapidly growing, and long-term and sustainable approaches are required to regain public trust. A well-developed crisis communication strategy is necessary, along with a detailed action plan to improve rotavirus vaccination coverage. A study on tailoring immunization programmes is anticipated to gather evidence to augment these future efforts.

2.10 Intussusception surveillance and adverse events following immunization

Dr Jacqueline Tate, Rotavirus Epidemiology Team Lead, United States Centers for Disease Control and Prevention

RotaShield, the first commercial rotavirus vaccine, was introduced in 1998 in the United States of America. Its association with intussusception had been flagged as a potential adverse event in clinical trials. Surveillance of intussusception post-licensure was recommended, and results showed one excess case of intussusception per 10 000 vaccinated infants; the vaccine was soon after withdrawn from the market. There are now four WHO prequalified vaccines. There was no risk of intussusception detected in the large clinical trials of Rotarix and RotaTeq which led to their licensure and global use. The recently WHO prequalified vaccines, Rotavac and Rotasil, do not have sufficient clinical trial data to quantify their associated risk of intussusception. Larger sample sizes with post-licensure data are required to assess a low level of risk of intussusception with vaccination. In addition, different populations may respond differently to the vaccine as demonstrated by differing vaccine effectiveness.

Intussusception varies significantly globally in terms of its incidence, diagnostic methods, treatment modalities, age distribution and fatality rates. Baseline incidence rates, for example, range from fewer than 10 cases per 100 000 infants (Bangladesh) to more than 300 cases per 100 000 infants (Viet Nam). Surgical intervention is commonly used for diagnosis and treatment in Africa, while other regions diagnose 85% of their suspected intussusception cases using ultrasound and enemas. Africa has the highest case fatality rate, reaching 10%, while other regions have rates lower than 1%. Most countries’ age distribution follows a bell-shaped curve, but the location of the curve’s peak differs depending on the region. The Western Pacific Region, for example, has the highest mean age for intussusception.

WHO recommends post-licensure surveillance of intussusception, linking intussusception cases to a child’s vaccination status and the timing of immunization. Large sample sizes are required to detect low level risks of intussusception. Twelve countries have used post-licensure surveillance data to conduct self-controlled case-series evaluations on the risk of intussusception induced by Rotarix vaccination. Cohort analysis on RotaTeq and Rotarix took place in the United States of America. These studies have shown a small increase risk of intussusception after vaccination but at lower levels compared to RotaShield. Studies conducted in Brazil and in seven African countries have shown that no associated risk of intussusception with the first dose of rotavirus vaccine. In most country studies, there was no risk following the second dose of the vaccine with the exception of studies conducted in Brazil and Australia that recorded a small increased risk. The number of diarrhoea hospitalizations and deaths prevented by the vaccine was substantially greater than the number of intussusception hospitalizations and deaths associated with the vaccine.
No increased risk of intussusception was observed following rotavirus vaccination in low-income countries in Africa. Reasons for this lack of risk in low-income countries in Africa are not known but could be due to several factors. First, there are low rates of intussusception in the first 12 weeks of life when vaccines are administered in these countries. Second, children in low-income countries have lower immune responses to rotavirus vaccination compared to children in high-income country settings. Therefore, the vaccine may be less likely to trigger an immunologic response that causes an intussusception. Third, co-administration of rotavirus vaccine and oral polio vaccine, which occurs in many low-income countries, also lowers the immune response to rotavirus vaccination.

The Asian Intussusception Surveillance Network was established to describe the epidemiology of intussusception hospitalizations among children under 2 years of age and also to investigate potential infectious etiologies of intussusception by testing for infectious pathogens in stool samples. Once countries in this network start using the rotavirus vaccine, self-controlled case studies will be conducted to identify the associated risk of intussusception with rotavirus vaccine in Asia.

There needs to be a better understanding of the pathogenesis and triggers of intussusception in young children as well as the risk factors. More data are needed on the risk of intussusception associated with the new WHO prequalified vaccines for rotavirus, Rotavac and Rotasili. Additional studies are needed to identify the risk of intussusception across different regions as well. Data collection for self-controlled case-series analyses is ongoing in Afghanistan, Pakistan, India, South Africa and in 3-5 lower-income African countries. This will begin to fill some of these data gaps. To date, despite the documented small increased risk of intussusception associated with rotavirus vaccines in some settings, regulatory agencies continue to unanimously reaffirm the recommendation for rotavirus vaccine use in all countries.

2.11 Updated on new rotavirus vaccines in the pipelines

*Dr Carl Kirkwood, Senior Programme Officer, Rotavirus Initiative Lead, Enteric and Diarrhoeal Diseases, Bill & Melinda Gates Foundation*

Approximately 50% (97) of countries worldwide have introduced rotavirus vaccine into their national childhood immunization programmes, and all have shown reductions in rotavirus-related morbidity and mortality. There are now four WHO prequalified vaccines (Rotarix, Rotasili, RotaTeq and Rotavac) available for use (Table 1); another two vaccines (Lanzhou, Rotavin) have been licensed nationally in China and Viet Nam, respectively (Table 2). In addition, manufacturers are continuing to develop a portfolio of oral live vaccines in many countries including China, Indonesia and Brazil. Having multiple manufacturers will enhance vaccine supply and security and provide a competitive marketplace.

The vaccine pipeline includes China’s Lanzhou Institute’s new lamb–human reassortant trivalent vaccine, which has shown extremely promising efficacy results in a Phase III clinical study; Viet Nam’s vaccine manufacturer, POLYVAC, has redeveloped their first-generation vaccine, and a reformulated liquid formulation is undergoing clinical trials. BioFarma in Indonesia is continuing to develop a human neonatal rotavirus vaccine (RV3BB), using a birth dose as the first delivery of a three-dose schedule, which has exhibited excellent clinical protection in a Phase IIb clinical study. PATH is developing a nonreplicating rotavirus vaccine, the trivalent P2-VP8 P[4], P[6], P[8] construct, with SK Chemicals as the commercial partner. This vaccine has been shown to be safe and immunogenic in Phase IIA clinical studies. The US CDC is developing an inactivated rotavirus vaccine, based on a whole-virus particle that is heat inactivated, following a similar strategy as
poliovirus. Serum Institute of India is the commercial partner, but the vaccine has not yet been tested in humans.

Rotavirus vaccines have already led to substantial improvements in child health, but effectiveness studies in high mortality settings suggest that further improvements are possible. The rotavirus vaccine portfolio, spanning from new live attenuated oral vaccines to nonreplicating rotavirus vaccine approaches, offers promises of improved vaccines that could be more effective in low-income country settings. These developments will also improve vaccine diversity, security and supply and will ensure ongoing market pressure.

### Table 1. World Health Organization Pre-Qualified Rotavirus Vaccines

<table>
<thead>
<tr>
<th>Vaccine Details</th>
<th>Rotarix (GSK)</th>
<th>RotaTeq (Merck)</th>
<th>RotaVac (Bharat)</th>
<th>RotaSIIL (Serum Institute of India)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaccine Type</td>
<td>Monovalent attenuated human rotavirus strain</td>
<td>Pentavalent, human-bovine reassortant vaccine</td>
<td>Monovalent attenuated human strain</td>
<td>Pentavalent, human-bovine reassortant vaccine</td>
</tr>
<tr>
<td>Dose per Schedule</td>
<td>2-dose 6/10 weeks DPT schedule</td>
<td>3-dose 2/4/6 months DPT schedule</td>
<td>3-dose DPT schedule</td>
<td>3-dose: 6/10/14 weeks DPT schedule</td>
</tr>
<tr>
<td>Presentation Liquid Presentation:</td>
<td>Liquid Presentation:</td>
<td>Liquid Presentation:</td>
<td>Lyophilized, with 2ml buffer 2 dose presentation Indian supply (public &amp; private) Global supply back-up</td>
<td></td>
</tr>
<tr>
<td>WHO-PQ</td>
<td>2007</td>
<td>2008</td>
<td>2018</td>
<td>2018</td>
</tr>
</tbody>
</table>

### Table 2. Summary of Nationally Licensed Rotavirus Vaccines

<table>
<thead>
<tr>
<th>Candidate</th>
<th>Producer</th>
<th>Strain</th>
<th>Characteristics</th>
<th>Route</th>
<th>Recent Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lanzhou Lamb rotavirus</td>
<td>Lanzhou Institute of Biological Products, China</td>
<td>Lamb strain G10P[12]</td>
<td>Attenuated, live vaccine Second generation: trivalent human–lamb reassortant strains (G2, G3 &amp; G4) 3 dose (2ml)</td>
<td>Oral</td>
<td>Licensed in China: 70 million doses distributed. Phase 3 efficacy study (~10,000) 70.3% efficacy SRVGE year 1</td>
</tr>
</tbody>
</table>
2.12 Rotavirus accelerated vaccine introduction network

Ms Molly Sauer, Deputy Director, Policy, Advocacy and Communications, International Vaccine Access Center (IVAC), Johns Hopkins Bloomberg School of Public Health

Approximately 500 children die of rotavirus daily, amounting to nearly 200,000 deaths each year of children aged under 5 years. Rotavirus infections and hospitalizations also have an economic and health systems impact (for instance, an admission for rotavirus represents 85% of an average family’s income in Bangladesh). Recent data from a large paediatric hospital in Bangladesh found that one out of every eight hospital admissions are due to acute gastroenteritis, and 54% of these cases were rotavirus positive. One out of every four children requiring admission are turned away because of bed shortages. Rotavirus vaccine could thus improve the management of other unrelated illnesses in these resource-poor settings by helping to reduce the number of beds filled by rotavirus diarrhoea cases. Tremendous progress has been made with vaccine introduction, but more efforts are needed. A significant number of countries with large birth cohorts and great disease burden have yet to introduce the vaccine.

RAVIN is a partnership between three organizations – IVAC, US CDC and John Snow, Inc. (JSI) – that work with a number of other key partners and collaborators such as WHO, Gavi, UNICEF, PATH and the ROTA Council to complement efforts from health ministries and build on relationships with other national institutions to support rotavirus vaccine introductions. RAVIN operates in eight large, Gavi-eligible countries: Afghanistan, Bangladesh, Benin, Cambodia, the Democratic Republic of the Congo, the Lao People’s Democratic Republic, Myanmar and Nepal. Its aim is to provide support to decision-makers, programme officials and partners for evidence-based decision-making and sustainable, equitable implementation. This includes identifying barriers and working with the ministries of health to find solutions, including: financing mechanisms for sustainable vaccine introduction; conducting advocacy trainings to help champions communicate data; and strengthening, monitoring and evaluating systems. For the eight focus countries, RAVIN has provided targeted support in response to country requests, supplementing ongoing country and partner work. This includes advocacy training, situational analyses, building an investment case, supporting Gavi application development, providing in-country support and hosting country exchange workshops. RAVIN focuses on countries to receive technical support on cold chain readiness, capacity strengthening, communication and social mobilization, planning and microplanning (national and subnational), and monitoring and evaluation to address areas critical to sustainable, timely and equitable rotavirus vaccine introduction.

2.13 Experiences from countries that have not yet introduced rotavirus vaccine

2.13.1 Experiences on rotavirus surveillance in Cambodia

Mr Ork Vichit, National Immunization Programme Manager, Ministry of Health, Cambodia

Cambodia has 100 operational districts within its 25 provincial health departments. Recently, the number of health centres increased to 1200, and it is expected to further expand in the coming year. Rotavirus surveillance in Cambodia is made up of one sentinel surveillance site which was operational from 2010 until 2016. Results show that around 50% of tested cases were positive for rotavirus infections among children aged 6–48 months admitted for acute gastroenteritis. Its seasonal distribution differs from many other countries, with peaks during the rainy seasons from November to January.
With Gavi support, Cambodia has introduced three new vaccines (PCV, inactivated polio vaccine or IPV, JE) within a two-year period in 2015–2017. There are no plans to introduce rotavirus vaccine, but it remains on the priority list. Reasons include concerns that too many vaccines have already been introduced during 2015-2017, and that HPV vaccine introduction will scale up to nationwide introduction by 2021. There is also uncertainty about the cost-effectiveness of the rotavirus vaccine in this country setting. The vaccine’s decreased efficacy in low-income country settings has also discouraged introduction. Efforts will continue to promote optimal treatment and case management along with water, sanitation and hygiene (WASH) interventions to mitigate diarrhoeal disease burden.

2.13.2 The Republic of Korea: experience from countries that have not yet introduced rotavirus vaccine in the national immunization programme

Dr Hyungul Jung, Deputy Scientific Director, Korea Centers for Disease Control and Prevention (KCDC)

The Republic of Korea has a population of 51 million across nine provinces. The NIP was launched in 1954 with seven vaccines including cholera and smallpox vaccines. The most recent vaccine introduction was the HPV vaccine in 2016. The NIP now offers approximately 20 types of vaccines. The public sector provides 10% of immunization, while the private sector provides 90% of vaccinations. KCDC has an immunization registry information system that effectively informs vaccination status.

RotaTeq and Rotarix were introduced through the private sector in 2007 and 2008, respectively. In 2017, the estimated vaccine coverage increased from 76% in 2013 to 84% currently. After the vaccine’s introduction, the number of rotavirus-positive samples decreased from 20% in 2003 to 10% in 2015. Incidence rates have also decreased from 8.6 to 1.6 rotavirus infections per 1000 children. Overall infection rates decreased by 64% among children aged between 2 months and 5 years.

Rotavirus surveillance has been carried out in 192 medical clinics and hospitals since 2017. There have been several small outbreaks in schools and hospitals. Rotavirus tends to peak in the spring from March to April. Surveillance has identified G1P8 as the most common genotype, and genotype G4P6 was more prevalent in babies under the age of 2 years. UNIVAC, an Excel-based CEA model, was used to undertake an economic evaluation of the rotavirus vaccine. If 95% or more of the 2018–2027 birth cohort is immunized with either Rotarix or RotaTeq, the averted costs would amount to US$ 14 000 and US$ 33 000 per disability-adjusted life year (DALY), respectively. Results show medical prevention costs surpass the societal costs. The Government is discussing with experts about introducing the vaccine into the NIP.

2.13.3 Rotavirus prevention through immunization: the Malaysian perspective

Dr Muhammad Bin Jikal, Principal Assistant Director, Communicable Disease Control Unit, Sabah State Health Department, Malaysia

Malaysia has a multi-ethnic population of 31 million and is made up of 13 states and three federal territories. Improvements in sanitation have now reached 96% of the population. The under-5 mortality rates from 1990 to 2017 have decreased from 16.8 to 8.4 per 1000 live births. The NIP started in 1950 and is part of the maternal and child health services, providing vaccines free of charge to all children. From 2015 onwards, a small fee was imposed on non-Malaysians for vaccination, but free vaccination is provided to non-Malaysians during outreach programmes and outbreak control.
In 2016, a National Health Morbidity Survey (NHMS) quantified the prevalence of diarrhoea infections as 4.4% among children aged 0–59 months. This value increased to 12.5% among children from households with untreated water. Currently, there is no rotavirus surveillance system in place, and it is not a notifiable disease under the national CDC legislation. However, surveillance of acute gastroenteritis is carried out by the district health offices through sentinel clinics to monitor trends. Data on acute gastroenteritis is also available from inpatients of 113 government hospitals.

The most recent rotavirus study was conducted in 2016 by Longanathan et al., whose meta-analysis estimated that 27 rotavirus-related deaths occur annually with 31 000 hospitalizations, 41 000 outpatient visits and 145 000 home-treated diarrhoea episodes among children aged under 5 years (9). The estimated annual incidence of rotavirus mortality among children aged under 5 years is one death per 100 000 children, 12 hospitalizations and 12 outpatient visits per 1000 children. With this disease burden, rotavirus infections are estimated to incur costs of US$ 34 million to the health-care provider and US$ 50 million to society, of which a third pertains to lost productivity. A preliminary study report in Sabah State shows that approximately 33% of samples were positive for rotavirus, of which 33% were of genotype G4P8.

Rotavirus vaccine introduction challenges include an emphasis on water, sanitation and hygiene to prevent all causes of diarrhoea. According to the NHMS, despite good access to health care for 95% of the population, rotavirus infections still are of concern. The vaccine’s halal status has delayed decisions about rotavirus vaccine introduction into the NIP. There are also concerns about competing public health priorities and the vaccine price. The cost of Rotarix and RotaTeq ranges from 120 to 180 Malaysian ringgit per dose in the private sector; at this price, it would not be cost-effective for inclusion into the NIP. Approximately 17% of children receive the vaccine through the private sector.

2.14 Recommendations from the WHO workshop on rotavirus and rotavirus vaccines in the South-East Asia Region

Professor Gagandeep Kang, Christian Medical College, Vellore, India

In October 2017, the WHO Regional Office for South-East Asia held a meeting on rotavirus and rotavirus vaccines. Rotavirus is the most common cause of acute gastroenteritis in countries that have not introduced the vaccine. It is recommended that, if necessary, countries use neighbouring country data to inform their decision-making for rotavirus vaccine introduction. Government agencies are also encouraged to integrate rotavirus surveillance with other VPD surveillance systems, while following WHO recommendations to conduct ELISA testing on at least 100 samples of hospitalized children with acute gastroenteritis per year. Countries that wish to obtain genotyping data should send at least 60 rotavirus-positive specimens to the Regional Reference Laboratory every year. Surveillance should be sustained for 2–3 years after introduction to assess the impact of rotavirus vaccine introduction. Gavi-eligible countries were conducting more standardized surveillance than non-Gavi countries since WHO in the Region specifically provided technical support to this set of countries. In response, WHO provides analytical support to smaller countries through the Region’s surveillance network.

Intussusception surveillance should be reinforced by training materials that include information on the recognition of acute abdominal illness, not just as adverse events following immunization (AEFIs), to report and monitor potential intussusception. Planned intussusception surveillance should include multiple stakeholders such as paediatricians, paediatric surgeons, immunization staff and other relevant partners. Immunization status and date of vaccination should be included in the surveillance of intussusception to successfully report AEFIs among children aged under 2 years.
Vaccine product selection should be made at an early phase of the vaccine introduction in order to develop appropriate trainings and prepare for delivery logistics. Once the vaccine has been introduced, countries should change the vaccine product only if there is a compelling reason justifying the switch, such as significant differences in vaccine safety or performance. Changing the vaccine would involve reconsidering the vaccine’s volume, dose presentation, reconstitution requirements, cold chain management, shelf-life and vaccine vial monitors. Thus far, data on children receiving mixed immunization series reflect positive outcomes, but the vaccines’ impact should still be monitored.

Countries are also encouraged to conduct CEAs for informed decision-making on vaccine introduction by national authorities. Excel-based tools to facilitate the CEA process are available. The UNIVAC tool was identified as a means to address the demands of decision-makers to have information on the cost-effectiveness of the vaccine’s introduction.

3. CONCLUSIONS AND ACTION POINTS

Attending participants and observers were divided into three groups: rotavirus surveillance, economic evaluations and programmatic implementation of rotavirus vaccination. Facilitators were given guiding questions and topics to consider during the group discussions to help elaborate on country experiences and barriers related to rotavirus vaccine introduction. The main objective of this exercise was the development of action points for each topic.

3.1 Rotavirus surveillance

Rotavirus vaccine introduction should be part of a comprehensive strategy to prevent and treat diarrhoea. Documenting its disease burden through national or sentinel hospital-based surveillance systems is important to guide evidence-based decision-making on rotavirus vaccine introduction and record the vaccine impact. A strong surveillance system with well-established indicators, clear case definitions, laboratory confirmation, data management, and reporting systems are needed to provide evidence-based data for policy-makers. Surveillance systems should be linked where possible with national immunization registries to gather relevant information on immunization status.

There are many challenges to implementing and monitoring rotavirus surveillance. Without clear case definitions and enrolment criteria, the countries’ rotavirus disease surveillance systems might underreport the disease burden. Making health-care workers aware of these suspected rotavirus cases may help address issues related to underreporting. Laboratory test results are seldom communicated to the staff from immunization programmes or physicians. Financial sustainability of surveillance programmes should also be considered to ensure their continued and long-standing functioning. National surveillance systems should also include all paediatric diarrhoea hospitalizations and not be limited to capturing watery diarrhoea cases. Good communication and coordination are needed across all levels of government to ensure that all stakeholders are well informed and working together to sustain the surveillance system. Intussusception and other AEFIs should be monitored through surveillance, and, when possible, the data should be integrated into the diarrhoeal disease surveillance systems. Countries may also want to undertake studies on intussusception to better understand its incidence before and after introduction of rotavirus vaccine.
3.1.1 Action points for Member States

Member States are encouraged to consider the following:

1. Share rotavirus and diarrhoeal disease surveillance data (disease burden, circulating genotypes, and where possible, vaccine impact) with the WHO Secretariat so that WHO can provide comprehensive summaries of regional data.
2. Consider integrating existing diarrhoeal surveillance activities into comprehensive VPD surveillance systems.
3. Consider establishing immunization registries for further linkage of immunization status to AEFI reports, hospital admissions and other health outcomes.
4. Ensure financial sustainability of national surveillance programmes.

3.1.2 Action points for WHO

WHO is requested to consider the following:

1. Continue to support sustained sentinel diarrhoeal surveillance activities through standardized protocols, collation and distribution of summary regional data.
2. Continue to support laboratory surveillance for rotavirus with laboratory confirmation and rotavirus genotyping using WHO-standardized methods, kits, data reporting and implementation of quality management systems.
3. Support countries to utilize vaccination status data collected during routine surveillance to monitor the impact of vaccination and enhance AEFI reporting systems.

3.2 Economic evaluations on rotavirus vaccine introductions

During the discussion, Member States agreed that there should be political will in addition to evidence-based decision-making for rotavirus vaccine introduction. Countries can use data made available through the WHO vaccine product, price and procurement (V3P) database to help with price references. It was recommended that economic models be standardized and based on realistic vaccine prices to aid evidence-based decision-making and that the WHO Secretariat work with UNICEF to support this process. Further guidance should also be provided on how to translate CEA results into actionable policies. Countries need to identify their own cost-effectiveness thresholds and vaccines should not be required to be cost saving. Budget impact analyses are also important for decision-making. Gavi graduation is a concern as NVIs place a strain on national immunization budgets.

3.2.1 Action points for Member States

Member States are encouraged to consider the following:

1. Encourage NITAGs and other decision-making bodies to use established economic evaluation models to inform vaccine introduction recommendations.
2. Introduce a policy process that ensures evidence is translated into actionable policy.
5. Adopt budget line items that secure financing for vaccines and related costs for immunization programmes.
3.2.2 Action points for WHO

WHO is requested to consider the following:

1. Communicate with Member States to understand what economic evaluations methods will be accepted by governments to inform decision-making with the aim of increased standardization of tools e.g. UNIVAC model.
2. Continue to collate and share vaccine price data in the Joint Reporting Form by country income strata, to provide plausible estimates of rotavirus vaccine cost that can be included in economic evaluations.
3. Explore the feasibility of pooled procurement mechanisms in the Region.

3.3 Programmatic implementation of rotavirus vaccination

Countries should ensure that there is early and country-specific product selection prior to the vaccine introduction. The vaccine presentation, from the national to the facility level, should be taken into careful consideration, as it affects the transportation, supply, storage, cold chain and ease of administration. Supply monitoring, financial sustainability and procurement plans should also be national priorities. Funding availability should be thoroughly reviewed for successful and sustained distribution of vaccines at the facility level. Reviews of infrastructure capacity should take place prior to NVI as storage and cold chain capacities could be strained.

Waste management and vaccine presentation affect health-care worker proficiency in administering the vaccine. While preparing for vaccine introduction, training manuals are critical along with the successful implementation of the vaccine delivery. Trainings should include building awareness around the vaccine benefits for effective communication with parents. Manuals and communication materials are also crucial in ensuring adequate vaccine distribution. Media sensitization is a key area for this communication process.

Frequent monitoring should be contextualized to evaluate the effectiveness of the vaccine implementation and its impact on the national immunization programme. Supportive supervision is also important to enhance the performance of health-care workers. The EPI team should consider these programmatic issues prior to rotavirus vaccine introduction since they determine distribution and service delivery. These factors should also be reviewed and considered by a national authoritative body (NITAG) during the decision-making process, which should also be supported by political will.

3.3.1 Action points for Member States

Member States are encouraged to consider the following:

1. Consider the following during NVI and implementation:
   a) early product selection (supply, procurement, product information);
   b) infrastructure capacity (cold chain, transport, funding availability);
   c) introduction and preparation (health-care worker training, training manuals, social mobilization, media and public communication about the benefits of the vaccine);
   d) launch (staff monitoring, financial sustainability plans, champions for advocacy); and
   e) monitoring of the introduction process (coverage, supervision, quality control, innovation to reach every child).
3.3.2 Action points for WHO

WHO is requested to consider the following:

1. Facilitate sharing the following experiences among countries:
   a) technical assistance with product selection; and
   b) technical assistance with upgrading cold chain and infrastructure.
REFERENCES


## Annex 1. Timetable

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<tr>
<th>Time</th>
<th>Tuesday, 11 December 2018</th>
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<td>08:00 – 08:30</td>
<td>Registration</td>
</tr>
<tr>
<td>08:30 – 09:00</td>
<td>1. Opening session</td>
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<tr>
<td></td>
<td>• Welcome remarks by the Responsible Officer</td>
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<td></td>
<td>• Opening remarks of the Regional Director</td>
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<td></td>
<td>• Self-introduction, Election of Officers</td>
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<td></td>
<td>• Administrative announcements</td>
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<td>• Group photo</td>
</tr>
<tr>
<td>09:00 – 09:10</td>
<td>2. Objectives and agenda of the meeting</td>
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<tr>
<td>09:10 – 09:25</td>
<td>3. Rotavirus disease and epidemiology</td>
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<td>09:25 – 09:40</td>
<td>4. Global rotavirus surveillance and laboratory network</td>
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<tr>
<td>09:40 – 09:55</td>
<td>5. Rotavirus surveillance network in the Western Pacific Region</td>
</tr>
<tr>
<td>09:55 – 10:10</td>
<td>6. Rotavirus regional laboratory network</td>
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<td></td>
<td>10:10 – 10:40 COFFEE BREAK</td>
</tr>
<tr>
<td>10:40 – 11:00</td>
<td>7. Rotavirus vaccines and immunization: opportunities and challenges</td>
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<tr>
<td>11:00 – 11:15</td>
<td>8.1 Japan</td>
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<td>11:15 – 11:30</td>
<td>8.2 Lao People’s Democratic Republic</td>
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<td>11:30 – 11:45</td>
<td>8.3 Mongolia</td>
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<td>11:45 – 12:00</td>
<td>8.4 China</td>
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<tr>
<td>12:00 – 12:30</td>
<td>Discussion</td>
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<tr>
<td></td>
<td>12:30 – 14:00 LUNCH BREAK</td>
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<tr>
<td>14:00 – 14:15</td>
<td>9. Rotavirus introduction in the Western Pacific Region</td>
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<tr>
<td>14:15 – 14:30</td>
<td>10.1 Fiji</td>
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<td>14:30 – 14:45</td>
<td>10.2 Kiribati</td>
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<td>14:45 – 15:00</td>
<td>10.3 Philippines</td>
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<td>15:00 – 15:15</td>
<td>10.4 Viet Nam</td>
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<tr>
<td>15:15 – 15:35</td>
<td>Discussion</td>
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<td>15:35 – 16:00 COFFEE BREAK</td>
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<tr>
<td>15:55 – 16:10</td>
<td>11. Rotavirus introduction in the European Region</td>
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<tr>
<td>16:10 – 16:25</td>
<td>12. Experiences from Armenia</td>
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<td>16:25 – 16:40</td>
<td>13. Intussusception surveillance and adverse events following immunization</td>
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<td>16:40 – 16:55</td>
<td>14. Updates on new rotavirus vaccines in the pipeline</td>
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<tr>
<td>16:55 – 17:15</td>
<td>Discussion</td>
</tr>
<tr>
<td>17:30 – 18:00</td>
<td>SDG’s Reception</td>
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<tr>
<td>18:00 – 18:30</td>
<td>:self-introduction, Election of Officers</td>
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<tr>
<td>18:30 – 19:00</td>
<td>Group photo</td>
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<tr>
<td>19:00 – 19:30</td>
<td>Discussion</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Time</th>
<th>Wednesday, 12 December 2018</th>
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<tbody>
<tr>
<td>08:30 – 08:45</td>
<td>15. Rotavirus Accelerated Vaccine Introduction Network (RAVIN)</td>
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<tr>
<td>08:45 – 09:00</td>
<td>16. Experiences from countries who have not yet introduced rotavirus vaccine</td>
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<tr>
<td>09:00 – 09:15</td>
<td>16.1 Cambodia</td>
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<tr>
<td>09:15 – 09:30</td>
<td>16.2 Republic of Korea</td>
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<td>09:30 – 10:00</td>
<td>16.3 Malaysia</td>
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<tr>
<td>10:00 – 10:30 COFFEE BREAK</td>
<td>Discussion</td>
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<tr>
<td>10:30 – 10:40</td>
<td>17. Introduction to group work</td>
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<td>10:40 – 11:30</td>
<td>18. Group work discussion (2 groups)</td>
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<td>11:30 – 12:00</td>
<td>19. Presentations from breakout session</td>
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<tr>
<td>12:00 – 12:30</td>
<td>Discussion</td>
</tr>
<tr>
<td>12:00 – 14:00 LUNCH BREAK</td>
<td>20. Update of action points from 2017 SEARO meeting</td>
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<tr>
<td>14:00 – 14:15</td>
<td>21. Review of conclusions and action points</td>
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<tr>
<td>14:15 – 14:35</td>
<td>22. Closing session</td>
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<tr>
<td>14:35 – 14:45</td>
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<td>14:45 – 15:00</td>
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