Overview of rotavirus vaccine introduction and operational implications of implementing current rotavirus schedules in LMICs

Global Framework for Rotavirus Vaccine Implementation Research
Ikechukwu U. Ogbuanu, MD, MPH, PhD; October 2-3, 2017

Outline

• Comparative burden in LMICs
• Vaccine introduction in LMICs
• Vaccine coverage
• Vaccine impact
• Summary and Discussion
Diarrhea and rotavirus mortality

~0.6 million childhood diarrhea deaths in 2013

215,000 childhood rotavirus deaths in 2013

~194,000 childhood rotavirus deaths occur in Gavi-eligible countries

WHO IVB estimates, 2016

215,000 global child rotavirus deaths, 2013

Data source: WHO IVB. Rotavirus disease burden estimates, April 2016

WHO IVB Member States

Map production: Immunization, Vaccines and Biologicals, (IVB), World Health Organization

Date of slide: 15 April 2016
Rotavirus mortality rate in children younger than 5 years, 2013

Ten countries with highest number (and percent global total) of child rotavirus deaths, 2013

Source: Estimated rotavirus deaths, WHO IVB as of April 2016
RV position paper
January 2013

- Rotavirus vaccines should be included in all national immunization programmes, particularly in south and south-eastern Asia and sub-Saharan Africa
- Encourages baseline incidence and monitoring of disease and intussusception
- First dose as soon as possible after 6 weeks of age
- Infants should receive vaccine up to 2 years

Global rotavirus vaccine introduction over time

Status of Introduction of Rotavirus Vaccine in WHO Member States

2006
National Rotavirus vaccine introduction by WB income classification or GAVI eligibility, as of September 2017

Sources: WHO/IVB Database, as of 05 September 2017, based on country reports; World Bank, List of economies, March 2017 (no classification for Niue and Cook Islands); GAVI, Countries ever eligible to apply for rotavirus support.

Countries that have introduced Rotavirus vaccine and global infant coverage for the last dose, 2006-2016

Rotavirus vaccine coverage by income status,* 2006-2016

Rotavirus vaccine last dose coverage in 84 member states

Pneumococcal vaccine 3rd dose coverage in 131 member states

Immunization coverage with last dose of Rotavirus vaccine in infants, 2016

* World Bank list of economies (March 2017): Income classification not available for: Cook Islands and Niue
Global vaccine coverage estimates, 1980-2016
BCG, DTP 1st and 3rd, Measles 1st and 2nd, Rubella 1st, HepB birth and 3rd, Hib3, Pol3, YFV, PCV3 and Rota (last dose)


Last dose of Rotavirus vaccine coverage by WHO region, 2006-2016

Global coverage at 25% in 2016
Over 100 million children did NOT receive last dose of rotavirus vaccine in 2016

70% of infants unvaccinated with last dose of rotavirus vaccine live in only 10 countries, 2016

1. Globally, only 35 million are vaccinated with last dose;
2. More than 100 million unvaccinated (or not fully vaccinated);
3. 70 million of these live in only 10 countries!


* In 2016, India and Pakistan both introduced in some parts of the country

### Rotarix™ & Rotateq™ Summary of product characteristics

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Human monovalent (Rotarix™)</th>
<th>Human-bovine, pentavalent (RotaTeq™)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of doses in schedule</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>EPI schedule</td>
<td>2 doses with DTP</td>
<td>3 doses with DTP</td>
</tr>
<tr>
<td>Min internal between doses</td>
<td>4 weeks</td>
<td></td>
</tr>
<tr>
<td>Method administration</td>
<td>Oral</td>
<td></td>
</tr>
<tr>
<td>Presentation</td>
<td>Liquid</td>
<td></td>
</tr>
<tr>
<td>Per dose cold chain requirement</td>
<td>17.1 cm³</td>
<td>46.3 cm³</td>
</tr>
<tr>
<td>Shelf Life</td>
<td>36 months at 2-8 C</td>
<td>24 months at 2-8 C</td>
</tr>
<tr>
<td>VVM type</td>
<td>VVM14 (changing to VVM7)</td>
<td>No VVM</td>
</tr>
<tr>
<td>Special precautions</td>
<td>None</td>
<td>No VVM technology validated for use with this vaccine. Those currently available do not match the stability profile of vaccine components. Important for vaccine potency that cold chain storage conditions are maintained from delivery to administration</td>
</tr>
<tr>
<td>Future product improvements</td>
<td>Spike tube PQed in 2016; currently being rolled out</td>
<td>VVM7 and 30% reduction in cold chain requirements, anticipated WHO PQ in late 2017</td>
</tr>
</tbody>
</table>
Both vaccines showed high efficacy in trials in high/middle income countries

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Region</th>
<th>Efficacy (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotarix</td>
<td>Europe</td>
<td>96% (90%-99%)</td>
</tr>
<tr>
<td>Rotarix</td>
<td>Latin America</td>
<td>85% (72%-92%)</td>
</tr>
<tr>
<td>RotaTeq</td>
<td>Europe/US</td>
<td>98% (88%-100%)</td>
</tr>
</tbody>
</table>

Vesikari et al and Ruiz-Palacios et al, NEJM 2006

Moderate efficacy of rotavirus vaccines in Africa and Asia

<table>
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<th>Vaccine</th>
<th>Region</th>
<th>Countries</th>
<th>Efficacy (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RotaTeq</td>
<td>Africa</td>
<td>Ghana, Kenya, Mali</td>
<td>64% (40%-79%)</td>
</tr>
<tr>
<td>RotaTeq</td>
<td>Asia</td>
<td>Bangladesh, Vietnam</td>
<td>51% (13%-73%)</td>
</tr>
<tr>
<td>Rotarix</td>
<td>Africa</td>
<td>South Africa, Malawi</td>
<td>62% (44%-73%)</td>
</tr>
</tbody>
</table>

Armah et al. Lancet 2010
Zaman et al. Lancet 2010
Madhi et al NEJM 2010
Sentinel Rotavirus surveillance showed vaccine impact in Ghana


Number of cases tested positive for rotavirus (Ghana)

RV Vaccine introduction
Summary

1. Unlike other vaccines in the routine immunization schedule, globally, only 25% of infants have received the last dose of rotavirus vaccine.

2. In 2016, 100 million infants globally were unvaccinated or partially vaccinated with rotavirus vaccines.
   - 70 million of these reside in only 10 countries, most of which have not introduced the vaccine.

3. In 2013, four countries (India, Nigeria, Pakistan and DRC) accounted for approximately half (49%) of all rota deaths under age five in 2013.

4. Many LIC and especially non-Gavi eligible MICs, although with the highest burdens, are yet to introduce the vaccine.

Acknowledgments

• Laure Dumolard
• Adam L. Cohen
• Fatima Serhan
• Sebastien Antoni
Countries with Rotavirus vaccine in the national immunization programme; and planned introductions in 2017

* Includes partial introduction

* Introduced* to date (91 countries or 47%)
* Planned introductions in 2017 (4 countries or 2%)
Not Available, Not Introduced/No Plans (99 countries or 51%)
Not applicable

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement. ©WHO 2017. All rights reserved.