A GLOBAL PERSPECTIVE ON ROTAVIRUS VACCINES: POLICY, SUPPLY VOLUMES AND PRICING

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GLOBAL ESTIMATE OF ROTAVIRUS MORTALITY IN YOUNG CHILDREN <5 YEARS OF AGE (2000-2013)

215,000 deaths in children U5 years of age (range 197,000 – 233,000)
NATIONAL ROTAVIRUS VACCINE INTRODUCTIONS BY GEOGRAPHIC REGION - 81 COUNTRIES*

*As of May 1, 2016
RV = rotavirus vaccine
COUNTRIES THAT HAVE NOT INTRODUCED ROTAVIRUS VACCINE (BY WHO REGION)

*As of June 1, 2016
RV = rotavirus vaccine
ROTAVIRUS VACCINE IS INTRODUCED INTO FOUR EARLY ADOPTER STATES IN INDIA, MARCH 2016

- India becomes the first country to Asia to recommend rotavirus vaccine for national introduction!
- Introduction in 4 States as pilot for scale-up across country
COUNTRIES WITH THE HIGHEST NUMBER OF ROTAVIRUS DEATHS IN YOUNG CHILDREN UNDER-5, 2013

- India: 47,082 deaths (22%)
- Nigeria: 30,800 deaths (14%)
- Pakistan: 14,700 deaths (7%)
- Democratic Republic of the Congo: 13,526 deaths (6%)
- Other Countries: 75,281 deaths (35%)

- Kenya: 3,908 deaths (2%)
- Niger: 3,978 deaths (2%)
- Chad: 4,240 deaths (2%)
- Ethiopia: 6,817 deaths (3%)
- Angola: 9,682 deaths (5%)
- Afghanistan: 4,792 deaths (2%)
ILLUSTRATIVE ROTAVIRUS VACCINE GLOBAL DEMAND FORECAST: SNAPSHOT OF COURSES
17 countries are expected to introduce over the next 5 years from 2016-2020 with Gavi support (Gavi SDF v12)
ROTAVIRUS VACCINES 2015 DEMAND FORECAST: PROJECTED REQUIRED SUPPLY FOR GAVI-73 IN COURSES

HOW THE CO-FINANCING POLICY WORKS THROUGH GRADUATION

100% of vaccine cost

Initial self-financing

Preparatory transition

Accelerated transition

Fully self-financing

Government share of vaccine cost

(variable duration)

World Bank low-income threshold

Phase 1 (variable duration)

Eligibility threshold

Phase 2 (5 years)

End of Gavi financing

Access to Gavi vaccine tenders (5 years)

Increasing GNI per capita

Years

Kallenberg et al. Health Aff 2016;35:250-258
MAJOR ISSUES AFFECTING DEMAND-TIMING AND LEVEL

Delayed country-readiness
- Lack of training
- Cold chain and other systems prep

Other competing priorities
- IPV introduction
- Ebola

Preference for one product
Availability of locally-produced vaccine
Concerns about long-term sustainability
GLOBALLY AVAILABLE ROTAVIRUS VACCINES

There are currently two vaccines that are WHO pre-qualified and commercially available internationally.

Rotarix™, GSK Biologicals
(derived from a single common strain of human rotavirus) G1P8

RotaTeq®, Merck Research
(Reassorted bovine-human rotavirus)
Genetically engineered vaccine consisting of 5 different strains to protect against the 5 most common human strains
**ROTA VIRUS VACCINE: UNICEF AWARDS FOR 2012-2016**

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Vaccine</th>
<th>Duration</th>
<th>Presentation</th>
<th>Doses</th>
<th>Schedule</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>GlaxoSmithKline (Belgium)</td>
<td>RV1</td>
<td>4 years</td>
<td>1 dose</td>
<td>136,200,000</td>
<td>2 doses</td>
<td>68,100,000</td>
</tr>
<tr>
<td>Merck (USA)</td>
<td>RV5</td>
<td>4 years</td>
<td>1 dose</td>
<td>16,332,100</td>
<td>3 doses</td>
<td>5,444,033</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>152,532,100</strong></td>
<td></td>
<td><strong>73,544,033</strong></td>
</tr>
</tbody>
</table>

Source: UNICEF Supply Division.

GAVI PRESENTATIONS OF ROTARIX™ & ROTATEQ®

3 generations of vaccine – decreasing cold chain space & complexity with each generation

<table>
<thead>
<tr>
<th></th>
<th>Rotarix</th>
<th>RotaTeq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doses/Course</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Size</td>
<td>16.6 cm³/dose</td>
<td>48 cm³/dose</td>
</tr>
<tr>
<td>VVM</td>
<td>Yes (VVM 14)</td>
<td>No</td>
</tr>
<tr>
<td>Price/Course</td>
<td>$5.00</td>
<td>$10.50</td>
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</tbody>
</table>

Vaccine Vial Monitor (VVM)

Rotarix, GSK
CHARACTERISTICS OF ROTAVIRUS VACCINES SELECTED BY COUNTRIES

- Countries choose their preferred products for Gavi approval for vaccine subsidy
- Countries indicate that they prefer Rotarix™, because of:
  - the Vaccine Vial Monitor (VVM)
  - the smaller cold chain footprint

The Gavi co-pay is equal for both vaccines (approximately US$0.30 / course of vaccine)

However, as countries begin graduating from Gavi support, we expect vaccine price to become more of a factor in country decision-making on which vaccine to choose.
CURRENT PUBLIC MARKET PRICES

Figure 6: Current public market price references

2016 Prices
Note: UNICEF Rotarix® price is in Euros (Eur 3.76/course), conversion to USD varies from year to year; exchange rate reference is 2016 average, USForex online.
RICH ROTAVIRUS VACCINE PIPELINE
DEVELOPMENT AND LICENSURE OF ROTAVAC®

ROTAVAC® licensure in India in 2014

- Shown to be safe and efficacious in Phase III trial in India
  - 54% efficacy against severe rotavirus gastroenteritis
  - Nearly 56% protection in the first year of life
- ROTAVAC® products could achieve major impact in India and in Gavi countries
- First-generation product to be priced at ~$1 per dose
- India introduced ROTAVAC® in March 2016
UNICEF VACCINE PROCUREMENT PRINCIPLES: CONSIDERED RELEVANT FOR ALL VACCINES TO ENSURE A HEALTHY MARKET

1. A **healthy industry** is vital to ensure uninterrupted and sustainable supply of vaccines
2. Procurement from **multiple suppliers** for each vaccine presentation
3. Procurement from manufacturers in **developing countries and industrialized countries**
4. Paying a price that is **affordable** to Governments and Donors and a price that reasonably covers manufacturers minimum requirements
5. UNICEF should provide manufacturers with **accurate and long-term forecasts**; Manufactures should provide UNICEF with accurate and long-term production plans
6. As a public buyer, providing grants to manufacturers is not the most effective method of obtaining capacity increases
7. The option to quote **tiered pricing** should be given to manufacturers.
MORE SECURE EPI VACCINE SUPPLY

2001: 5 suppliers from 5 countries of production

Belgium 1
France 1
Switzerland 1
Senegal 1
Republic of Korea 1

Source: UNICEF Supply Division
MORE SECURE VACCINE SUPPLY

2014: 16 manufacturers* from 11 countries of production

*N includes 14 Gavi suppliers and 2 manufacturers of prequalified Gavi vaccines.
**One US manufacturer also produces in the Netherlands.

Note: Country of production represents country of national regulatory agency responsible for vaccine lot release.

Source: UNICEF Supply Division and WHO list of pre-qualified vaccines, 2014
WORKING TOWARD A COMPETITIVE SUPPLIER MARKET

Supply-side interventions help lower market entry barriers and costs

• Research and discovery largely publicly funded
  • Including transfer/availability of IP
• Clinical development costs often shared with public health partners or government
• Shared costs of vaccine clinical trials and other studies in low-resource settings
• Technical assistance (e.g. development, production, regulatory, legal)
  • Support for developing country manufacturers
WORKING TOWARD SUSTAINABLE DEMAND

Short and long-term demand in developing countries can be uncertain

Demand uncertainty translates into risk for manufacturers and therefore may:

• Reduce the number of market entrants
• Delay development efforts
• Keep prices higher than desired

Demand-side interventions

• WHO policy-making
• Subsidized vaccines (GAVI, other donors)
• Country support for immunization system-strengthening, vaccine introduction
• Country support for decision-making
SUMMARY

• Successful rotavirus vaccine introductions in more than 80 countries
• Rate of uptake varies widely among WHO regions
• Projected growth in demand, primarily in low and lower-middle income countries—global demand expected to exceed 100 million courses by 2025
• Many factors contribute to demand uncertainty
• Robust product pipeline can contribute to supply security and increase impact of rotavirus vaccines
• Ongoing work by global vaccine community is critical to ensure supply-demand balance and thus maximize impact of rotavirus vaccines, reducing childhood mortality and morbidity
EVERY PERSON DESERVES THE CHANCE TO LIVE A HEALTHY, PRODUCTIVE LIFE