Economic analysis for evidence-based policy-making on a national immunization program: a case of rotavirus vaccine in Thailand*

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Background

- A population of 67 million
- GNI per capita, US$ 4,210 in 2010
- Thailand’s path to UC against GNI per capita, 1970-2010
<table>
<thead>
<tr>
<th>Health scheme</th>
<th>Beneficiaries</th>
<th>Payment method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil Servant Medical Benefit Scheme (CSMBS)</td>
<td>Government employees, retirees and their dependents</td>
<td>Fee-for-service</td>
</tr>
<tr>
<td>Social Security Scheme (SSS)</td>
<td>Private-sector employees</td>
<td>Capitation</td>
</tr>
<tr>
<td>Universal Coverage Scheme (UCS) managed by the National Health Security Office (NHSO)</td>
<td>Who are not under the CSMBS and SSS. 75% of the Thai population</td>
<td>Capitation 2,693.5 baht (US$ 78.80) per capita in 2011</td>
</tr>
</tbody>
</table>
• During 1977–1999, EPI was managed by MoPH, from policy to technical support, vaccine logistics and supply, vaccine deliver, to monitoring and evaluation.

• Since 2000, EPI program has undergone major shifts, under UC scheme, with NHSO as major funding partner.

• NHSO takes care of financing for vaccines and vaccine delivery, including procurement and supply of vaccines to all health care providers.

• The Ministry of Public health (MoPH) is now responsible for
  – Policy / strategy development and guidance, as well as technical support to health care providers
  – Vaccination services
Advisory Committee on Immunization Practice (ACIP)

- ACIP committees was established by the MoPH in 1970.
- In 2001 ACIP became part of a larger national advisory body, the Thai National Vaccine Committee (NVC).
- ACIP make recommendations for
  - Vaccine introduction
  - Vaccine schedules
  - Vaccines for high-risk groups
  - Vaccines beyond the infant immunization schedule
  - Vaccine formulations
  - Choice of vaccines for a specific disease
Challenge of vaccine introduction

• Introduction of new vaccines is a high-cost and high-impact issues.
• Policy on vaccine introduction is developed by MoPH, under the advice of ACIP.
• Main decision criteria include
  – Disease burden
  – Public health impact
  – Vaccine safety and efficacy
  – Cost implications.
• Decision on financing is made by NHSO, whose main decision criteria include cost-benefit, cost effectiveness and budget burden.
Pathway for recommendations of the Thai Advisory Committee on Immunization Practice

Advisory Committee on Immunization Practice (ACIP)
- Makes recommendation / Consultation

Department of Disease Control (DDC)
1. Conducts pilot / model program
2. Develops proposal for new vaccine introduction

Ministry of Public Health (MoPH)
- Approves the proposal

National Health Security Office (NHSO)
- Reviews, prioritizes, and develops budget plan

Cabinet
- Approves budget

Parliament
- Approves budget

New vaccine introduction plan and budget approved
The case of rotavirus vaccine

Economic analysis (NVI+Pharmacy, Mahidol)

Rotarix  RotaTeq  ACIP  ACIP  Department of Disease Control

2006  2008  2009  2010  2011

Non-EPI vaccines

Basic guidelines:
- Disease burden/ impact
- Vaccine efficacy/ safety
- Economics (cost-effectiveness/ budget impact)

NVI=National Vaccine Institute of Thailand
ACIP=Advisory Committee on Immunization Practice
Research questions

• Based on the current situation, is rotavirus vaccination cost-effective?
• If not, at what vaccine price is it cost-effective?
• Then, what is the budget needed for the vaccine supply?
Study design

- This study was designed as an economic evaluation employing **modeling** technique to explore **cost-effectiveness, cost-benefit analysis and budget impact** of incorporating rotavirus vaccine into the NIP.
- The study was conducted in both societal and provider perspectives.
- The vaccines investigated were 2-dose and 3-dose vaccines. Immunization regimen was at 2, 4 and 6 months for the first, second and third doses.
- Children were assumed to receive the vaccine together with the OPV vaccine.
• A decision analytic model in the form of a decision tree was constructed.
• A birth cohort in 2009 was used in the model, and was monitored until the age of 60 months.
• The number in the vaccinated group was based on vaccination coverage. The number of cases was based on incidence and vaccine efficacy.
• End points were no rotavirus gastroenteritis, and rotavirus gastroenteritis with self-treatment/outpatient, inpatient, or death.
• Outcome measures were deaths averted, and disability-adjusted life years (DALYs) averted.
• Costs of illness and of the vaccination program in a societal perspective covered both direct and indirect costs of both service provider and service receiver. In a provider perspective, the costs were only those incurred by the public health sector.
Fig. 1. Schematic model of rotavirus immunization in Thailand.
Cohort \times \text{Coverage rate} \downarrow \text{Vaccinated children} \downarrow \times \text{Efficacy} \downarrow \text{Immunized children} \downarrow = \text{Cohort} - \text{immunized children} \downarrow \text{Susceptible children} \downarrow - \text{Dead cases} \downarrow \text{Adjusted Susceptible children} \downarrow \times \text{incidence rate} \downarrow \text{Rotavirus cases}
Disability-adjusted life years (DALYs) estimates

- DALYs = Years of life lost (YLL)
- + years lost due to disability (YLD)

- In the calculation of YLD, since there was no disability weight for rotavirus diarrhea, the disability weight of complicated diarrhea (0.402) and uncomplicated diarrhea (0.056) was assumed and used for inpatient and non-inpatient cases, respectively.

- Duration of morbidity = 5.83 days (1.85 days before coming to the hospital, LOS=2.98 days and 1 additional day after hospital treatment). Life expectancy was 71 years.
Direct medical cost

Charge | Hospital cost | Charge

Treatment (before) | Treatment (study site) | Treatment (after) | Recovery period

Cure | Death

Travel and meal cost
Cost of informal care

Direct nonmedical cost

Indirect cost

Mortality cost
Vaccine efficacy

• Efficacy of the vaccine was varied due to different virus serotypes.
• Based on a review, we used 70% for both 2-dose and 3-dose vaccines as a base case, 86% and 43% for sensitivity analysis.
• For death prevention, we used 93%.
• Adverse events or adverse events following immunization (AEFI) were assumed to be none.
• Vaccine coverage was estimated at 98.6%, based on a previous study in Thailand.
Cost of rotavirus diarrhea (CoInv)

Cost of the vaccine (CoV)
$42/$31 per dose

Disability-Adjusted Life Year (DALYnv)

Disability-Adjusted Life Year (DALYv)

Cost of rotavirus diarrhea (Colv)

Morbidity Mortality

Vaccine efficacy

(Colv+CoV)-CoInv

DALYnv-DALYv

>3 GDP per DALY avoided

Not cost-effective
Cost of rotavirus diarrhea (CoInv)

Cost of the vaccine (CoV) $4.98/$3.32 per dose

Disability-Adjusted Life Year (DALYnv)

Cost of rotavirus diarrhea (Colv)

Disability-Adjusted Life Year (DALYv)

Threshold/break-even price analysis

(Colv+CoV)-CoInv

DALYnv-DALYv

=1 GDP per DALY avoided

Cost-effective
Rotarix  RotaTeq  ACIP  ACIP
2006  2008  2009  2010

Non-EPI vaccines

Rotavirus vaccine

Basic guidelines:
-Disease burden/ impact
-Vaccine efficacy/ safety
-Economics (cost-effectiveness/ budget impact)

Effectiveness and cost-effectiveness analysis
(DDC+Pharmacy, Mahidol)

Pilot project in 1 province

Break-even prices

Economic analysis (NVI+Pharmacy, Mahidol)

2011  2012  2013  2014

Informal price negotiation?
(approx. 27,000 vs >700,000 children/ year)

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DDC=Department of Disease Control
Conclusions

• Economic information is basically needed for policy development.
• However, policy makers have limitations to understand the economic information.
• Therefore, study design should be appropriate to the context.
• In essence, the economic information should come from a collaboration research project (MoH+academics) to guarantee the acceptance.