Evaluation of Vaccines and Immunization Programs at Universidade de São Paulo

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Evaluation of Vaccines and Immunization Programs at USP*

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  – Eliseu A. Waldman, Ana Paula Sayuri Sato

• Instituto de Medicina Tropical, USP – Expedito Luna

• Reference Center for Special Immunobiologicals, CRIE

* Pinheiros Campus
Evaluation of Vaccines

Faculdade de Medicina / CRIE

• Evaluation immunogenicity and safety of vaccines in immunocompromised hosts (HIV+, solid organ transplant, rheumatologic diseases), the elderly and healthcare workers
• Hepatitis B in HIV+
• Pneumococcal in HIV+
• Varicella in renal transplant
• Yellow fever vaccine in HIV+ and seniors
• H1N1 in the elderly, renal and liver transplant, rheumatologic diseases
• Influenza in renal transplant
• Influenza vaccine produced by Butantan Institute in seniors and healthy adults 18-59 y (ANVISA requirement for licensure)

Faculdade de Saúde Pública

• Evaluation of MenCc effectiveness in São Paulo

Instituto de Medicina Tropical

• Evaluation of influenza vaccine (collaboration Butantan Institute)
Evaluation of Immunization Program

Faculdade de Medicina
• Evaluation of the Reference Centers for Special Immunobiologicals, CRIES (collaboration MoH)
• Assessment of cold chain in primary healthcare centers (UBS) in south and middle-west regions of São Paulo city (collaboration DI/SMS)

Faculdade de Saúde Pública
• Evaluation of adverse events following immunization (AEFI)
  – AEFI following DTP (diphtheria, tetanus and pertussis) vaccination, in São Paulo (collaboration SES/SP)
  – AEFI following tetravalent (DTP+Hib) vaccine at the national level
• Evaluation of electronic records in immunization in Curitiba, PR
• Evaluation of a nominal immunization register system in a medium city (Araraquara) in São Paulo state
• Vaccination coverage and reasons for incomplete schedule in Araraquara, SP
• Health impact assessment of MenCc vaccination program in São Paulo city
Economic evaluation of introducing new vaccines in the Brazilian National Immunization Program (PNI)

Department of Preventive Medicine and Department of Infectious and Parasitic Diseases, Faculdade de Medicina
2004. PNI universal childhood immunization schedule: BCG, OPV, DTPw+Hib, HepB and MMR

New vaccines already in use in developed countries: PCV7, MenCc, varicella, hepatitis A (rotavirus in later development)

→ Very high costs compared to traditional EPI vaccines:
  - PCV7 = US$50/dose (US$ 200/FIC*) (Brazilian MoH, 2004)

New vaccines available in Brazilian private clinics

→ ↑ inequities in access to immunization

Pediatric and Immunization Societies put pressure on the MoH to incorporate these new vaccines into universal immunization

*FIC = fully immunized child
Cost-effectiveness analyzes of new vaccines Project (2005-2014)

Brazilian National Immunization Program (PNI)

- Rotavirus
- Varicella
- Pneumo conjugate
- Meningo C conjugate
- Hepatitis A

- HPV
- IPV – OPV
- dTPa
- Pneumo PS 23

Budget Impact of new vaccines introduction – hepatitis A
Necessary data for cost-effectiveness studies

- **Epidemiological estimates** of specific diseases: Incidence, prevalence, complications, sequelae, mortality, case-fatality
- **Health service utilization and costs** of specific diseases
  - Access and use of health resources: visits, hospitalizations, treatment patterns – diagnostic tests, procedures and drugs
- **Specific Vaccine characteristics**: efficacy/effectiveness, safety, costs, coverage
- Major determinants of CEA results: disease incidence, HSU and costs and vaccine costs – vary widely across different countries → EA should consider local data
Data sources for CEA in Brazil

• Secondary data
• Health Information Systems
  – Mortality Information System (SIM/DATASUS): population based
  – Information System on Live Births (SINASC): population based
  – Information System on Notifiable Conditions (SINAN): population based
  – SUS Hospital Information System (SIH/SUS): SUS coverage (~70% of all hospital.)
  – Ambulatory Information System (SIA/SUS): SUS coverage
• Census, Surveys
  – National Survey by Household Sample (PNAD / IBGE) - Health Supplement
• Costs
  – MoH Bank of Prices, TUNEP, CBHPM (tabela procedimentos AMB), ABCFarma
• Scientific publications
  – Unpublished research: CAPES thesis databank
• Primary data collection
### Summary of CEA of new vaccines introduction in PNI

<table>
<thead>
<tr>
<th></th>
<th>Rotavirus</th>
<th>Varicella</th>
<th>PCV10</th>
<th>MenCc</th>
<th>Hepatitis A</th>
<th>HPV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
<td>Decision tree, 1 cohort, for 5y</td>
<td>Dynamic, population 0-70 y, for 30 y</td>
<td>ProVac, decision tree 20 cohorts of newborns to ≤5y</td>
<td>Decision tree, 1 cohort of children for 10y</td>
<td>Dynamic, population 0-72 y for 24y</td>
<td>CERVIVAC, 1 cohort 11y girls, 100y</td>
</tr>
<tr>
<td><strong>ICER (/YLS)</strong></td>
<td>R$ 1 028 R$ 1 713</td>
<td>R$ 14 749 R$ 16 582</td>
<td>R$ 21 369 R$ 24 245</td>
<td>R$ 21 620 R$ 21 896</td>
<td>Economic</td>
<td>R$ 13 355 R$ 13 565</td>
</tr>
<tr>
<td><strong>GDP</strong></td>
<td>R$ 10.692</td>
<td>R$ 10.69</td>
<td>R$ 10.69</td>
<td>R$ 12.69</td>
<td>R$ 15.24</td>
<td>R$ 15 780</td>
</tr>
<tr>
<td><strong>Interpretation</strong></td>
<td>Very cost-effective</td>
<td>Cost-effective</td>
<td>Cost-effective</td>
<td>Cost-effective</td>
<td>Economic</td>
<td>Very cost-effective</td>
</tr>
<tr>
<td><strong>Break even</strong></td>
<td>--</td>
<td>R$ 33.30 (1) R$ 15.10 (2)</td>
<td>R$ 19.88</td>
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<td></td>
</tr>
<tr>
<td><strong>Incorporation, Year</strong></td>
<td>Yes Mar 2006</td>
<td>Yes Aug 2013</td>
<td>Yes Mar 2010</td>
<td>Yes Sep 2010</td>
<td>Not yet, 2014 (1 dose)</td>
<td>Yes Mar 2014</td>
</tr>
<tr>
<td><strong>$/dose at introduction</strong></td>
<td>R$18.60 US$7</td>
<td>R$ 28.40 MMRV</td>
<td>R$ 30.00</td>
<td>R$ 19.00</td>
<td>R$ 22.50</td>
<td>R$ 31.00</td>
</tr>
</tbody>
</table>

*YLS = years of life saved; *$/vaccine dose that makes the program highly cost-effective
CEA of new vaccines introduction in Brazil

• Beginning: researchers inexperience

• Each vaccine had its specificities depending on the natural history and epidemiology of disease; health services utilization necessary for treatment of disease (inpatient / outpatient), availability of data in Health Information Systems and from research, and the vaccine characteristics, bringing new challenges for the researchers
USP and MoH Collaboration

- PNI/MoH decides which vaccine should be evaluated
- USP team writes the project, estimates time needed to conduct the study, gets financial support from MoH, the National Council for Development of Science (CNPq), other...
- USP team take all decisions regarding the model and parameters to be used and data to be considered
- MoH do not interfere in the study design, data analyses or interpretation of results
- USP team writes detailed reports for the PNI/MoH, presents results in MoH meetings and publishes CEA results / other papers
- Intense communication between the researchers and the PNI/SVS/MoH, discussing the steps, challenges, time needed
Team: Faculdade de Medicina, Universidade de São Paulo

Coordenation:

Prof. Hillegonda Maria Dutilh Novaes (Department of Preventive Medicine)

Researchers:

Prof. Ana Marli C. Sartori (Department of Infectious and Parasitic Diseases)
Prof. Patricia C de Soárez (Department of Preventive Medicine)
Joice Valentim, Alex Itria
Laura Lagôa, Lígia Figueiredo, Margarete Vicentine, Éder Gatti

Collaboration:

- Prof. Raymundo Azevedo, Department of Pathology, FMUSP and
- Prof. Marcos Amaku, Department of Preventive Veterinary Medicine, Faculdade de Veterinária, USP (Dynamic models - Varicella and Hepatitis A)
- Prof. Ricardo Ximenez and Prof. Celina Martelli, Universidade Federal de Pernambuco (Hepatitis A)
- Dr. Gulnar Azevedo e Silva, Epidemiology Division, Brazilian National Cancer Institute, Andreia Rodrigues Ayres and Cristina Rama; ProVac/PAHO (HPV)
- Prof. Cristiana Toscano and Prof. Alex Itria (Universidade Federal Goias)
Some published papers

- Sartori AMC; de Soárez PC; Novaes HMD; Amaku M; de Azevedo RS; Moreira RC; Pereira LMMB; Ximenes RAA; Martelli CMT. Cost-effectiveness analysis of universal childhood hepatitis A vaccination in Brazil: Regional analyses according to the endemic context. *Vaccine* 2012; 30: 7489-7497.
- Sartori AMC; de Soárez PC; Novaes HMD. Cost-effectiveness of introducing the 10-valent pneumococcal vaccine into the universal immunisation of infants in Brazil. *Journal of Epidemiology and Community Health* 2012; 66: 210-217.
- de Soárez PC; Sartori AMC; Nobrega LAL; Itria A; Novaes HMD. Cost-effectiveness analysis of universal infant immunization program with meningococcal C conjugate vaccine in Brazil. *Value in Health*, 2011; 14: 1019-27
- Sartori AMC; Novaes CG; de Soárez PC; Toscano CM; Novaes HMD. Estimating health service utilization for treatment of pneumococcal disease: The case of Brazil. *Vaccine* 2013; 31(S): C63-C71.
We are also interested in:

• Budget impact analyzes of new vaccines introduction
• Health impact assessment of vaccination programs
• Using secondary data for monitoring impact in health services
Teaching

Faculdade de Medicina
• Lecturers for undergraduates
• Practical training in immunizations for medical residents and trainees
• Course on vaccines for graduating students

Faculdade de Saúde Pública
• Summer / Winter Short courses
• Training program in epidemiology applied to immunization - 10 courses (2002 – 2005), 120 health professionals, who works at PNI and Secretary of Health of the states from all over the country (collaboration with Laura Rodrigues)