

# 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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  - Department of Preventive Medicine
    - Hillegonda Maria Dutilh Novaes
- Faculdade de Saúde Pública, USP
  - Eliseu A. Waldman, Ana Paula Sayuri Sato
- Instituto de Medicina Tropical, USP – Expedito Luna
- Reference Center for Special Immunobiologicals, CRIE

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# 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**

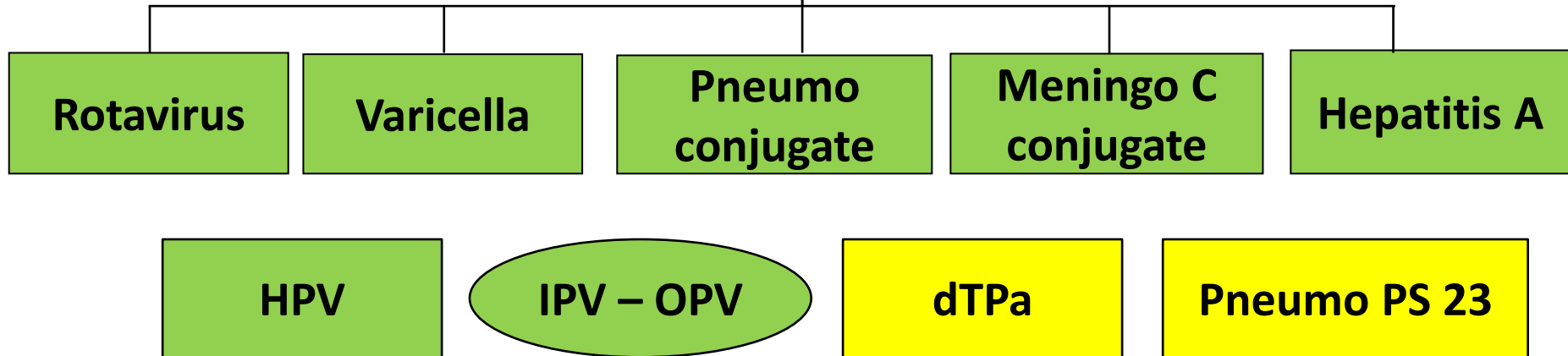
# Background

- 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:
  - BCG, OPV, DTPw, measles + hepB + Hib = US\$10/FIC\* (UNICEF, 2005)
  - 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)



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

|                         | Rotavirus                        | Varicella                            | PCV10   | MenCc                                       | Hepatitis A                        | HPV                                |
|-------------------------|----------------------------------|--------------------------------------|---|---|------------------------------------|------------------------------------|
| Base Year / Conclusion  | 2004 / 2006                      | 2004 / 2007                          | 2004 / 2009   | 2006 / 2009                                 | 2008 / 2011                        | 2008 / 2012                        |
| Model                   | Decision tree, 1 cohort , for 5y | Dynamic, population 0-70 y, for 30 y | ProVac, decision tree 20 cohorts of newborns to ≤5y | Decision tree, 1 cohort of children for 10y | Dynamic, population 0-72 y for 24y | CERVIVAC, 1 cohort 11y girls, 100y |
| Vaccine price/dose      | R\$ 18.6<br>US\$ 7               | R\$ 43.19                            | R\$ 39.75<br>US\$ 15                                | R\$ 32.43                                   | R\$ 16.89                          | R\$ 24.13<br>US\$ 13.19            |
| ICER (/YLS)             |                                  | (1 dose)                             | 4 doses, DALYs                                      |   | (2 doses)                          |                                    |
| - Society               | R\$ 1 028                        | R\$ 14 749                           | R\$ 21 369  | R\$ 21 620                                  | Economic                           | R\$ 13 355                         |
| - Health system         | R\$ 1 713                        | R\$ 16 582                           | R\$ 24 245  | R\$ 21 896                                  | Economic                           | R\$ 13 565                         |
| GDP                     | R\$ 10.692                       | R\$ 10.69                            | R\$ 10.69   | R\$ 12.69                                   | R\$ 15.24                          | R\$15 780                          |
| Interpretation          | Very cost-effective              | Cost-effective                       | Cost-effective                                      | Cost-effective                              | Economic                           | Very cost-effective                |
| Break even*             | --                               | R\$ 33.30 (1)<br>R\$ 15.10 (2)       | R\$ 19.88   | R\$ 16.22                                   | --                                 | --                                 |
| Incorporation, Year     | Yes<br>Mar 2006                  | Yes<br>Aug 2013                      | Yes<br>Mar 2010                                     | Yes<br>Sep 2010                             | Not yet, 2014<br>(1 dose)          | Yes<br>Mar 2014                    |
| \$/dose at introduction | R\$18.60<br>US\$7                | R\$ 28.40<br>MMRV                    | R\$ 30.00   | R\$ 19.00                                   | R\$ 22.50                          | R\$ 31.00                          |

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.
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## **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)



**Thank  
You** *Mahalo*  
*Tack* **Kiitos**  
*Grazie* **Toda**  
*Obrigado* **Thanks**  
*Takk* **Merci**  
**Gracias**

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