

Hôpital Européen Georges Pompidou

# The role of vaccination in the control of antibiotic resistance in pneumococci, French experience

*Emmanuelle Varon, Laurent Gutmann*

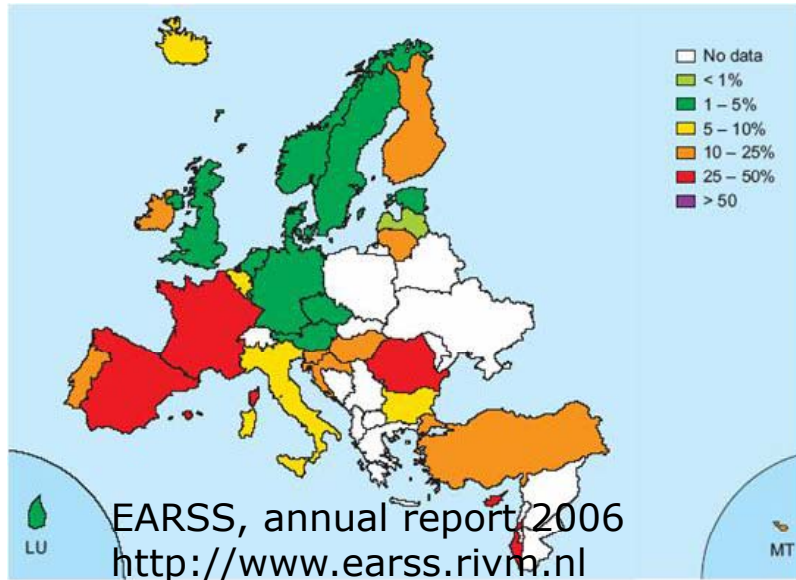
Centre National de Référence des Pneumocoques,

*Agnès Lepoutre, Daniel Lévy-Brühl*

Institut National de Veille Sanitaire, France

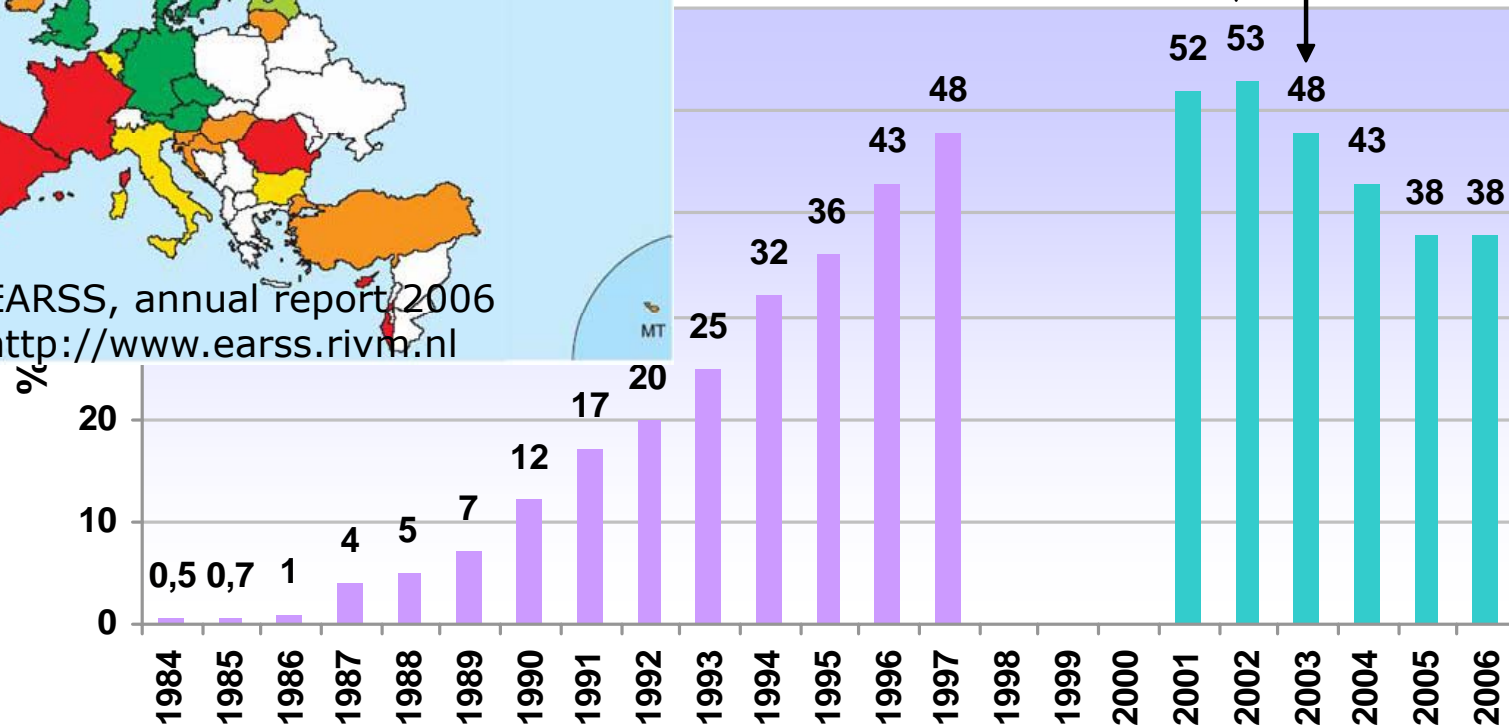
CNRP

# Penicillin non susceptible *S. pneumoniae* in France



National plan for a rational use of antibiotics

↓ PCV7 introduction



1984-1997: GEEP - P. Geslin; 2001-2006: CNRP-ORP

CNRP

CNRP, Annual report 2007

# Public health measures

- National plan for a rational use of antibiotics (Nov 2001)
  - From 2002 to 2007, antibiotic consumption in outpatient decreased by 23%, and by 34% in children <6 years
- Conjugate vaccine 7-valent (PCV7)
  - Recommended since 2003 in children < 2 years old at risk (3 doses + 1 booster)
    - Medical
    - Living conditions
  - Since June 2006, recommended for ALL children < 2 years
  - Slow increasing coverage: 44% and 56% of 6-12 months children received 3 PCV7 doses in 2006 and 2007, respectively.

CNRP

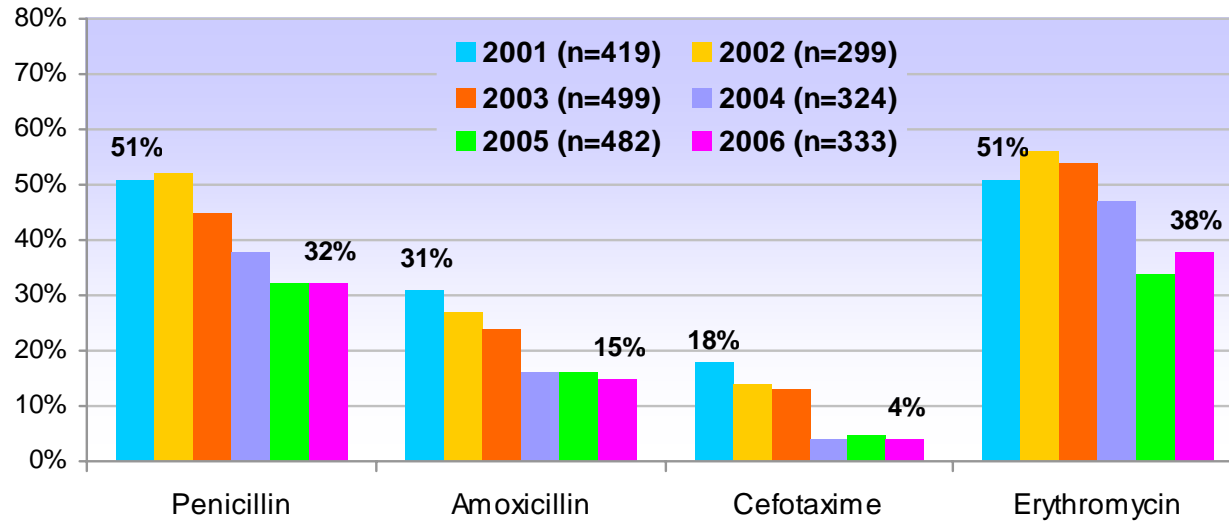
# Pneumococci surveillance network: Observatoires Régionaux du Pneumocoque coordinated by CNRP

- 23 « Observatoires Régionaux du Pneumocoque » (ORP) connected with
  - 431 laboratories
  - 444 health care facilities (3 036 126 admissions in medical wards)
    - Teaching hospitals 24%
    - General hospitals 69%
    - Private care facilities 7%
  - Coverage: 61.4% admissions in medical wards
- Incidence rates (EPIBAC laboratories network) were applied to
  - Proportion of PNSP → rates of PNSP disease
  - Distribution of serotypes → serotype-specific rates

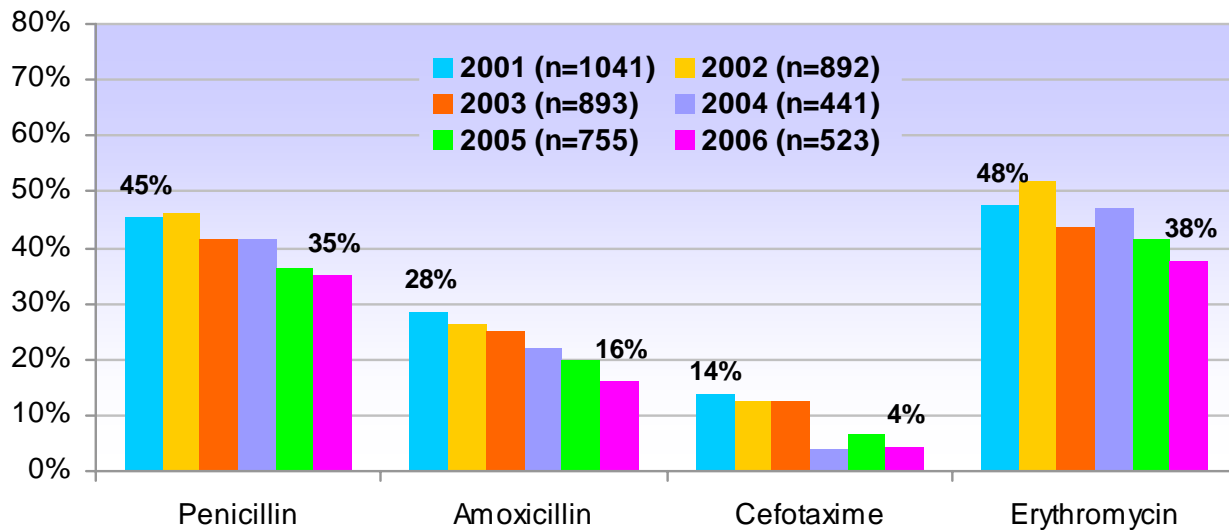
CNRP

# Evolution of resistance of invasive strains

≤ 15 years



> 15 years

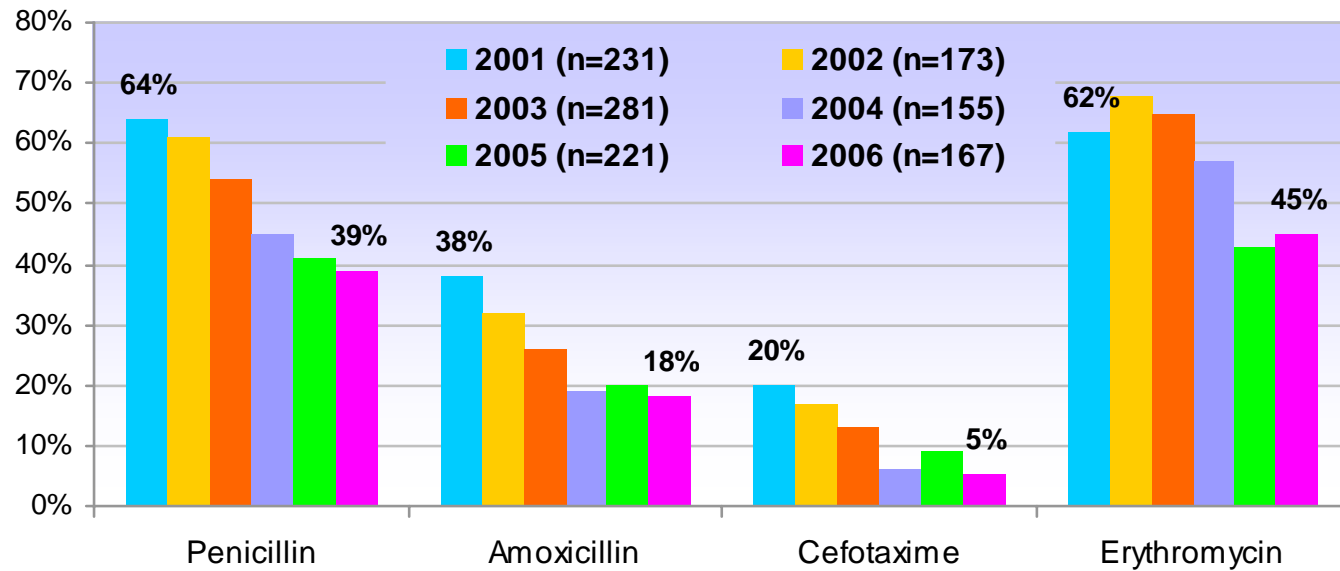


Invasive strains (CSF, blood cultures)

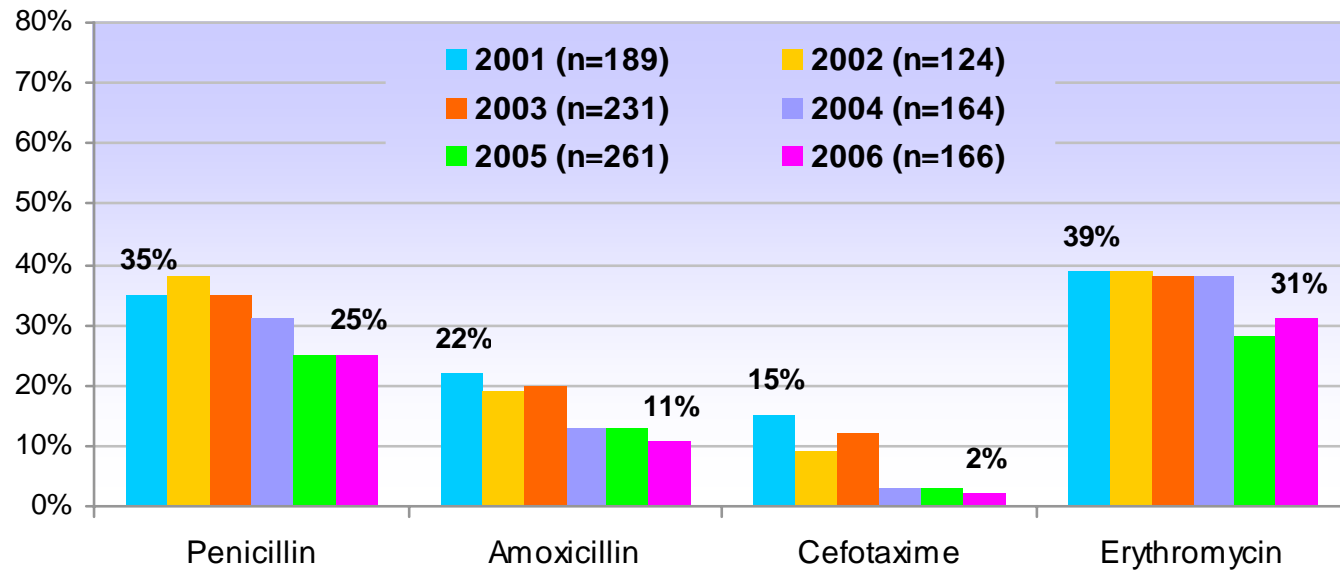
CNRP

# Evolution of resistance in children

< 2 years



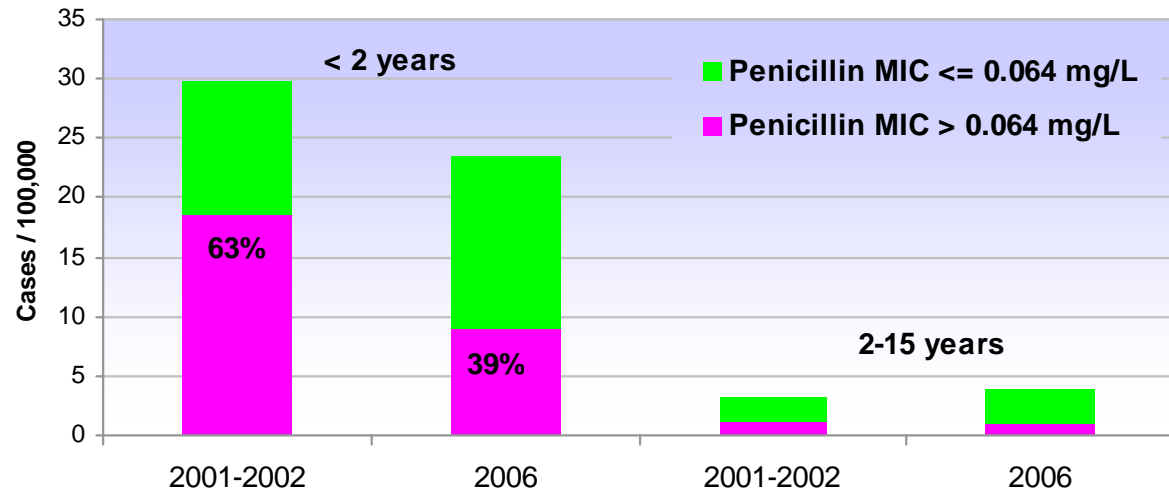
2-15 years



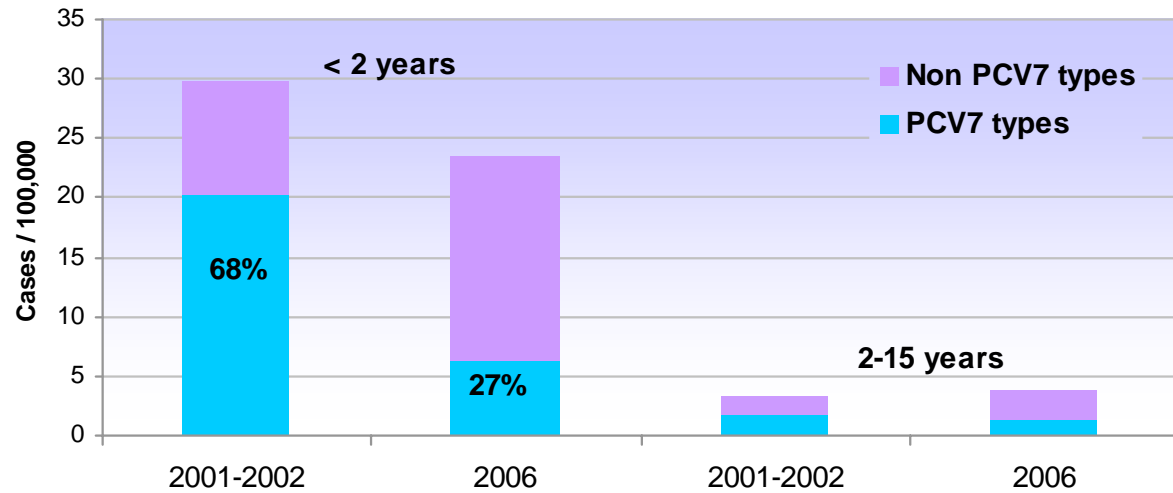
Invasive strains (CSF, blood cultures)

CNRP

# Incidence rate of IPD in children according to age



Incidence rate of IPD in children < 2 years old significantly decreased (-21%,  $p < 10^{-3}$ ) from 2001-2002 to 2006 (EPIBAC, InVS)

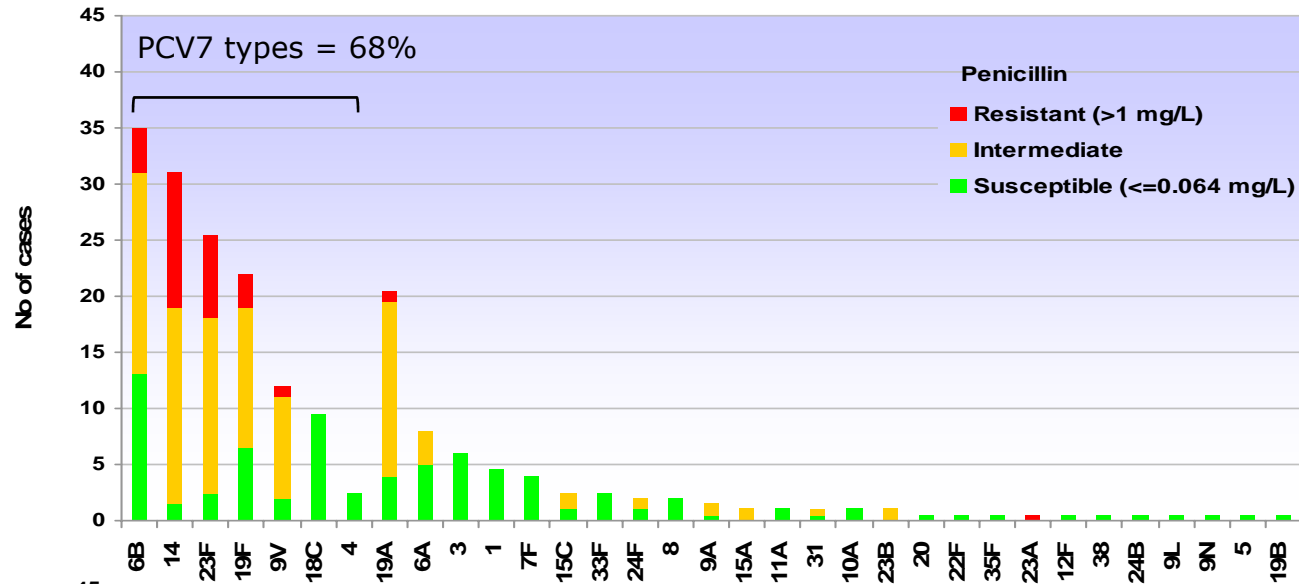


PCV7 types: 4, 6B, 9V, 14, 18C, 19F, 23F

CNRP

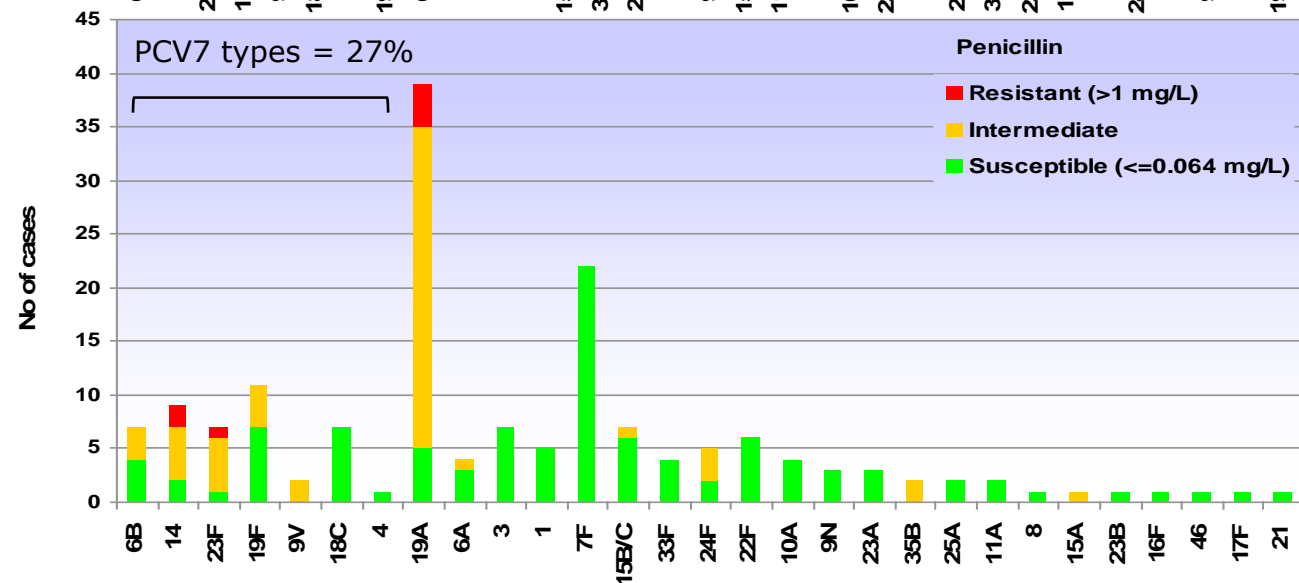
# Susceptibility to penicillin of serotypes involved in IPD among children < 2 years

2001-2002 (n=403)  
PSDP = 63%



2006 (n=166)  
PSDP = 39%

Serotype 19A and 7F  
have become the  
leading cause of IPD in  
children < 2 years old



CNRP



## Role of public health measures in the decrease of the % PNSP isolated from IPD in children < 2 years in France

- The changes in % PNSP between 2001-2002 and 2003-2006 can be due to :
  - ⊙ Evolution of serotype distribution
  - ⊙ Change in % PNSP among each serotype group (vaccine and non-vaccine types)
- Use of demographic decomposition method to distinguish between the two effects

# Decomposition method\* : application to the change in PNSP rate since 2001-2002

$i$  : 1 for Vaccine-type (VT), 2 for Non-Vaccine type (NVT)

$C_{i \text{ year} X}$  : Proportion of VT ( $i=1$ ) or NVT ( $i=2$ ) strains during the year  $X$

$P$  : % PNSP

$P_i$  : Specific % PNSP in VT strains ( $i=1$ ) or NVT strains ( $i=2$ )

$$P_{\text{year } X} - P_{2001-2002} = \quad (1) \quad + \quad (2) \quad =$$

$$(1) : \sum_i [P_{i \text{ year} X} - P_{i \text{ 2001-2002}}] \times [(C_{i \text{ 2001-2002}} + C_{i \text{ year} X}) / 2]$$

Change associated with the change in serotype specific % PNSP

+

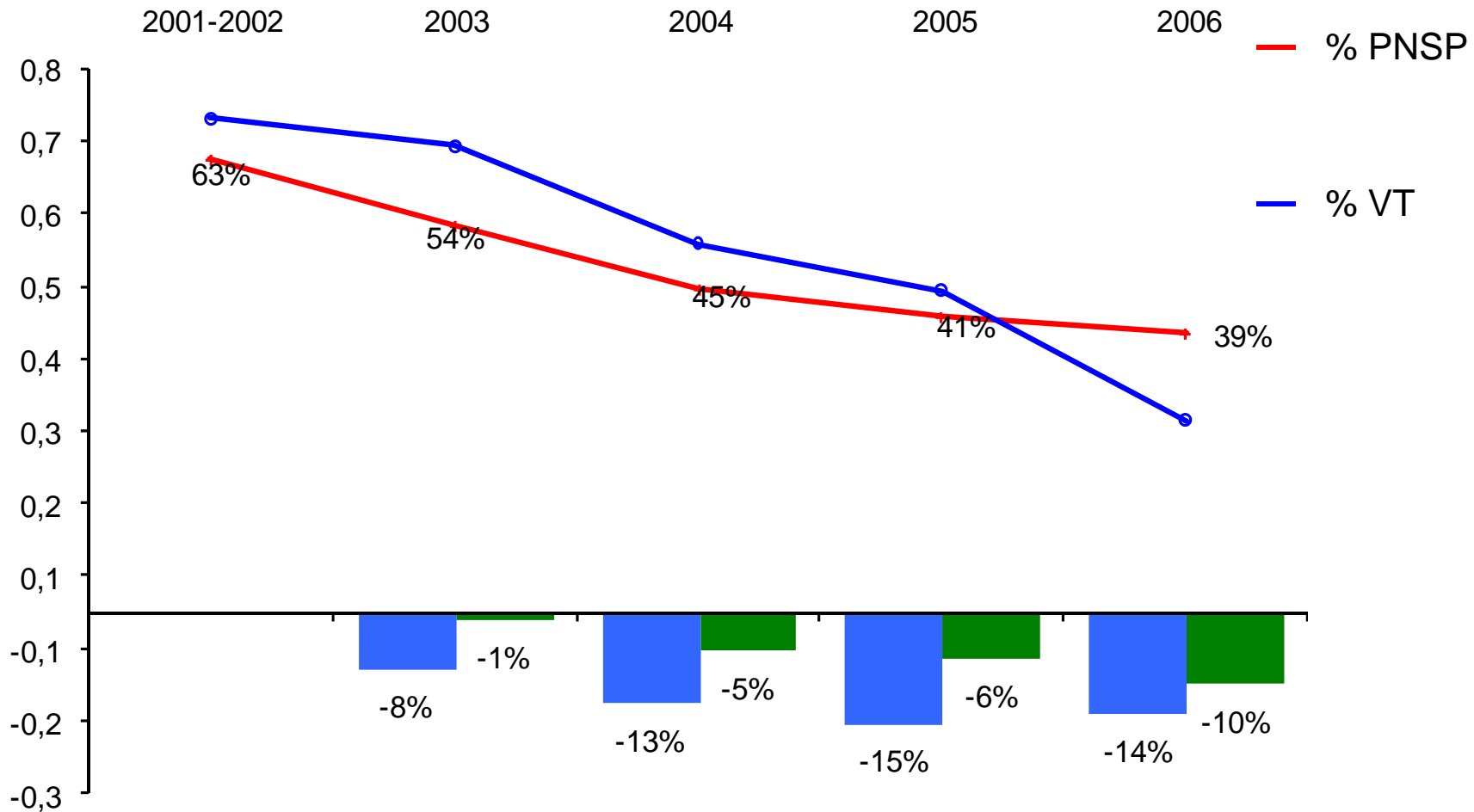
$$(2) : \sum_i [C_{i \text{ year} X} - C_{i \text{ 2001-2002}}] \times [(P_{i \text{ 2001-2002}} + P_{i \text{ year} X}) / 2]$$

Change associated with the change in serotype distribution (VT / NVT)

CNRP

\*Kitagawa JASA 1955

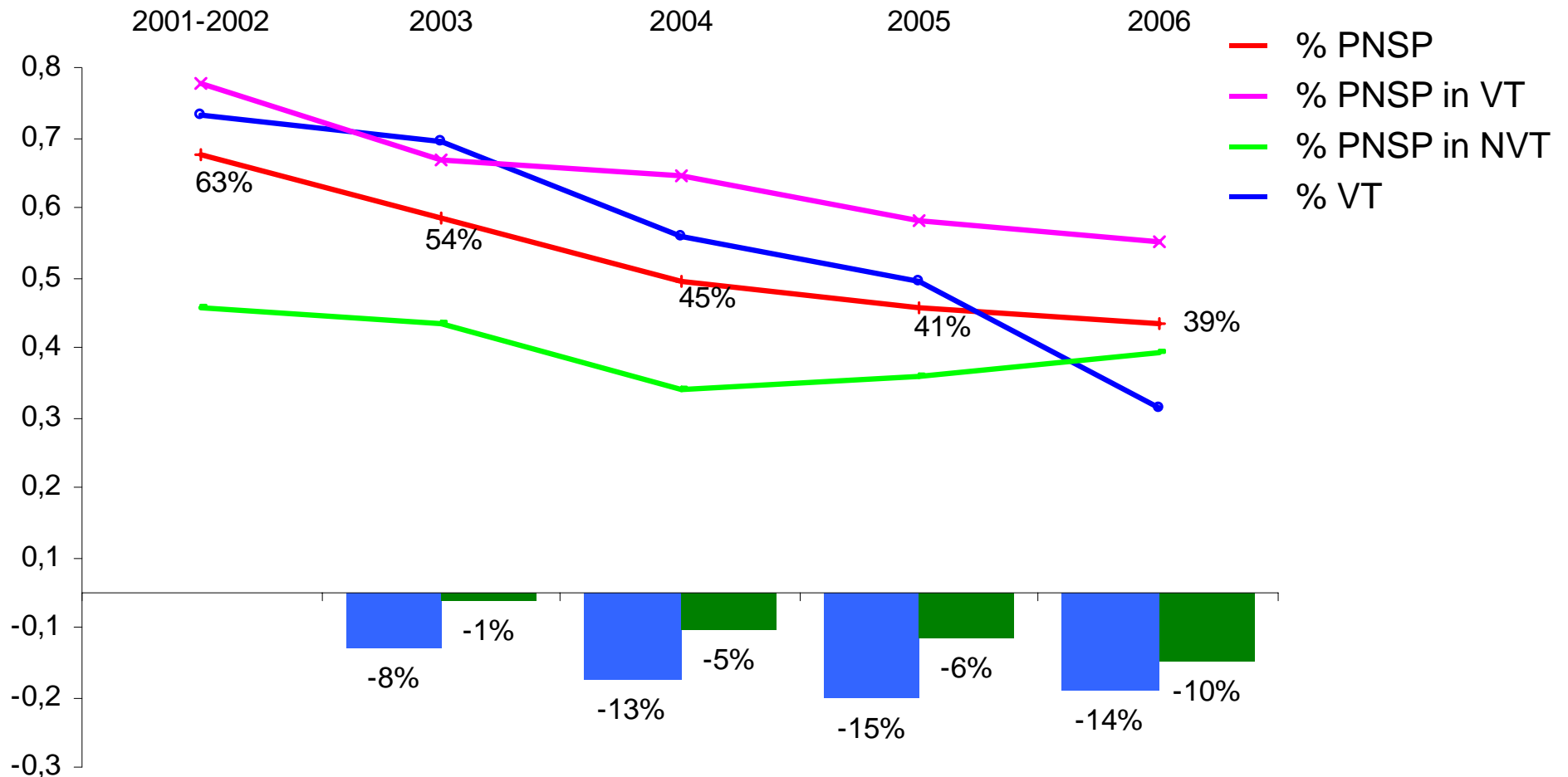
# % PNSP change in children < 2 years old, pneumococcal invasive disease



CNRP

■ Change associated with serotype specific % PNSP  
■ Change associated with serotype distribution (VT or NVT)

# PNSP rate change in children < 2 years old, pneumococcal invasive disease



CNRP

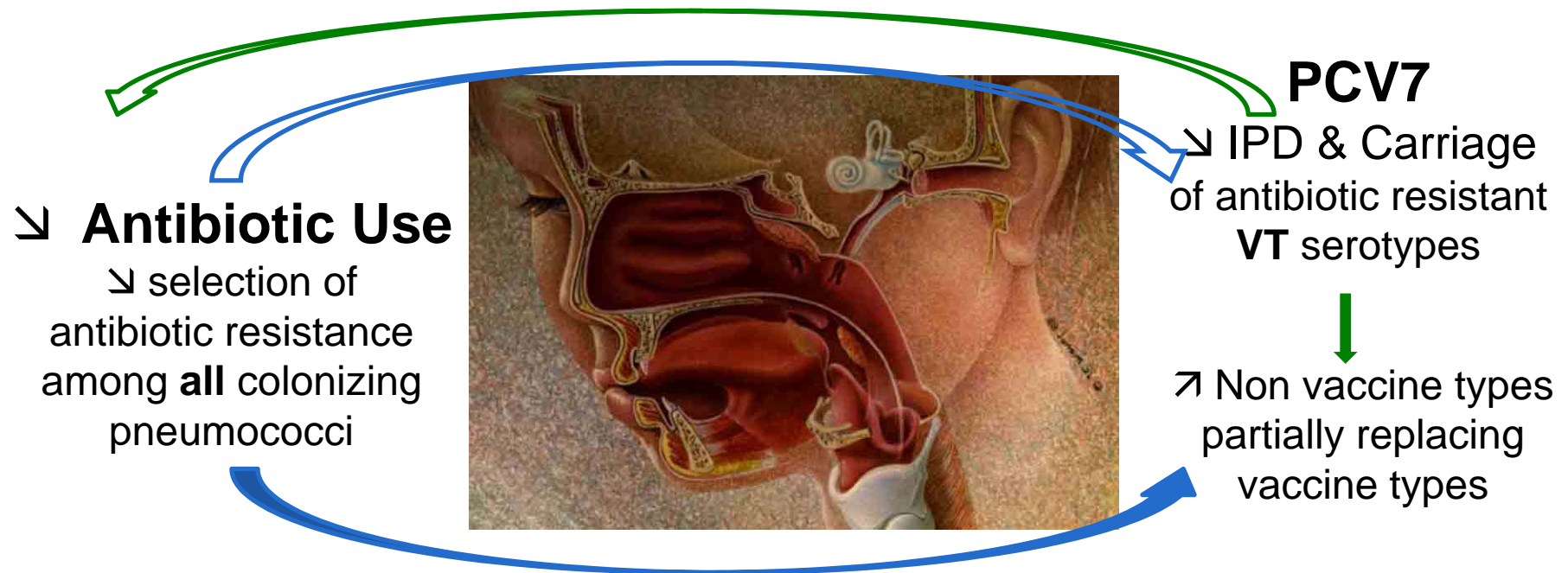
■ Change associated with serotype specific % PNSP  
■ Change associated with serotype distribution (VT or NVT)

# Conclusions

- Change in VT and NVT specific % PNSP accounted for most of the change in % PNSP observed until 2005 in children < 2 years old
  - It suggests that PCV introduction was not the main reason for the decrease in % PNSP in children < 2 years of age
- Since 2005, the decrease in PNSP VT is partially compensated by an increase in PNSP NVT

CNRP

The most common types **colonizing** children < 2 years old were 6B, 9V, 14, 19F, 23F which accounted for about 80% of PNSP before PCV7 implementation



Efforts to decrease antibiotic consumption in outpatients are still required to limit the emergence of antibiotic resistant pneumococci (**non VT ++**) in both vaccinees and contacts

CNRP