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

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Penicillin non susceptible \(S.\ pneumoniae\) in France

National plan for a rational use of antibiotics

PCV7 introduction


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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.
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
Evolution of resistance of invasive strains

≤ 15 years

> 15 years

Invasive strains (CSF, blood cultures)

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Evolution of resistance in children

< 2 years

2-15 years

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Invasive strains (CSF, blood cultures)

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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

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

2001-2002 (n=403)
PCV7 types = 68%
PSDP = 63%

2006 (n=166)
PCV7 types = 27%
PSDP = 39%

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

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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

\[ i \quad : \quad 1 \text{ for Vaccine-type (VT), } 2 \text{ for Non-Vaccine type (NVT)} \]

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

\[ P \quad : \quad \% \text{ PNSP} \]

\[ P_{i} \quad : \quad \text{Specific } \% \text{ PNSP in VT strains (i}=1) \text{ or NVT strains (i}=2) \]

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

\[ (1): \Sigma [P_{i \text{ yearX}} - P_{i \text{ 2001-2002}}]x[(C_{i \text{ 2001-2002}} + C_{i \text{ yearX}})/2] \quad \text{Change associated with the change in serotype specific } \% \text{ PNSP} \]

\[ + \]

\[ (2): \Sigma [C_{i \text{ yearX}} - C_{i \text{ 2001-2002}}]x[(P_{i \text{ 2001-2002}} + P_{i \text{ yearX}})/2] \quad \text{Change associated with the change in serotype distribution (VT / NVT)} \]

*Kitagawa JASA 1955*
% PNSP change in children < 2 years old, pneumococcal invasive disease

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
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.
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.

- **Antibiotic Use**
  - Selection of antibiotic resistance among **all** colonizing pneumococci

**PCV7**
- IPD & Carriage of antibiotic resistant VT serotypes
- Non vaccine types partially replacing vaccine types

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.

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