



Pneumococcal surveillance data after PCV10: the Dutch experience

5.1.2e



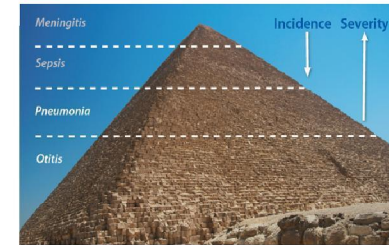
Objectives

- › Epidemiology of pneumococcal infections after PCV10
- › Role of infant vaccinations for elderly
- › Influence of the SARS-CoV2 pandemic on pneumococcal infections



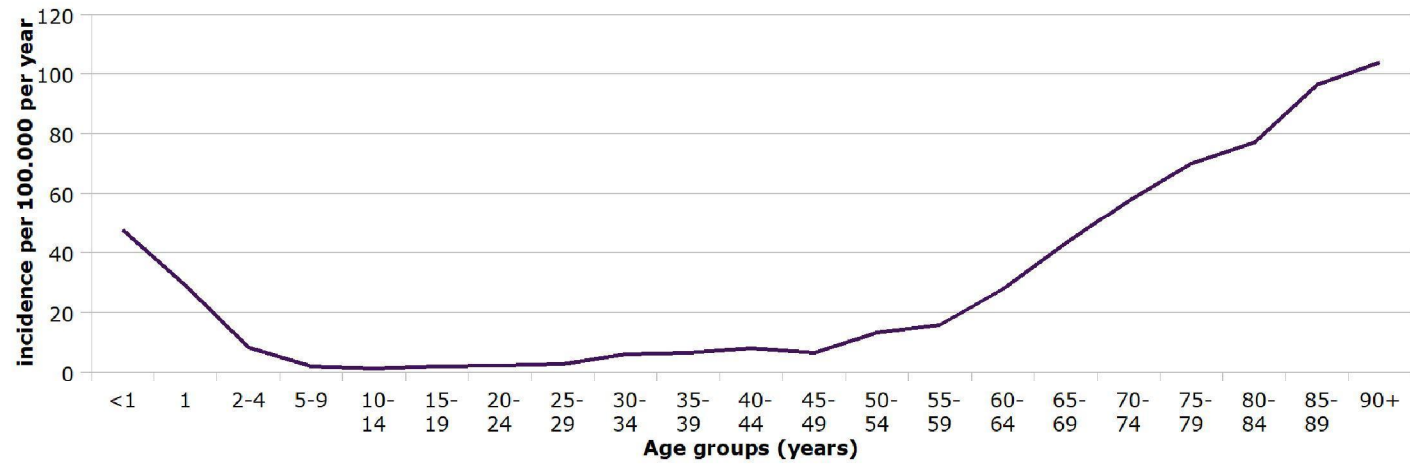
Pneumococcal disease

- > *Streptococcus pneumoniae* - gram-positive bacterium
- > Polysaccharide capsule
 - Virulence factor
 - > 90 serotypes
- > Commensal upper respiratory tract
 - Carriage prevalence: Children 60-90%; elderly 5-10%
- > Disease
 - Invasive disease (IPD) → meningitis, sepsis, invasive pneumonia
 - Non-invasive disease → pneumonia, otitis media
- > High incidence in young children and elderly





IPD by age





Pneumococcal vaccination

POLYSACCHARIDE VACCINES

- > Not immunogenic in children
- > No memory induced
- > No booster response
- > Short duration of protection
- > PPV23

CONJUGATE VACCINES

- > Polysaccharide conjugated to carrier protein
- > Immunogenic in children
- > Memory induced and booster response
- > Longer duration of protection
- > PCV7, PCV10, PCV13, (PCV15/20)



Pneumococcal vaccines

| Vaccine | Serotypes | | | | | | | | | | | | |
|---------|-----------|----|----|----|-----|-----|-----|---|---|----|---|----|-----|
| PCV7 | 4 | 6B | 9V | 14 | 18C | 19F | 23F | | | | | | |
| PCV10 | 4 | 6B | 9V | 14 | 18C | 19F | 23F | 1 | 5 | 7F | | | |
| PCV13 | 4 | 6B | 9V | 14 | 18C | 19F | 23F | 1 | 5 | 7F | 3 | 6A | 19A |



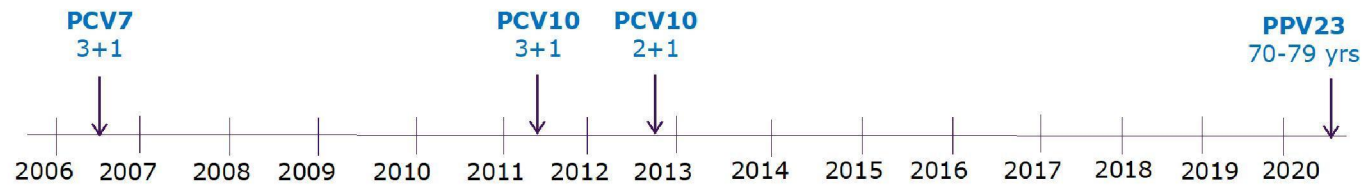
Pneumococcal vaccination

| | Months | | | | | | | | | | | | | | | | | | Years | | | | | | | | | |
|----------------|--------|-----|---|-----|---|-----|----|----|-----|----|----|----|----|---|---|---|---|----|-------|----|----|----|----|----|----|------|-------|-------|
| | 2 | 3 | 4 | 5 | 6 | 10 | 11 | 12 | 13 | 14 | 15 | 18 | 23 | 2 | 3 | 5 | 6 | 12 | 18 | 19 | 50 | 60 | 64 | 65 | 75 | ≥ 76 | | |
| Austria | | PCV | | PCV | | PCV | | | PCV | | | | | | | | | | | | | | | | | | PCV13 | |
| Belgium | | PCV | | PCV | | | | | PCV | | | | | | | | | | | | | | | | | | | PCV13 |
| Bulgaria | | PCV | | PCV | | | | | PCV | | | | | | | | | | | | | | | | | | | PCV13 |
| Croatia | | PCV | | PCV | | | | | PCV | | | | | | | | | | | | | | | | | | | PCV13 |
| Cyprus | | PCV | | PCV | | | | | PCV | | | | | | | | | | | | | | | | | | | PCV13 |
| Czech Republic | | | | PCV | | | | | PCV | | | | | | | | | | | | | | | | | | | PCV13 |
| Denmark | | | | | | | | | | | | | | | | | | | | | | | | | | | | PCV13 |
| Estonia | | | | | | | | | | | | | | | | | | | | | | | | | | | | PCV13 |
| Finland | | | | | | | | | | | | | | | | | | | | | | | | | | | | PCV13 |
| France | | | | | | | | | | | | | | | | | | | | | | | | | | | | PCV13 |
| Germany | | | | | | | | | | | | | | | | | | | | | | | | | | | | PCV13 |
| Greece | | | | | | | | | | | | | | | | | | | | | | | | | | | | PCV13 |
| Hungary | | | | | | | | | | | | | | | | | | | | | | | | | | | | PCV13 |
| Iceland | | | | | | | | | | | | | | | | | | | | | | | | | | | | PCV13 |
| Ireland | | | | | | | | | | | | | | | | | | | | | | | | | | | | PCV13 |
| Italy | | | | | | | | | | | | | | | | | | | | | | | | | | | | PCV13 |
| Latvia | | | | | | | | | | | | | | | | | | | | | | | | | | | | PCV13 |
| Lithuania | | | | | | | | | | | | | | | | | | | | | | | | | | | | PCV13 |
| Luxembourg | | | | | | | | | | | | | | | | | | | | | | | | | | | | PCV13 |
| Malta | | | | | | | | | | | | | | | | | | | | | | | | | | | | PCV13 |
| Netherlands | | | | | | | | | | | | | | | | | | | | | | | | | | | | PCV13 |

- 2+1 schedule
- PCV10 or PCV13



Pneumococcal vaccination in NL



- > Vaccination coverage PCV ~95% since introduction
- > No recommendation for elderly until 2020



Herd effects due to PCV7

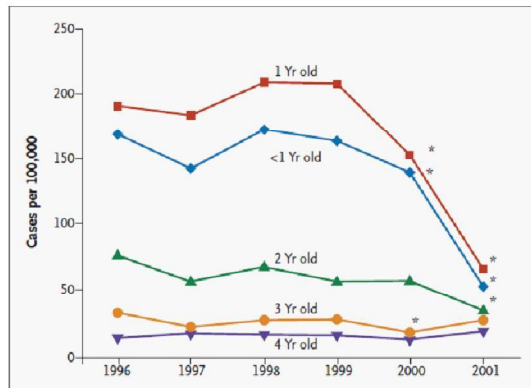


Figure 1. Rates of Invasive Pneumococcal Disease among Children under Five Years Old, According to Age and Year.
 Data are from the Active Bacterial Core Surveillance from 1996 through 2001. The 1996 and 1997 rates do not include data from New York State. Asterisks indicate $P < 0.05$ for comparisons of the rate in 2000 or 2001 with the combined rate for 1998 and 1999.

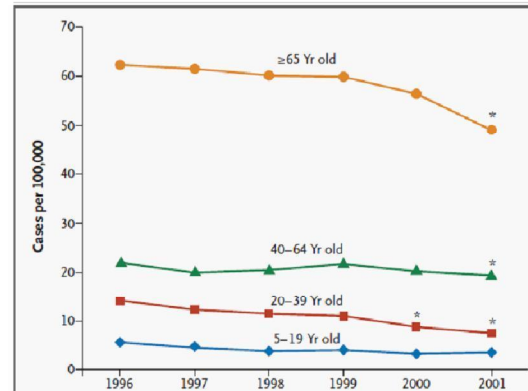
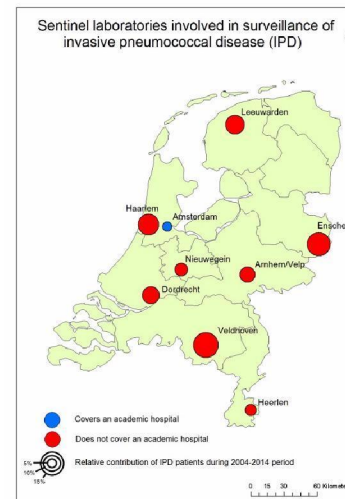


Figure 3. Rates of Invasive Pneumococcal Disease among Persons at Least Five Years Old, According to Age Group and Year.
 Data are from the Active Bacterial Core Surveillance from 1996 through 2001. The 1996 and 1997 rates do not include data from New York State. Asterisks indicate $P < 0.05$ for comparisons of the rate in 2000 or 2001 with the combined rate for 1998 and 1999.



IPD surveillance

- > Sentinel laboratory surveillance from 2004
 - Covering 25% of the Netherlands
 - Positive isolates from blood and/or CSF
 - Age, sex, date of material taken, serotype
- > Nationwide laboratory surveillance for <5 year olds from 2008
- > Notification data for children born after 2006
 - Vaccination status, clinical presentation, outcome





Evaluation of vaccination program

Impact

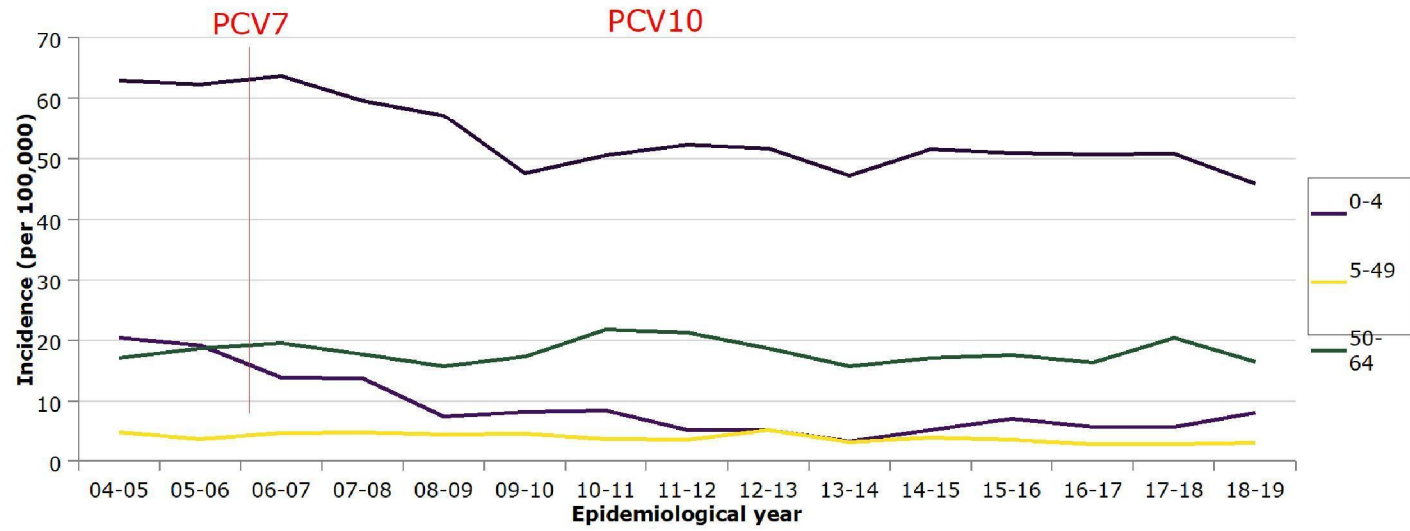
- › Before – after analysis
- › By age group
- › By serotype (vaccine types and non-vaccine types)
- › Direct and indirect (herd) effects
- › Dependent on vaccination coverage and effectiveness

Effectiveness

- › Vaccine eligible children
- › Compare vaccination status in vaccine type IPD cases and non-vaccine type IPD cases
- › Direct effect of vaccination
- › Real world evidence

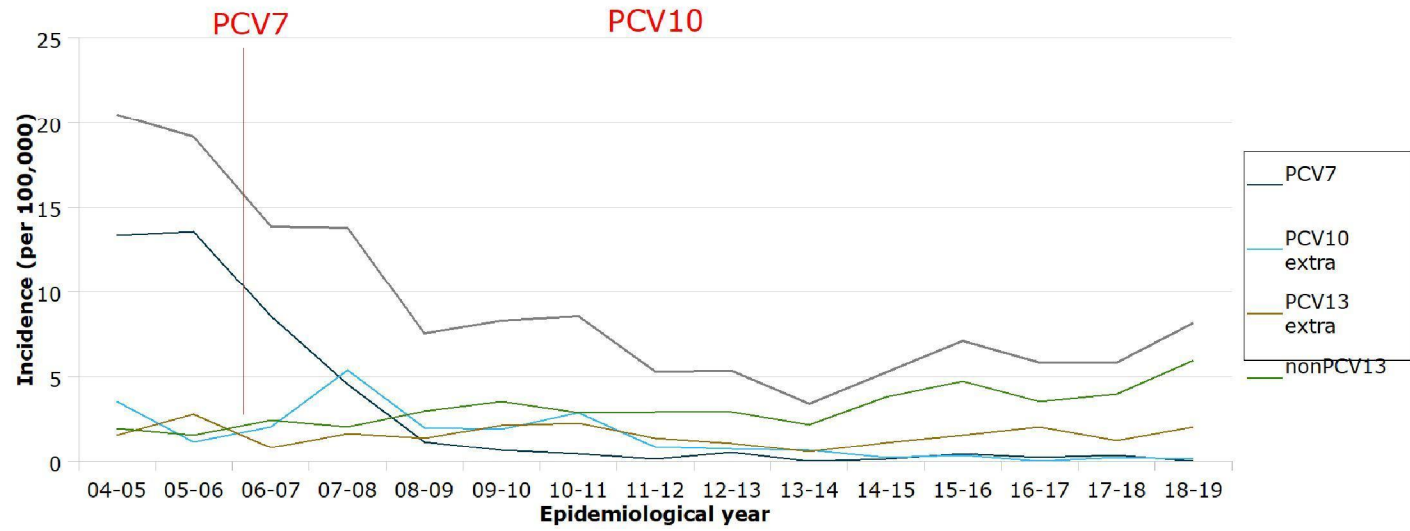


Overall IPD by age group



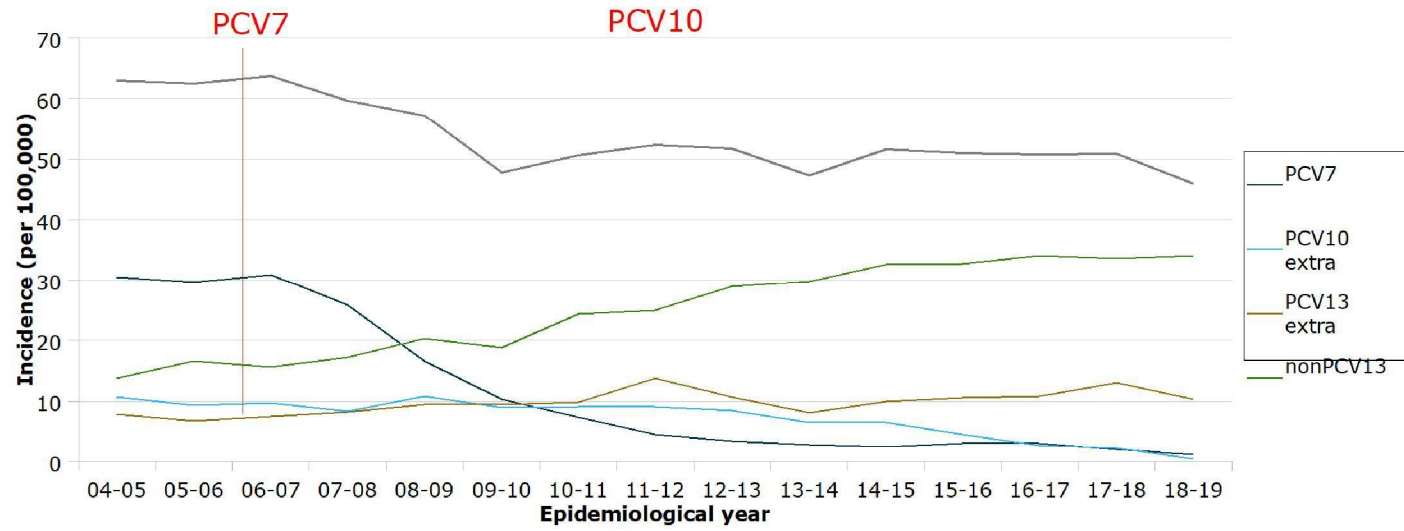


IPD in <5 year olds





IPD in 65+ year olds





Vaccine effectiveness

Table 3
Number of invasive pneumococcal disease (IPD) cases and controls vaccinated and vaccines effectiveness (VE) of PCV10.

| | Number of PCV10 cases vaccinated /total cases (%) | Number of non-PCV10 cases vaccinated /total controls (%) | OR (95%CI) | VE % (95%CI) |
|---|--|---|--------------------|---------------|
| Overall | 8/13 (62) | 206/218 (94) | 0.09 [0.03; 0.32] | 91 [67; 97] |
| Before October 2013 3 + 0/3 + 1 schedule | 5/6 (83) | 63/70 (90)* | 0.24 [0.02; 2.73] | 76 [-173; 98] |
| After October 2013 2 + 0/2 + 1 schedule | 3/7 (43) | 138/148 (93)* | 0.05 [0.01; 0.25] | 95 [75; 99] |
| Sex | | | | |
| Male | 4/7 (57) | 122/126 (97) | 0.04 [0.007; 0.26] | 96 [74; 99] |
| Female | 4/6 (67) | 84/92 (91) | 0.19 [0.03; 1.21] | 81 [-21; 97] |
| Age (in year) | | | | |
| 0-1 | 2/4 (50) | 150/157 (96) | 0.05 [0.006; 0.38] | 95 [62; 99] |
| 2-4 | 6/9 (67) | 56/61 (92) | 0.18 [0.03; 0.94] | 82 [6; 97] |

* The comparison here is made between cases respecting the vaccine schedule and cases receiving no dose of IPD vaccine (dose = 0).

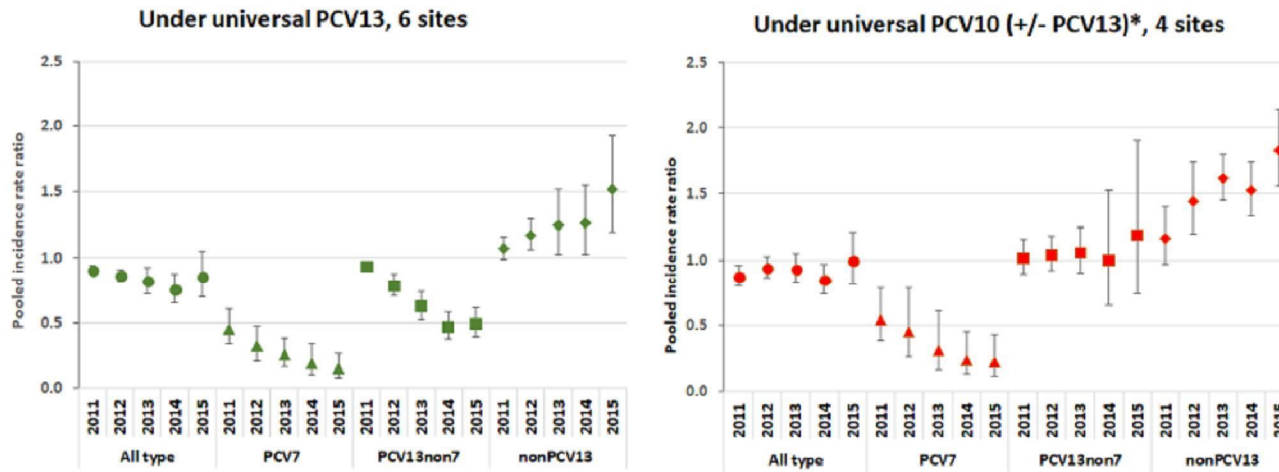


Summary IPD after PCV10

- › Good effectiveness of PCV10
- › Reduction in IPD in children <5 yrs and elderly
- › IPD caused by serotypes included in PCV10 nearly disappeared
 - Also in carriage
- › Increasing IPD incidence due to serotypes not included in PCV10
- › Impact on overall IPD is decreasing due to replacement
 - Higher valent vaccines?



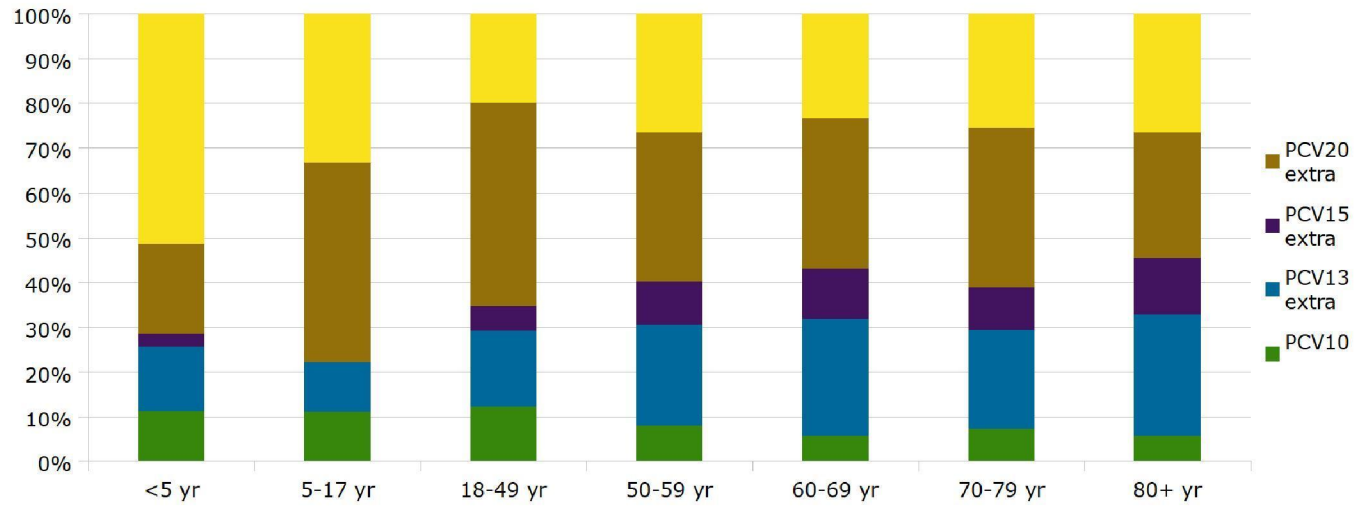
PCV10 or PCV13?



Elderly



PCV15/PCV20?



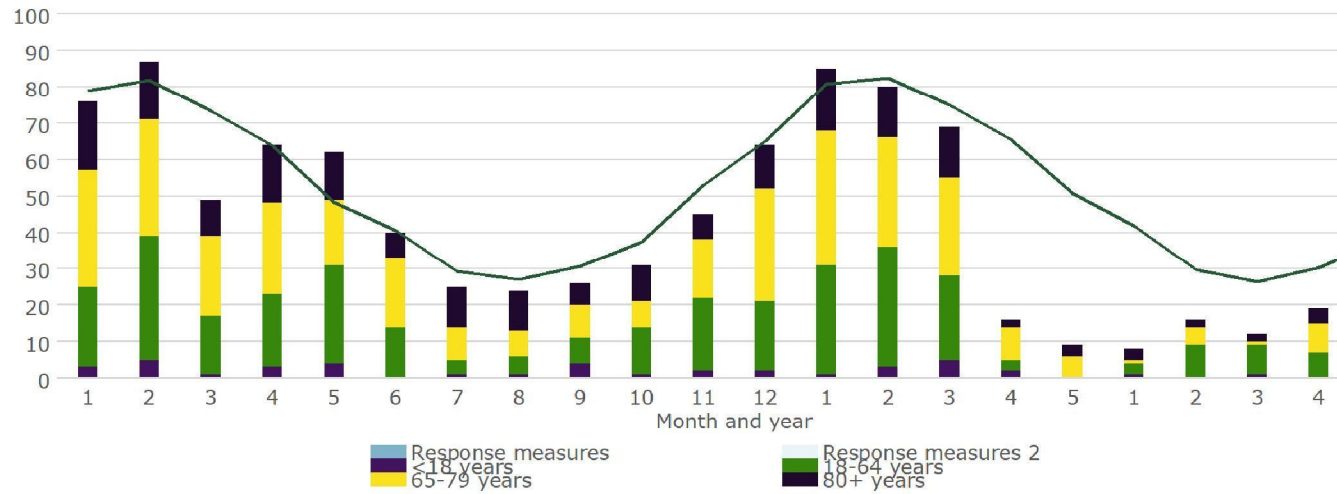
IPD after PCV10 | 3-12-2020

Knol et al, RIVM report 2020-0168



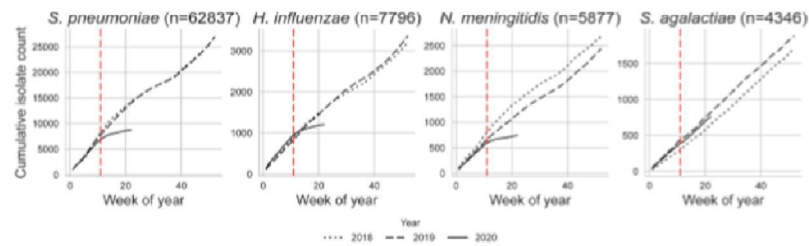
Impact COVID-19 pandemic

Q2: 80% reduction
Q3: 40% reduction

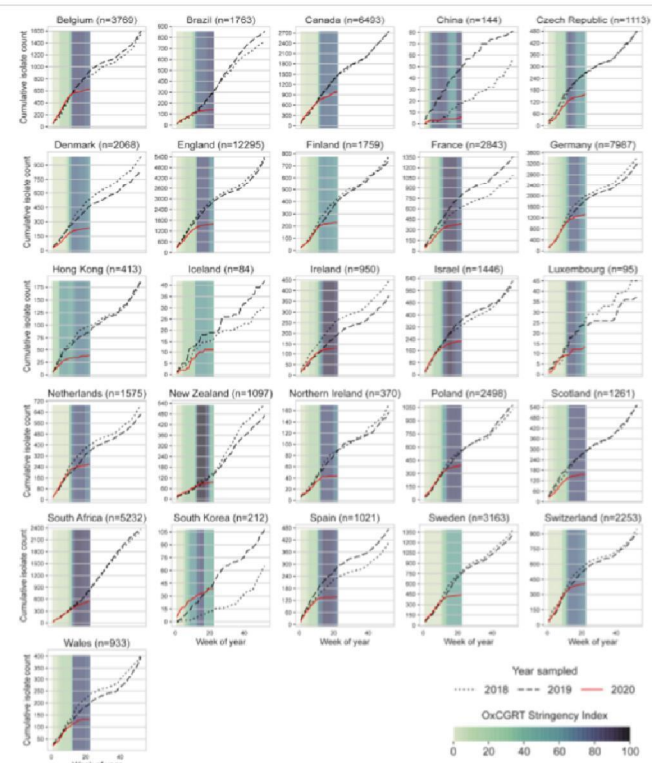




Impact COVID-19 pandemic - worldwide



IPD after PCV10 | 3-12-2020



Brueggemann et al, MedRxiv 2020



Impact COVID-19 pandemic

- › Currently reduction in IPD
 - Less transmission due to measures (social distancing, hand hygiene, school closure)
 - Less health care seeking behaviour, less diagnostics, less reporting
- › COVID-19 risk factor for IPD?
 - Bacterial superinfection → antibiotic use
 - Increased susceptibility due to lung damage
- › Rebound effect?
- › Vaccination coverage?



Take home message

- › PCV7/PCV10 have reduced overall IPD in children and elderly
 - › Maximum vaccine effects have been reached
 - › Overall impact is reduced by ongoing serotype replacement
 - › Higher valent PCV may be the solution
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- › Currently reduced IPD incidence due to COVID-19 measures
 - › Ongoing surveillance essential to monitor long term trends