

OBJECTIVES

Streptococcus pneumoniae remains a leading cause of pneumonia, sepsis and meningitis and disproportionately affects young children and the elderly. In July 2006, vaccination with pneumococcal conjugate vaccine was generally recommended in Germany for all children ≤ 24 months. In this study, we present the burden of disease and serotype distribution among adults with invasive pneumococcal disease (IPD) before and after the start of childhood vaccination.

METHODS

The GNRCS has monitored the epidemiology of IPD in adults in Germany since 1992. Cases of IPD in adults are reported by a laboratory-based surveillance system, including over 300 laboratories throughout Germany. The present analysis includes cases documented between 1992 and 2013. Species confirmation was done by optochin testing and bile solubility testing. All isolates were serotyped using the Neufeld Quellung reaction.

RESULTS

In the first 14 seasons of our surveillance an average of 341 isolates from IPD among adults were received per season. Due to the introduction of a web-based surveillance system (Pneumoweb), these numbers could be increased to about 2000 in the last 6 seasons (Fig. 1A). 80% of the burden of disease for IPD in adults occurs at ages older than 50 years (Fig 1B).

Before the introduction of childhood vaccination (1992-2006) the most prevalent serotypes among adults with IPD were 14, 3, 7F, 4, 23F, 1 and 9V. In 2013-2014 serotypes 3, 12F and 22F were most prevalent. Serotypes more prevalent in 2013-2014 as compared to the pre-vaccination era were 6C, 10A, 12F, 15A/C, 16F, 23A, 23B (PenR), 24F, 35B and 35F (Table 1).

Before childhood vaccination 40-45% of IPD cases among adults were caused by PCV7 serotypes. After vaccination this percentage was gradually reduced to 5.7% in 2013-2014 (Fig. 2). This indicates a herd protection effect among adults.

In 2009, higher valent vaccination (PCV10 (April 2009) and PCV13 (December 2009)) was introduced among children (current uptake: PCV10: 5%, PCV13: 95%). Among adults, a reduction of the percentage of IPD caused by the six additional serotypes from 47.1% in 2010-2011 to 31.6% in 2013-2014 was observed (Fig. 2). The reduction was observed for serotypes 1, 7F and 19A (Fig. 3).

The amount of IPD cases caused by serotype 3 appears to be uninfluenced by childhood vaccination. The prevalence has remained between 14 and 15% since 2009 (Fig. 4).

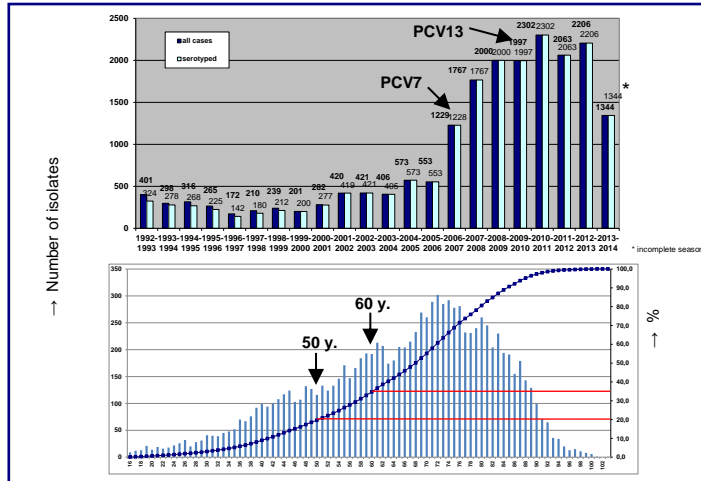


Fig. 1: A: Number of cases of IPD from adults in Germany and number of serotyped cases per pneumococcal season (July to June in the following year). B: Age distribution of reported IPD cases (1992-2013, n=10,567).

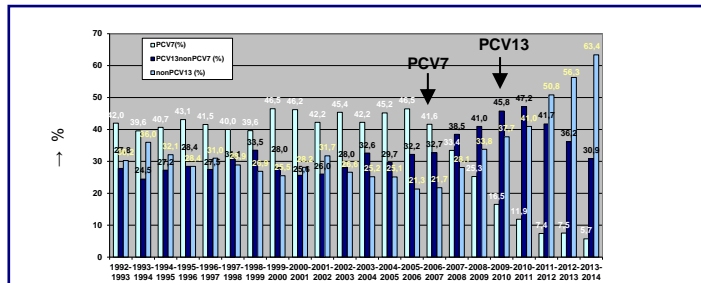


Fig. 2: Percentage of PCV7, PCV13-non-PCV7 and non-PCV13 serotypes among cases of IPD from adults in Germany.

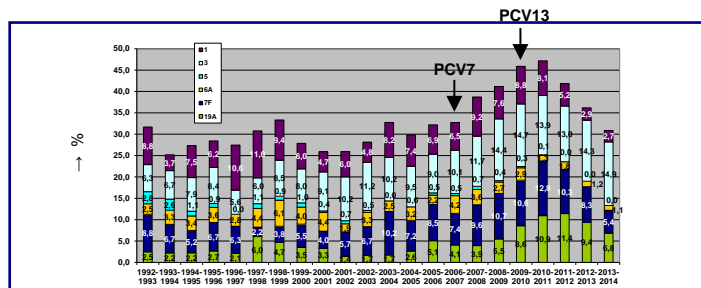


Fig. 3: Percentage cases with serotypes 1, 3, 5, 6A, 7F and 19A among cases of IPD from adults in Germany.

Table 1: Prevalence of serotypes among IPD in adults (age ≥ 16 y.) in Germany, before (1992-2006) and 7 years (2012-2013) and 8 years (2013-2014) after the introduction of childhood conjugate vaccination (PCV7: 2006, PCV10/PCV13: 2009).

Serotype	average 1993-2006	%	Serotype	2012-2013	%	Serotype	2013-2014	%	Serotype	2013-2014	%
all	330	100.0	all	2006	100.0	all	1344	100.0			
PPV23	279	87.3	PPV23	1557	75.5	PPV23	958	71.3			
PCV13	221	72.3	PCV13	1074	49.2	PCV13	492	36.6			
PCV10	184	57.6	PCV10	473	22.9	PCV10	185	13.8			
PCV7	159	43.4	PCV7	153	7.4	PCV7	77	5.7			
14	591	13.2	3	288	13.0	3	316	14.3	3	200	14.9
3	389	8.7	7F	212	10.3	7F	184	8.3	22F	102	7.6
4	368	8.2	7F	212	10.3	7F	184	8.3	22F	102	7.6
7F	307	6.9	22F	128	6.2	22F	151	6.8	19A	92	6.8
1F	296	6.6	12F	113	5.2	12F	133	6.0	19A	72	5.4
9V	285	6.4	1	108	5.2	1	106	4.8	9N	63	4.7
22F	227	5.7	6C	75	3.6	6C	89	5.0	6C	41	3.0
6B	183	4.1	8	71	3.4	8C	78	3.4	23B	63	3.9
8	160	3.6	9N	65	3.2	11A	71	3.2	15A	50	3.7
10A	153	3.4	23B	60	2.9	10A	66	3.0	10A	47	3.5
6A	140	3.1	11A	59	2.9	23B	65	2.9	24F	44	3.3
19A	128	2.9	10A	58	2.8	6A	64	2.9	23A	43	3.2
12F	120	2.7	23A	50	2.4	10A	60	2.9	35F	36	2.7
9N	119	2.7	15A/C	45	2.2	23A	59	2.7	6C	35	2.6
16F	105	2.3	24F	45	2.2	24F	60	2.4	11A	33	2.5
22F	103	2.3	35F	39	1.9	4	42	1.9	35F	33	2.5
11A	101	2.3	6A	38	1.8	31F	41	1.9	33F	29	2.2
10A	80	1.8	14	37	1.8	14	32	1.5	23B	26	1.9
24F	67	1.0	4	32	1.6	35B	32	1.5	16F	21	1.6
20	38	0.8	16B	28	1.4	35F	35	1.5	4	19	1.4
5	35	0.8	31	26	1.3	19F	29	1.3	10A	16	1.2
33F	35	0.8	38	26	1.3	38	28	1.3	19F	15	1.1
6C	29	0.7	23B	26	1.2	23B	27	1.2	6B	16	1.1
23A	31	0.7	35F	23	1.1	16F	22	1.2	31	13	1.0

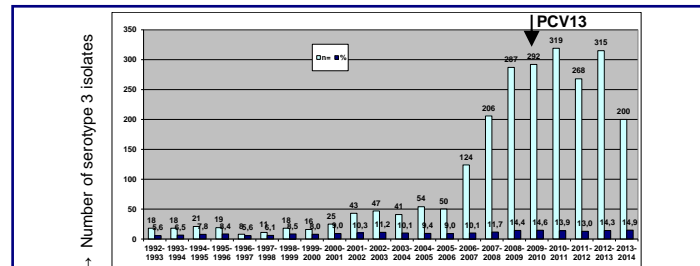


Fig. 4: IPD among adults caused by serotype 3, per pneumococcal season.

CONCLUSIONS

- Since the general recommendation for childhood pneumococcal conjugate vaccination a clear reduction in IPD has been observed among children.
- In addition, the percentage of IPD among adults caused by PCV7 serotypes was strongly reduced, indicating a herd protection effect.
- However, the burden of disease remains high (about 2000 reported cases per pneumococcal season)
- Following the introduction of higher valent childhood conjugate vaccines (Proportion of PCV10/PCV13 usage in Germany 5%/95%) in 2009, the additional serotypes included in these vaccines were less prevalent.
- In the current season (2013-2014) the prevalence of serotypes 1, 7F and 19A has diminished among adults with IPD.
- Prevalence of serotype 3 IPD was not influenced by childhood vaccination and remained 14-15% among adults.
- Serotypes 6C, 12F, 15A/B/C, 23B, 22F and 35F have gained importance among IPD in German adults.
- Serotype 23B is the strongest increasing serotype, and is often penicillin non-susceptible.