

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 (PCV) was generally recommended in Germany for all children ≤ 24 months. In addition to a reduction of IPD caused by vaccine serotypes among children, herd protection resulted in reduced prevalence of vaccine serotypes among IPD in adults. This herd protection was observed for PCV7 serotypes as well as for the additional serotypes in PCV13, with the exception of serotype 3. In this study, we present the dynamics of serotype 3 among IPD in adults in different age groups.

METHODS

Pneumococcal isolates recovered from adults with IPD were serotyped at the GNRCS using the Neufeld-Quellung-reaction.

RESULTS

In the period prior to childhood vaccination (1992-2006) serotype 3 prevalence among adults remained stable (8-10%). In the PCV7-period (2006-2010) prevalence increased to 14%, in the PCV13-period (2011-2016) to 17% (Fig. 1).

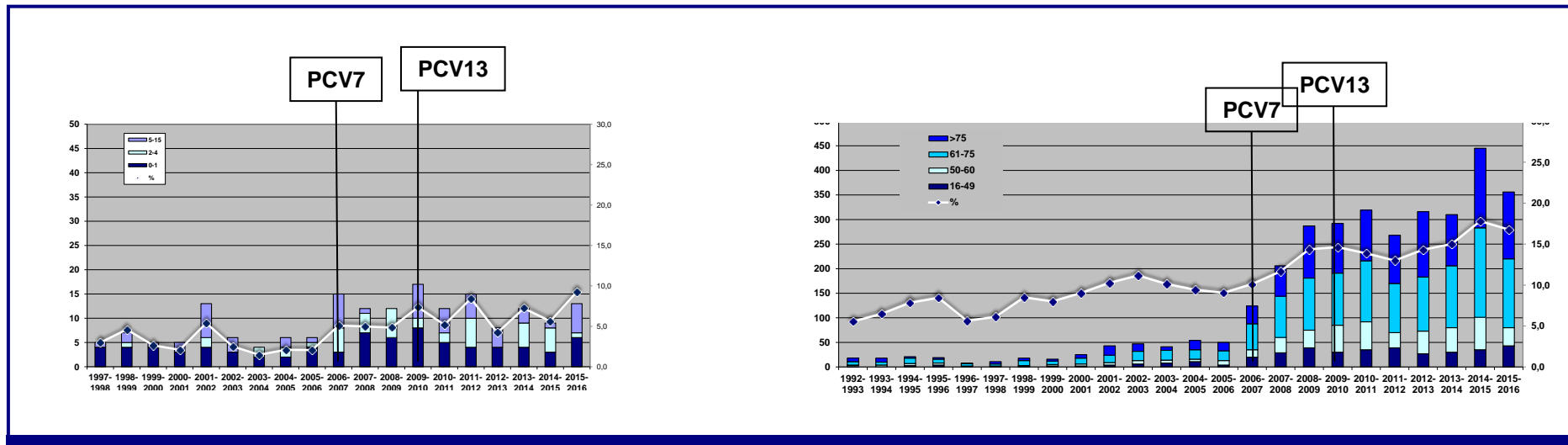


Fig. 1: Case numbers per age group and percentages of IPD caused by serotype 3 among children (left) and adults (right).

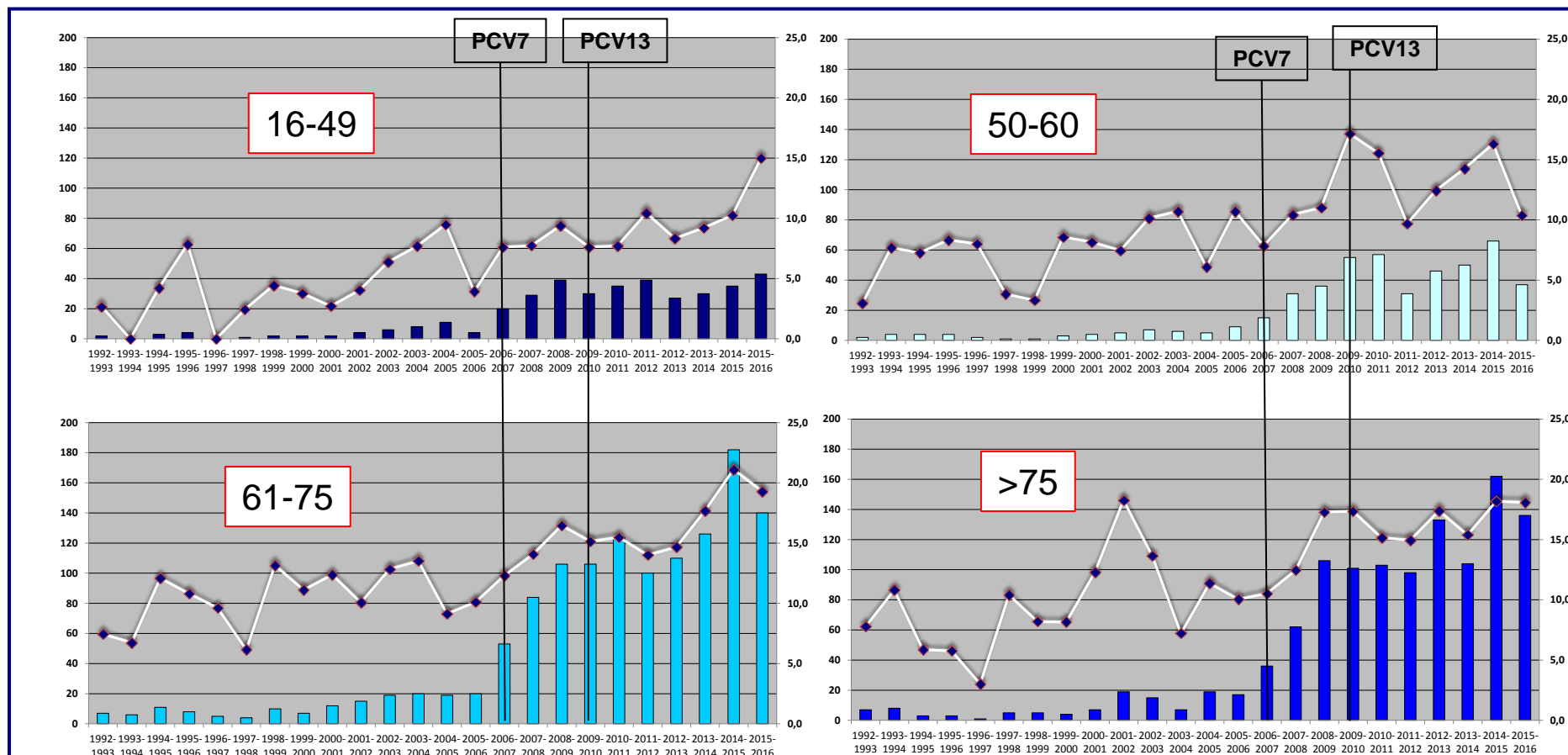


Fig. 2: Case numbers per age group and percentages of IPD caused by serotype 3 among adults in age groups 16-49, 50-60, 61-75 and >75 years.

Table 1: Prevalence of serotypes among adults (age ≥ 16 y.) with IPD in Germany, before (1997-2006) and after (2006-2016) the introduction of childhood conjugate vaccination (PCV7: 2006, PCV10/PCV13: 2009).

Serotype	all 1992-2006	%	Serotype	2006-2007	%	Serotype	2007-2008	%	Serotype	2008-2009	%	Serotype	2009-2010	%	Serotype	2010-2011	%	Serotype	2011-2012	%	Serotype	2012-2013	%	Serotype	2013-2014	%	Serotype	2014-2015	%	Serotype	2015-2016	%
all	4477	100.0	total	1227	100.0	total	1767	100.0	total	2000	100.0	total	1997	100.0	total	2302	100.0	total	2063	100.0	total	2209	100.0	total	2066	100.0	total	2500	100.0	total	2122	100.0
PPV23	3911	87.4	PPV23	1067	87.0	PPV23	1529	86.5	PPV23	1677	83.9	PPV23	1642	82.2	PPV23	1915	83.2	PPV23	1557	75.5	PPV23	1648	74.6	PPV23	1492	72.2	PPV23	1799	72.0	PPV23	1525	71.9
PCV13	3238	72.3	PCV13	912	74.3	PCV13	1271	71.9	PCV13	1324	66.2	PCV13	1244	62.3	PCV13	1359	59.0	PCV13	1014	49.2	PCV13	965	43.7	PCV13	750	36.3	PCV13	807	32.3	PCV13	618	29.1
PCV10	2581	57.7	PCV10	687	56.0	PCV10	933	52.8	PCV10	875	43.8	PCV10	757	38.2	PCV10	473	22.9	PCV10	473	22.9	PCV10	415	18.8	PCV10	273	13.2	PCV10	221	8.8	PCV10	128	6.0
PCV7	1943	43.4	PCV7	510	41.6	PCV7	591	33.4	PCV7	505	25.3	PCV7	330	16.5	PCV7	273	13.9	PCV7	153	7.4	PCV7	166	7.5	PCV7	120	5.8	PCV7	107	4.3	PCV7	74	3.5

This increase was not the same in different age groups. Among 16-49 year olds, prevalence only increased in the PCV13-period, reaching 15% in 2015-2016. In the age groups 50-60 and >75 prevalence increased strongly in the PCV7-period but not in the PCV13-period. In the age group 61-75 prevalence of serotype 3 increased in both vaccination periods, reaching 21% in 2015-2016 and 19% in 2015-2016 (Fig. 2).

The serotype prevalence of IPD among adults shows that serotype 3 was the second most prevalent serotype before vaccination and has been the most prevalent serotype since 2001-2008 (Table 1).

Interestingly, among 21 cases of children <2 years of age with serotype 3 IPD, 11 (52%) were not vaccinated and 3 (14%) had not received a booster dose.

Table 2: Vaccination status of children <2 years of age with IPD caused by serotype 3.

Year	Isolate No	Diagnosis	Age (months)	Serotype	Vaccination status	Conclusion
2011-2012	53052	mastoidectomy	20	3	not vaccinated	not vaccinated
	54293	meningitis	4	3	not vaccinated	not vaccinated
	50067	pneumonia, pleuraempyema	15	3	PCV13	2 doses, no booster
2012-2013	49689	pneumonia, pleuraempyema	15	3	PCV13	fully vaccinated
	54776	meningitis, sepsis	2	3	not vaccinated	not vaccinated
	58511	HUS	19	3	PCV13	no booster
2013-2014	55801	sepsis	10	3	PCV13	vaccinated acc. to age
	56004	pneumonia	4	3	PCV13	vaccinated acc. to age
	59609	meningitis, sepsis	1	3	not vaccinated	not vaccinated
2014-2015	62090	Sepsis	2	3	not vaccinated	not vaccinated
	62551		14	3	not vaccinated	not vaccinated
	63578	mastoiditis	17	3	PCV13	no booster
2015-2016	65045		1	3	not vaccinated	not vaccinated
	66340		4	3	not vaccinated	not vaccinated
	66979		1	3	not vaccinated	not vaccinated
2015-2016	68364		1	3	unknown	
	68872	meningitis	1	3	not vaccinated	not vaccinated
	69822	pneumonia, pleuritis, pleuraempyema	7	3	PCV10	vaccinated acc. to age
	70152	otitis media, mastoiditis	3	3	unknown	
	70842		14	3	not vaccinated	not vaccinated
71385	pneumonia	23	3	PCV13	vaccinated acc. to age	

CONCLUSIONS

- Since the start of childhood vaccination, prevalence of serotype 3 IPD has strongly increased among adults, both during the PCV7- and PCV13-periods.
- The increase shows different dynamics in different age groups, with the highest prevalence among adults older than 60 years of age.
- Contrary to other serotypes in PCV13, herd protection effects are not observed for serotype 3.
- This might be due to a limited effect of PCV13 on carriage in children, or to a separate circulation of serotype 3 among adults.
- Interestingly enough, among children < 2 years of age with IPD caused by serotype 3, 66% were not or incompletely vaccinated.