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Invasive pneumococcal disease among children in Germany, ten years after PCV13 introduction

M. van der Linden, A. Itzek, S. Perniciaro and M. Imöhl
National Reference Center for Streptococci (GNRCS) and Institute of Medical Microbiology, RWTH-Aachen, Germany

BACKGROUND

Childhood PCV vaccination was generally recommended in Germany in 2006. In 2009, two higher-valent PCVs (PCV10, PCV13) were licensed. Here, we present data on invasive pneumococcal disease (IPD) cases following PCV introduction.

METHODS

IPD in children in Germany has been monitored since 1997. Isolates were serotyped using the Neufeld Quellung reaction.

RESULTS

The GNRCS has been collecting IPD isolates from children since 1997 (**Fig. 1**). From July 2019 to June 2020, the GNRCS received 104 IPD isolates from children <2 years, representing a reduction of 32% compared to 2005/2006 (before vaccination; n=154), but an increase since 2011-2012 (n=75) (**Fig. 2**). In the two older age groups a slight reduction in cases was observed. The proportion of cases caused by PCV13 serotypes has decreased from 88% before vaccine introduction to 69% at the introduction of higher-valent vaccines to 15% in 2019-2020 (**Fig. 3**).

Of 43 cases with PCV13 serotypes, vaccination status could be ascertained for 28. Of these only 7 (25%) were vaccinated according to age. (**Table 1**).

In 2019-2020, the most prevalent serotypes among IPD in children <16 years were 3 (14.7%), 24F (11.4%) and 10A (6.5%) (**Table 2**).

In 2019-2020, among children <16 years, coverage of PCV13 was 23.9%. Future vaccines PCV15 (31.0%) and PCV20 (53.8%) would increase coverage considerably (**Fig. 4**).

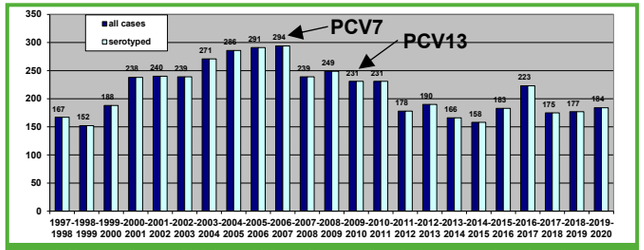

Fig. 1: Number of cases of IPD from children <16 years of age in Germany and number of serotyped cases per pneumococcal season (July to June in the following year).

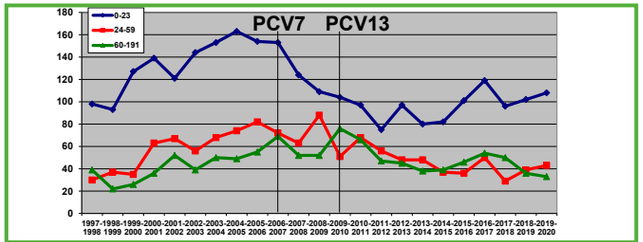

Fig. 2: Number of cases of IPD from children in Germany per pneumococcal season in three age groups: 0-1 year (blue), 2-4 years (red), 5-15 years (green).

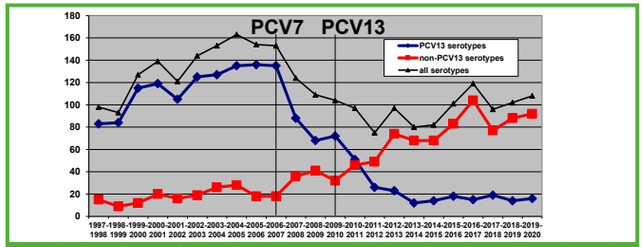

Fig. 3: Number of cases of IPD with PCV13- and non-PCV13 serotypes from children <2 years in Germany per pneumococcal season.

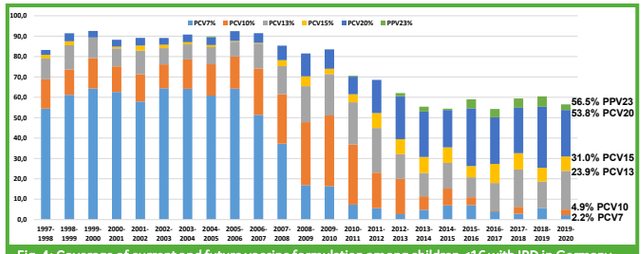

Fig. 4: Coverage of current and future vaccine formulation among children <16 with IPD in Germany

Table 1: Vaccination status of children 0-15 years of age with IPD caused by serotypes 3, 19F or 19A.

Isolate	Diagnosis	Age (mo)	Serotype	Vaccination status	Conclusion
90002		12	3	not vaccinated	not vaccinated
89103	Bakteriämie	17	3	not vaccinated	not vaccinated
89075	meningitis	63	3	not vaccinated	not vaccinated
91188	pneumonia	85	3	not vaccinated	not vaccinated
88731	pneumonia	22	3	yes	no further vaccination data
91816	pleuraempyema	12	3	PCV13	no booster
89152	pneumonia	13	3	PCV13	no booster
90587	pleuraempyema	14	3	PCV13	no booster
91407	pneumonia	21	3	PCV13	no booster
91165	pneumonia	47	3	PCV13	1 dose, date unknown
91053	pneumonia	48	3	PCV13	no booster
88793	pneumonia, sepsis	166	3	PCV7	1 dose + booster
89035		20	3	PCV13	vaccinated acc. to age
90060	sepsis	34	3	PCV13	vaccinated acc. to age
90810	pneumonia	39	3	PCV13	3 doses at age 2
91566	mastoiditis	48	3	PCV13	vaccinated acc. to age
89669		1	3	unknown	
89869		26	3	unknown	
90459	meningitis, sepsis	35	3	unknown	
90167	meningitis	45	3	unknown	
89121	meningitis	49	3	unknown	
89697	meningitis	60	3	unknown	
90909		70	3	unknown	
91155	meningitis	77	3	unknown	
91166	pneumonia	132	3	unknown	
89253	sepsis	180	3	unknown	
90812		8	19A	not vaccinated	not vaccinated
88730	meningitis, sepsis	24	19A	not vaccinated	not vaccinated
89407	meningitis	75	19A	yes	no further vaccination data
91272	pleuraempyema	29	19A	PCV13	vaccinated acc. to age
91849		59	19A	PCV13	vaccinated acc. to age
91159	meningitis	86	19A	PCV13	2 doses 2nd year of life
91736		107	19A	unknown	
91486		143	19A	unknown	
91927	mastoiditis	4	19F	not vaccinated	not vaccinated
91604	pneumonia, sepsis	22	19F	not vaccinated	not vaccinated
91191		38	19F	not vaccinated	not vaccinated
91756		1	19F	unknown	
91352	pneumonia	53	19F	unknown	

Table 2: Serotype ranking among IPD in children <16 y. in Germany.

	Serotype	average 1997-2006	%	Serotype	2016-2017	%	Serotype	2017-2018	%	Serotype	2018-2019	%	Serotype	2019-2020	%
	total	230	100,0	total	223	100,0	total	175	100,0	total	177	100,0	total	184	100,0
	PCV20	207	90,0	PPV23	121	54,3	PPV23	104	59,4	PPV23	107	60,5	PPV23	104	56,5
	PPV23	202	87,8	PCV20	112	50,2	PCV20	96	54,9	PCV20	98	55,4	PCV20	99	53,8
	PCV15	198	86,1	PCV15	61	27,4	PCV15	57	32,6	PCV15	45	25,4	PCV15	57	31,0
	PCV13	195	84,8	PCV13	40	17,9	PCV13	43	24,6	PCV13	33	18,6	PCV13	44	23,9
	PCV10	175	76,1	PCV10	10	4,5	PCV10	11	6,3	PCV10	10	5,6	PCV10	9	4,9
	PCV7	143	62,2	PCV7	8	3,6	PCV7	5	2,9	PCV7	10	5,6	PCV7	8	4,3
1	14	61	26,5	3	22	9,9	3	24	13,7	10A	21	11,9	3	27	14,7
2	6B	17	7,4	10A	20	9,0	10A	15	8,6	23B	17	9,6	24F	21	11,4
3	19F	17	7,4	15C	17	7,6	24F	14	8,0	15B	12	6,8	10A	12	6,5
4	23F	17	7,4	23B	17	7,6	22F	10	5,7	3	11	6,2	15C	10	5,4
5	1	17	7,4	24F	17	7,6	8	9	5,1	19A	11	6,2	23B	10	5,4
6	18C	14	6,1	22F	16	7,2	23B	9	5,1	15C	10	5,6	19A	8	4,3
7	7F	13	5,7	12F	12	5,4	19A	8	4,6	22F	9	5,1	8	8	4,3
8	4	9	3,9	15B	10	4,5	12F	8	4,6	12F	8	4,5	12F	8	4,3
9	9V	9	3,9	35F	8	3,6	15C	8	4,6	19F	7	4,0	15B	8	4,3
10	6A	8	3,5	19A	7	3,1	38	8	4,6	8	7	4,0	22F	7	3,8
11	3	6	2,6	38	7	3,1	1	6	3,4	24F	7	4,0	35F	7	3,8
12	19A	6	2,6	15A	6	2,7	19F	4	2,3	9N	6	3,4	33F	6	3,3
13	24F	4	1,7	19F	5	2,2	33F	4	2,3	38	6	3,4	11A	6	3,3
14	10A	3	1,3	33F	5	2,2	11A	4	2,3	11A	5	2,8	38	6	3,3
15	22F	2	0,9	11A	5	2,2	17F	4	2,3	27	4	2,3	19F	5	2,7
16	8	2	0,9	23A	5	2,2	16F	4	2,3	33F	3	1,7	21	4	2,2
17	15B	2	0,9	8	4	1,8	15B	3	1,7	17F	3	1,7	27	4	2,2
18	9N	2	0,9	9N	4	1,8	21	3	1,7	21	3	1,7	15A	3	1,6
19	9A	2	0,9	17F	3	1,3	23A	3	1,7	23A	3	1,7	35B	3	1,6
20	15A	2	0,9	12A	3	1,3	27	3	1,7	35B	3	1,7	6B	2	1,1
21	15C	2	0,9	16F	3	1,3	35F	3	1,7	23F	2	1,1	9N	2	1,1
22	5	1	0,4	35B	3	1,3	9N	2	1,1	10B	2	1,1	20	2	1,1
23	33F	1	0,4	20	2	0,9	20	2	1,1	15A	2	1,1	10B	2	1,1
24	11A	1	0,4	6C	2	0,9	10B	2	1,1	28F	2	1,1	16F	2	1,1

CONCLUSIONS

- More than ten years after the introduction of higher-valent vaccines, PCV13 serotypes have been reduced among children, but serotypes 3, 19F and 19A persist.
- A large number of the remaining vaccine-type IPD cases occur in non- or incompletely vaccinated children.
- Currently, serotypes 3, 24F and 10A are the most prevalent serotypes among children <16 years in Germany.
- Future vaccine formulation would considerably increase serotype coverage.