

## Invasive pneumococcal disease among children in Germany, effects of conjugate vaccination and COVID pandemic

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### BACKGROUND

Childhood PCV vaccination was generally recommended in Germany in 2006. In 2009, two higher-valent PCVs (PCV10, PCV13) were licensed. Since March 2020, a COVID pandemic has strongly deregulated daily life. Here, we present data on invasive pneumococcal disease (IPD) cases in the era of conjugate vaccination during a worldwide pandemic.

### METHODS

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

### RESULTS

From July 2020 to June 2021, the GNRCS received 27 IPD isolates from children <2 years, of which 2 had PCV13 serotypes (one vaccinated, one vaccination status unknown). For all children <16 years, 52 IPD isolates were received, of which 4 had PCV13 types (two vaccinated, two vaccination status unknown; **Fig. 1, Table 1**). The case numbers represent a strong reduction compared to the season before (2019-2020, >2y: 108, <16y: 184; **Fig. 2**). The coverage of PCV13 in 2020-2021 was very low (7.7%). Future vaccines would increase coverage moderately (PCV15: 9.6%) to considerably (PCV20: 32.7%; **Fig. 3, Table 2**).

From March to December 2020, only 56 IPD cases were received, as compared to 113 and 146 in 2018 and 2019, respectively. From Jan-Mar 2021, only 4 cases of IPD were received compared to 62, 53 and 77 in the same period in 2018, 2019 and 2020, respectively (**Fig. 4**).

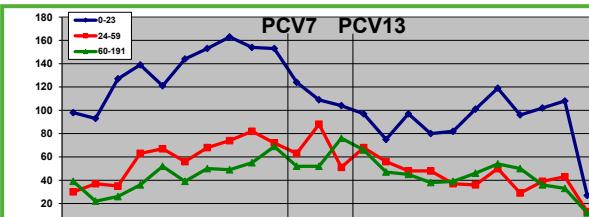


Fig. 1: Number of cases of IPD from children in Germany per pneumococcal season in three age groups: 0-1 year (blue), 2-4 years (red), 5-15 years (green)

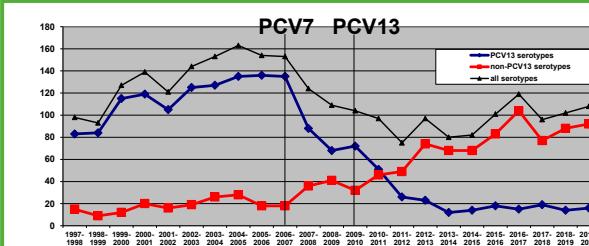


Fig. 2: Number of cases of IPD with PCV13- and non-PCV13 serotypes from children <2 years in Germany per pneumococcal season

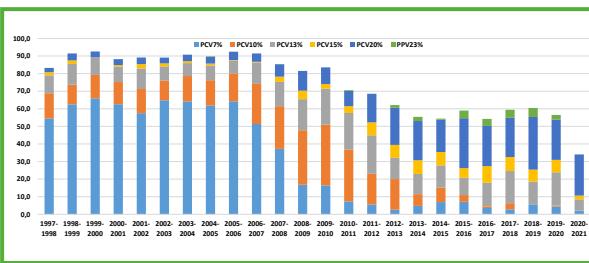


Fig. 3: Coverage of current and future vaccine formulation among children <16 with IPD in Germany

Isolate	Diagnosis	Age (mo)	Serotype	Vaccination status	Conclusion
93215	sepsis	7	19A	PCV13	only one dose at 4 mo.
93126	sepsis, pneumonia	13	6B	unknown	
93373		39	19A	unknown	
93518		87	3	PCV13	not booster

Reduced numbers seem to be due to social distancing measures, and not to decreased reporting, as there was no reduction in reported Group B Streptococcus cases (**Fig. 5**).

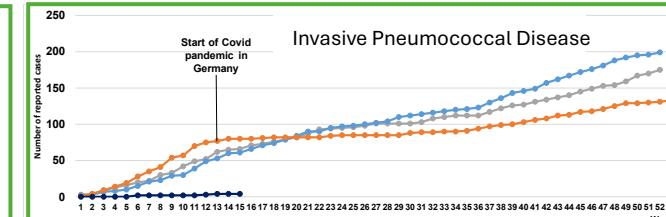


Fig. 4: Number of cases of IPD from children <16 y. in Germany per calendar week

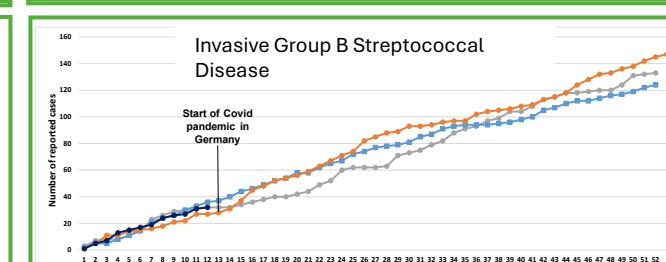


Fig. 5: Number of cases of invasive GBS disease in Germany per calendar week

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

Serotype	average 1997-2006	%	Serotype	2017-2018	%	Serotype	2018-2019	%	Serotype	2019-2020	%	Serotype	2020-2021	%	
total	230	100,0	total	175	100,0	total	177	100,0	total	184	100,0	total	52	100,0	
PCV20	207	90,0	PPV23	104	59,4	PPV23	107	60,5	PPV23	104	56,5	PCV20	17	32,7	
PPV23	202	87,8	PCV20	96	54,9	PCV20	98	55,4	PCV20	99	53,8	PPV23	17	32,7	
PCV15	198	86,1	PCV15	57	32,6	PCV15	45	25,4	PCV15	57	31,0	PCV15	5	9,6	
PCV13	195	84,8	PCV13	43	24,6	PCV13	33	18,6	PCV13	44	23,9	PCV13	4	7,7	
PCV10	175	76,1	PCV10	11	6,3	PCV10	10	5,6	PCV10	9	4,9	PCV10	1	1,9	
PCV7	143	62,2	PCV7	5	2,9	PCV7	10	5,6	PCV7	8	4,3	PCV7	1	1,9	
1	61	26,5	3	24	13,7	10A	21	11,9	3	27	14,7	15C	8	15,4	
2	17	7,4	10A	15	8,6	23B	17	9,6	24F	21	11,4	23B	8	15,4	
3	19F	17	7,4	24F	14	8,0	15B	12	6,8	10A	12	6,5	10A	7	13,5
4	23F	17	7,4	22F	10	5,7	3	11	6,2	15C	10	5,4	24F	7	13,5
5	1	17	7,4	8	9	5,1	19A	11	6,2	23B	10	5,4	23A	3	5,8
6	18C	14	6,1	23B	9	5,1	15C	10	5,6	19A	8	4,3	19A	2	3,8
7	7F	13	5,7	19A	8	4,6	22F	9	5,1	8	8	4,3	11A	2	3,8
8	4	9	3,9	12F	8	4,6	12F	8	4,5	12F	8	4,3	6B	1	1,9
9	9V	9	3,9	15C	8	4,6	19F	7	4,0	15B	8	4,3	3	1	1,9
10	6A	8	3,5	38	8	4,6	8	7	4,0	22F	7	3,8	33F	1	1,9
11	3	6	2,6	1	6	3,4	24F	7	4,0	35F	7	3,8	8	1	1,9
12	19A	6	2,6	19F	4	2,3	9N	6	3,4	33F	6	3,3	12F	1	1,9
13	24F	4	1,7	33F	4	2,3	38	6	3,4	11A	6	3,3	15B	1	1,9
14	10A	3	1,3	11A	4	2,3	11A	5	2,8	38	6	3,3	7B	1	1,9
15	22F	2	0,9	17F	4	2,3	27	4	2,3	19F	5	2,7	7C	1	1,9
16	8	2	0,9	16F	4	2,3	33F	3	1,7	21	4	2,2	15A	1	1,9
17	15B	2	0,9	15B	3	1,7	17F	3	1,7	27	4	2,2	16F	1	1,9
18	9N	2	0,9	21	3	1,7	21	3	1,7	15A	3	1,6	28A	1	1,9
19	9A	2	0,9	23A	3	1,7	23A	3	1,7	35B	3	1,6	28F	1	1,9
20	15A	2	0,9	27	3	1,7	35B	3	1,7	6B	2	1,1	35D	1	1,9
21	15C	2	0,9	35F	3	1,7	23F	2	1,1	9N	2	1,1	35F	1	1,9
22	5	1	0,4	9N	2	1,1	10B	2	1,1	20	2	1,1	NT	1	1,9
23	33F	1	0,4	20	2	1,1	15A	2	1,1	10B	2	1,1	4	0	0,0
24	11A	1	0,4	10B	2	1,1	28F	2	1,1	16F	2	1,1	9V	0	0,0

### CONCLUSIONS

- Eleven years after the introduction of higher-valent vaccines, PCV13 serotypes have been reduced among children.
- Currently, serotypes 15C, 10A, 23B and 24F are the most prevalent serotypes among children <16 years in Germany.
- Future vaccine formulations would considerably increase serotype coverage.
- The COVID pandemic has had a strong reducing effect on IPD, most probably through reduced respiratory