

Immediate re-emergence of invasive pneumococcal disease in Germany after strong reduction throughout SARS-CoV-2 pandemic lockdown

M. van der Linden, M. Imöhl and A. Itzek

German National Reference Center for Streptococci (GNRCS) and Institute of Medical Microbiology, RWTH-Aachen, Germany

Mark van der Linden
University Hospital RWTH Aachen
Institute of Medical Microbiology
National Reference Center for Streptococci
Pauwelsstrasse 30, 52074 Aachen, Germany
mlinden@ukaachen.de

BACKGROUND

Streptococcus pneumoniae remains a leading cause of infectious disease among children and older adults. In July 2006, vaccination with pneumococcal conjugate vaccine (PCV) was generally recommended in Germany for all children ≤24 months of age. Apart from a strong direct effect, pneumococcal conjugate vaccination has shown herd protection among non-vaccinated children and adults. For adults ≥60 years of age, a recommendation for vaccination with PPV23 has been in place since 1998. Since March 2020, the SARS-CoV-2 pandemic has strongly deregulated daily life. Here, we present data on invasive pneumococcal disease (IPD) cases in Germany in the era of conjugate vaccination during the SARS-CoV-2 pandemic.

METHODS

The GNRCS has monitored the epidemiology of IPD in Germany in children since 1997 and adults since 1992. All isolates were serotyped using the Neufeld-Quellung-reaction.

RESULTS

Childhood PCV-vaccination has changed the serotype distribution both among children as well as among adults (**Figs.1, 2, 3**). The prevalence of PCV13 vaccine serotypes among children <18 years reduced from 70% to 20%, among adults ≥18 years and ≥60 years from 70% to 30%. The percentage of PCV13 serotypes in IPD among adults has remained stable for 7 seasons. PCV15 would have increased serotype coverage among children from 18.5% to 25.3% in 2018-2019, and from 31.8% to 34.6% in 2021-2022. PCV20 would have covered 55.6% and 58.9%, respectively. Relative coverage increase was lower in 2021-2022, due to the effects of the SARS-CoV-2 pandemic. For adults ≥18 years coverage increase for PCV15 (compared to PCV13) would have been 8.6% in 2018-2019, and 5.2% in 2021-2022, for PCV20 35.1% and 26.8%, respectively. For adults ≥60 years coverage increases were 9.1% and 5.4% for PCV15 in 2018-2019 and 2021-2022, respectively, for PCV20, 33.4% and 25.9%, respectively (**Figs.4, 5, 6**).

During the SARS-CoV-2 pandemic a strong reduction in IPD cases was observed among all age groups (**Figs 7, 8**). This reduction seems to be induced by social distancing measures, and not by decreased reporting, as reported Group B-Streptococcus cases showed no change (**Fig. 9**).

With annulment of the social distancing restrictions in fall 2021, reported IPD case numbers have increased to pre-pandemic levels, both among children, and adults. For children, case numbers per week stayed on pre-pandemic levels in 2022 (**Fig. 7**). For adults, in the first 10 weeks of 2022, case numbers were higher than in the same period in 2021, but still considerably lower than in the pre-pandemic years 2018 and 2019 (**Fig. 8, Tab. 1**). The strongest reduction was observed in the age group >75 years.

Some serotypes (12F, 22F) seem to be more affected by this reduction, with serotype 12F almost disappearing in 2021 among adults (**Fig. 10**). Even though serotype 12F levels show long time fluctuations over the period 1992-2022, the reduction in the seasons 2020-2021 and 2021-2022 are disproportionally strong (**Fig. 11**). Serotype 22F percentages have increased over time, ever since the start of childhood PCV vaccination in 2006, but showed a strong reduction during the SARS-CoV-2 pandemic as well (**Fig. 12**).

CONCLUSIONS

- The herd protection effect of PCV7/PCV13 on serotype distribution of IPD among adults in Germany has reached its limit, with PCV13 serotypes remaining at a prevalence of about 30%.
- PCV15 would increase serotype coverage (compared to PCV13) among children by 3-7%, among adults ≥18 years or ≥60 years by 5-9%.
- PCV20 would increase serotype coverage (compared to PCV13) among children by 27-37%, among adults ≥18 years or ≥60 years by 26-35%.
- The SARS-CoV-2 pandemic has had a strong reducing effect on IPD, particularly on serotypes 12F and 22F, which, in turn, affected the theoretical serotype coverage of PCV15 and PCV20.
- The loosening of non-pharmaceutical interventions in fall 2021, resulted in an immediate return to pre-pandemic IPD case numbers, both for children and adults in the second half of 2021. In 2022, case numbers remained on the pre-pandemic level for children, but reduced once more for adults, most prominently in oldest age group (>75y.).

Serotype	2017-2018	%	Serotype	2018-2019	%	Serotype	2019-2020	%	Serotype	2020-2021	%	Serotype	2021-2022	%
total	180	100.0	total	178	100.0	total	107	100.0	total	70	100.0	total	107	100.0
PPV23	107	59.4	PPV23	108	60.7	PPV23	105	56.1	PPV23	29	41.4	PPV23	69	64.5
PCV20	99	55.0	PCV20	99	55.6	PCV20	100	53.5	PCV20	29	41.4	PCV20	63	58.9
PCV15	58	32.2	PCV15	45	25.3	PCV15	37	30.5	PCV15	12	17.1	PCV15	37	34.6
PCV13	44	24.4	PCV13	33	18.5	PCV13	44	23.5	PCV13	9	12.9	PCV13	34	31.8
PCV10	11	6.1	PCV10	10	5.6	PCV10	9	4.8	PCV10	1	1.4	PCV10	7	6.5
PCV7	5	2.8	PCV7	10	5.6	PCV7	8	4.3	PCV7	1	1.4	PCV7	7	6.5

Fig. 1: Serotype distribution among IPD isolates from children <18 years of age in Germany. Single serotype prevalences are ranked.

Serotype	2017-2018	%	Serotype	2018-2019	%	Serotype	2019-2020	%	Serotype	2020-2021	%	Serotype	2021-2022	%
total	102	100.0	total	113	100.0	total	238	100.0	total	1031	100.0	total	1345	100.0
PPV23	2336	75.3	PPV23	2385	74.3	PPV23	1702	71.3	PPV23	696	69.5	PPV23	919	68.3
PCV20	2039	65.7	PCV20	2076	65.2	PCV20	1528	64.0	PCV20	607	60.6	PCV20	823	61.2
PCV15	1243	40.1	PCV15	1231	38.7	PCV15	928	38.5	PCV15	367	36.7	PCV15	533	39.6
PCV13	777	31.5	PCV13	699	30.1	PCV13	706	29.6	PCV13	307	30.7	PCV13	463	34.4
PCV10	190	6.1	PCV10	187	5.9	PCV10	149	6.2	PCV10	69	6.9	PCV10	84	6.2
PCV7	161	5.2	PCV7	171	5.4	PCV7	142	5.9	PCV7	66	6.6	PCV7	80	5.9

Fig. 2: Serotype distribution among IPD isolates from adults ≥18 years of age in Germany. Single serotype prevalences are ranked.

Serotype	2017-2018	%	Serotype	2018-2019	%	Serotype	2019-2020	%	Serotype	2020-2021	%	Serotype	2021-2022	%
total	2298	100.0	total	2343	100.0	total	1723	100.0	total	696	100.0	total	865	100.0
PPV23	1689	73.6	PPV23	1709	72.9	PPV23	1173	68.1	PPV23	489	67.4	PPV23	627	65.7
PCV20	1464	63.8	PCV20	1500	64.0	PCV20	1086	61.3	PCV20	407	58.5	PCV20	565	58.2
PCV15	938	40.8	PCV15	929	39.7	PCV15	687	39.7	PCV15	280	37.4	PCV15	370	38.7
PCV13	718	31.3	PCV13	718	30.6	PCV13	484	28.7	PCV13	216	31.0	PCV13	318	33.3
PCV10	113	4.9	PCV10	110	4.7	PCV10	77	4.5	PCV10	34	4.9	PCV10	43	4.5
PCV7	96	4.2	PCV7	101	4.3	PCV7	73	4.2	PCV7	32	4.6	PCV7	42	4.4

Fig. 3: Serotype distribution among IPD isolates from adults ≥60 years of age in Germany. Single serotype prevalences are ranked.

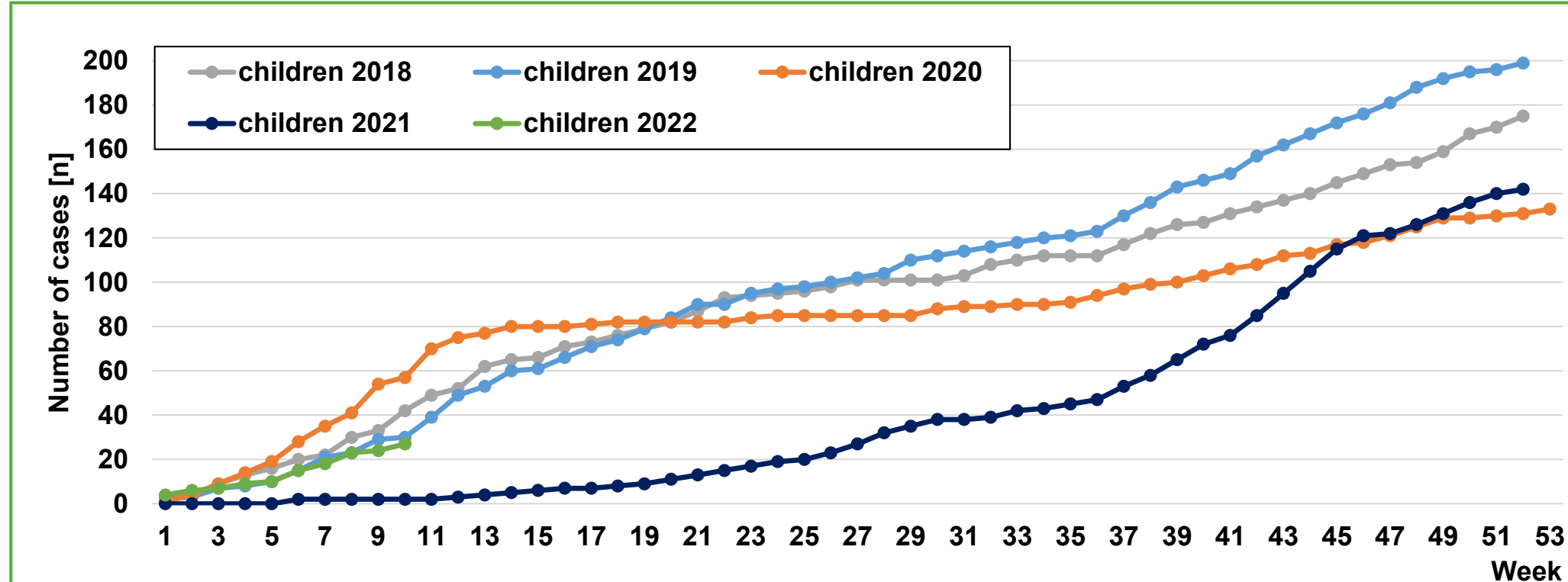


Fig. 7: Cumulative number of reported IPD cases from children <18 years of age in Germany.

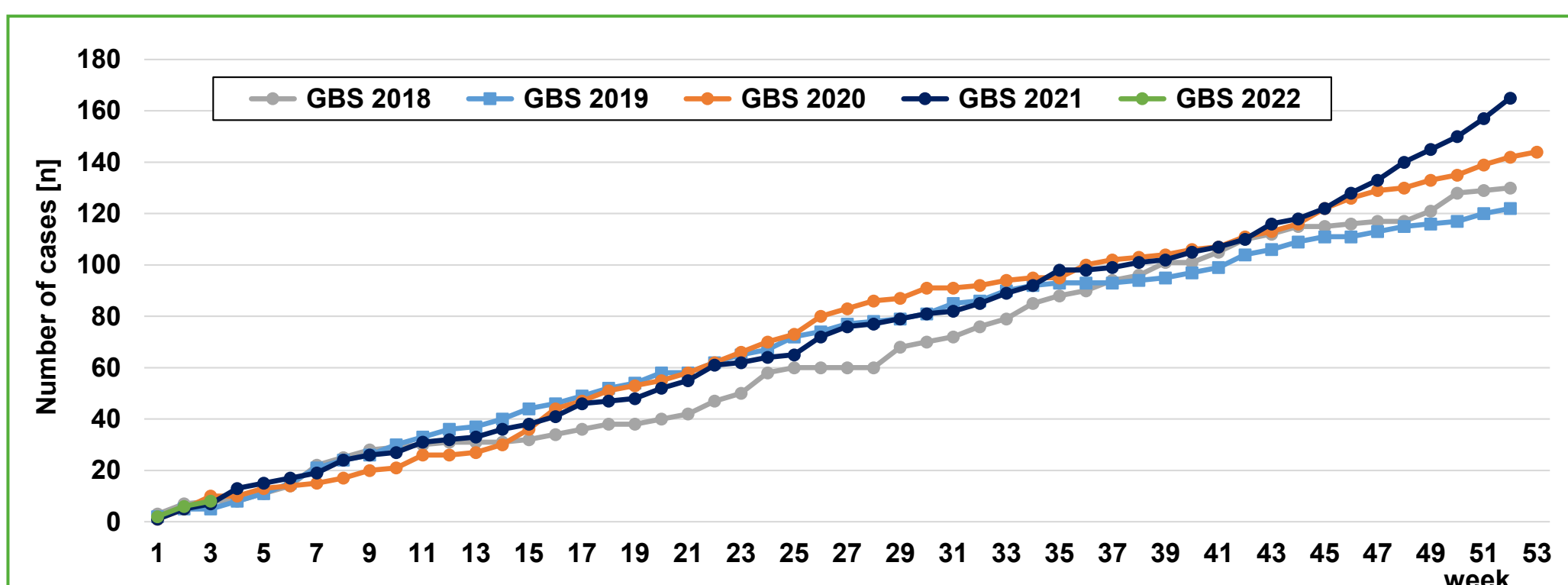


Fig. 9: Cumulative number of reported invasive Group B-streptococcal disease among all age groups in Germany.

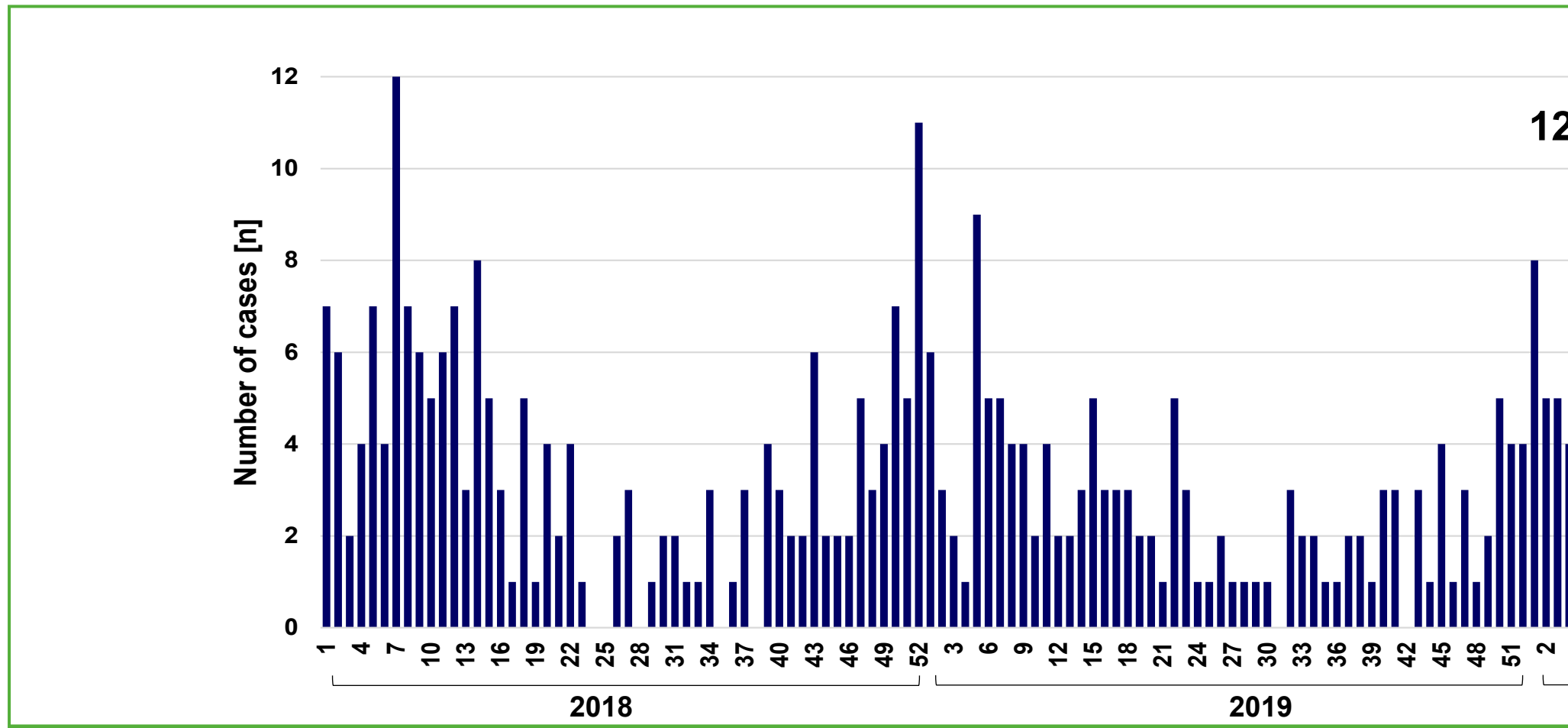


Fig. 10: Number of IPD cases among adults ≥18 years of age with serotype 12F per calendar week, 2019-2022.

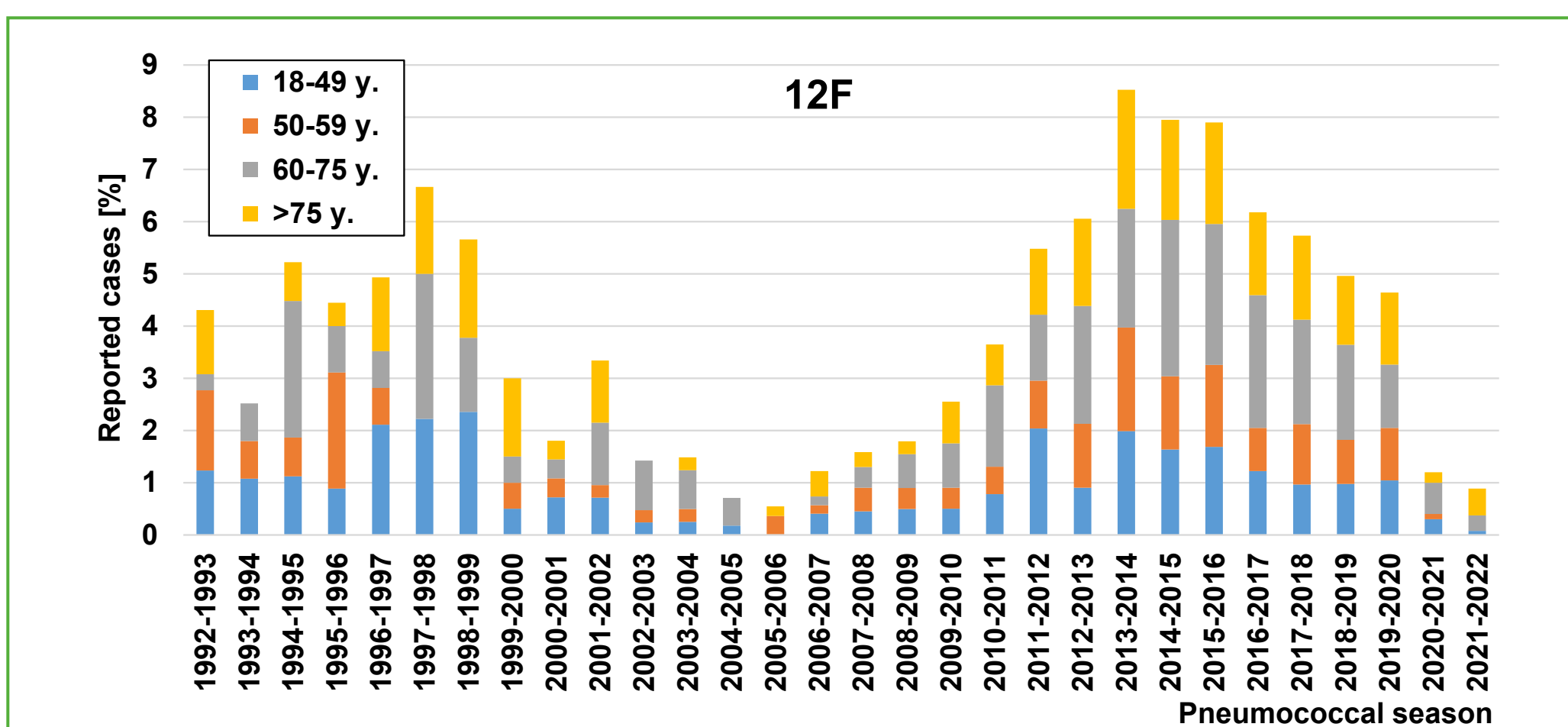


Fig. 11: Percentage of IPD isolates with serotype 12F, isolated from adults ≥18 years of age, 1992-2022

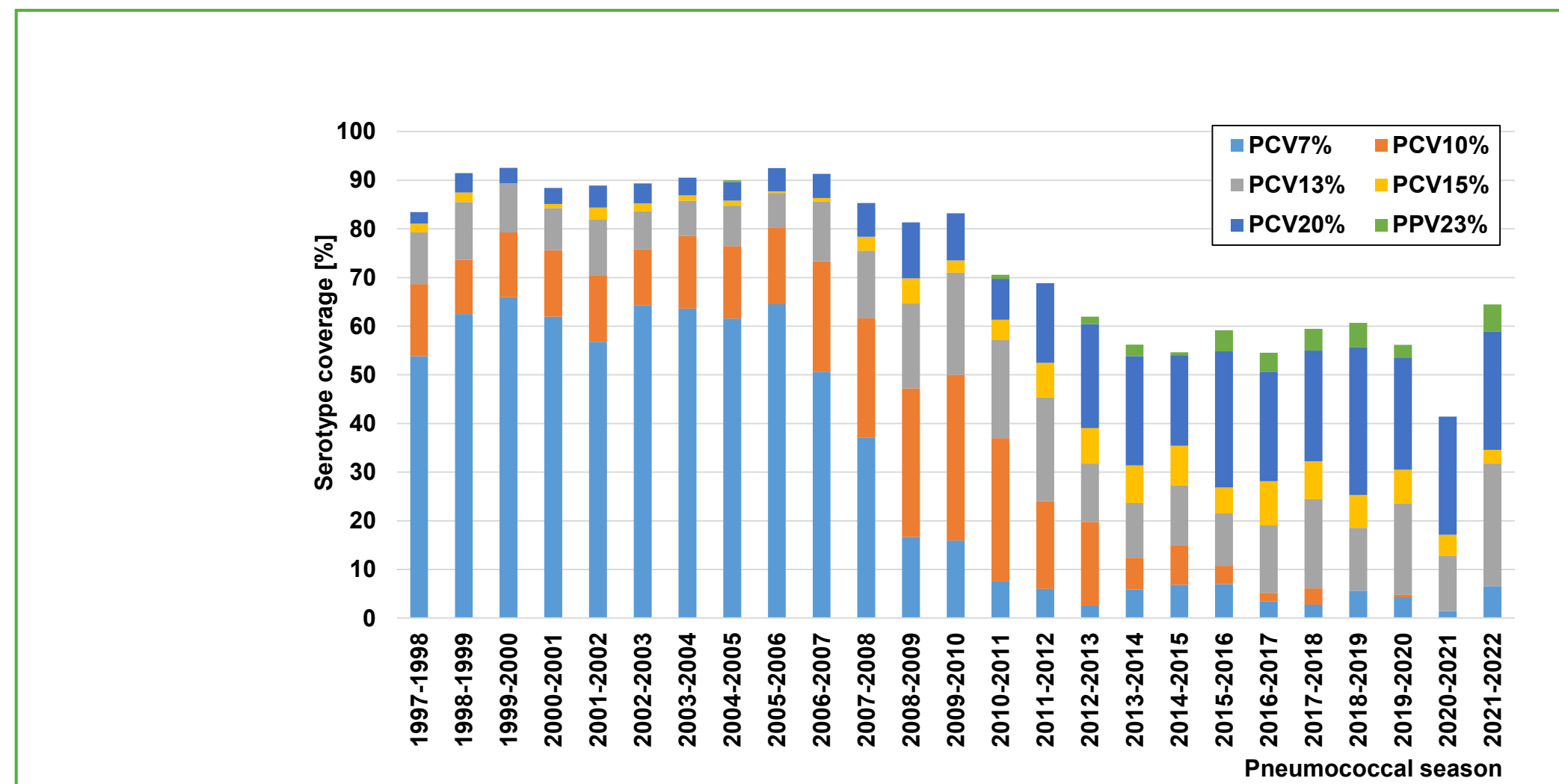


Fig. 4: Serotype coverage of different vaccine formulations among IPD isolates from children <18 years of age in Germany.

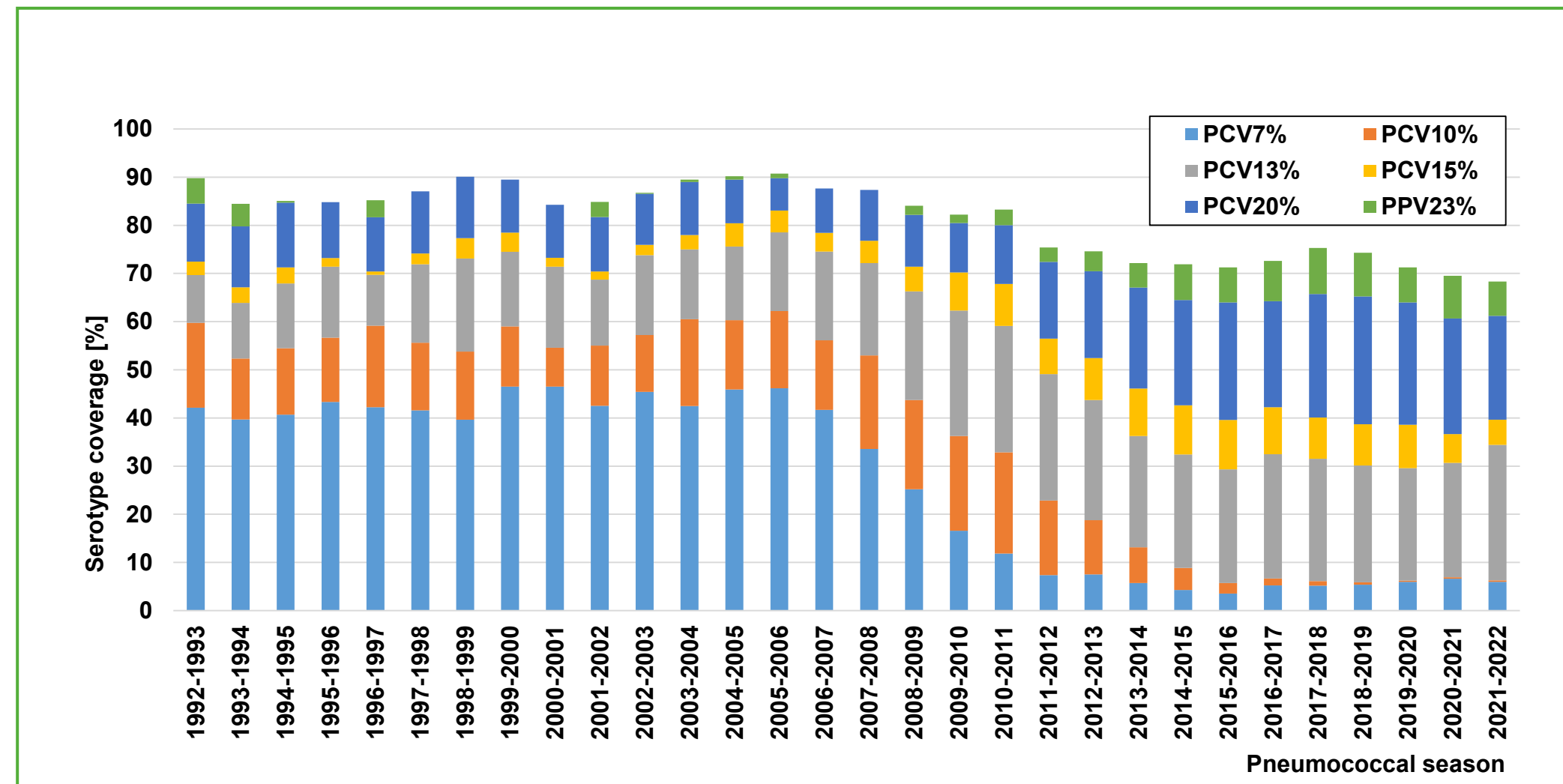


Fig. 5: Serotype coverage of different vaccine formulations among IPD isolates from adults ≥18 years of age in Germany.

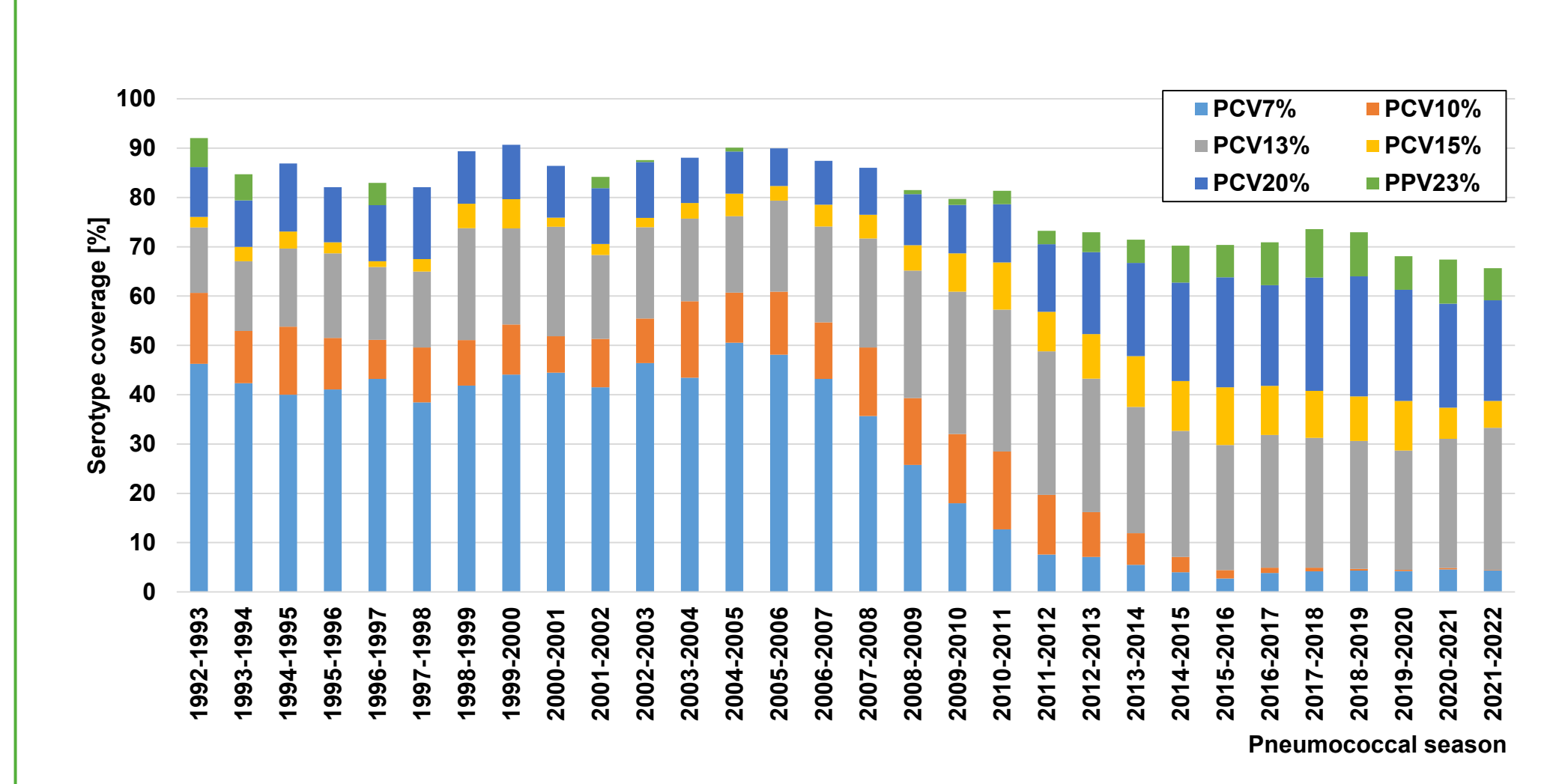


Fig. 6: Serotype coverage of different vaccine formulations among IPD isolates from adults ≥60 years of age in Germany.

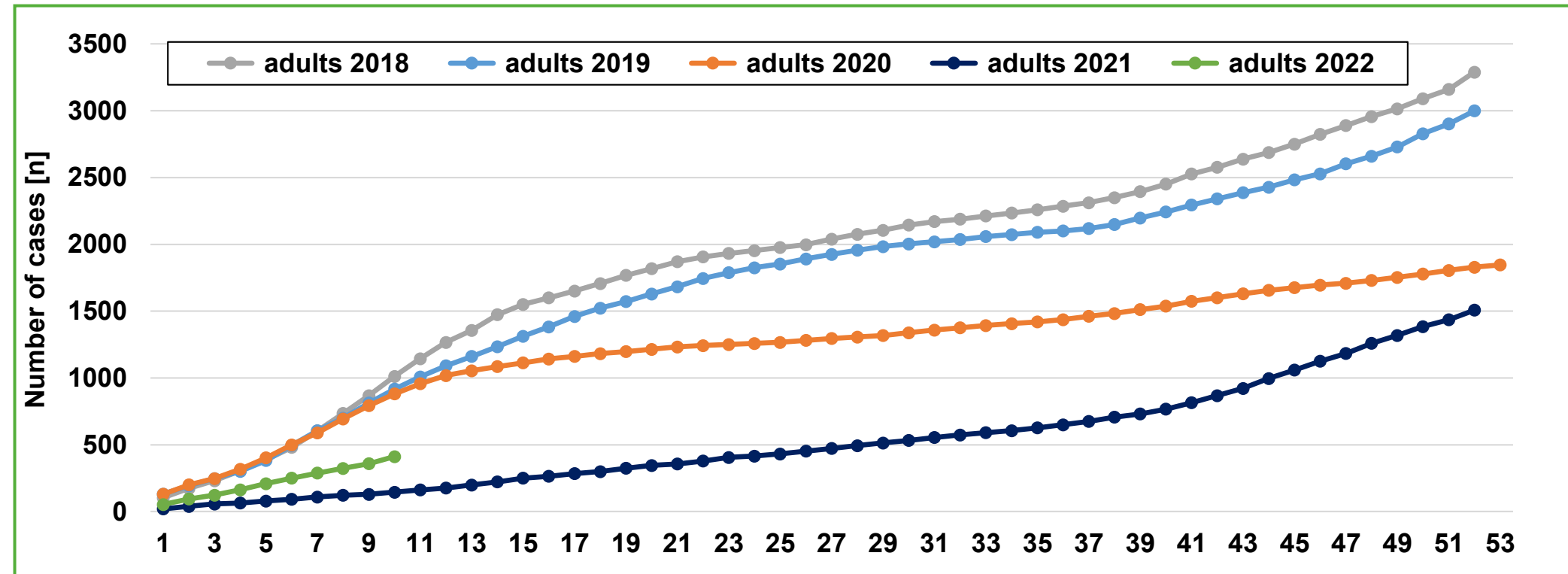


Fig. 8: Cumulative number of reported IPD cases from adults ≥18 years of age in Germany.

Tab. 1: IPD case numbers among adults from Nov 15 - Dec 31, 2021 and Jan 1 - Mar 15, 2022, compared to the same periods in 2018 and 2019.

Age group (years)	Nov 15 - Dec 31, 2021 cases (n=)	Nov 15 - Dec 31, 2018 cases (n=)	Nov 15 - Dec 31, 2019 cases (n=)	Reduction 2021 vs. 2018 (%)	Reduction 2021 vs. 2019 (%)
18-49	87	83	83	4.8	-2.2
50-59	91	100	93	-9.0	-11.7
60-75	253	270	263	-6.3	-3.8
>75	246	298	264	-17.4	-6.8

Age group (years)	Jan 1 - Mar 15, 2022 cases (n=)	Jan 1 - Mar 15, 2018 cases (n=)	Jan 1 - Mar 15, 2019 cases (n=)	Reduction 2022 vs. 2018 (%)	Reduction 2022 vs. 2019 (%)
18-49	71	126	113	-43.7	-37.2
50-59	73	132	132	-51.3	-44.7
60-75	178	406	342	-56.2	-48.0
>75	148	396	361	-62.6	-59.0

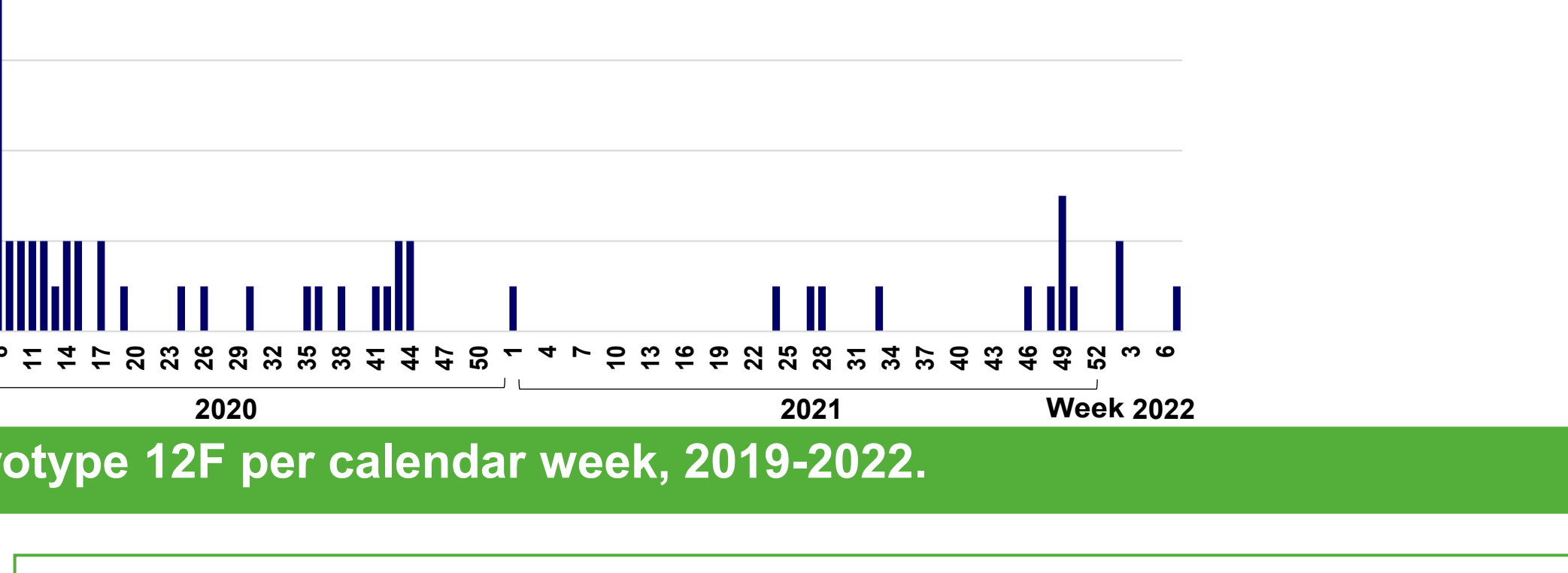


Fig. 12: Percentage of IPD isolates with serotype 22F, isolated from adults ≥18 years of age, 1992-2022