

Background Information

- The World Health Organization estimates that serious disease resulting from infection with *Streptococcus pneumoniae* causes 826,000 deaths per year in young children.
- Just over 4 million children under 6 live in Germany. Each colored block on the right is home to about a million.
- Invasive Pneumococcal Disease (IPD)* occurs when bacteria are found in areas of the body that should be sterile, like the blood (sepsis), the cerebrospinal fluid (meningitis), and the pleural fluid (pneumonia).
- IPD is most dangerous to young children and the elderly. Many infants in Germany are vaccinated with the widest-coverage conjugate vaccine available (PCV13). Few adults are vaccinated.
- The German National Reference Center for Streptococci (GNRCS)** tracks and analyzes IPD cases and trends.
- Spatial epidemiology studies allow the GNRCS to pinpoint areas with poor vaccine uptake, determine the most effective vaccine dosing schedule, and examine regional differences in serotype distribution.

**Streptococcus pneumoniae*, also called pneumococcus, causes both non-invasive (impetigo, otitis media, sinusitis) and invasive (meningitis, pneumonia, sepsis) types of disease. Children under 2 years old are especially at risk of contracting IPD, hence the importance of vaccinating infants.

Pneumococci are described primarily by their polysaccharide capsule, or serotype. Serotypes vary in virulence, prevalence, and antibiotic resistance.

The first-generation pneumococcal conjugate vaccine (PCV7) protects against 7 of 90 known serotypes (4, 6B, 9V, 14, 18C, 19F, 23F) and was recommended for all infants in Germany starting in 2006.

The second-generation vaccine was introduced in late 2010, and protects against 13 serotypes (PCV13: 4, 6B, 9V, 14, 18C, 19F, 23F, 1, 5, 7F, 3, 6A, 19A).

**The GNRCS has been collecting data on streptococcal disease since 1992. Questionnaires arrive with samples of isolated bacteria and include limited amounts of patient information.

GNRCS labs perform microbiological and genetic testing on the samples and the results of which, combined with the questionnaire, form the surveillance profile for IPD in Germany.

How many cases of IPD occur in German children? Where do they occur? Is the vaccine working?

Figure 2. Number of cases of IPD by BLG in children under 6

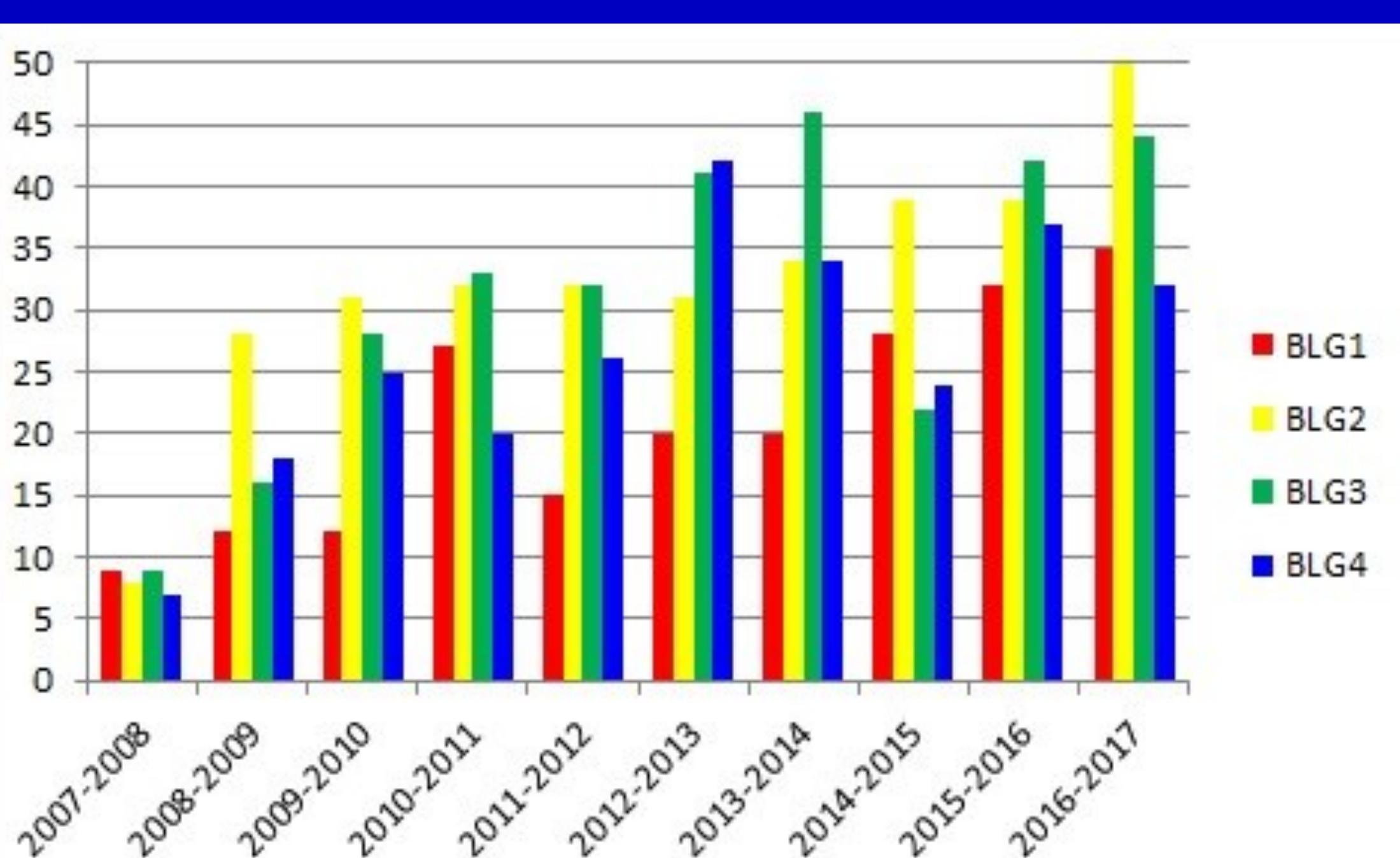


Figure 3. Number of IPD cases per 100,000 children under 6

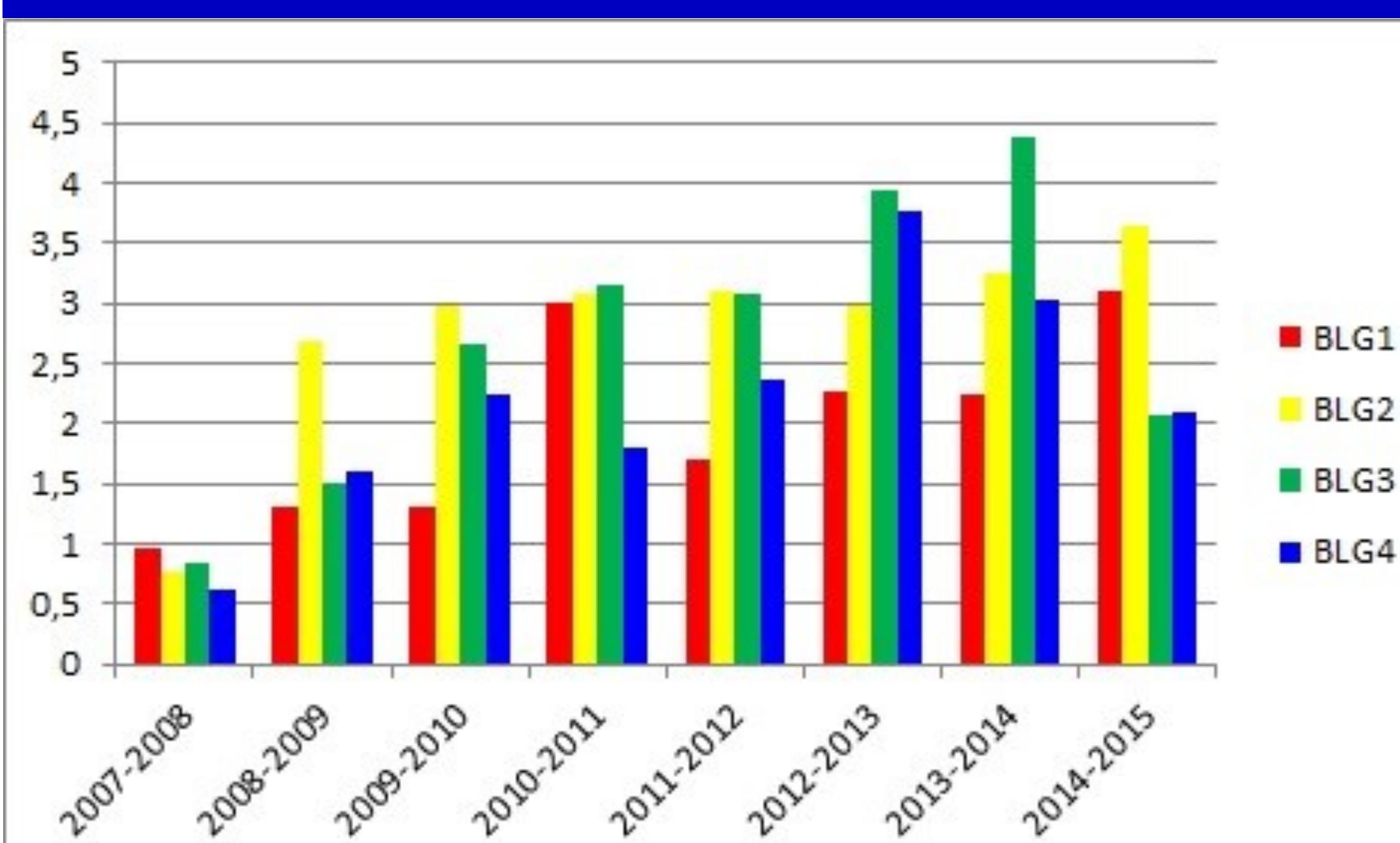


Figure 4. PCV7-serotype IPD cases in children under 6

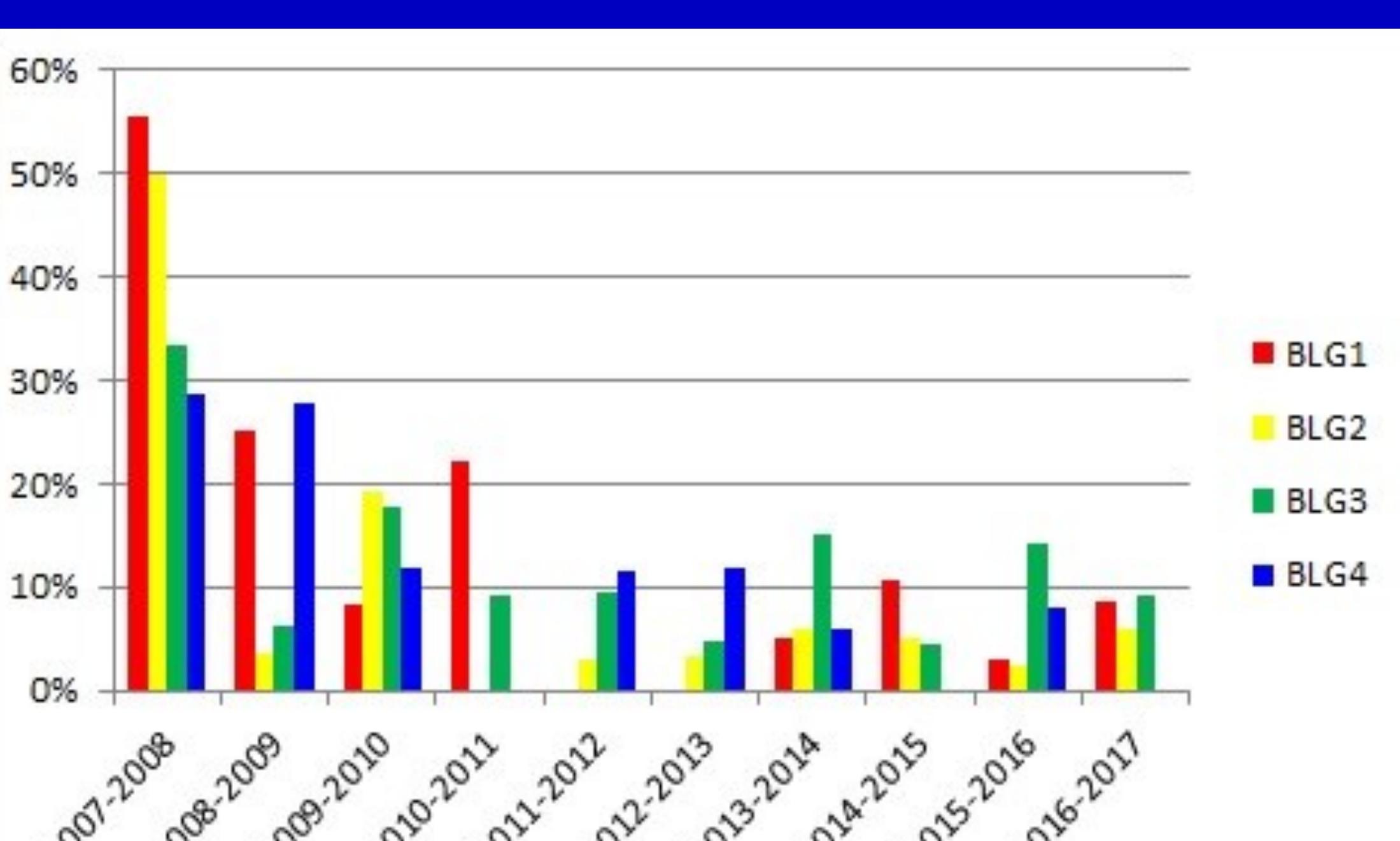


Figure 5. PCV13-non7-serotype IPD cases in children under 6

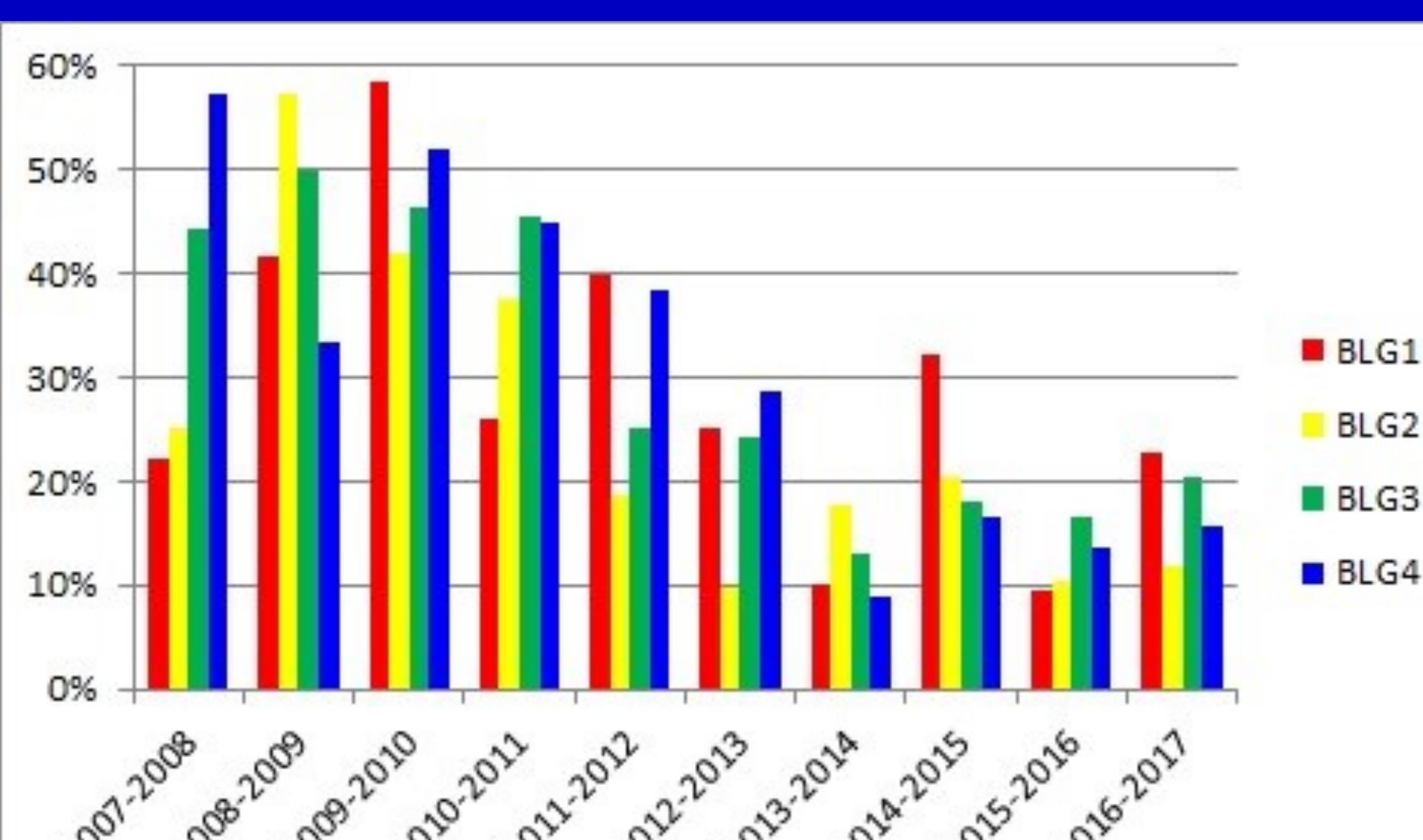


Figure 1. Analysis groups for children under 6 in Germany



Table 1. Leading serotypes of IPD in children under 6 in Germany, 2016-2017

Analysis group	Serotype	Number of cases
BLG1	12F	5
	23B, 3	4
	19A, 24F	3
BLG2	10A	7
	3	5
	24F	4
BLG3	3	6
	23B, 15B	4
	10A, 22F	3
BLG4	15C	5
	3	4
	24F, 23B, 10A	3

What have we learned?

- Vaccination has had a profound impact on IPD in Germany.
- The current leading serotypes are less resistant to antibiotics.
- Children remain a vulnerable population.
- The six new serotypes present in the second-generation vaccine have not disappeared as quickly as those in the first-generation vaccine.
- No dominant serotype currently exists in IPD in children.
- The non-vaccine serotypes are on the rise, and vary by region.