

Hospitalization Costs and Disease Burden of *B. Pertussis* in Germany: A Retrospective Analysis of Nationwide Inpatient Data Collected From 2019 to 2023

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Hospitalization costs due to *B. pertussis* among adults increase with age. Hence, booster vaccinations are of considerable economic relevance.

Digital poster
Supplementary data



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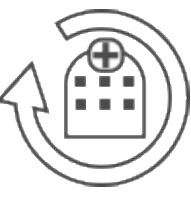
Aims



- The primary objective of this study was to estimate the **mean hospitalization cost** due to *B. pertussis* among children and adults.
- Secondary/exploratory objectives were to describe **characteristics of hospitalized *Bordetella pertussis* (*B. pertussis*) patients**, the utilization of hospital care and costs in inpatients with respiratory complications of interest.



Study design



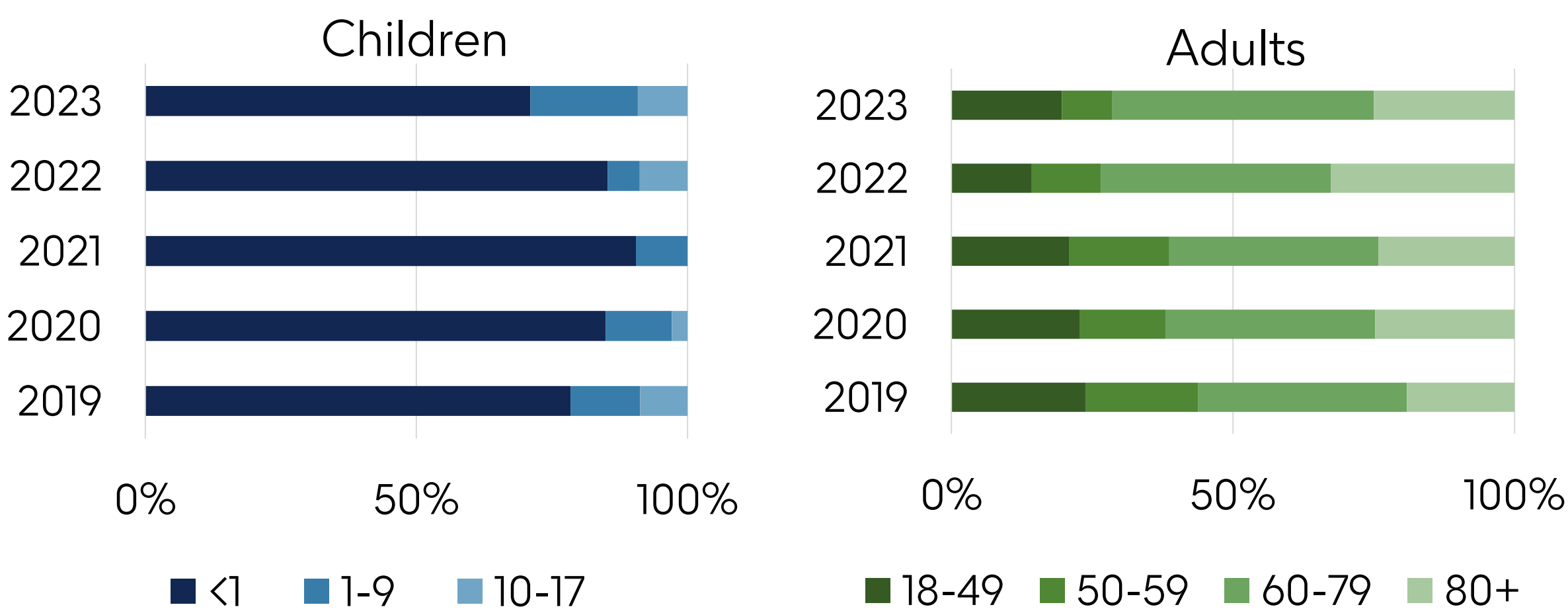
- This **retrospective study** uses aggregated inpatient data from the Institute for the Hospital Remuneration System (InEK).
- B. pertussis* cases** were identified using International Statistical Classification of Diseases and Related Health Problems – German Modification (ICD-10-GM) codes A37.0 and A37.9 as primary diagnoses and hospitalization in a main department in Germany from 2019 to 2023.
- All analyses were performed separately for children (aged 0 to ≤17 years) and adults (aged ≥18 years), and for each year.
- Cost estimates were derived from the **age-group-specific diagnosis-related group** distributions and the respective mean lengths of stay, offset against the year-specific federal base rates (and nursing care revenues from 2020 onwards), and inflation-adjusted to 2023, see supplementary material.



Demographics

- Across study years, **714 children** (2019-2023: 389, 139, 21, 34, 131; respectively) and **523 adults** (2019-2023: 251, 105, 62, 49, 56; respectively) were hospitalized with *B. pertussis*.
- In adults, more hospitalized patients were female, ranging from 54.3% to 61.2% (no such trend was observed in children) (Table S1 and S2).
- Over the study period, **78.0% of adults were aged ≥50 years**, while **79.0% of children were under 1 year of age (YOA)** (Figure 1).
- Across study years, **7.0% of children and 3.3% of adults required intensive care unit admission**.

Figure 1: Age distribution of hospitalized *B. pertussis* cases



Results



- Hospitalization costs per case ranged from € 2,524 to € 3,078 in children and € 3,022 to € 3,917 in adults (Table 1 and 2).
- Costs among adults increased with age, ranging from € 2,466 to € 3,499 in those 18-49 YOA, € 3,022 to € 3,852 in those 50-59 YOA, € 3,022 to € 3,854 in those 60-79 YOA and € 3,022 to € 4,953 in those ≥80 YOA.
- Patients with pneumonia or acute respiratory distress syndrome (ARDS) showed increased costs, ranging from € 2,745 to € 3,584 in children and from € 3,010 to € 5,099 in adults for pneumonia, and from € 3,022 to € 5,417 in children and from € 3,022 to € 5,446 in adults for ARDS.
- Mean length of hospital stay (standard deviation) increased with age among adults, ranging from 6.6 (3.9) to 7.8 (6.3) days compared to a range from 3.4 (1.5) to 6.0 (6.7) days in children (Figure 2).

Table 1: Mean hospitalization cost per *B. pertussis* case among children

Subgroup	2019	2020	2021	2022	2023
0-17 YOA	€ 2,524	€ 3,078	€ 2,535	€ 2,993	€ 2,676
0-9 YOA	€ 2,569	€ 3,078	€ 2,535	€ 2,989	€ 3,073
10-17 YOA	€ 2,524	-	-	-	€ 2,689
Pneumonia*	€ 2,745	-	-	-	€ 3,584
ARDS*	€ 3,022	€ 4,435	-	€ 5,417	€ 4,446

*- indicates that a cost estimate could not be calculated as less than 5 cases were admitted to hospital in the respective year and therefore no data could be extracted from the InEK database.

* Pneumonia/ARDS costs were derived by case-weighting costs of *B. pertussis* patients aged 0-17 YOA with primary and secondary pneumonia/ARDS diagnosis.

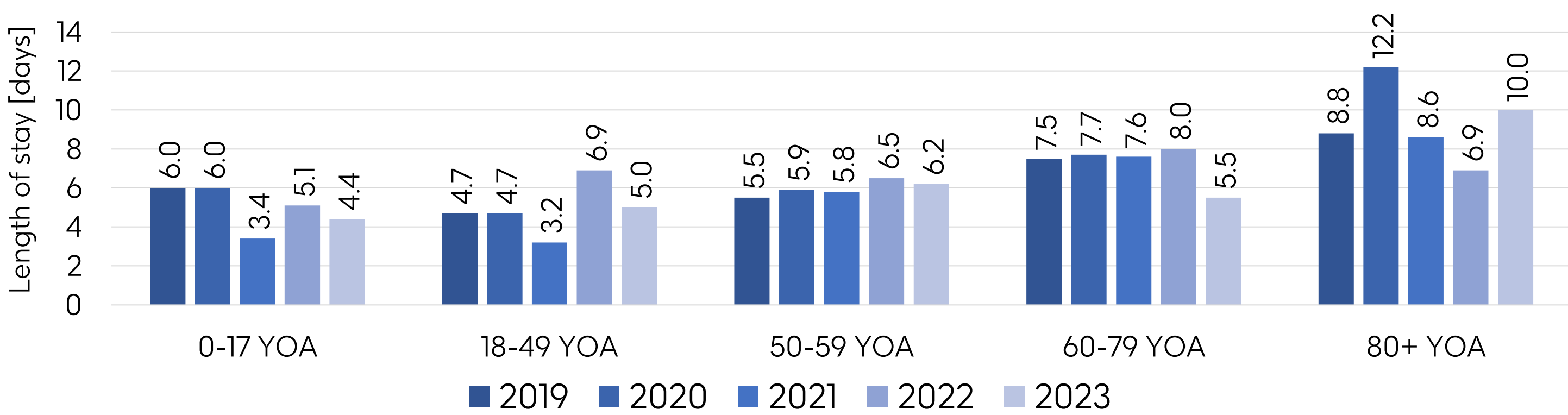
Table 2: Mean hospitalization cost per *B. pertussis* case among adults

Subgroup	2019#	2020	2021	2022	2023
≥18 YOA	€ 3,022	€ 3,406	€ 3,344	€ 3,666	€ 3,917
18-49 YOA	€ 3,022	€ 2,851	€ 2,466	€ 3,499	€ 3,427
50-59 YOA	€ 3,022	€ 3,170	€ 3,155	€ 3,453	€ 3,852
60-79 YOA	€ 3,022	€ 3,406	€ 3,612	€ 3,854	€ 3,618
80+ YOA	€ 3,022	€ 4,219	€ 3,884	€ 3,575	€ 4,953
Pneumonia*	€ 3,010	€ 3,906	€ 3,568	€ 3,995	€ 5,099
ARDS*	€ 3,022	€ 4,120	€ 4,041	€ 3,960	€ 5,446

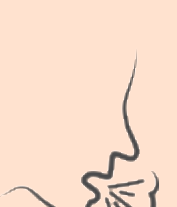
* Pneumonia/ARDS costs were derived by case-weighting costs of *B. pertussis* patients aged ≥18 YOA with primary and secondary pneumonia/ARDS diagnosis.

In 2019, cost estimates were similar across all groups because only one diagnosis-related group code was used for billing in most cases, nursing care costs had not yet been itemized, and the average length of stay for each group was within boundary limits.

Figure 2: Mean length of hospital stay per *B. pertussis* case



Background

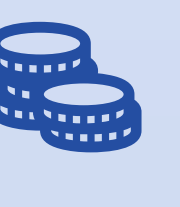


- Whooping cough is usually caused by the bacterium *B. pertussis* and can last for multiple weeks to months.^{1,2}
- Infection-related hospitalizations and complications occur most frequently in infants, followed by older adults.²
- To date, published information on inpatient health economic implications due to *B. pertussis* is limited for Germany

Conclusions



Both infants and adults are at risk of *B. pertussis* hospitalizations.



Hospitalization costs in adults increase with age.



Booster vaccinations are of considerable economic relevance.

Abbreviations

ARDS: acute respiratory distress syndrome; *B. pertussis*: *Bordetella pertussis*; ICD-10-GM: International Statistical Classification of Diseases and Related Health Problems – German Modification; InEK: Institute for the Hospital Remuneration System; YOA: years of age.

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Disclosures

Conflicts of Interest: MK, JR, JW, AM, MW and PV are employed by GSK. On a voluntary basis, AM also sits on the Board of Trustees for mental health charity "Beyond Conflict" (registered UK charity number: 1176499) and works as distance learning tutor for MSc in Clinical Trials (London School of Hygiene and Tropical Medicine). The authors declare no other financial and non-financial relationships and activities. Funding: GSK (study identifier: VEO-001006).