EE555

Inpatient Burden of Influenza and Influenza-like Illness among Adults Aged 60 and Older in Germany, 2019–2024

Anna C. Meyer[1], Saskia Kiesel[1], Moritz Wick[1], Oliver Damm[1]

[1]Sanofi-Aventis Deutschland GmbH, Berlin, Germany

*Presenting Author: Anna C. Meyer (E-Mail: annacarina.meyer@sanofi.com)

Key Takeaways

- Substantial burden of influenza/ILI hospitalisations in recent seasons in the elderly population.
- Southern Germany shows the highest incidence of hospitalisations, mirroring its comparatively low influenza vaccination coverage.

OBJECTIVE

To present nationwide trends for the *clinical and economic inpatient burden of influenza* and influenza-like illness (ILI) in the German population aged 60 years and older from 2019–2020 to 2023–2024 in comparison with children and younger adults.

CONCLUSIONS

- Despite a temporary decline in influenza/ILI activity following the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) pandemic, we observed an **increasing burden of influenza/ILI** in the German population in recent seasons.
- Almost half of all influenza/ILI hospitalisations are attributable to individuals **aged 60 years and older.**
- **Older adults** contribute substantially to the influenza/ILI burden due to longer hospital stays, higher risk of ICU treatment, higher in-hospital mortality, and higher average hospitalisation costs compared to younger age groups.
- The incidence rate of hospitalisations among older adults was especially **high in southern Germany** where public health surveillance reports particularly poor influenza vaccination coverage.
- Public health efforts to **promote influenza vaccination** and reduce the burden of influenza in the older population remain important.

BACKGROUND

- Influenza is a common acute respiratory infection associated with significant morbidity and mortality. In Germany, seasonal influenza has been linked to as many as 26,000 excess deaths annually, the majority of which occur among individuals aged 60 years and older[1].
- According to German surveillance data, minimal influenza activity was reported between 2020 and 2022[2], but studies on influenza burden in Germany have been limited since 2020.
- To prevent severe disease due to influenza virus, public health authorities recommend annual influenza vaccination for all adults aged 60 years and older as well as for other high-risk populations, but vaccination coverage remains substantially below the 75% target of the World Health Organisation (WHO). Since 2021, coverage has declined consistently, reaching as low as 38% among older adults during the 2023–2024 season[3].

METHODS

Study design

This descriptive observational study is based on nationwide inpatient data covering the entire German population compiled by the institute for reimbursements in hospitals (InEK) for reimbursement purposes4. The study period covers five consecutive influenza seasons from 2019–2020 to 2023–2024. An influenza season is defined as a 12-month period from July to June of the following year.

Definition of influenza/ILI

Influenza/ILI was defined based on the International Classification of Diseases (ICD) Version 10, German modification (ICD-10-GM) codes J09–J11. All inpatient episodes with an ICD-10-GM diagnosis of J09–J11 as the primary cause of hospitalisation were extracted from the InEK database*. The number of influenza/ILI hospitalisations among adults aged 60 years and older was reported for each season along with the mean length of stay, patient characteristics, and proportion of patients treated in an intensive care unit (ICU), in-hospital mortality, and they were compared with influenza/ILI hospitalisations among children aged 0–17 and adults aged 18–59 years.

Estimation of inpatient costs

Inpatient costs were estimated based on the observed distribution of recorded diagnosis-related group (DRG) codes. In accordance with a previous study[5], mean reimbursement amounts for each DRG code were estimated as the sum of the DRG-specific reimbursement amount (annual federal base rate multiplied with DRG-specific relative reimbursement value) and care revenue (annual daily rate for patient care multiplied with DRG-specific mean length of stay). Mean costs per hospitalisation were calculated as the weighted average of mean costs for each DRG code.

Hospitalisation incidence

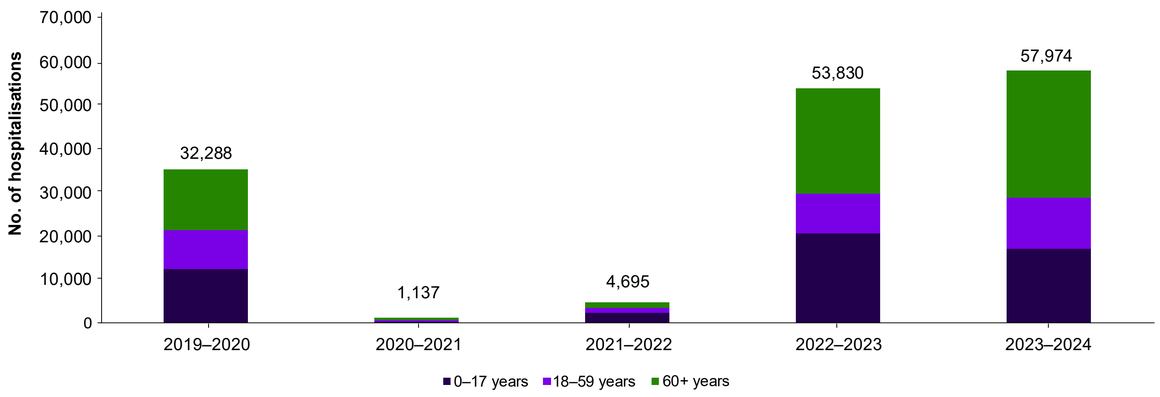
Hospitalisation incidence per 100,000 individuals aged 60 years and older was calculated for each season and German federal state. The population as of December 31st of the respective season was retrieved from the German national statistics office and serves as the denominator[6]. Direct age-standardisation using the total German population as standard population was used to ensure comparability between the federal states.

*For each year, the latest available data delivery in the InEK database was used for analyses of epidemiology and clinical burden. Due to data limitations, cost estimations are based on the latest preliminary data deliveries ("Unterjährige Datenlieferung DRG") and on patients with available DRG codes, leading to minor deviations in patient numbers.

RESULTS

- We identified 152,924 influenza/ILI hospitalisations across five seasons, 45.1% occurred among individuals aged 60 years and older. The highest number of hospitalisations was observed in 2023–2024 (N=57,974), while only 1,137 and 4,695 influenza/ILI hospitalisations occurred in 2020–2021 and 2021–2022, respectively (**Figure 1**).

Figure 1: Number of influenza/ILI hospitalisations in Germany by age group and season



- In almost all seasons, the incidence rate of influenza/ILI hospitalisations was the highest among children aged 0–17 years and the lowest among adults aged 18–59 years (**Table 1**). However, the average length of stay, proportion of patients treated in an ICU, and the in-hospital mortality rates were the highest among older adults and considerably lower among children. Overall, the average length of stay was twice as long among older adults than among children, while the proportion of patients treated in ICU was 1.5 to 3-times elevated. In-hospital mortality rate reached up to 0.2% among children, up to 1.7% among adults aged below 60 years, and ranged between 5.8% and 12.3% among adults aged 60 years and older.

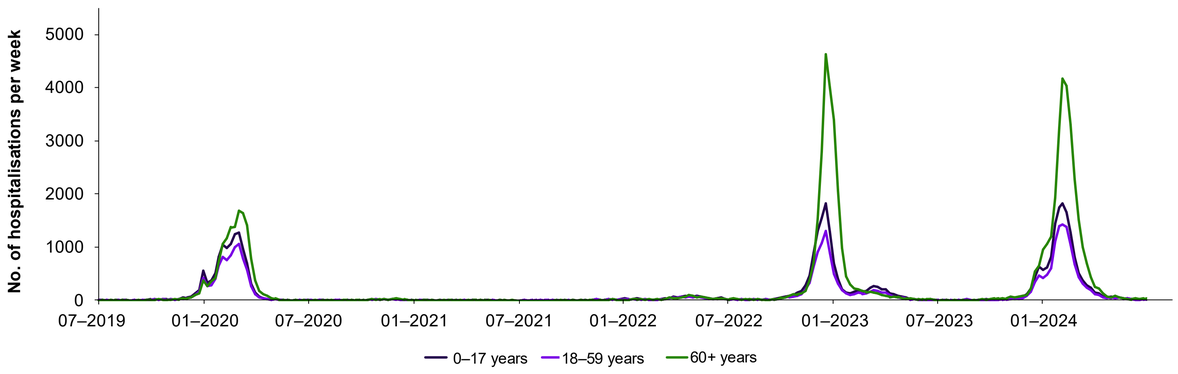
Table 1: Characteristics of influenza/ILI hospitalisations by age group and season

Season	Number of influenza/ILI hospitalisations	Incidence per 100,000 population	Length of stay in days, mean (SD)	Proportion treated in ICU	In-hospital mortality rate	Mean costs per hospitalisation† (€)
0–17 years						
2019–2020	12,415	90.8	3.2 (2.8)	3.0%	0.1%	1,880
2020–2021	205	1.5	3.1 (1.7)	5.9%	0.0%	1,744
2021–2022	2,258	16.3	2.8 (1.9)	4.0%	0.0%	1,867
2022–2023	20,524	147.5	3.1 (3.3)	4.4%	0.1%	2,304
2023–2024	17,027	121.8	3.0 (3.1)	4.0%	0.2%	2,533
18–59 years						
2019–2020	8,934	19.5	4.6 (5.8)	9.4%	1.1%	2,684
2020–2021	435	1.0	5.1 (6.5)	5.3%	0.2%	2,225
2021–2022	1,244	2.8	3.5 (3.2)	4.6%	0.5%	2,156
2022–2023	9,122	20.5	4.6 (5.9)	9.9%	1.1%	3,301
2023–2024	11,818	26.6	5.4 (6.8)	12.5%	1.7%	4,678
60 years and older						
2019–2020	13,939	58.7	8.0 (8.1)	12.5%	6.6%	3,634
2020–2021	497	2.1	8.5 (8.8)	7.8%	12.3%	2,921
2021–2022	1,193	4.9	7.8 (7.2)	9.0%	5.8%	2,960
2022–2023	24,184	98.1	8.1 (6.7)	11.3%	8.6%	4,789
2023–2024	29,129	116.3	8.0 (6.9)	12.5%	7.7%	5,430

†Calculated among 97.0% of cases with available information on DRG code.

- Between 25.4% (2021–2022) and 50.2% (2023–2024) of influenza/ILI hospitalisations were attributable to individuals aged 60 years and older.
- **Figure 2** shows the weekly number of influenza/ILI hospitalisations during the study period. Most influenza/ILI hospitalisations occurred during three peaks, each spanning approximately two months during the winter months of the 2019–2020, 2022–2023, and 2023–2024 seasons.

Figure 2: Weekly number of influenza/ILI hospitalisations by age group, July 2019 to June 2024

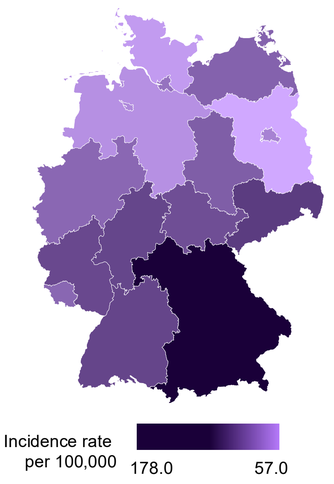


- In each season, the mean costs per hospitalisation were the highest among older adults, ranging between €2,921 in 2020–2021 and €5,430 in 2023–2024 (**Table 1**).
- **Table 2 and Figure 3** show the age-standardised incidence rate of influenza/ILI hospitalisations among adults aged years 60 and older, for whom influenza vaccination is generally recommended by German authorities, for each federal state in the latest season observed (2023–2024)[7]. The incidence rate varied substantially between the federal states with the highest incidence rate observed in Bavaria, followed by Saxony and Baden-Württemberg, and lowest incidence rate in the state of Brandenburg.

Table 2: Age-standardised incidence rate of influenza/ILI hospitalisations among adults aged 60 years and older across German federal states, 2023–2024 season

	Age-standardised incidence rate per 100,000 population
Baden-Württemberg	128.3
Bavaria	177.9
Berlin	84.1
Brandenburg	57.0
Bremen	79.6
Hamburg	96.0
Hesse	127.8
Mecklenburg-Western Pomerania	107.3
Lower Saxony	74.1
North Rhine-Westphalia	103.5
Rhineland-Palatinate	125.7
Saarland	103.8
Saxony	134.7
Saxony-Anhalt	110.6
Schleswig-Holstein	66.0
Thuringia	121.6

Figure 3: Age-standardised incidence rate of influenza/ILI hospitalisations among adults aged 60 years and older across German federal states, 2023–2024 season



ABBREVIATIONS: DRG, Diagnosis-related group; €, Euro; ILI, Influenza-like illness; ICU, Intensive care unit; InEK, Institute for reimbursements in hospitals; ICD-10-GM, International Classification of Diseases-Version 10-German modification; SD, Standard deviation; SARS-CoV-2, Severe Acute Respiratory Syndrome Coronavirus 2.

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