Original Article

The Prevalence of Hospitalized Cases of Necrotizing Fasciitis

Anatomical Distribution, Amputations, and In-Hospital Mortality, 2019–2024

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Summary

Background: Necrotizing fasciitis is a life-threatening soft-tissue infection that still carries an in-hospital mortality of 11–30% and an amputation rate of 7–22% despite modern treatment. Only limited population-based data have been available for Germany to date.

Methods: We carried out a retrospective, nationwide descriptive analysis of aggregated administrative routine data from the German DRG system. All hospitalizations with a main diagnosis of necrotizing fasciitis (ICD-10-GM: M72.6) from 2019 to 2024 were included. The prevalence, demographic features, and anatomical distribution of necrotizing fasciitis were studied, as well as the rate of major amputations and in-hospital mortality.

Results: There were 12 799 hospitalized cases of necrotizing fasciitis over the years of the study. The mean annual prevalence was 2.6 cases per 100 000 people; an upward trend was seen from 2022 onward. Men and patients over age 50 were overrepresented. The most commonly affected sites were the pelvic/femoral region and the lower leg. Major amputations, mainly of a lower limb, were performed in 6.7% to 9.3% of cases. The in-hospital mortality rate averaged 14.9% and remained high throughout the study period. In-hospital mortality largely depended on the anatomic site and was higher with more extensive disease.

Conclusion: In Germany, necrotizing fasciitis is associated with a considerable disease burden, high mortality, and high amputation rates. Men and patients over age 50 are at higher risk of developing this disease, and its mortality is highest in patients with extensive disease or involvement of the proximal lower limb. These are the first robust population-based data on necrotizing fasciitis in Germany.

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Necrotizing fasciitis is a life-threatening progressive soft-tissue infection characterized by rapid spread along fascial planes as well as extensive tissue necrosis. Even when treated with up-to-date intensive care and surgical management strategies, it continues to be associated with high in-hospital mortality and amputation rates (11–30% and 7–22%, respectively) (1–7).

Various bacterial pathogens can cause the condition, including monomicrobial infections with β-hemolytic streptococci or *Staphylococcus aureus* and polymicrobial (mixed) infections (8, 9). The typical route of entry is via skin and soft-tissue lesions. Common triggers include postoperative wounds, traumatic injuries, perianal infections, and injection sites. Spontaneous disease onset without clear entry point has also been reported in some cases. Key predisposing factors include, most notably, diabetes mellitus, peripheral vascular disease, chronic kidney disease, immunosuppression, and obesity (1, 10, 11).

Clinically, necrotizing fasciitis usually presents with nonspecific early signs and symptoms, such as pain, swelling and skin changes, which may initially be mild, but do not always reflect the extent of the underlying tissue destruction (12–14). Such discrepancies render early diagnosis difficult and contribute significantly to delays in initiating treatment and to an unfavorable prognosis. Given the often rapidly progressive disease course, early clinical evaluation and a rigorous management strategy are critical in the treatment of patients with necrotizing fasciitis (12, 13, 15, 16).

Even though the condition is of high clinical significance, only limited epidemiological data on necrotizing fasciitis are available for Germany. The existing data come from case series and regional or single-center analyses

Table 1

Annual prevalence, case numbers, sex distribution, and mortality rates associated with necrotizing fasciitis in Germany (2019–2024)

Year	Cases (n)	Prevalence / 100 000	Male (%)	Female (%)	Mean age (years)	Mortality (%)
2019	1954	2.4	57.6	42.4	62.5	13.7
2020	1928	2.3	55.5	44.5	61.4	14.6
2021	1833	2.2	54.4	45.6	62.7	14.8
2022	2043	2.5	56.8	43.2	62	15.1
2023	2618	3.1	57.1	42.9	61.1	16.2
2024	2423	2.9	58.4	41.6	60.6	15.1

Note: The percentages represent the proportion of patients relative to the total number of cases included in each year.
A sex-specific analysis of mean age and mortality could not be performed based on the aggregated data.

Table 2

Annual number of major amputations for necrotizing fasciitis in Germany as well as distribution on upper and lower extremities (2019–2024)

Year	Major amputations (n)	Lower extremity n (%)	Upper extremity n (%)
2019	146	140 (95.9)	6 (4.1)
2020	142	136 (95.8)	6 (4.2)
2021	123	123 (100.0)	0 (0.0)
2022	189	183 (96.8)	6 (3.2)
2023	204	192 (94.1)	12 (5.9)
2024	215	198 (92.1)	17 (7.9)

Note: The percentages are based on all major amputations documented in the respective year.

based on a small number of cases; thus, there is a lack of reliable information on the nationwide prevalence and anatomical distribution of the condition and the clinical endpoints observed across Germany. International data show the rarity of the disease, but, at the same time, highlight its clinical significance. For Europe, there is only limited population-based data on the prevalence of the necrotizing fasciitis available, indicating a rare condition that shows regional variations (7, 17).

Prevalence estimates vary considerably across the globe, ranging from 0.2 to 32.6 cases per 100 000 population, with higher prevalence rates in tropical regions (1, 3). Given the often rapid progression of the disease, a systematic analysis of in-hospital outcomes at the population level is needed to understand the clinical and health-system implications of the condition.

In this study, we intended to conduct a nationwide epidemiological analysis of necrotizing fasciitis in Germany based on the complete set of nationwide routine data available for the period 2019–2024. We looked at the prevalence, demographic characteristics and anatomical distribution of the disease, as well as the rates of major amputations and in-hospital mortality.

Methods

In this retrospective, nationwide epidemiological study, we performed an analysis of all cases of necrotizing fasciitis hospitalized in Germany during the period 2019–2024. The data used were made available by the Institute for the Hospital Payment System (InEK, Institut für das Entgeltsystem im Krankenhaus) from the German Diagnosis Related Groups (DRG) statistics. InEK routinely records all inpatient treatments in German acute care hospitals based on the diagnoses and procedures documented for billing purposes.

We used the ICD-10-GM code M72.6 to identify inpatient cases of necrotizing fasciitis and included only cases where the condition was the main diagnosis. In this way, it was ensured that necrotizing fasciitis was clinically the primary disease. Because of this approach, however, cases where the condition was coded as a secondary diagnosis may be underrepresented in our analysis. All hospital stays that occurred during the study period were included in the analysis. The prevalence of necrotizing fasciitis was calculated as the number of cases of inpatient treatment per 100 000 population. Population data from the German Federal Statistical Office (Destatis) were used for this purpose and the population figures as of December 31 of the respective year served as the reference.

We conducted a descriptive analysis of the demographic characteristics, such as age and sex, as well as the anatomical region affected by necrotizing fasciitis. We assigned the anatomical regions based on the corresponding ICD-10-GM subclassifications of the code M72.6 and grouped them according to the defined anatomical categories.

As clinical endpoints, we used in-hospital mortality (overall and site-specific) and the occurrence of a major amputation. A major amputation was defined as the surgical removal of an upper or lower extremity proximal to the wrist or ankle during the hospital stay. Major amputations were identified based on the respective codes of the German procedure classification OPS (*Operationen- und Prozedurenschlüssel*) that specify an amputation of the upper or lower limb. In-hospital mortality was defined as death during the same hospital stay.

The statistical analysis was conducted in a purely descriptive manner; due to the use of aggregated data, no inferential statistical analysis could be performed. Categorical variables were presented as absolute frequencies and percentages. Microsoft Excel (Microsoft Corp., Redmond, WA, USA) was used for data analysis and preparation; Microsoft Copilot was used to assist in generating the Figure.

This study required neither an ethics review nor a patient consent under applicable German law, as the analysis was solely based on fully anonymized routine administrative data with no personal identifiers.

Results

In the period from 2019 to 2024, a total of 12 799 inpatient treatment cases with a main diagnosis of necrotizing fasciitis were recorded in Germany. Annual numbers of cases varied during the observation period, ranging from 1833 cases in 2021 to 2618 cases in 2023. The annual prevalence rates ranged between 2.2 and 3.1 cases per 100 000

Table 3

Anatomical distribution and in-hospital mortality of necrotizing fasciitis in Germany, 2019–2024

Code	Anatomical region	2019		2020		2021		2022		2023		2024	
		Cases n (%)	Mortality %	Cases n (%)	Mortality %	Cases n (%)	Mortality %	Cases n (%)	Mortality %	Cases n (%)	Mortality %	Cases n (%)	Mortality %
M72.60	Multifocal	89 (4.6)	27	67 (3.5)	26.9	72 (3.9)	22.2	82 (4)	31.7	142 (5.4)	33.1	107 (4.4)	34.6
M72.61	Shoulder	33 (1.7)	0	34 (1.8)	0	28 (1.5)	0	17 (0.8)	0	30 (1.2)	0	24 (1)	0
M72.62	Upper arm	65 (3.3)	0	78 (4.1)	12.8	44 (2.4)	0	55 (2.7)	14.5	112 (4.3)	15.2	104 (4.3)	14.4
M72.63	Lower arm	83 (4.3)	10.8	92 (4.8)	9.8	81 (4.4)	13.6	73 (3.6)	6.9	156 (6)	12.8	138 (5.7)	10.1
M72.64	Hand	48 (2.5)	16.7	34 (1.8)	0	36 (2)	0	44 (2.2)	11.4	76 (2.9)	7.9	51 (2.1)	0
M72.65	Pelvic/femoral region	576 (29.5)	18.9	600 (31.1)	20.8	544 (29.7)	20	688 (33.7)	17.9	764 (29.2)	21.7	751 (31)	19
M72.66	Lower leg	638 (32.7)	12.2	578 (30)	11.4	541 (29.5)	13.3	625 (30.6)	13.3	761 (29.1)	14.3	692 (28.6)	13.2
M72.67	Ankle/foot region	107 (5.5)	0	121 (6.3)	7.4	137 (7.5)	12.4	108 (5.3)	7.4	139 (5.3)	5	123 (5.1)	4.1
M72.68	Trunk/neck/head region	279 (14.3)	9.7	301 (15.6)	12.3	322 (17.6)	9.9	325 (15.9)	13.2	408 (15.6)	11	390 (16.1)	12.3
M72.69	Site unspecified	36 (1.8)	0	23 (1.2)	0	28 (1.5)	21	26 (1.3)	23.1	30 (1.2)	0	43 (1.8)	16.3

The figures are based on absolute numbers of cases and percentages relative to the respective total annual case number.
Mortality is expressed as the percentage of deaths in each category. Mortality rates for small subgroups should be interpreted with caution. M72.69 indicates cases in the routine data where the anatomical site is not specified.

population; we observed an increase in prevalence, particularly from 2022 onward *(Table 1)*.

The proportion of male patients was higher throughout the entire study period. The proportion of men ranged from 54.4% to 58.4%, while the proportion of women ranged from 41.6% to 45.6%. The age distribution showed a noticeable increase in disease occurrence among older age groups. The vast majority of cases were patients aged 50 years and older, with particularly high case numbers in the 65–74 and ≥ 80 age groups. Over the entire observation period, the mean age of the patients remained stable, ranging from 60.6 to 62.7 years *(Table 1)*. Pediatric cases were rare, accounting for less than 0.5% of the total number of cases in each year.

The general in-hospital mortality due to necrotizing fasciitis ranged between 13.7% and 16.2%, showing moderate fluctuations over the years with no clear trend *(Table 1)*.

A total of 1019 major amputations were documented during the period from 2019 to 2024. The annual proportion of major amputations among all inpatient treatment cases ranged from 6.7% to 9.3%. In every year covered by the study, the vast majority of major amputations were lower-limb amputations, accounting for between 92.1% and 100% of the cases. Major amputations of the upper extremity were rare and accounted for no more than 7.9% of all amputation cases *(Table 2)*.

A more detailed analysis of the affected body regions showed that necrotizing fasciitis occurred predominantly in the lower extremities. Throughout the entire study period, the pelvic/femoral region was the most commonly involved anatomical site, ranking higher than the lower leg in five of the six years studied. Together, these two locations accounted for the majority of all cases. Further commonly affected regions included the trunk, neck and head region as well as the ankle/foot region. Necrotizing fasciitis affecting multiple sites (M72.60) occurred in a smaller proportion of cases, but this proportion remained stable over the years. In routine data, this clinical presentation typically indicates extensive infection with involvement of several adjacent anatomical regions. Necrotizing fasciitis that simultaneously affects several non-adjacent areas of the body is very rarely observed in clinical practice; however, it was not possible to further differentiate this subtype due to study design-related limitations and the underlying rules for coding. Sites of involvement on the upper extremity, including the shoulder region, upper arm, forearm, and hand, were overall rare *(Table 3)*.

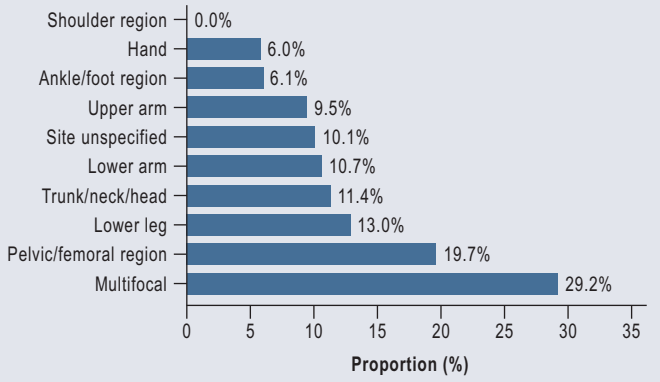
In-hospital mortality varied significantly, depending on the anatomical region. The highest mortality rates were observed in cases of multifocal disease, followed by infections of the pelvic/femoral region, as well as the trunk, neck and head regions. In contrast, lower mortality rates were observed overall for infections of the distal extremities, particularly of the hand and ankle/foot regions. For the shoulder region, no in-hospital mortality was recorded during the entire study period *(Table 3, Figure)*.

Discussion

In this study, we identified a total of 12 799 inpatient cases of necrotizing fasciitis in Germany in the period 2019–2024, based on a nationwide epidemiological survey. The prevalence rates ranged from 2.2 to 3.1 cases per 100 000 population, while the in-hospital mortality rates remained stable at a high level (between 13.7% and 16.2%).

According to the latest studies, the prevalence of the disease has increased in recent years, both in Germany and worldwide (18, 19). The increase in case numbers observed from 2022 onward could be the result of multiple factors. Possible explanations include increased awareness of the condition, changes in diagnosis and

Figure



Mean in-hospital mortality among inpatient treatment cases with necrotizing fasciitis in Germany, by anatomical site, 2019–2024. The figures represent the unweighted mean of the annual mortality rates within each anatomical category.

coding—particularly due to the broader use of imaging modalities and the more precise capture of severe soft-tissue infections in everyday clinical practice—as well as structural changes in the healthcare system in the wake of the COVID-19 pandemic. A nationwide retrospective cohort study from the Netherlands found an incidence of 1.1–1.4 cases per 100 000 population, with a reported mortality rate of 23–29% (7). A population-based study from England, covering the period from 2002 to 2017, revealed an incidence of 0.9 to 2.1 per 100 000 population, with a mortality rate of approximately 16% (17). Differences in diagnostic and treatment structures across healthcare systems, in particular with regard to the time-sensitive surgical removal of the source of infection, as well as variations in comorbidity profiles and the spectrum of pathogens may also play a role. In addition, a nationwide analysis from France indicates that the mortality among patients treated in centers with more than three cases per year is lower, underscoring the potential role of experience, interdisciplinary structures and standardized treatment pathways (20). Given this background, a systematic analysis of the disease that takes geographical and demographic characteristics into account appears to be of particular value for the targeted advancement of diagnosis and treatment at national level.

Early diagnosis and treatment of necrotizing fasciitis are crucial for successfully managing the disease, especially in high-risk patients (21). Therefore, it seems critical to identify at-risk patient groups so that the necessary diagnostic workup and treatment can be initiated in a timely manner. In this study, we found a higher proportion of male patients, whose proportion ranged from 54.4% to 58.4 percent, depending on the capture year. Other studies also reported similar distribution patterns (22). The observed difference may be attributable to the higher exposure of men to traumatic events or surgical procedures, but the nature of the available data does not allow to investigate this further. In addition, cases of necrotizing fasciitis were found to be more prevalent among older age groups. Without knowledge of the underlying reference population, however, this finding by itself does not indicate an age-related increase in the risk of developing the disease. The distribution observed could also be influenced by the increased use of inpatient care that tends to occur with advancing age. According to the literature, however, older age was associated with a less favorable prognosis (23). Rather than being interpreted as independent risk factors, male sex and older age may be better understood as markers of an elevated comorbidity profile, notably including obesity and diabetes mellitus as predisposing factors (24, 25). Given that no information on comorbidities is available from the study population, this association cannot be evaluated. Given the observed higher prevalence in men and older persons, necrotizing fasciitis should be considered in the differential diagnosis of nonspecific soft tissue infections in these groups.

The nationwide analysis of the anatomical distribution of the disease shows a clear predominance of lower-extremity cases. Pelvic/femoral region and the lower leg are the most commonly involved regions, while distal locations and the upper extremity are significantly less frequently involved. Multiple international studies consistently highlighted a predisposition to necrotizing fasciitis in the proximal lower extremity as well as in the anogenital and pelvic regions (26, 27). A Scandinavian prospective multicenter study also reported a higher prevalence in the anogenital, pelvic and lower-limb regions (5). In these cohorts, anogenital and pelvic sites were more commonly associated with polymicrobial infections compared to monomicrobial infections, reflecting the typical spectrum of pathogens in these regions. Other studies found a high prevalence of necrotizing fasciitis of the lower extremity as well as differences in the microbiological spectrum, including increased rates of infections with multidrug-resistant pathogens in the anogenital region and the lower extremities (28), anatomical regions that are associated with increased in-hospital mortality. Possible explanations include microlesions serving as local entry portals, anatomical proximity to potentially contaminated areas, and limited options to treat multidrug-resistant pathogens.

The proportion of multifocal manifestations observed in this subgroup is overall low, ranging from 3.5% to 5.4% annually. The aspect most relevant to clinical practice, however, is not the rate of occurrence, but rather the significantly higher mortality rate associated with multifocal disease, where the mortality rate is 29.2%, the highest observed. According to the literature, synchronous multifocal necrotizing fasciitis is a rare and special type of the disease with an unfavorable prognosis (29). The increased mortality observed in our study population in cases of multifocal involvement is consistent with clinical studies reporting a significant systemic disease burden with high sepsis and mortality rates in patients with synchronous multifocal disease. In a Taiwanese case-control study, the mortality rate associated with synchronous multifocal necrotizing fasciitis was significantly higher compared to that associated with unifocal disease (68.4% versus 14.4%) (29).

Surgical management also shows considerable differences between the upper and lower extremity, similar to those observed in the anatomical distribution. In our study population, major amputations were performed in 6.71% to 9.25% of cases and almost exclusively on the lower extremities. These findings are in line with international population-based data, where amputations performed to control the source of infection are typically reported in the range of single-digit to low double-digit percentages (7). A marked tendency toward lower-limb amputations is also reported in a large Thai study, in

which the amputation rate was 8.4 percent and amputations were performed predominantly on the lower limb, while upper-limb surgeries accounted for only a very small proportion of cases (30). Apart from the often large-scale involvement of extensive soft-tissue compartments and the rapid spread along fascial planes, vascular factors, in particular the higher prevalence of peripheral arterial disease in the lower extremities, may also contribute to the elevated amputation rate.

In advanced cases of the disease where repeated debridement has failed to control the infection, major amputation is often the last resort to achieve rapid removal of the source of infection. By contrast, necrotizing fasciitis of the upper extremity is rather uncommon. Even if amputation is needed, most of these cases require partial amputations or distal resections rather than major amputations (31).

Limitations

Our study is based on nationwide administrative routine data from the German DRG system, collected primarily for billing purposes. The results can be influenced by coding-related differences. While limiting the analysis to cases where the condition was coded as the main diagnosis increases diagnostic specificity, this approach may lead to an underestimation of the actual number of cases. Readmissions and transfers could not be ruled out and might have had a minor impact on the results. Detailed clinical information, e.g., regarding microbiology, therapy and the course of treatment, was not available. Given the aggregated data structure, it was not possible to perform inferential statistical or multivariate analyses, nor to draw conclusions about individual risk factors. Nevertheless, the comprehensive national coverage and the observation period from 2019 to 2024 allow for a robust description of inpatient care for necrotizing fasciitis in Germany.

Conclusion

This nationwide descriptive analysis shows that, in Germany, necrotizing fasciitis is associated with a high disease burden and significant in-hospital mortality (14.9%). Furthermore, it is responsible for a considerable proportion of major amputations. Men and persons aged 50 and older are particularly affected. Extensive forms of the disease account for a disproportionately high mortality rate, while infections of the pelvic region and the proximal lower extremity are the most common types and the types most strongly associated with amputations. Our findings are the first to provide robust population-based data for Germany—a key foundation for future detailed clinical studies as well as the advancement of care structures.

Conflict of interest statement
The authors declare no conflict of interest.

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Supplementary material
Complete list of full references:
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Supplementary material to accompany the article

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